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# Rate of Fetal Macrosomia with Maternal and Early Neonatal Complications in Internally Moved People Affected by Violence

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## ABSTRACT

***Background:*** *Fetal macrosomia is usually distressing to obstetricians and neonatologists. In the current study, involved mothers had poor social and medical circumstances, as they were migrated forcefully within the country borders due to war, from their original homeland to safer camps which had miserable situations.* ***Objectives:*** *To study rate, risk factors, and complications of macrosomia in people with low socio-economic living conditions and missed medical follow up.* ***Methods:*** *All internally displaced pregnant women who gave birth to neonates weighed ≥4000 g were involved in the study. All required history, examination, care, and investigations were practiced by the attending obstetrician and neonatologist. Cases of normal birth weight neonates from the same sample of internally moved mothers were considered as controls.* ***Results:*** *Fetal macrosomia rate was 15.77% (143 out of 907). Observed significant macrosomia risk factors were maternal age ≥30 years, multiparity, body mass index ≥30, previous or family history of macrosomia, gestational age >40 weeks, cesarean section, diabetes, and hypertension. Meconium-stained liquor, shoulder dystocia, uterine atony, and genital trauma, were major maternal complications, while main neonatal sequelae were Apgar score (<7) at first minute, birth asphyxia, admission to NICU, hypoglycemia, polycythemia, and respiratory distress.* ***Conclusion:*** *Higher rate and more frequently encountered risk factors of macrosomia than national and international figures found in our sample (of forcefully moved mothers) were probably related to poor living circumstances, and absence of regular medical follow up with antenatal care.*

**Keywords:** Macrosomia, Rate, Sequelae, Forcefully displaced mothers, Poor medical care, Socio-economic state

## INTRODUCTION

Exaggerated intrauterine fetal growth or birth weight ≥4000 g could define macrosomia, but in fact, no neonatal birth weight parameter has been used to identify macrosomia, including >4000 g to 4500 g, and >90$^{th}$-95$^{th}$ centile for gestational age and sex [1,2].

Delivering a giant baby is distressing to the mother, her baby, obstetrician, and neonatologist. It may lead to unfavorable outcomes during the whole process started from pregnancy through delivery and finally after giving birth [3].

Maternal risk factors with certain diseases are a major key that assists macrosomia occurrence, leading to different complications affecting both mother and her baby [2].

Little attention has been offered to high birth weight infants even though they have elevated perinatal morbidity and mortality rates. It is important to study fetal macrosomia in order to aid in better management of affected pregnancies, and anticipate their sequelae [4,5].

### Objectives

To look deeply into the issue of fetal macrosomia regarding its rate, risk factors, and complications (maternal or neonatal), in mothers forcefully displaced because of violence, and lived in camps and habitations with bad circumstances and poor medical services.

## PATIENTS AND METHODS

This prospective work took place at Medical City Hospital, Department of Obstetrics and Gynecology, and in neonatology unit, in Baghdad, Iraq, from 1st of December 2017 till the end of May 2018. During the above 6 months, only pregnant ladies who visited the hospital aiming to deliver their babies and forcefully left their own houses and land were involved.

These women came from internally moved or displaced families to safer places or camps within the country, because of the war that broke out in their areas. Although these camps were away from violence, they had low social, medical, and environmental living conditions. These pregnant ladies did not get regular antenatal care.

After identification of mother`s background address (moved or native), and after delivery all neonates (of internally migrated mothers) were weighed. Only macrosomic term (≥37 weeks of gestation) newborns ≥4000 grams were recruited in the study with their mothers, twins, and triplets were excluded from the study [6].

Newborns delivered to single term mothers (≥37 weeks of gestation) with birth weights 2500-3999 grams (g), were randomly selected as a control group after matching of the sex of babies, in a ratio of 3 controls per one case (of macrosomia). An informed consent was obtained from all mothers and/or caregivers.

Relevant data were collected by the attending obstetrician with full history. In addition, all pregnant women were sent routinely for serum blood sugar (once or more as recommended by the available obstetrician), it should have been ≥92 mg/dl for fasting samples or ≥180 mg/dl for 60 minutes' postprandial, to diagnose diabetes when no history was given [7].

Also, blood pressure was measured for all pregnant ladies; the cut-line to diagnose hypertension was ≥140/90 mmHg [8].

Postpartum hemorrhage was defined as an excessive blood loss of >500 milliliters after delivery [9]. Shoulder dystocia defined as "requirement of additional obstetric maneuvers when gentle downward traction has failed to affect the delivery of the shoulders" [10].

Body mass index (BMI) was evaluated for all involved women based on height and weight. Results were divided into two categories, either <30 (under, normal or over-weight) or ≥30 (obese) [11].

Apgar score was evaluated by the attending neonatologist within 1 minute and 5 minutes after birth. According to the hospital policy, a score of 7-10 needed no intervention; a score of 4-7 might necessitate some prompt and temporary resuscitation parameters, while the least score of 0-3 required immediate aggressive resuscitation including intubation and admission to intensive care unit of neonates [12].

Within the first hour after delivery, all early neonatal macrosomia-related complications were estimated through clinical examination and/or radiological assessment.

A heel pricks capillary blood sample was taken from all involved neonates to test hypoglycemia (<47 mg/dl), and polycythemia [13,14].

This study was approved by a scientific and ethical committee of the College of Medicine, and Al-Kindy College of Medicine, University of Baghdad, Iraq. All procedures performed in the current study were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### Statistical Analysis

Statistical package for the social sciences (SPSS) version 22 was used to analyze the data; statistical tests were utilized as needed. A p-value ≤ 0.05 was considered as statistically significant. Univariate analysis of risk factors was performed by conditional logistic regression so that we could identify how powerful the association was with the outcome.

Analysis through multivariate conditional logistic regression was done on variables that appeared significantly in the previous univariate analysis. Binary logistic regression approach was helpful in analyzing the maternal or the fetal sequelae. Odds ratio (OR) with 95% confidence intervals (CIs), were evaluated for both the risk factors and the complications.

## RESULTS

During the study period, the total number of women gave birth to a single newborn in our hospital was 3248. We found 907 (27.92%) women were internally displaced (moved) due to fighting. Of them, 143 (15.77%) women delivered macrosomic babies (≥4000 grams), which could express the prevalence rate of macrosomia in the current sample. For each woman with macrosomia, another 3 pregnant females without macrosomia were randomly selected from the same total number of internally moved mothers (907), which was named as the control group, to compare it with the case group (with macrosomia).

Case and control groups had 143, 429 pregnant ladies, respectively. Only 1 macrosomic baby within our sample died because of birth asphyxia. His mother was diabetic and obese. Maternal age of 30 years and more, multiparity, obese mothers, previous history or family history of macrosomia, postdate pregnancy, cesarean section delivery, maternal diabetes mellitus, and mother`s hypertension, were statistically significant risk factors for fetal macrosomia (Table 1).

**Table 1 General mother's risk factors**

| Risk factor | Case (macrosomia) group (143) n (%) | Control (normal birth weight) group (429) n (%) | Odds ratio | 95% confidence interval (95% CI) | p-value |
|---|---|---|---|---|---|
| **Maternal age** | | | | | |
| <18 years | 12 (8.39%) | 43 (10.02%) | 1.000 | - | - |
| 18->30 years | 55 (38.46%) | 270 (62.94) | 0.3681 | 0.2493 to 0.5435 | 0.0001 |
| ≥30 years | 76 (53.15%) | 116 (27.04%) | 3.0607 | 2.0692 to 4.5274 | 0.0001 |
| Multiparity | 122 (85.31%) | 176 (41.03%) | 8.3512 | 5.0580 to 13.7885 | 0.0001 |
| **BMI (kg/m$^2$)** | | | | | |
| <30 (under, normal or over-weight) | 52 (36.36%) | 301 (70.16%) | 0.243 | 0.1631 to 0.3620 | 0.0001 |
| ≥30 (Obese) | 91 (63.64%) | 128 (29.84%) | 4.1152 | 2.7624 to 6.1305 | 0.0001 |
| Smoking | 5 (3.50%) | 21 (4.90%) | 0.7039 | 0.2605 to 1.9025 | 0.4889 |
| Previous mother`s history of macrosomia | 30 (20.98%) | 5 (1.17%) | 22.5133 | 8.5409 to 59.3438 | 0.0001 |
| Family history of macrosomia | 21 (14.69%) | 4 (0.93%) | 18.2889 | 6.1610 to 54.2905 | 0.0001 |
| Gestational age >40 weeks | 63 (44.06%) | 15 (3.50%) | 21.735 | 11.7877 to 40.0766 | 0.0001 |
| **Mode of Delivery** | | | | | |
| Cesarean section | 133 (93.01%) | 295 (68.76%) | 6.0414 | 3.0780 to 11.8576 | 0.0001 |
| Normal vaginal | 10 (6.99%) | 134 (31.34%) | 0.1655 | 0.0843 to 0.3249 | 0.0001 |
| Diabetes mellitus | 63 (44.05%) | 18 (4.19) | 17.9813 | 10.1081 to 31.9867 | 0.0001 |
| Hypertension | 36 (25.17%) | 52 (12.12%) | 2.4393 | 1.5153 to 3.9267 | 0.0002 |

Meconium-stained liquor, shoulder dystocia, uterine atony, and genital tract trauma were statistically significant obstetrical risk factors of macrosomia (Table 2). Regarding genital tract injury, only perineal tear caught significance level.

**Table 2 Obstetrical maternal complications**

| Event | Macrosomia group (143) n (%) | Control group (429) n (%) | Odds ratio | 95% confidence interval (95% CI) | p-value |
|---|---|---|---|---|---|
| Meconium-stained liquor | 37 (25.87%) | 30 (6.99%) | 4.6425 | 2.7407 to 7.8637 | 0.0001 |
| Shoulder dystocia | 19 (13.29%) | 3 (0.70%) | 21.7581 | 6.3344 to 74.7366 | 0.0001 |
| Post-partum hemorrhage | 5 (3.50%) | 4 (0.93%) | 3.8496 | 1.0194 to 14.5376 | 0.0468 |
| Atony of uterus | 18 (12.59%) | 6 (1.40%) | 10.152 | 3.9449 to 26.1258 | 0.0001 |
| Genital tract injury | 9 (6.29%) | 3 (0.70%) | 9.5373 | 2.5452 to 35.7382 | 0.0008 |
| Perineal tear | 5 (3.50%) | 2 (0.47%) | 7.7355 | 1.4840 to 40.3208 | 0.0052 |
| Vaginal lacerations | 3 (2.10%) | 1 (0.23%) | 9.1714 | 0.9463 to 88.8844 | 0.0558 |
| Cervical lacerations | 1 (0.69%) | 0 (0.00%) | 9.0421 | 0.3663 to 223.2210 | 0.1783 |

Table 3 concentrated on neonates. Apgar score (<7) at first minute, birth asphyxia, admission to neonatal intensive care unit (NICU), hypoglycemia, polycythemia, and respiratory distress were significantly associated with macrosomia.

**Table 3 Major neonatal sequelae due to macrosomia and general characteristics**

| Outcome | Macrosomia group (143) n (%) | Control group (429) n (%) | Odds ratio | 95% confidence interval (95% CI) | P value |
|---|---|---|---|---|---|
| Brachial plexus injury | 2 (1.41%) | 0 (0.0%) | 15.1767 | 0.7243 to 318.0207 | 0.0797 |
| Skeletal fractures (clavicle or long bones) | 1 (0.69%) | 0 (0.0%) | 9.0421 | 0.3663 to 223.2210 | 0.1783 |
| **Apgar score (<7) at** | | | | | |
| One minute | 10 (6.99%) | 4 (0.93%) | 7.9887 | 2.4651 to 25.8891 | 0.0005 |
| Five minutes | 1 (0.69%) | 3 (0.70%) | 1.0000 | 0.1032 to 9.6907 | 1.0000 |
| Birth asphyxia | 19 (13.29%) | 9 (2.1%) | 7.1505 | 3.1556 to 16.2032 | 0.0001 |
| Admission to neonatal intensive care unit (NICU) | 17 (11.89%) | 22 (5.19%) | 2.496 | 1.2853 to 4.8473 | 0.0069 |
| Hypoglycemia | 36 (25.17%) | 22 (5.13%) | 6.2243 | 3.5145 to 11.0233 | 0.0001 |
| Polycythemia | 8 (5.60%) | 1 (0.23%) | 25.363 | 3.1437 to 204.6226 | 0.0024 |
| Respiratory distress | 18 (12.59%) | 19 (4.43%) | 3.1074 | 1.5820 to 6.1034 | 0.0010 |
| **Sex of newborn** | | | | | |
| Female | 48 (33.57%) | 188 (43.82%) | 0.6477 | 0.4359 to 0.9624 | 0.0316 |
| Male | 95 (66.43%) | 241 (56.18%) | 1.5439 | 1.0390 to 2.2941 | 0.0316 |

## DISCUSSION

Fetal macrosomia is an identifiable challenge in current practice due to associated fetal and maternal complications [2]. Nevertheless, while some of the known risk factors and complications of macrosomia are preventable, there is a worldwide increase in its incidence [4].

There are many publishes throughout the world talk about macrosomia, but herein this study we tried to involve a unique sample of forcefully displaced pregnant women (with their macrosomic babies) to find out if they had the same local or global rates, risk factors, and complications, as most of them had been settled in exceptional conditions of living which might have an impact on the outcome results.

We found that the prevalence rate of fetal macrosomia was (15.77%) which is considered higher than the others average rate. It was (1.4%) in a previous local Iraqi paper and in Turkey, it was (5.2%), while in Hawaii it was (10.9%) [15-17].

These differences in rates may be related to differences in race, ethnicity, climate, and genetic influences [17]. Based on our data, low socio-economic factors with poor medical care might have an influence on such higher rates.

Age of the pregnant mother (≥30 years) was a strong risk factor for fetal macrosomia. It was mentioned in another paper, this may be due to the fact that with increasing mother`s age, there may be an effect on metabolism, thereby accelerating the velocity of growth in the baby [4,18].

Multiparity and increased maternal body mass index were noticed significantly with macrosomia, as said by other researchers with a higher incidence of occurrence [19]. This may be explained by lower socio-economic state and poorer nutritional background related to difficult living conditions seen in our pregnant women, they were apparently slimmer and with less parity than usual local pregnant ladies.

Previous mother`s history or family history of macrosomia were found to have a significant relationship as a risk factor. This opinion was advocated by some workers [20]. Diabetes was historically one of the most famous risk factors of macrosomia and considered as an independent risk factor, it occurred in (44.05%) of our women, which is higher than what was reported by Chinese authors (26%) [10,21].

Our internally displaced women could not reach their obstetricians for antenatal care regularly, and they missed educational sessions about low glycemic index lifestyle during pregnancy, in addition to the virtual hardness of having highly-priced diet food, all these factors, added to racial, social, and environmental parameters, may be behind our elevated rates of diabetes in macrosomia cases.

Maternal complications significantly related to obstetrical events in our sample were meconium-stained liquor, shoulder dystocia, atony of uterus, and genital tract injury [22,23]. Meconium stained liquor occurred in (25.87%),

while shoulder dystocia took place in (13.29%). These results were compared to another local study that mentioned (29.8%) and (13.4%), respectively [15].

Neonatal brachial plexus injury and skeletal fractures were found mainly in macrosomic babies (1.41% versus zero, and 0.69% versus zero) respectively. Nearly similar results were mentioned by other papers [24,25]. Apgar score (<7) at one minute was significantly complicating macrosomic newborns, occurred in (6.99%), which is just close to what was found by reporters from Denmark [26].

Other significant neonatal complications were birth asphyxia, admission to neonatal intensive care unit (NICU), hypoglycemia, polycythemia, and respiratory distress [27,28]. We noticed that rates of maternal and neonatal complications found within the current study were in parallel with other published data, this may be related to optimum (or near optimum) medical care offered by our involved hospital during delivery, and shortly after that.

Some limitations were encountered that adversely affect this study, like its short duration (just 6 months), data collected in a single setting, non-availability of some laboratory investigations such as serum electrolytes (for neonates), and some cases of unnoticed gestational diabetes could be missed by absence of glucose tolerance test (in spite of a routine maternal blood sugar sampling on admission).

The prospective approach of this study, sample population type (which was studied for a first time, up to our knowledge), and a cooperative team (obstetricians and neonatologists) who dealt promptly with complications occurred in both sides (maternal and neonatal), represent strong aspects of this study.

## CONCLUSION

After a detailed inspection of our results in contrast to others throughout the globe, the finding of higher rates of macrosomia, with more frequently seen risk factors in forcefully moved people with unhealthy living conditions, should draw the attention of obstetricians, neonatologists, medical staffs, and policymakers. We suggest setting regular visits of health care professionals to camps or interim places (where these mothers live) before and during pregnancy, to educate them about the most important prophylactic health parameters, encourage them to protect themselves and their future babies from macrosomia, and screening for any unnoticed relevant disease such as diabetes or hypertension.

## DECLARATIONS

### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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