

The effects of maternal age and parity on the birth weight of newborns among mothers with singleton pregnancies and at term deliveries

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Abstract

Background: Birth weight is the most important factor determining the survival, growth and development of a newborn. Parity and maternal age have been shown to increase the risk of adverse neonatal outcomes, such as intra-uterine growth restriction (IUGR), low birth weight (LBW) and mortality.

Objective of the study: The study was aimed at investigating the effects of maternal age and parity on the birth weight of newborns from singleton pregnancies and term deliveries.

Materials and Methods: An institutional-based, retrospective, cross-sectional study design was employed at Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia from April to July 2018. In total, 4,590 mothers with term delivery and singleton pregnancy from June 2015 to May 2017 were included in the study. Data on gestational age (GA), parity, history of ANC follow-up, source of referral and birth weight of the child was included. The collected data were analyzed using SPSS version 23 statistical package, and multiple logistic regression was carried out to determine the effect of maternal age and parity with respect to LBW.

Results: Grand multiparous women (parity ≥ 5) have an adjusted odds ratio (AOR) of 3.89 with 95% confidence interval (CI = 2.19, 6.93) compared to multiparous women (p=2-4). Nulliparous women (p=0) have an AOR of 0.23 (95%CI = 0.19, 0.38) compared to multiparous women. Primiparous women (p=1) have an AOR of 0.22 (95% CI = 0.16, 0.30) compared to multiparous women. Women aged 40 and above have an AOR of 1.96 (95% CI = 1.22, 3.20) compared to women aged 30-34. The mean birth weight (MBW) of newborns was 3,075.41 \pm 569.58 grams (mean \pm SD).

Conclusions: In this study, the risk of LBW was higher in grand multiparous women compared to multiparous women. Primiparous and nulliparous women have less risk of having an LBW baby compared to multiparous women. A maternal age of 40 and above were associated with a higher risk of delivering an LBW newborns compared to a maternal age of 30-34. Therefore, special attention should be given to deliveries at an advanced age and multiparous cases to reduce the incidence of LBW. *Ethiop. J. Health Dev.* 2019; 33(3):00-00]

Key words: Birth weight, maternal age, low birth weight, multiparous, primiparous, nulliparous

Introduction

In both developed and developing countries, birth weight is the most important factor that affects neonatal and post-neonatal mortality, and morbidity of infants and children. Thus, birth weight has long been a subject of clinical and epidemiological investigations and a target for public health interventions (1).

Advanced maternal age and parity have been shown to increase the risk of adverse neonatal outcomes, such as intrauterine growth restriction (IUGR), low birth weight (LBW), prematurity, and mortality (2).

Advanced maternal age is associated with increased risk of LBW and preterm delivery in primi-gravida and multiparas. LBW children have more respiratory, cognitive, and neurological problems than those born with normal birth weight. Preterm babies have higher risks of heart defects, lung disorders, cerebral palsy, and delayed development (3).

Many maternal and environmental factors are known to affect birth weight through woman's reproductive lifespan (4). Besides biological factors such as gestational age (GA), maternal anthropometry, weight and height, education, sex of delivered child, and lifestyle factors such as dietary habits, tobacco or

caffeine consumption, can also influence birth weight.

Studies have also shown that socioeconomic factors, such as maternal education and household income are important factors affecting birth weight. For example, low education, poverty, and poor nutritional status are coexistent features of women in rural parts of India, who are at increased risk of adverse reproductive outcomes, including LBW and preterm birth (5). Maternal parity is also a well-recognized predictor of infant birth weight, with the lowest birth weights observed among infants born to nulliparous women (6).

The rate of LBW decreases significantly with the increasing age of the mother after 18 years of age. In the current study, teenage mothers (<20 years) had 1.5 times greater risk of delivering LBW babies compared with mothers aged 20 years and above. The rate of LBW infants was seen to decrease significantly with increasing parity (7).

The relationship between maternal age, parity and birth weight are conflicting, which may be due to a failure of knowing that age and higher birth order are correlated each other at the small amount of data, or to differences in the inherited factors and the socio-economic background of the samples (8).

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Generally, the first and fourth births had lower birth weight than both second and third births across all maternal ages. In addition, male gender of the child and a maternal age of 40-44 had significantly positive effects on birth weight (9).

The objective of the present study was to assess the effects of parity and maternal age on the birth weight of newborns among mothers with singleton pregnancy and term deliveries at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Materials and Methods

The study was conducted in the Obstetrics and Gynecology ward at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. The hospital was selected because of its high patient load.

An institution-based, retrospective, cross-sectional study was conducted between April and July 2018 based on the hospital's medical register of mothers with term and singleton deliveries in the ward from June 2015 to May 2017.

The medical record numbers (MRNs) of all mothers who delivered from June 2015 to May 2017 were retrieved. Mothers with term and singleton deliveries were selected. Data were collected using a well-structured checklist adapted from earlier studies, using MRN and identification number (ID no.) as reference. The case records of mothers with singleton and term deliveries were extracted, and details were recorded in relation to their age, medical condition, the mode of delivery, GA, parity, and birth weight of the baby.

Birth weight was classified as low (<2,500 grams), very low (<1,500 grams), extremely low (<1,000 grams) or macrosomia (>4,000 grams) (10).

Inclusion and exclusion criteria

All mothers with term and singleton deliveries who had a data record in the hospital during the study period were included. Excluded from the study were mothers who had chronic diseases such as HIV/AIDS, diabetes mellitus (DM), cardiac diseases, hypertension or

eclampsia, anemia, chronic liver disease and chronic kidney disease. Also excluded were mothers who gave birth to babies with gross congenital anomalies; mothers whose newborns had died during delivery; and mothers with incomplete medical records.

Finally, based on the inclusion and exclusion criteria of the study, only complete medical records which cover all variables for the study were selected. Then, all variables were collected from the Microsoft excel at a sheet. The birth weight of the newborns was the dependent variable. Independent variables were maternal age, parity, source of referral, GA, ANC follow-up, mode of delivery and fetal presentation.

To maintain data quality, properly designed data collection materials were developed and checked by senior statisticians. Necessary supervisions were done during the data collection period and repeated data clearance was done before analysis.

The data were checked after each data collection for completeness. The data were entered into EPI data manager and analyzed using SPSS version 23. The results were summarized in the form of proportions and frequency tables for categorical variables. The continuous variable (birth weight) was summarized using mean, median, mode and standard deviation. P-values were computed for categorical variables using multiple logistic regression tests, with $p < 0.05$ considered as statistically significant. Binary and multiple logistic regression analysis were carried out to distinguish the effects of independent variables on the dependent variable. In this study, 'parity' is defined as the number of times that a women has given birth to a fetus with a GA of 28 weeks or more, regardless of whether the child was born alive or was stillborn. 'Low birth weight' is defined by the World Health Organization as the birth weight of an infant of 2,499 grams or less, regardless of GA.

Results

Socio-demographic features

Of the 4,590 participants, 1,740 (37.9%) were in the age group 25-29, while 136 (3%) were above 40 years of age, as illustrated on Figure 1.

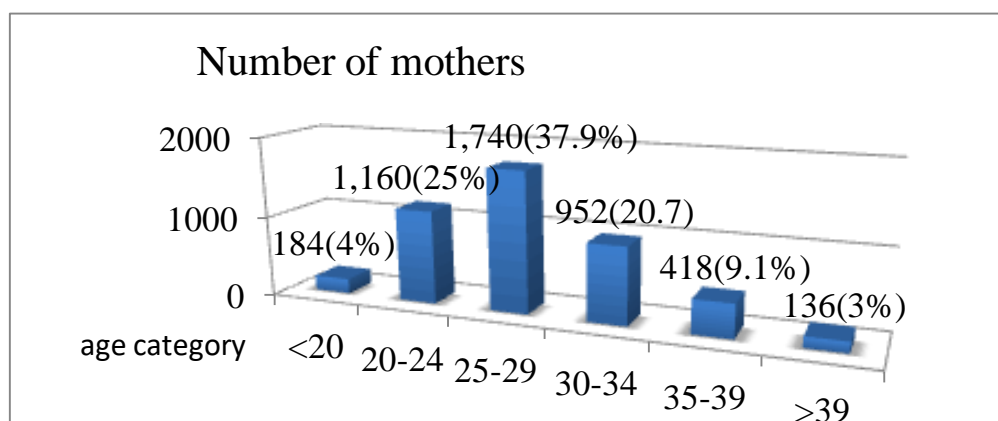


Figure 1: Frequency of age categories of mothers with term and singleton deliveries

The mean age of participants, parity and GA are respectively shown below on Table 1. The study has included all mothers with a parity of 0 (nulliparous

women) to a parity of 9. Of the 4,590 participants, more than half (53.2%) were nulliparous, as shown on Figure 2.

Table 1: **Socio demographic features of mothers with term and singleton deliveries**

	Maternal age	Parity	Gestational age Last Normal Menstruation period
Mean	27.48	.90	39.77
Std. Deviation	5.35	1.30	1.29

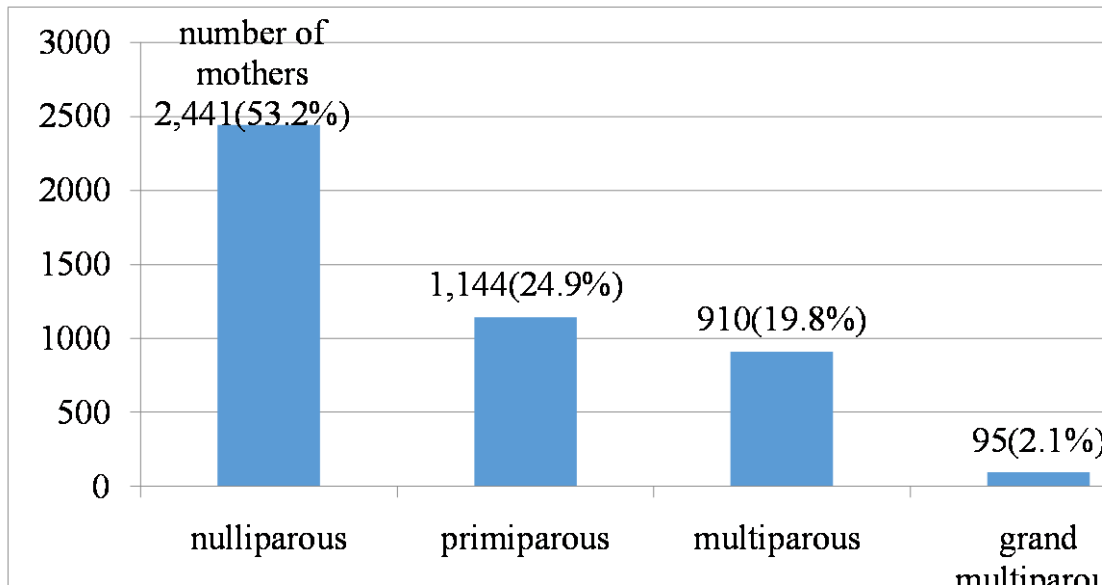


Figure 2: **Frequency of age category of mothers with term and singleton deliveries**

As indicated on Table 2 below, more than half (53.2%) of all mothers with term and singleton deliveries were nulliparous (parity = 0); 24.9% were primiparous; 19.8% were multiparous; and only 2.1% were grand multiparous.

gradually becomes decreased from parity = 1 (primiparous) to grand multiparous (parity 5 or more). The change in MBW was highest from parity 2-4 (multiparous) to parity 5 or more (grand multiparous). Approximately 37.9% of mothers were in the 25-29 age group, with only 3% of mothers with term and singleton deliveries aged ≥40.

The mean birth weight (MBW) was higher among primiparous than nulliparous women, however, it

Table 2: **Mean birth weight with respect to parity groups for the study on the effects of maternal age and parity on birth weight of newborns of mothers with term and singleton deliveries**

Parity	Frequency	Mean birth weight±standard deviation (in grams)	P-value
0 (nulliparous)	2,441 (53.2%)	3,155.2±512.1	0.01
1 (primiparous)	1,144 (24.9%)	3,170.7±491.4	0.011
2-4 (multiparous)	910 (19.8%)	2,833.8±646.8	0.01
≥5 (grand multiparous)	95 (2.1%)	2,191.6±647.6	0.001

Table 3 below showed that the MBW decreased from age ≤19 to age 20-24, increased at age 25-29, and decreased from age 25-29 to age ≥40. The MBW

increment was highest from age 35-39 to age 40 and above.

Table 3: Mean birth weight with respect to maternal age for the study on the effects of maternal age and parity on birth weight of newborn of mothers with term and singleton deliveries

Maternal age (years)	Frequency	Mean birth weight±standard deviation (in grams)	P-value
≤19	184 (4%)	3,159.1±518.8	0.765
20-24	1,160 (25.3%)	3,144.1±514.8	0.718
25-29	1,740 (37.9%)	3,168.1±506.2	0.299
30-34	952 (20.7%)	3,004.2±589.9	0.00
35-39	418 (9.1%)	2,844.7±664.3	0.052
≥40	136 (3%)	2,397.8±673.5	0.006

According to the present finding, the mean birth weight of newborns was= 3,075.4±569.58 grams (mean±SD). The mean gestational age of newborns was 39.77±1.28 weeks (mean±SD).

Table 4 below indicated that independent variables such as parity categories (0, 1, 2-4, and 5 or more) and age categories (≤19, 20-24, 25-29, 30-34, 35-39 and ≥40) were analyzed by binary and multiple logistic regression to assess their significance with LBW. Age groups 30-34 and parity 2-4 (multiparous) were taken as a reference.

Independent variables (covariates) in the binary and multiple logistic regression model were tested for their significance with LBW; those covariates with a *p*-value ≤0.05 at 95% CI (**), such as parity 0, 1, 2-4 (ref.) and 5 or more and maternal age ≥40, were considered as significant with LBW. However, the remaining age groups were not.

Nulliparous women (*p*=0) had an AOR of 0.23 (CI: 0.19, 0.38), which implies that they have no risk of having an LBW baby compared to multiparous women, and further implying that nulliparous women were unlikely to have an LBW newborn.

Primiparous women (*p*=1) had an AOR of 0.22 (CI: 0.16, 0.30), implying that they have no increased risk of delivering an LBW baby compared with multiparous women. So, primiparous women were unlikely to have an LBW newborn.

However, grand multiparous women (*p*≥5) had an AOR of 3.89 (CI: 2.19, 6.93), indicating a 3.89 times greater risk of delivering an LBW baby compared with multiparous women (*p*=2-4).

Mothers aged 40 and above had an AOR of 1.9 (CI: 1.215, 3.15), indicating a 1.89 times greater risk of delivering a baby with LBW compared with those in the 30-34 age group.

Table 4: Odds ratios by parity and maternal age on birth weight for term and singleton deliveries

Variables	Low birth weight	Multiple logistic regression	
	Frequency (%)	P-value	AOR (95% CI)
Parity			
0	2,441 (53.2%)	.000	0.267 (0.19, 0.37)**
1	1,144 (24.9%)	.000	0.218 (0.16, 0.30)**
2-4	910 (19.8%)	.000	Ref.
5 or more	95 (2.1%)	.000	3.89 (2.19, 6.93)**
Maternal age (years)			
≤19	184 (4%)	0.765	1.08 (0.63, 1.86)
20-24	1,160 (25.3%)	0.718	1.07 (0.75, 1.523)
25-29	1,740 (37.9%)	0.299	0.84 (0.623, 1.157)
30-34	952 (20.7%)	0.000	Ref.
35-39	418 (9.1%)	0.052	1.30 (0.997, 1.699)
≥40	136 (3%)	0.006	1.96 (1.215, 3.15)**

Reference exposure: parity 2-4; age 30-34

Discussion

This study intended to investigate the effect of maternal age and parity on the birth weight of newborns of 4,590 mothers with term and singleton deliveries.

The findings of the study showed that grand multiparous (*p*=5 or more) women with term and singleton deliveries had a 3.89 times greater risk of delivering LBW babies than multiparous women.

Nulliparous and primiparous women were unlikely to deliver LBW babies compared to multiparous women. This finding is consistent with a prospective study conducted in Iran in 2013 of 858 mothers with term and singleton deliveries, which showed that birth weight increased appreciably from first to second births (*p*=0.042) and decreased significantly from second to fourth birth and above (*p*=0.031). A study carried out in Jimma University in 2015 showed that LBW was higher among grand multiparous women compared to

low parity groups. In addition, a health survey study of 60 sub-Saharan countries revealed a pattern of increasing risk of LBW deliveries at extremely high parities (9,17,18). These similarities may be due to the large sample size of the studies, and the fact that grand multiparous women are highly associated with adverse fetal outcomes like low birth weight.

In contrast to the present study, a study of 378 pregnant women conducted in India at Guwahati Hospital showed that there was a high risk of a baby being underweight in primiparous women than other parity groups (21). A meta-analysis study from 14 cohorts studies which was conducted in the USA revealed that nulliparous women compared with women who were parity 2 or more had the highest odds ratio (risk) of having a baby with LBW (adjusted odds ratio OR: 1.80) (2). In addition, a prospective cohort study conducted in Cambridge University Hospital, which included 1,335 term and singleton deliveries, indicated that infants of primiparous women were lighter than those born to multiparous women. A cross-sectional study conducted in Kolkata, India of 331 singleton delivered children found that primiparous ($p=1$) women had two times the risk of delivering an LBW baby compared with parity = 2, and a four times greater risk of delivering an LBW baby compared to parity = 3 and above (7,22). These differences might be due to the fact that there are genetic variations among population; t, and environmental factors (altitude, diet).

The present study revealed that a maternal age of 40 and above was associated with a 1.96 times greater risk of having an LBW baby compared with the 30-34 age group. However, other age groups were not significantly associated with LBW.

In agreement with this finding, a retrospective study of 2,551 mothers conducted in Japan in 2017 suggested that pregnant women aged ≥ 40 were at a 1.97 times higher risk of delivering an LBW babies compared to the reference group (30-34 years) (19). Similarly, a prospective study conducted in Iran in 2013, which included 858 mothers with term and singleton deliveries, indicated that a maternal age of 40-44 accounted for large decrements in the birth weight of singleton and term deliveries. In addition, a study conducted in Gonder Referral Hospital, northern Ethiopia, confirmed that birth weight decreases as maternal age increases (9,12), while a further study undertaken in Tikur Anbessa Specialized Hospital in Addis Ababa revealed that pregnant mothers aged 35 and above were found to have a 3.2 times higher risk of having an LBW baby compared to other age groups (11). These similarities reflect the fact that the age groups of the women in these studies were similar.

In contrast to the current study on the effect of maternal age on birth weight, a study done in Jimma, southwest Ethiopia, revealed that maternal age did not significantly affect the birth weight of newborns. Similarly, a population comparison study undertaken in Japan showed that maternal age was not associated with the birth weight of newborns (21,22). Finally, a

retrospective study done in Kolkata, India, on 331 singleton-delivered children showed that young mothers (<19 years) had a three times (AOR = 2.91, 95% CI: 1.53, 5.65, $p < 0.001$) greater risk of delivering an LBW baby compared to other age groups (9). These differences might be due to the inadequate sample size of the studies compared to the current one.

According to the present study, the MBW was $3,075.41 \pm 569.58$ grams (mean \pm SD). This is a lower MBW than a retrospective study conducted in Jimma, southwest Ethiopia, which was $3,183 \pm 25$ grams and one cross-sectional prospective study done in Metu Karl Hospital, southwest Ethiopia, which included 1,832 singleton births, in which the MBW was 3,147 grams (15,16).

On the other hand, the current study finding of MBW was higher than a prospective descriptive study conducted in Gonder Referral Hospital, northern Ethiopia, where the MBW of 373 singleton term neonates was approximately $3,003 \pm 600$ grams. And in an earlier prospective study carried out in 1999 at Tikur Anbessa Specialized Hospital, the MBW was $3,065 \pm 465$ grams (19,20). These birth weight differences might be due to genetic as well as lifestyle factors, such as chewing chat, drinking alcohol and cigarette smoking.

Conclusions

The risk of delivering LBW babies was higher in grand multiparous (parity = 5 or more) women compared with multiparous women. In contrast, primiparous and nulliparous women had no increased risk of giving birth to LBW newborns.

In the current study mothers aged 40 and above had a 1.96 times greater risk of having LBW newborns compared to mothers in the 30-34 age group. The rest of the age groups were not associated with increased risk of having LBW newborns.

Finally, the result will be important to be used by national health policy makers to take early possible measures to reduce rate of LBW and to bring ideas supporting.

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