# Neonatal Morbidity in Early-Term and Full-Term Newborns: A Retrospective Study at a Tertiary Hospital

*Adelina Sitari[1]*, Filipa Lima[1], Catarina Ferreira[1], Vera Santos[2], Maria Helena Neves de Queirós Gonçalves[3]*

[1]Department of Pediatrics, Unidade Local de Saúde do Algarve – Faro Hospital, Faro, Portugal

[2]Department of Neonatology and Pediatric Intensive Care, Unidade Local de Saúde do Algarve – Faro Hospital, Faro, Portugal

[3]Faculty of Science and Technology, University of Algarve; Center for Statistics and Applications, University of Lisbon, Lisbon, Portugal

***Corresponding author:**

***Adelina Sitari***

Department of Pediatrics, Unidade Local de Saúde do Algarve – Faro Hospital. Rua Leão Penedo 8000-386, Faro, Portugal, E-mail: sitariadelina@gmail.com

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**ABSTRACT**

**Introduction:** Early-term newborns (37–38 weeks) have increased neonatal morbidity compared with full-term newborns (39–41 weeks). This study aimed to compare maternal and neonatal characteristics between both groups.

**Methods:** A retrospective observational study was conducted at a Portuguese tertiary hospital including 390 term newborns. Maternal and neonatal variables were analyzed, including pregnancy complications, birth weight, hyperbilirubinemia, hypoglycemia, feeding pattern, neonatal intensive care admission, and referral at discharge. Student's t-test and Chi-square test were applied.

**Results:** Early-term newborns had lower birth weight (2975.44 ± 458.71 g vs. 3383.49 ± 417.86 g; $p<0.001$), higher neonatal intensive care admission (8.6% vs. 3.3%; $p=0.025$), hyperbilirubinemia (11.2% vs. 4.7%; $p=0.019$), and referral at discharge (15.5% vs. 3.3%; $p<0.001$). Exclusive breastfeeding was less frequent in the early-term group (61.2% vs. 76.6%; $p=0.004$).

**Conclusion:** Early-term newborns showed increased neonatal morbidity compared with full-term newborns. These findings support strategies to avoid elective deliveries before 39 weeks.

**Keywords:** Early Term, Full Term, Neonatal Morbidity, Breastfeeding

## INTRODUCTION

Fetal maturation is a continuous and dynamic physiological process that extends until at least 39 weeks of gestation. Historically, all deliveries occurring after 37 completed weeks



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were classified as "term births," implying complete neonatal adaptation to extrauterine life. However, accumulating evidence over the past two decades has demonstrated significant heterogeneity in neonatal outcomes within the term gestational period itself, leading to the subdivision of term birth into early term (37–38 weeks), full term (39–41 weeks), and late term (≥42 weeks) categories [1,2].

Multiple multicenter studies have consistently demonstrated that early-term neonates exhibit higher rates of respiratory, metabolic, and neurological morbidity compared with full-term neonates [1,3,4]. This increased vulnerability is largely attributable to persistent pulmonary and neurological immaturity at 37–38 weeks of gestation, including reduced surfactant synthesis, incomplete alveolar fluid clearance, and less mature central respiratory regulation [2,4]. Consequently, early-term newborns present increased incidence of transient tachypnea of the newborn, neonatal respiratory distress syndrome, oxygen supplementation requirement, and admission to neonatal intensive care units (NICU).

In parallel, hepatic and glucose metabolic pathways remain functionally immature during this gestational window. Early-term neonates possess lower hepatic glycogen stores and reduced brown adipose tissue reserves, predisposing them to neonatal hypoglycemia. Furthermore, hepatic enzymatic immaturity compromises bilirubin conjugation and clearance, increasing the risk of hyperbilirubinemia and phototherapy requirement [3,5]. These metabolic limitations, combined with decreased sucking efficiency, lower arousal states, and impaired feeding coordination, may negatively affect breastfeeding establishment and maintenance, contributing to lower exclusive breastfeeding rates during the immediate neonatal period [6].

Brain development, particularly involving the cerebral cortex and cerebellum, undergoes substantial volumetric expansion and myelination between 34 and 40 weeks of gestation, influencing neonatal tone, behavioral regulation, autonomic stability, and thermoregulation [4,7]. Therefore, even delivery one or two weeks earlier within the term period may result in clinically significant reduction in neonatal physiological reserve and adaptive capacity.

Within the Portuguese population, Barros et al. estimated that approximately 27% of births occur before 39 weeks of gestation, a prevalence comparable to the European average [5]. A considerable proportion of these deliveries result from elective obstetric interventions, frequently in the absence of compelling medical indications. This trend has contributed to the implementation of restrictive "<39 weeks" policies aimed at postponing elective deliveries until complete fetal maturation is achieved, thereby reducing avoidable respiratory morbidity and unnecessary neonatal hospitalization [2,8].

In addition to its clinical implications, early-term birth represents a significant economic and social burden. Petrou [8] demonstrated that healthcare costs increase progressively with decreasing gestational age, even within the term spectrum, owing to increased surveillance requirements, higher NICU admission rates, and prolonged hospital stay. Furthermore, Leal et al. [7] suggested that early neonatal morbidity may adversely affect long-term neurodevelopmental outcomes and early mother–infant interaction.

Collectively, current evidence challenges the traditional perception that delivery after 37 weeks is uniformly low risk and supports the recognition of early-term birth as a state of relative physiological immaturity requiring differentiated clinical surveillance.

The present study aimed to compare neonatal outcomes between early-term and full-term newborns in a Portuguese tertiary hospital, specifically evaluating differences in respiratory, metabolic, and adaptive morbidity, breastfeeding patterns, and post-discharge referral rates, in order to contribute to national evidence supporting 39 weeks of gestation as a critical physiological milestone for optimal neonatal maturation [9-11].

## METHODS

A retrospective, observational, single-center study was conducted based on the analysis of clinical data from term neonates born at a Portuguese tertiary-care hospital during the first trimester of 2022. The aim of the study was to compare neonatal morbidity between early-term and full-term newborns.

A total of 390 term neonates were included and stratified into two groups according to gestational age:

- **Group 1 – Early-term:** 37–38 weeks of gestation (n=116);
- **Group 2 – Full-term:** 39–41 weeks of gestation (n=274).



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Preterm neonates (<37 weeks of gestation), post-term neonates (≥42 weeks of gestation), and cases with incomplete clinical data were excluded.

Fourteen maternal and neonatal variables were analyzed, including maternal age, mode of delivery (vaginal delivery, instrumental delivery, or cesarean section), presence of gestational complications — namely gestational diabetes mellitus, gestational hypertension, and preeclampsia — birth weight, hyperbilirubinemia, hypoglycemia, feeding type, admission to the Neonatal Intensive Care Unit (NICU), and post-discharge referral.

Hyperbilirubinemia was defined as circulating total bilirubin levels >5 mg/dL, according to the institutional neonatal surveillance protocol used for early biochemical identification of neonatal jaundice. Neonatal hypoglycemia was defined as capillary blood glucose levels <40 mg/dL.

Statistical analysis was performed using IBM SPSS Statistics® software, version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were compared using Student's t-test, while categorical variables were analyzed using the Chi-square test. Statistical significance was established at $p<0.05$.

## RESULTS

A total of 390 term neonates were included, of whom 116 (29.7%) were classified as early-term (37–38 weeks of gestation) and 274 (70.3%) as full-term (39–41 weeks of gestation).

Mean maternal age was significantly higher in the early-term group compared with the full-term group (31.84 ± 6.67 vs. 30.18 ± 5.73 years; p=0.006). A significant association was also observed between gestational age category and the presence of gestational complications ($\chi^2$=19.42; Cramer's V=0.223; p<0.001).

Early-term neonates had a significantly lower mean birth weight compared with full-term neonates (2975.44 ± 458.71 g vs. 3383.49 ± 417.86 g; p<0.001).

A higher frequency of Neonatal Intensive Care Unit admission was observed among early-term neonates (8.6% vs. 3.3%; $\chi^2$=5.07; Cramer's V=0.113; p=0.025), as well as a higher incidence of hyperbilirubinemia (11.2% vs. 4.7%; $\chi^2$=5.47; Cramer's V=0.118; p=0.019).

Exclusive breastfeeding was less frequent in the early-term group (61.2% vs. 76.6%; $\chi^2$=10.817; Cramer's V=0.117; p=0.004), whereas post-discharge referral was significantly more common among these neonates (15.5% vs. 3.3%; $\chi^2$=19.421; Cramer's V=0.224; p<0.001).

No statistically significant differences were found regarding mode of delivery (p=0.194) or the incidence of neonatal hypoglycemia (p=0.444).

Cramer's V coefficients ranged from 0.11 to 0.22, indicating associations of small to moderate magnitude. Overall, early-term neonates demonstrated higher neonatal morbidity compared with full-term neonates (Table 1).

**Table 1:** Comparison of Maternal Characteristics and Neonatal Outcomes Between Early-Term (37–38 Weeks) and Full-Term (39–41 Weeks) Newborns

| Variable | Early-term (37–38 weeks) n=116 | Full-term (39–41 weeks) n=274 | p-value |
|---|---|---|---|
| Maternal age (years) | 31.84 ± 6.67 | 30.18 ± 5.73 | 0.006 |
| Birth weight, (g) | 2975.44 ± 458.71 | 3383.49 ± 417.86 | <0.001 |
| Gestational complications, n (%) | 57 (49.1) | 84 (30.7) | <0.001 |
| Cesarean delivery, n (%) | 39 (33.6) | 71 (25.9) | 0.194 |
| Exclusive breastfeeding, n (%) | 71 (61.2) | 210 (76.6) | 0.004 |
| NICU admission, n (%) | 10 (8.6) | 9 (3.3) | 0.025 |
| Post-discharge referral, n (%) | 18 (15.5) | 9 (3.3) | <0.001 |
| Hyperbilirubinemia, n (%) | 13 (11.2) | 13 (4.7) | 0.019 |
| Hypoglycemia, n (%) | 3 (2.6) | 4 (1.5) | 0.444 |

## DISCUSSION

The findings of the present study demonstrate that, even within the gestational age range traditionally classified as term, clinically relevant differences exist between early-term neonates (37–38 weeks of gestation) and full-term neonates (39–41 weeks of gestation). Early-term newborns exhibited higher neonatal morbidity, reflected by lower birth weight, increased frequency of NICU admission, higher incidence of hyperbilirubinemia, lower prevalence of exclusive breastfeeding, and greater need for post-discharge referral.

Mean maternal age was significantly higher in the early-term group, and a significant association was observed between gestational age and gestational complications. This finding may reflect a higher-risk obstetric profile among pregnancies culminating in delivery before 39 weeks of gestation, frequently associated with conditions such as gestational hypertension, gestational diabetes mellitus, and preeclampsia. Although the retrospective design does not allow causal inference, the results suggest that maternal complications may contribute to earlier delivery and, consequently, to increased neonatal vulnerability.

Mean birth weight was significantly lower among early-term neonates. This result is consistent with previously published international literature and reinforces the importance of the final weeks of gestation for fetal growth, accumulation of energy reserves, and metabolic maturation. Despite both groups being classified as term neonates, the findings suggest that early-term birth may represent a period of still incomplete physiological maturation.

A higher frequency of NICU admission was observed among early-term neonates. This finding is in agreement with previous studies demonstrating increased need for neonatal monitoring and supportive care in this gestational subgroup. Persistent residual respiratory and metabolic immaturity at 37–38 weeks may contribute to a higher incidence of transient respiratory distress, feeding difficulties, and adaptive instability during the first hours of life.

The incidence of hyperbilirubinemia was significantly higher among early-term newborns. This observation may be related to functional hepatic immaturity, particularly reduced bilirubin conjugation capacity during the final weeks of gestation. The increased frequency of hyperbilirubinemia in this group highlights the importance of adequate clinical surveillance and systematic neonatal screening during the early postnatal period.

Exclusive breastfeeding was less prevalent among early-term neonates. This finding is consistent with studies describing reduced sucking effectiveness, increased somnolence, and less mature neuromotor coordination in neonates born before 39 weeks of gestation. These limitations may impair the early establishment of breastfeeding and increase the need for targeted lactation support during the first hours and days of life.

Post-discharge referral was significantly more frequent among early-term newborns, suggesting a greater need for postnatal follow-up related to feeding difficulties, jaundice, or weight monitoring. This finding may also reflect increased clinical awareness regarding the elevated risk profile of this gestational group, enabling earlier intervention and potentially reducing hospital readmissions.

No statistically significant differences were identified regarding mode of delivery or the incidence of neonatal hypoglycemia. The absence of association with hypoglycemia may be related to the overall low frequency of this outcome in the study population or to the implementation of early preventive measures in neonates considered at increased metabolic risk.

Cramer's V coefficients demonstrated associations of small to moderate magnitude, consistent with the multifactorial nature of neonatal morbidity. Nevertheless, the consistency of the observed findings confers clinical relevance to the results and reinforces the concept that even small differences in gestational age within the term period may translate into important differences in neonatal adaptation.

The main strengths of this study include the sample size, the simultaneous evaluation of multiple neonatal outcomes, and the comparative analysis between well-defined gestational age groups. However, several limitations should be acknowledged, particularly the retrospective single-center design, which may limit the generalizability of the findings, as well as the absence of multivariate analysis to control for potential confounding factors, including parity, maternal body mass index, and smoking habits.

Overall, the results of this study support the growing body of evidence indicating that early-term neonates constitute a subgroup with increased clinical vulnerability compared with full-term newborns. These findings reinforce the importance



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of avoiding elective deliveries before 39 weeks of gestation unless medically indicated and support the implementation of neonatal surveillance strategies specifically targeted toward early-term infants

## CONCLUSION

Early-term neonates (37–38 weeks of gestation) demonstrated higher neonatal morbidity, lower birth weight, increased frequency of NICU admission, higher prevalence of jaundice, and lower rates of exclusive breastfeeding at discharge when compared with full-term neonates (39–41 weeks of gestation).

**These findings reinforce the need to:**

I. Avoid elective deliveries before 39 weeks of gestation unless medically justified;

II. Implement specific neonatal surveillance protocols for early-term newborns;

III. Promote exclusive breastfeeding through individualized support during the first hours of life;

IV. Develop national multicenter studies incorporating multivariate analysis and long-term follow-up.

The implementation of obstetric and neonatal care policies guided by this evidence may contribute to reducing preventable neonatal morbidity, optimizing healthcare resources, and improving outcomes among Portuguese newborns.

## STATEMENTS

**Conflicts of Interest:** The authors declare no conflicts of interest.

**Ethics Statement and Patient Consent Statement**

The authors declare that the research presented in this manuscript adheres to the ethical principles outlined by the Unidade Local de Saúde do Algarve Ethics Committee. All procedures involving human participants were conducted in accordance with the ethical standards of Portugal and the Declaration of Helsinki (1964), as revised in 2013. Due to the retrospective and anonymized nature of the study, informed consent was waived.

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