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Study on prevalence of Macrosomia and associated maternal risk factors in our population

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Abstract
Introduction: Macrosomia is defined as birth weight more than 4,000 grams or greater than 90% for gestational age after correcting for neonatal gender and ethnicity. Its prevalence varies among different races and different ethnic groups; it affects approximately 6-10% of all new-born.
Objectives of the study: To determine the prevalence of macrosomia and to evaluate the associated predisposing factors in our population.
Materials and Methods: We obtained the written informed consent form from all the subjects involved in our study. Data collection questionnaire was given to the subjects for collecting the information regarding maternal risk factors. Those with singleton pregnancy regardless to maternal age, number of parity, type of previous delivery, those willing to participate were included in the study. Multiple pregnancies, pre-gestational or gestational diabetes mellitus, and those who had given birth to a baby with a birth weight of < 500 grams were excluded from the study.
Results: In our study, we found that the prevalence of macrosomia was 12.23%, 68 infants had macrosomia out of 556 infants being delivered during the study period. Over all, 58% and 52% of infants were male and female respectively. The prevalence of macrosomia was well correlated with the maternal risk factors assessed in our study.
Conclusion: As the results indicated, the prevalence of macrosomia was very high in our population. The prevalence of macrosomia was significantly correlated with maternal age, pre-pregnancy weight, weight gain during pregnancy, maternal diabetes, and duration of pregnancy.

Keywords: gestational diabetes mellitus, macrosomia, prevalence, maternal age and obesity

Introduction
Macrosomia (huge body of the foetus) is defined as birth weight more than 4,000 grams or greater than 90% for gestational age after correcting for neonatal gender and ethnicity (90th percentile). Its prevalence varies among different races and different ethnic groups; it affects approximately 6-10% of all new-born. The diagnosis of fetal macrosomia can be made only by measuring birth weight after delivery; therefore, the condition is confirmed only after delivery of the neonate. Fetal macrosomia is encountered in up to 10% of deliveries [1].
It is known that fetal macrosomia is associated with several maternal and perinatal complications such as infection, postpartum haemorrhage, prolonged labour, high degree perineal tears, caesarean delivery, anaesthetic accidents, and thromboembolic events [2]. According the American College of Obstetricians and Gynecology (ACOG) practice bulletin macrosomic foetuses have a greater risk for perinatal asphyxia, meconium aspiration, clavicular fracture, brachial plexus injury, and shoulder dystocia [3]. Furthermore, previous reports have shown that macrosomic infants are at increased risk of developing hypertension, obesity, and type 2 diabetes mellitus in adulthood [4].
Many maternal factors contribute to the incidence of macrosomia which include gestational diabetes mellitus (GDM), pre-pregnancy obesity, weight gain more than the suggested cut-off points during pregnancy, maternal height, maternal age, multiparity, gestational age, infant sex, and previous history of macrosomic delivery. The amount of maternal weight gain during pregnancy can be an important predicting factor for fetal growth. Normal weight gain during pregnancy can be affected by pre-pregnancy obesity or mother's nutritional status during pregnancy. Prolonged gestation can also be one of the risk factor for the development of macrosomia, as in PG most foetuses continue to grow thus increasing the incidence of head and hip disproportion and shoulder dystocia [5-10]. Hence we have taken up this study to find out the Prevalence of macrosomia and associated maternal risk factors in our population.

Objectives of the study
The objectives of our study were to determine the prevalence of macrosomia and to evaluate the associated predisposing factors in our population

Materials and Methods
Source of data and Study design
Cohort study was conducted at Obstetrics and Gynecology Department, Dept. of OBG, NC Medical College, Panipat form June 2019 to March 2020. We obtained the written informed consent form from all the subjects involved in our study.

Inclusion Criteria
Those with singleton pregnancy regardless to maternal age, number of parity, type of previous delivery, those willing to participate were included in the study.

Exclusion Criteria
Multiple pregnancies, pre-gestational or gestational diabetes mellitus, and those who had given birth to a baby with a birth weight of < 500 grams were excluded from the study.

Data collection
Data was collected from the case files or directly by the questionnaire of these subjects participated in the study regarding 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. Body mass index (BMI) was defined as the mass in kilograms divided by the square of the body height in meters (kg/m^2) and classified as per WHO. GDM was diagnosed as per Carpenter and Coustan criteria [11, 12].

Antenatal Assessment of Gestational Age
If menstrual cycles were regular and abdominal examination findings correlated, then the last menstrual period (LMP) was taken as the best estimate of gestational age. If menstrual cycles were irregular or the LMP was unknown, a scan at the first antenatal visit for women in their first and second trimesters was performed, and the gestational age by ultrasound scan was recorded. Hadlock's formula was used for the estimation of gestational age. CRL measurement was used up to 13 weeks of gestation. From 14 weeks gestation onward, the average of the biparietal diameter (BPD), head circumference (HC), femur length (FL), and abdominal circumference (AC) measurements was used.

Large for Gestational Age
For each gestational week of pregnancy, the 90th percentile of the birth weight was calculated. Babies whose birth weight was more than the 90th percentile of the cut-off values specific for gestational ages based on all deliveries that met inclusion criteria, were categorized as LGA.
Only deliveries that occurred between 28 and 42 weeks of pregnancy were considered in this study.

Measurements
The outcomes measurements were maternal characteristics and medical history delivery details and maternal and perinatal morbidity data were observed.

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.

Results
We included 556 mothers admitted to our hospital in our unit during the study period. In our study, we found that the prevalence of macrosomia was 12.23%, 68 infants had macrosomia out of 556 infants being delivered during the study period. Over all, 58% and 52% of infants were male and female respectively. All the maternal risk factors were evaluated and correlated with the prevalence of macrosomia. Maternal age was evaluated: we found that the prevalence of macrosomia was (47%) in mothers aged 35 years. Family history was evaluated: we found prevalence of 23.5% in subjects with family history of macrsomia. Past History was evaluated: we found prevalence of 26.4 % in subjects with previous history of macrsomia. BMI was evaluated: we found that macrosomia was highly prevalent 45.5% in subjects with BMI>30 kg/m^2. Subjects diagnosed with Gestational Diabetes had macrosomic new-born with incidence of 42.6%, signifying that the GDM is a high-risk factor for macrosomia. Multiparity was evaluated: we found prevalence of 80.8 % in subjects with multiparity.

Table 1: Shows the maternal risk factors among the Subjects Studied (no = 400)

	Macrosomia (no)	Percentage (%)
1. Maternal Age >35 years (n=38)	32	47%
2. Family History (n=23)	16	23.5%
3. Past History (n=24)	18	26.4%
4. Obesity (n=41)	31	45.5%
5. Diabetes (n=36)	29	42.6%
6. Multiparity (n=72)	55	80.8%

Discussion
In our study, we found that the overall prevalence of macrosomia was 12.23%, 68 infants had macrosomia out of 556 infants being delivered during the study period. Over all, 58% and 52% of infants were male and female respectively. The prevalence of macrosomia was high in maternal age >35 years, family history and previous history of macrosomia, obesity, diabetes, and multiparity. All these maternal risk factors were well correlated with the prevalence of macrosomia. The studies conducted by Gharibzadeh *et al*., the showed 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 [13]. 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%. [14] 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. 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 [15, 16]. Diabetes and macrosomia: Maternal insulin is known to be the primary hormone responsible for intrauterine foetal growth. During pregnancy, irregularity of maternal postprandial blood glucose levels and excessive insulin secretion, especially in the second- and third-trimester can cause foetal macrosomia. A systematic review by Falavigne *et al*. reported that treatment of gestational diabetes mellitus (GDM) was effective in reducing the rates of macrosomia, preeclampsia, and shoulder dystocia. Therefore, the risk of foetal macrosomia should be considered during prenatal care for pregnant women with pre-gestational diabetes mellitus or GDM [17, 18].

Conclusion
The prevalence of macrosomia was very high in our population. 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 play a key role in preventing macrosomia among infants.

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