# Maternal And Neonatal Outcomes In Non-Diabetic Large For Gestational Age Vs. Appropriate For Gestational Age Births: A Prospective Comparative Study

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## Introduction

Large for Gestational Age (LGA) and Appropriate for Gestational Age (AGA) are terms used to describe the weight of a newborn to their gestational age. LGA is defined as a birth weight greater than the 90$^{th}$ percentile for gestational age (ACOG,2020b).[1] The WHO definition of AGA refers to a fetus or newborn whose birthweight falls between the 10$^{th}$ and 90$^{th}$ percentile for their gestational age.[2] Diabetes, especially gestational diabetes, is a known risk factor for LGA, but the impact of LGA in non-diabetic pregnancies has been less well-studied. This study aims to explore and compare maternal and neonatal outcomes in non-diabetic pregnancies that result in LGA versus AGA births. The findings could offer insights into how LGA affects maternal health, the course of pregnancy, and the immediate neonatal period in the absence of diabetes.

## Materials and Methods

This prospective, comparative, observational study was conducted between 2016 and 2024 at the Mahatma Gandhi Medical College and Research Institute in Pondicherry. This study compared maternal and neonatal outcomes in the non-diabetic LGA group (90 cases): babies with a weight > 4 kg, with the AGA group (90 controls): babies born next to a non-diabetic LGA baby with a birth weight between 2.5 - 4 kg.

The maternal variables included age, parity, gestational age, body mass index (BMI), weight gain during pregnancy, any comorbidities, previous history of macrosomia, need for induction of labour, prolonged latent phase of labour, mode of delivery, indication for caesarean delivery, and delivery complications including atonic PPH, traumatic PPH and perineal tears. The neonatal variables included gender, birth weight, APGAR score, neonatal complications including shoulder dystocia, neonatal hypoglycaemia, birth injury, neonatal intensive care unit (NICU) admission and perinatal death.

## Results

The mean maternal age was similar between the two groups, indicating that age was not a confounding factor. BMI was significantly higher in the LGA group compared to the AGA group, highlighting a strong association between maternal obesity and LGA births. Weight gain during pregnancy was significantly greater in the LGA group, further reinforcing the role of maternal weight gain in fetal macrosomia as shown in Table 1.

**Table 1. Comparison between the groups**

| | Group | Mean | SD |
|---|---|---|---|
| AGE | Case | 26.4222 | 4.2293 |
| | Control | 25.8444 | 3.4929 |

| | Group | Mean | SD |
|---|---|---|---|
| **BMI in kg/m2** | **Case** | **28.0928** | **4.3146** |
| | **Control** | **21.0989** | **1.7601** |
| **WEIGHT GAIN IN PREGNANCY** | **Case** | **15.5722** | **2.7142** |
| | **Control** | **11.4900** | **1.0461** |
| **FETAL WEIGHT in Kg** | **Case** | **4.1643** | **0.1711** |
| | **Control** | **2.9693** | **0.3578** |

Caesarean section (CS) rates were significantly higher in LGA pregnancies (65 patients, 72.2%) compared to AGA pregnancies (17 patients, 18.8%), with emergency CS being more common in LGA cases, as shown in Table 2. Prolonged labour was significantly more common in LGA pregnancies, further justifying the need for operative delivery in these cases. Traumatic postpartum hemorrhage (PPH) was significantly higher in LGA pregnancies (8 cases vs. none in AGA). Atonic PPH was reported in 30 cases of LGA pregnancies (33.3%) compared to only 1 case in AGA pregnancies (1.1%). This suggests that uterine overdistension in LGA pregnancies increases the risk of PPH. Perineal tears were also more common in LGA births due to the mechanical trauma associated with delivering large babies.

**Table 2**

| Maternal Variables | Subcategory | Case | | Control | | p-value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| PARITY | Multiparous | 46 | 58.2% | 33 | 41.8% | 0.0509 |
| | Primigravida | 44 | 43.6% | 57 | 56.4% | 0.0406 |
| GESTATIONAL AGE | 37-40 | 69 | 49.3 | 71 | 50.7 | |
| | More than 40 | 21 | 52.5 | 19 | 47.5 | 0.719 |
| GENDER | Female | 24 | 13.3 | 37 | 20.6 | |
| | Male | 66 | 36.7 | 53 | 29.4 | |
| PREVIOUS HISTORY OF MACROSOMIA | No | 77 | 46.1% | 90 | 53.9% | |
| | Yes | 13 | 100.0% | 0 | 0.0% | |
| NEED FOR INDUCTION | Nil | 57 | 46.3% | 66 | 53.7% | |
| | Macrosomia | 4 | 0.0% | 0 | 100.0% | |
| | Post dates | 17 | 65.4% | 9 | 34.6% | |
| | Premature rupture of membranes | 9 | 47.4% | 10 | 52.6% | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Prolonged latent phase of labour | 7 | 87.5% | 1 | 12.5% | |
| PROLONGED LABOUR | No | 72 | 44.7% | 89 | 55.3% | <0.001 |
| | Yes | 18 | 94.7% | 1 | 5.3% | |
| TRAUMATIC PPH | No | 82 | 47.7% | 90 | 52.3% | |
| | Yes | 8 | 100.0% | 0 | 0.0% | |
| PERINEAL TEAR | No | 75 | 46.0% | 88 | 54.0% | <0.001 |
| | Yes | 15 | 88.2% | 2 | 11.8% | |
| ATONIC PPH | No | 60 | 40.3% | 89 | 59.7% | <0.001 |
| | Yes | 30 | 96.8% | 1 | 3.2% | |

Mean birth weight was significantly higher in LGA newborns (4.16 ± 0.17 kg) compared to AGA newborns (2.97 ± 0.35 kg). APGAR scores at 5 and 10 minutes were slightly lower in LGA newborns, but the difference was not statistically significant. NICU admission rates were comparable between the groups as shown in Table 3. Neonatal hypoglycemia was more common in LGA newborns (5 cases, 5.5%) compared to AGA newborns (1 case, 1.1%), though the difference was not statistically significant.

**Table 3**

| Neonatal Variables | Subcategory | Case | | Control | | p-value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| GENDER | Female | 24 | 13.3 | 37 | 20.6 | |
| | Male | 66 | 36.7 | 53 | 29.4 | |
| SHOULDER DYSTOCIA | No | 87 | 49.2% | 90 | 50.8% | |
| | Yes | 3 | 100.0% | 0 | 0.0% | |
| NICU ADMISSION | No | 72 | 49.7% | 73 | 50.3% | 0.8506 |
| | Yes | 18 | 51.4% | 17 | 48.6% | |
| NEONATAL HYPOGLYCEMIA | No | 85 | 48.9% | 89 | 51.1% | 0.2108 |
| | Yes | 5 | 83.3% | 1 | 16.7% | |
| BIRTH INJURY | Clavicular fracture | 1 | 100.0% | 0 | 0.0% | |
| | No | 89 | 49.7% | 90 | 50.3% | |
| PERINATAL DEATH | No | 90 | 50.0% | 90 | 50.0% | |

## Discussion

There were 21,612 deliveries, and 90 were non- diabetic LGA births in our study. BMI was significantly higher in the LGA group compared to the AGA group, highlighting a strong association between maternal obesity and LGA births. Women with a BMI ≥ 30 are more likely to have LGA infants due to genetic and metabolic factors (Catalano et al., 2012).[3] Maternal weight gain above the recommended guidelines increases the risk of complications like LGA, preterm birth, and cesarean delivery (ACOG, 2013).[4] In our study, weight gain during pregnancy was significantly greater in the LGA group, further reinforcing the role of maternal weight gain in fetal macrosomia. Studies have shown that women who have previously delivered a macrosomic infant are 3 to 4 times more likely to deliver an LGA infant in a subsequent pregnancy (Landon et al., 2011). [5]Our study showed 13 cases with a history of macrosomia in a previous pregnancy delivered LGA infants. Similarly, maternal age, especially advanced maternal age, can increase the risk of fetal overgrowth in subsequent pregnancies (Cunningham et al., 2014).[6] There were no similar results in the present study.

In pregnancies where there is an increased risk of delivering an LGA infant, induction of labour may be considered around 38-39 weeks. The primary reason for this is to avoid complications such as shoulder dystocia, brachial plexus injury, and other forms of birth trauma that may occur in cases of excessive fetal growth (Kovacs et al., 2016).[7]Macrosomia as an indication for induction was nearly 4 cases in our study. Studies have shown that a prolonged latent phase is linked to a higher incidence of CS and labour abnormalities. Neonatal concerns include lower 5-minute APGAR scores and a greater need for resuscitation (Baurd J et al).[8] Fetal macrosomia is a known risk factor for labour abnormalities and CS, which may suggest a potential influence on labour progression, including the latent phase. (Chelmow D et al)[9] In our study, prolonged labour was significantly more common in LGA pregnancies, justifying the need for operative delivery. A study analyzing term singleton deliveries found that 44.0% of LGA infants were delivered via CS, whereas the rate was 26.1% for AGA infants (Zhou ZR, Guo Y et al)[10]. Similar results were obtained in the present study; Cesarean section (CS) rates were significantly higher in LGA pregnancies compared to AGA pregnancies, with emergency CS being more common in LGA cases.

An observational study conducted at a tertiary care center reported that perineal tears occurred in 4% of vaginal deliveries, with traumatic PPH observed in 1.44% of cases. Notably, 92% of the perineal tear cases were associated with the delivery of larger babies, indicating a strong correlation between fetal size and perineal trauma. [11] Similar results were observed in our study, which showed that traumatic postpartum hemorrhage (PPH) was significantly higher in LGA pregnancies. Atonic PPH was reported in 30 cases of LGA pregnancies compared to only 1 case in AGA pregnancies. Perineal tears were also more common in LGA births, due to mechanical trauma associated with delivering large babies. A retrospective study found that LGA pregnancies had a 5.1-fold increased risk of neonatal trauma, including Brachial Plexus Birth Palsy (BPBP) and clavicle/humeral fractures, compared to AGA pregnancies. Specifically, the odds of BPBP increased with birth weight, being 6.9 times higher for infants weighing 4,000 to <4,500 g, 27 times higher for those 4,500 to <5,000 g, and 72 times higher for infants ≥5,000 g**.**[12]Birth injuries were rare in our study but noted in LGA cases (1 case of clavicular fracture, 100% in the LGA group).

LGA neonates had a higher incidence of neonatal hypoglycemia with risks increasing alongside birth weight percentiles.[13] In the present study, Neonatal hypoglycemia was more common in LGA newborns compared to AGA newborns, though the difference was not statistically significant. A study analyzing 1,090 newborns reported a median birth weight of 3.4 kg for males and 3.2 kg for females, with males more frequently classified as macrosomic (5.6% vs. 2.3%).[14] In our study, male gender preponderance was higher among LGA births compared to AGA births, encompassing 70.56% in cases compared to 33.89% in controls. A study concluded that term LGA births exhibited a 55% increased risk of adverse outcomes compared to term AGA births. [15] Though there was no perinatal mortality reported in our study, APGAR scores at 5 and 10 minutes were slightly lower in LGA newborns, but the difference was not statistically significant. NICU admission rates were comparable between the groups.

**Conclusion**

LGA infants have a higher likelihood of experiencing adverse outcomes, and maternal health is also compromised. Healthcare providers must be aware of these risks to ensure better management and outcomes for both mothers and infants. LGA pregnancies are associated with higher rates of labour complications, particularly prolonged labour, emergency CS, and birth trauma. Neonatal hypoglycemia and birth injuries require close monitoring in LGA newborns, even when immediate outcomes appear stable. The study highlights the importance of distinguishing between LGA and AGA births in non-diabetic pregnancies.

**References**

1. Macrosomia: ACOG Practice Bulletin, Number 216. Obstet Gynecol. 2020 Jan;135(1):246-248.
2. World Health Organization. (2016). ICD-10: international statistical classification of diseases and related health problems: tenth revision. World Health Organization.
3. Catalano, P. M., et al. (2012). Obesity and pregnancy: The impact of maternal obesity on pregnancy outcomes. Best Practice & Research Clinical Obstetrics & Gynaecology, 26(1), 1-10.
4. American College of Obstetricians and Gynecologists. ACOG Committee opinion no. 548: weight gain during pregnancy. Obstet Gynecol. 2013 Jan;121(1):210-2.
5. Landon M.B., et al. (2011). The recurrence of large for gestational age infants in subsequent pregnancies. Obstetrics & Gynecology, 118(2), 313-320.
6. Cunningham, F.G., et al. (2014). Williams Obstetrics. 24th ed. McGraw-Hill Education.
7. Kovacs S.A., et al. (2016). The need for labour induction in pregnancies with large for gestational age infants. Journal of Obstetrics and Gynaecology, 36(4), 406-410.
8. Burd J, Woolfolk C, Dombrowski M, Carter EB, Kelly JC, Frolova A, Odibo A, Cahill AG, Raghuraman N. Risks Associated with Prolonged Latent Phase of Labour. Am J Perinatol. 2024 Oct 10.
9. Chelmow D, Kilpatrick SJ, Laros RK Jr. Maternal and neonatal outcomes after prolonged latent phase. Obstet Gynecol. 1993 Apr;81(4):486-91.
10. Zhou ZR, Guo Y. Growth Status of Full-Term Infants with Different Sizes for Gestational Age During the First Year of Life. Pediatric Health Med Ther. 2024 Aug 8;15:265-272
11. Agrawal T, Kalra R, & Suryavanshi A. (2018). Evaluation of complications during third stage of labour among women delivering at tertiary care center. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 7(7), 2706–2713.
12. M.Dodd and P.G.Lindqvist. Antenatal awareness and obstetric outcomes in large fetuses: A retrospective evaluation. European Journal of Obstetrics and Gynecology and Reproductive Biology, Volume 256 (2012), 314 – 319.
13. Weissmann-Brenner A, Simchen MJ, Zilberberg E, Kalter A, Weisz B, Achiron R, Dulitzky M. Maternal and neonatal outcomes of large for gestational age pregnancies. Acta Obstet Gynecol Scand. 2012 Jul;91(7):844-9.
14. Magnano San Lio R, Barchitta M, Maugeri A, Campisi E, Favara G, Granados CO, La Mastra C, La Rosa MC, Galvani F, Pappalardo E, Ettore C, Ettore G and Agodi A (2025) Sex differences in delivery and neonatal characteristics of new-borns from the “MAMI-MED” cohort. Front. Public Health. 13:1498125
15. Suárez-Idueta L, Ohuma EO Chang C-J, Hazel EA, Yargawa J, Okwaraji YB, et al. Neonatal mortality risk of large-for-gestational-age and macrosomic live births in 15 countries, including 115.6 million nationwide linked records, 2000–2020. BJOG. 2023;00:1–12.