

# Evaluation of the Prevalence of Macrosomia and the Maternal Risk Factors

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## ABSTRACT

**Background:** Macrosomia is a term used to describe newborns with a birth weight of 4,000 g or above. Fetal macrosomia increases the risk of perinatal mortality and morbidity. Clavicular fracture, brachial plexus injuries, and hypoglycemia are the important side-effects of this condition. Infant sex and maternal factors including age, body mass index (BMI), height, weight gain during pregnancy, prior history of diabetes, macrocosmic delivery, gestational age, and parity are among factors associated with macrosomia. The purpose of this cross-sectional study was to evaluate the prevalence of macrosomia and the associated risk factors in Asalian Hospital of Khorramabad during July-September 2010.

**Methods:** Data were collected using a questionnaire containing 10 variables as the risk factors for macrosomia. The gathered data were analyzed, using SPSS version 16.

**Results:** Overall, 59 cases of macrosomia were reported among 500 live births. Frequency of macrosomia was estimated at 11.8%. As the results indicated, 69.5% of the neonates were male and 30.5% were female. The maternal risk factors affecting the prevalence of macrosomia included maternal age at pregnancy, obesity (BMI $\geq$ 30), weight gain more than 18 kg during pregnancy, prior history of diabetes mellitus, history of macrosomic birth, prolonged gestation, and multiparity (parity $\geq$ 5). However, there was no significant relationship between mother's occupation and macrosomia.

**Conclusion:** As the results indicated, the prevalence of macrosomia was high in Khorramabad city (11.8%). Therefore, in order to prevent macrosomia, it is recommended that mothers over 35 years of age avoid pregnancy via contraceptive methods. In addition, maternal obesity should be prevented before pregnancy by suitable diets, and blood glucose monitoring should be performed during pregnancy via insulin therapy.

**Keywords:** Macrosomia, Maternal risk factor, Neonate, Weight

## Introduction

Macrosomia is defined as birth weight more than 4,000 grams; this term may also refer to the huge body of the fetus. As the statistics have indicated, the frequency of macrosomia is about 5% of all deliveries. Moreover, the prevalence of this condition in the United States has been estimated at 10% (1-4).

Many maternal factors can contribute to the incidence of macrosomia including gestational diabetes mellitus (GDM) (2, 5), pre-pregnancy obesity (6), weight gain more than the suggested cut-off points during pregnancy (2), maternal height (7), maternal age (7, 8), multiparity (8, 9), gestational age (9), infant sex (1, 10), and prior history of macrosomic delivery (10, 11).

The amount of maternal weight gain during pregnancy can be an important predicting factor for fetal growth (6). Normal weight gain during pregnancy can be affected by pre-pregnancy

obesity or mother's nutritional status during pregnancy. In general, overweight women should gain less weight during pregnancy (6, 11, 12).

The normal duration of pregnancy ranges between 37 and 42 weeks since the last menstrual period (average= 40 weeks) (8, 9, 13). Prolonged gestation (PG) refers to a pregnancy lasting more than 42 weeks. The prevalence of PG is 3-12%, with an average of 10% (2, 3, 7, 14, 15). In PG, most fetuses continue to grow, thus increasing the incidence of head and hip disproportion and shoulder dystocia. Moreover, the incidence of macrosomia is directly associated with Menstrual age; therefore, the safest age for pregnancy is 20 to 35 years for mothers (1, 5, 7, 16).

Macrosomia is a common complication, which can increase the risk of lacerations (2, 3), cesarean delivery (4), hysterectomy, postpartum hemorrhage, infections, thrombotic events, and need for blood

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transfusion (7, 8, 10-13). On the other hand, the fetus can be at risk of asphyxia, intracranial hemorrhage, shoulder dystocia, brachial plexus palsy, clavicle fractures, stillbirth, hypoglycemia, hypocalcaemia, hyperbilirubinemia, and prolonged stay at neonatal intensive care unit (NICU) (7, 10-13).

As the literature suggests, macrosomia leads to different complications for mothers and fetuses (10). Therefore, prevention, diagnosis, and treatment of this condition are of high significance. The aim of this study was to determine the prevalence of macrosomia and evaluate the associated predisposing factors in Khorramabad city, Iran.

## Materials and Methods

### Study setting

This study was performed in Khorramabad city, the capital of Lorestan Province. Khorramabad is located in the west of Iran, near the Zagros Mountains. According to a census performed in 2006, the population of this city was 328,544 in 75,945 families (17).

### Study samples

The study population included 500 mothers, admitted to the Asalian Maternity hospital of Khorramabad during July-September 2010. It should be mentioned that Asali Hospital is the only public women's hospital in Khorramabad city.

### Data collection

A researcher-made questionnaire, evaluated by 5 faculty members of Lorestan University of Medical Sciences (LUMS), was given to the subjects for collecting data including maternal age, pre-pregnancy weight, gestational weight before delivery, maternal height, prior history of GDM, parity, gestational age, mother's history of macrosomic birth, mother's occupational status, and infant sex.

### Ethical considerations

All the gathered information and data, related to mothers and their infants, were secretly coded, and the data were only used by the research team.

### Statistical analysis

Data analysis was performed by SPSS version 16. Correlations between the prevalence of macrosomia and variables such as maternal age, height, occupational status, gestational age, history of macrosomic birth, pre-pregnancy body mass index (BMI), and parity were evaluated by

multivariate logistic regression. The model's prediction accuracy was approximately 89%.

## Results

In this study, the prevalence of macrosomia was 11.8%, i.e., 59 infants were macrosomic. Overall, 69.5% and 30.5% of infants were male and female, respectively.

Predisposing maternal factors including maternal age, obesity ( $\text{BMI} \geq 30$ ), weight gain of about  $\geq 18$  kg during pregnancy, prior history of GDM, history of macrosomic birth, PG, and multiparity ( $\text{parity} \geq 5$ ) were significantly correlated with the prevalence of macrosomia ( $P < 0.05$ ).

The highest prevalence of macrosomia was reported in mothers, aged 35 years or more (18.5%), and the lowest incidence rate was related to mothers younger than 20 years of age (5.8%) ( $P = 0.07$ ).

No macrosomic birth was reported in mothers with BMI less than  $18.5 \text{ kg/m}^2$ ; macrosomia was mostly found in mothers with  $\text{BMI} \geq 30 \text{ kg/m}^2$  (31.6%). In addition, the prevalence of macrosomia was 18.6% in mothers with weight gain  $> 18$  kg during pregnancy.

In this study, parity was significantly correlated with the prevalence of macrosomia, i.e., high parity resulted in the higher prevalence of macrosomia. Similarly, maternal height was directly associated with macrosomia; in fact, taller mothers had more macrosomic births. Moreover, prior history of macrosomic birth was significantly related to the incidence of macrosomia; in other words, prior history of macrosomic birth increased the risk of having macrosomic infants.

As the results indicated, GDM had a positive and significant association with the incidence of macrosomia. The mean gestational age was 279.88 days in the macrosomic group and 273.97 days in the non-macrosomic group. Multivariate logistic regression showed that the risk of macrosomic birth in non-diabetic mothers was 84.7% lower than diabetic mothers.

The majority of macrosomic infants were boys. In fact, our results showed that the incidence of macrosomia in male infants is 2.331 times higher than female neonates. In addition, a 1-week increase in gestational age could increase the risk of macrosomia by approximately 9%. Based on our results, maternal age, occupational status, and gravid had no significant correlation with the prevalence of macrosomia.

## Discussion

Based on our findings, the prevalence of macrosomia is high (11.8%) in Khorramabad city. The prevalence of macrosomia was significantly correlated with maternal age ( $\geq 35$  years old), maternal weight ( $\text{BMI} \geq 30$ ), weight gain during pregnancy, prior history of diabetes, multiparity ( $\geq 5$ ), weight gain during pregnancy, prior history of macrosomic birth, and male infant sex. Furthermore, multivariate logistic regression model showed that gestational age, GDM history, prior history of macrosomic birth, and maternal height had the most significant correlations with the prevalence of macrosomia, respectively.

According to a cross-sectional study by Gharibzadeh et al., the prevalence of macrosomia was estimated at 6.1% in Tehran, Iran. Also, the risk of macrosomia increased with maternal age, prior history of diabetes in mothers, maternal obesity, multiparity, and PG (18).

Fakhri showed that macrosomia can be categorized into two groups: 4000-4499 g and 4500 g or more. In 1998, Fakhri showed that the prevalence of macrosomia in 4000-4499 g group is 5.1%, while its prevalence in the 4500 g group is 1.1%. In consistence with our study results, the prevalence of this condition was correlated with maternal GDM, PG, obesity, parity ( $\geq 5$ ), and 95<sup>th</sup> percentile (or higher) of BMI (based on pre-pregnancy maternal weight) (19).

Fakhri et al., in another study at Imam Khomeini Hospital of Tehran, showed that the prevalence of macrosomia is approximately 4.3% (20). In another similar study in Mashhad, Iran, Ma'moory et al. showed that multiparity and PG can be two of the most important predisposing factors for macrosomia (21). Another study conducted in Kerman, Iran, showed that the prevalence of macrosomia is about 68.8% among boys and 31.2% among girls. However, the prevalence of diabetes was 49% and 0.5% in mothers with and without macrosomic births, respectively (22).

Metzger et al. performed a study on 23,000 pregnant women in the United States. They showed that the incidence of macrosomia is about 13.6% among obese mothers and 20.2% among diabetic and obese mothers (23). Moreover, as a previous study indicated, a 25% increase in pre-pregnancy BMI is a very important predisposing factor for macrosomia; in fact, the incidence of macrosomia in cases with high BMI is 200 times more than others (24).

Saberi et al. showed that the incidence of macrosomia is lower in central parts of Iran,

compared to other regions. Moreover, the incidence of macrosomia was correlated with PG, although it did not have a significant relationship with high parity (25).

A study undertaken in Nigeria showed that 90.9% of macrosomic births occurred in the full term group, while in adverse 3.5% were observed in the other groups (26). In another article, predisposing factors for macrosomia were evaluated, and the results showed that maternal obesity, multiparity, GDM, and PG were predisposing risk factors for macrosomia (27).

In congruence with our study results, Ekabu et al. showed that the prevalence of macrosomia was about 4%, and the mean of mother's age was 27.2 years. Parity in about 58% of mothers was  $\geq 5$ , and the number of macrosomic boys was 2.1 times more than girls. In addition, the incidence of macrosomia had a significant correlation with the prior history of macrosomic birth, maternal weight, diabetes in mothers, and PG (28).

Consistent with our findings, in some previous studies, predisposing factors such as GDM, PG, prior history of macrosomic birth, infant sex (male gender), maternal weight, and maternal age were considered to be important factors for macrosomic birth (29-34).

## Conclusion

As the results indicated, the prevalence of macrosomia was very high in Khorramabad city. The prevalence of macrosomia was significantly correlated with maternal age, pre-pregnancy weight, weight gain during pregnancy, maternal diabetes, and duration of pregnancy. Therefore, effective and sufficient diet before and during pregnancy, weight management before and during pregnancy, blood glucose monitoring, and governmental policies are essential for preventing macrosomia among infants.

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