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Impact Of Maternal Education On Birth Weight and Gestational Age In West Java: A 2022 Study

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ABSTRACT

Background: *Infant development is greatly influenced by maternal health. Maternal factors such as level of education and age impact self-care during pregnancy, resulting in heterogeneity of birth weight and gestational age.* ***Objective:*** *This study analyzes the association between maternal level of education and age with birth weight and gestational age.* ***Methods:*** *A cross-sectional study with simple random sampling was performed by using medical records at Dr. Hasan Sadikin General Hospital Bandung from 1st January to 31st December 2019. Subjects were mothers who delivered single live-born and infants without congenital anomalies at Dr. Hasan Sadikin General Hospital Bandung. Data analysis represents the proportion between groups and the Mann-Whitney test (p<0.05) to observe the association between variables.* ***Results:*** *A total of 1574 birth data encounter the criteria in this study. Types of delivery, abnormality of amnion fluid, IUGR, PROM, and pregnancy complications didn't differ between high- and low-risk groups of mothers. High-risk maternal age (<20 and >35 years old) was associated with gestational age (preterm birth, c=36.59 weeks; p=0.036). Maternal level of education wasn't associated with gestational age and birth weight, also maternal age wasn't associated with birth weight (p>0.05).* ***Conclusion:*** *High-risk maternal age (<20 and >35 years old) was associated with gestational age (preterm birth), however, a low level of education (no education, elementary school, and junior high school) wasn't shown to be related. Birth weight wasn't affected by maternal age and level of education. Further studies that account for socioeconomic aspect in regards of education level and birth weight and gestational age are necessary.*

Keywords: Birth Weight, Gestational Age, Maternal Age, Maternal Level of Education.

INTRODUCTION

Infant development in the uterus is a crucial period that can determine birth outcomes in the future. Maternal health can affect infant development (Mayer and Joseph, 2013). Mothers who realize how important the health of the baby and themselves try to obtain information about pregnancy (Birmeta, Dibaba and Woldeyohannes, 2013). Antenatal care is a form of health service that can promote maternal and fetal health. It contains nutritional counseling, assesses maternal and fetal health, and gives supplements (e.g., folic acid and iron tablets) to prevent adverse outcomes in infants. Mother's role in preparing their pregnancy is an essential factor. Awareness of maternal and fetal health is affected by factors such as the maternal level of education and age.

Education can affect health quality (Vikram and Vanneman, 2020). Education amongst mothers assists to obtain health information and increased involvement in making decisions in need of healthcare, for example, antenatal care. (Acharya *et al.*, 2010) Research in Italy reports that maternal level education was associated with low birth weight (LBW) and preterm birth (PTB), the higher the level of education, the lower the incidence of LBW and PTB. (Cantarutti *et al.*, 2017) As reported by WHO and UNICEF, the incidence of LBW in the world reached 20. 5 million in 2015. In Indonesia, according to Indonesian Nutrition Status Survey, the incidence of LBW reaches 6% of the total newborn babies in Indonesia (Kementerian Kesehatan Republik Indonesia, 2022). It is estimated that, globally, there are 15 million cases of PTB every year.

Mothers with young (<20 years old) and advanced age (>35 years old) tend to undergo LBW and preterm birth. This is due to maternal age, which can influence their quality of reproductive organs. If not

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optimal, it will result in poor birth outcomes. (Goisis *et al.*, 2017) (Wong *et al.*, 2020) The prevalence of early-age marriage (<18 years old) in Indonesia reached 11.21% in 2018 (Hakiki *et al.*, 2020). That is what accounts for the majority of pregnancies at young ages. Retrospective research in Taiwan states that LBW and preterm birth are affected by maternal age (Weng, Yang and Chiu, 2014).

A child's well-being is a fundamental marker of progression toward the achievement of the Sustainable Development Goals(SDGs_. Optimal conditions of the mother for preparing the birth of a healthy child reflect the capacity of the health system to prevent and manage complications during pregnancy and childbearing that had been performed effectively. The purpose of this research study is to observe the association between the maternal level of education and age to birth weight and gestational age to better understand the possible factors that may cause their occurrences. This study is expected to provide new information for physicians in educating the general public about how education and maternal age might affect pregnancy and birth, especially in populations with low education level, which is often assumed by public to have a limited health resource and information.

METHODS

This cross-sectional study was conducted at Dr. Hasan Sadikin General Hospital Bandung from 1st January to 31st December 2022. This study uses medical records in the Department of Pediatrics, Division of Neonatology at Dr. Hasan Sadikin General Hospital Bandung. Subjects were data of mothers who delivery from 1st January to 31st December 2022. The inclusion criteria were mothers who deliver single live-born babies and infants without congenital anomalies. The exclusion criteria were stillbirth infants, twin babies, infants with congenital anomalies, and infants whose data were inaccessible. The sample was selected by simple random sampling.

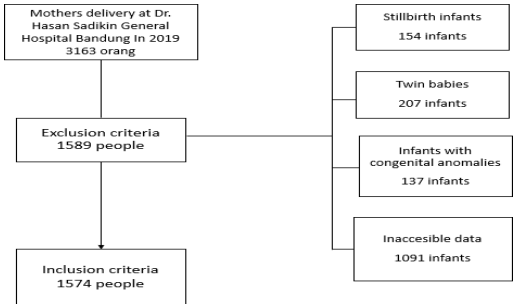

Figure 1. Diagram of inclusion and exclusion criteria

This research study was approved by the Research Ethical Committee of Faculty of Medicine Universitas Padjadjaran no.1091/UN6.KEP/EC/2023 and Ethical Committee of Dr. Hasan Sadikin General Hospital Bandung no. LB.02.01/X.2.2.1/25748/2023.

The data selected according to the inclusion and exclusion criteria will be analyzed by univariate and bivariate analysis. The univariate analysis is used to observe the patient's characteristics. It consists of parity, types of delivery, history of premature rupture of membrane (PROM), IUGR (Intrauterine Growth Restriction), and pregnancy complications (preeclampsia, eclampsia, gestational diabetes, and chronic hypertension). Characteristics of patients were presented as number (%). Independent variables in this study are the maternal level of education and age. Maternal level of education is classified into low (no education, elementary school, and junior high school) and high (senior high school, vocational, undergraduate, and postgraduate). Maternal age is classified into low-risk (20-35 years old) and high-risk (<20 and >35 years old). Dependent variables are birth weight and gestational age. The bivariate analysis is used to observe both independent and dependent variables which will further be analyzed by the Mann-Whitney test to differentiate between two variables if the data do not have normal distribution. This study is statistically significant if p-value <0.05. The data were processed by software IBM® SPSS 26.

RESULTS AND DISCUSSION

Out of 3163 data, 1589 were excluded, leaving 1574 data to be analyzed. The data excluded are stillbirth babies, twin babies, infants with congenital anomalies, and inaccessible data.

Table 1. Characteristics of Mothers Delivery at Dr. Hasan Sadikin General Hospital Bandung In 2022

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	Maternal Age			Maternal Level of Education		
	High-Risk (n=472)	Low-Risk (n=1102)	*p* value	High (n=954)	Low (n=620)	*p* value
Parity, n (%)						
Nulliparous	174 (36.9%)	469 (42.6%)	0.001	437 (45.8%)	206 (33.2%)	0.001
Primiparous	88 (18.6%)	364 (33.0%)		297 (31.1%)	115 (25.0%)	
Multiparous	210 (44.5%)	269 (24.4%)		220 (23.1%)	259 (41.8%)	
Types of Delivery, n (%)						
Spontaneous Vaginal Delivery	239 (50.6%)	543 (49.3%)	0.224	468 (49.1%)	314 (50.6%)	0.768
Vacuum Extraction/Forceps Delivery	11 (2.3%)	45 (4.1%)		33 (3.5%)	23 (3.7%)	
Sectio Caesarea	222 (47,0%)	514 (46,6%)		453 (47.5%)	283 (45.6%)	
Abnormality of Amnion Fluid, n (%)						
None	471 (99.8%)	1093 (99.2%)	0.374	946 (99.2%)	618 (99.7%)	0.412
Polyhydramnion	0 (0.0%)	1 (0.1%)		1 (0.1%)	0 (0.0%)	
Oligohydramnios	1 (0.2%)	8 (0.7%)		7 (0.7%)	2 (0.3%)	
IUGR, n (%)						
None	468 (99.2%)	1079 (97.9%)	0.083	936 (98.1%)	611 (98.5%)	0.516
Yes	4 (0.8%)	23 (2.1%)		18 (1.9%)	9 (1.5%)	
PROM, n (%)						
None	429 (90.9%)	989 (89.7%)	0.486	860 (90.1%)	558 (90.0%)	0.924
Yes	43 (9.1%)	113 (10.3%)		94 (9.9%)	62 (10.5%)	
Complication in Pregnancy, n (%)						
None	409 (86.7%)	985 (89.4%)	0.266	848 (88.9%)	546 (88.1%)	0.863
Preeclampsia/Eclampsia	54 (11.4%)	103 (9.3%)		92 (9.6%)	65 (10.5%)	
Others	9 (1.9%)	14 (1.3%)		14 (1.5%)	9 (1.5%)	

Analysis results on patient's characteristics show maternal age was associated with parity (p=0.001). The majority of the data are 210 people (44.5%) were multiparity in high-risk and 469 people (42.6%) were nulliparity in low-risk. Mostly, mothers were delivered by spontaneous vaginal delivery (50.6% in high-risk;49.3% in low-risk). Abnormality of amnion fluid, PROM, IUGR, and pregnancy complications mostly occur in low-risk age (p>0.05). We found 259 people (41.8%) in low level education group were multiparity and 437 people (45.8%) were nulliparity in high level group (p=0.001). Types of delivery in two groups mostly delivered by spontaneous vaginal delivery. Characteristics of patients are shown in Table 1.

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Table 2. Association between Maternal Level of Education and Age with Gestational Age

	Gestational Age						
	Mean	Median	95% CI		Min	Max	*p* value
			Lower Bound	Upper Bound			
Maternal Level of Education							
High	36,76	37,00	36,61	36,92	26	42	0,776
Low	36,76	37,00	36,57	36,96	26	42	
Maternal Age							
High-Risk	36,59	37,00	36,37	36,82	27	41	0,036
Low-Risk	36,84	37,50	36,69	36,98	26	42	

Table 2 shows that maternal age was associated with gestational age (p=0.036). However, maternal level of education wasn't associated with gestational age (p=0.776).

Table 3. Association between Maternal Level of Education and Age with Birth Weight

	Birth Weight						
	Mean	Median	95% CI		Min	Max	*p* value
			Lower Bound	Upper Bound			
Maternal Level of Education							
High	2594,59	2600,00	2557,56	2631,62	300	4400	0,326
Low	2620,17	2650,00	2573,25	2667,09	700	4600	
Maternal Age							
High-Risk	2577,15	2600,00	2523,72	2630,59	700	4600	0,175
Low-Risk	2616,45	2610,00	2581,81	2651,09	300	4400	

Discussion

The representation of maternal age and level of education are 1102 people (70%) low-risk age (20-35 years old) and 954 people (60.6%) high level of education (senior high school, vocational, undergraduate, and postgraduate).

Gestational age as a fundamental component of antenatal care becomes the main key in the management of pregnancy complications (Cunningham *et al.*, 2014). The adherence of antenatal visits is influenced by the maternal level of education (Arthur, 2012). Research of the population in Italy states there was a significant association between maternal level of education with preterm birth, the higher the level of education, the lower the incidence of PTB (Cantarutti *et al.*, 2017). In this study, we found no association between maternal level of education and gestational age. Pregnancy complications (preeclampsia or hypertension) can mediate PTB; however, this study wasn't included in the analysis, thus further research is needed (Cantarutti *et al.*, 2017). As reported by research in French Guiana mothers with hypertension or preeclampsia tend to undergo PTB by 83.6% (Leneuve-Dorilas *et al.*, 2019).

A cohort study in Canada reports that maternal age can affect PTB. The distribution pattern of maternal age who undergo PTB was following 'U' shaped.[16] Mothers of young age (20- 24 years old) tend to undergo PTB (aOR 1.08) and spontaneous PTB (aOR 1.09). However, mothers with advanced age (>35 years old) have a higher risk of iatrogenic PTB (aOR 1.15) as a result of certain medical conditions (Fuchs *et al.*, 2018) (Khalil *et al.*, 2013). The findings of risk factors such as diabetes mellitus, preeclampsia, placenta previa, PROM, and chronic hypertension cause infant must be delivered immediately, thus preterm birth can occur (Leneuve-Dorilas *et al.*, 2019), (Fuchs *et al.*, 2018), (Khalil *et al.*, 2013),

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(Jiang *et al.*, 2018). Previous studies noted that PTB often occurs in young (<20 years old) and advanced age (>35 years old) due to pregnancy complications (Fuchs *et al.*, 2018) (Khalil *et al.*, 2013). Our study suggests a significant association between maternal age and gestational age which are in line with those previous studies. We found PROM and other pregnancy complications mostly occur in mothers with low-risk age (20-35 years old),which is, therefore, inconsistent with the previous study which reports increased susceptibility to pregnancy complication in high-risk maternal age (Fuchs *et al.*, 2018). However, this may be due to a higher proportion of participants in the low-risk maternal age group.

Birth weight is a sensitive health indicator in the baby because it is related to the baby's health (Gelfand *et al.*, 2012). Variations in birth weight occur as a result of factors especially maternal factors, that might affect pregnancy. Other factors include nutritional status during pregnancy, body mass index (BMI) before conception, weight gain during pregnancy, and hemoglobin concentration (Khoushabi and Saraswathi, 2010), (STAMNES KOEPP *et al.*, 2012), (Sekhavat, Davar and Hosseinidezoki, 2011). These four things are related to nutrition that will be received by the babies. If nutrition deficiency in babies occurs, the baby tends to undergo IUGR and, finally, LBW can occur.

According to this study, there wasn't a significant association between maternal age and birth weight. This is in contrast with the previous study that suggest significant association between maternal age and birth weight (Gelfand *et al.*, 2012). The significant association related to parity and ethnic/race of the mother. Mothers with more than one parity have experience in their previous pregnancy; therefore, they are more aware in their next pregnancy (Muula, Siziya and Rudatsikira, 2011). It is necessary to do further research related to maternal parity which can be confounding bias in this study.

Research in Malawi reports that maternal level of education had an association with LBW (Muula, Siziya and Rudatsikira, 2011). A higher level of education can increase socioeconomic status. Increased socioeconomic status makes mothers easily able to access healthcare, thus LBW can be prevented (Acharya *et al.*, 2010), (Branco da Fonseca *et al.*, 2014). The result in this study is inconsistent with the previous study, this might be because socioeconomic status wasn't studied in regard to education level status. A study in Nepal found a correlation between caste and risk of small-for-gestational age babies (Hazel *et al.*, 2022). Higher economic status, along with higher level of education, may result in mothers being more resourceful in aiding their pregnancy and be more open to information regarding pregnancy, such as information about healthy diet, recommended lifestyle and exercise, and regular pregnancy check-ups in health facilities. Unfortunately, these factors were not studied in our study, thus, affecting our results.

Limitations in this study where that issues caused by nutritional status, BMI before conception, weight gain during pregnancy, nutritional status, hemoglobin concentration, socioeconomic status, support during pregnancy and pregnancy complications such as urinary tract infection weren't studied, which basically can affect birth weight and gestational age. Therefore, further research that accounts for all these factors is necessary.

CONCLUSIONS

High-risk maternal age (<20 and >35 years old) was associated with gestational age (preterm birth), although a low level of education (no education, elementary school, and junior high school) wasn't shown to be related. Birth weight wasn't affected by maternal age and level of education. Further research that accounts for socioeconomic status, nutritional status, and other complications that might occur in regard of maternal age and maternal level of education may be needed to better explain their correlation with birth weight and gestational age.

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