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Retrospective Analysis of Low Birth Weight in NICU Admissions: Incidence, Risk Factors, and Neonatal Outcomes, 2024

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ABSTRACT

Background: Low birth weight (LBW), birth weight below 2500 g regardless of gestational age, remains a major contributor to neonatal morbidity and mortality worldwide, especially in low- and middle-income countries, yet updated local data from eastern Libya are limited. Objective: To determine the incidence of LBW among neonates admitted to the neonatal intensive care unit (NICU) of Tobruk Medical Center during 2024, identify associated maternal and obstetric risk factors, and assess neonatal outcomes. Methods: A retrospective cohort study included all live-born neonates below 2500 g admitted to the NICU during 2024. Maternal (parity, medical history, obstetric complications) and neonatal (gestational age, sex, birth weight, multiple gestation, congenital anomaly, mode of delivery, outcome) variables were extracted from medical records. Incidence and odds ratios (OR) with chi-square testing were calculated; $p < 0.05$ was considered significant. Results: Of 654 NICU admissions, 163 neonates were LBW, an incidence of 24.9%. Preterm birth accounted for 55.2% of cases and was significantly associated with LBW (OR ≈ 3.22, $p < 0.001$). Multiple pregnancy accounted for 25.8% of cases, and 45.4% of mothers had at least one medical condition, most often urinary tract infection (10.4%) or anaemia (6.7%). Caesarean section was performed in 62% of cases, predominantly urgent (64.4%). Mortality was 24.5%. Conclusion: LBW forms a substantial proportion of NICU admissions in Tobruk and is strongly associated with prematurity, multiple gestation and maternal comorbidity. The high mortality underlines the need for improved antenatal care, early identification of high-risk pregnancies and stronger neonatal care in eastern Libya.

1. INTRODUCTION

Low birth weight (LBW), defined by the World Health Organization (WHO) as a birth weight of less than 2500 grams regardless of gestational age, remains one of the most important indicators of neonatal health and a major determinant of

survival worldwide. LBW is further categorised into very low birth weight (VLBW, < 1500 g) and extremely low birth weight (ELBW, < 1000 g), groups that carry progressively higher risks of mortality and long-term morbidity. Despite advances in obstetric and neonatal care, LBW continues to represent a critical global public health challenge, particularly in low- and middle-income countries (LMICs & World Health Organization, 2019). Recent global estimates indicate that approximately 14–15% of all live births worldwide are of low birth weight, corresponding to more than 20 million newborns annually (UNICEF & WHO, 2019, 2023). Although some regions have experienced gradual reductions, progress remains uneven. The burden is disproportionately concentrated in South Asia and sub-Saharan Africa, where limited access to quality antenatal care, maternal malnutrition, infections, and socioeconomic inequalities contribute significantly to the persistence of LBW. In many LMICs, LBW is closely intertwined with prematurity, intrauterine growth restriction (IUGR), and preventable maternal conditions. Evidence from recent international studies (2022–2025) confirms that LBW is strongly associated with increased neonatal mortality, particularly within the first 28 days of life. A large regional analysis from the Middle East and North Africa (MENA) region demonstrated that neonates born with LBW had significantly higher odds of early neonatal death compared with normal-weight infants (Bachemir, Borumandnia, & Taherian, 2026). Similarly, population-based research in the United States showed persistent disparities in LBW prevalence linked to maternal sociodemographic and medical risk factors (Moustafa, McGaughey, & Hamilton, 2024). Studies from Somalia (Hassan et al., 2025) and other LMIC settings have reported LBW prevalence rates ranging from 15% to 20%, particularly in contexts affected by poverty, limited prenatal surveillance, or health system fragility.
The aetiology of LBW is multifactorial. Preterm birth remains one of the strongest predictors, as infants delivered before 37 weeks are biologically predisposed to lower birth weights. Maternal medical conditions such as anaemia, urinary tract infection, diabetes mellitus, hypertensive disorders, thyroid disease, and placental abnormalities are consistently reported risk factors in recent literature (Bian, Zhang, & Liu, 2013; Wahyuni, Ferdinandus, et al., 2024). A 2024 analysis in SSM–Population Health highlighted the interaction between maternal health status, adequacy of prenatal care, and birth weight outcomes (Moustafa et al., 2024). In addition, multiple gestation is a well-established contributor to LBW, largely because of uteroplacental insufficiency and higher rates of preterm delivery. Beyond immediate survival, LBW has profound long-term consequences. Survivors are at increased risk of neurodevelopmental delay, impaired cognitive performance, growth restriction, chronic respiratory disease, and later-life metabolic disorders (Dhivar, Gandhi, et al., 2024). Emerging evidence also links LBW to increased susceptibility to non-communicable diseases in adulthood through fetal programming mechanisms. LBW is therefore not only a neonatal issue but a life-course health concern. In conflict-affected and resource-limited settings, the challenge is amplified. Regional analyses in the Eastern Mediterranean have shown that political instability, economic hardship, and disruption of maternal health services are associated with worsening neonatal indicators, including LBW prevalence and neonatal mortality (Comfort et al., 2024; Elmighrabi, Fleming, & Agho, 2024). These contextual determinants are particularly relevant for countries undergoing prolonged health system strain. Contemporary data from eastern Libya are, however, scarce. Tobruk Medical Center serves as a major referral facility in the eastern region, managing high-risk pregnancies and neonatal intensive care cases. Understanding the current incidence, risk factors, and outcomes of LBW in this setting is essential for guiding targeted interventions and strengthening maternal–newborn health strategies. This retrospective cohort study therefore aims to (1) determine the incidence of LBW among neonates admitted to the NICU at Tobruk Medical Center in 2024, (2) identify the maternal and obstetric risk factors associated with LBW, and (3) assess neonatal outcomes, particularly mortality. By situating local findings within the broader international context, this study seeks to contribute meaningful evidence to inform public health planning and improve neonatal survival in Libya.

2. METHOD

Study Design

This retrospective cohort study will investigate the incidence of low birth weight, risk factors, and outcomes among newborns delivered at Tobruk Medical Center between January 1, 2024, and December 31, 2024.

Data Collection

Data will be extracted from patient medical records at Tobruk Medical Center. The data collection process will involve reviewing records of all deliveries during the specified period and extracting relevant information on maternal and neonatal characteristics, pregnancy outcomes, and birth weight.

Inclusion Criteria

All live births were delivered at Tobruk Medical Center between January 1, 2024, and December 31, 2024, with Birth weight below 2500 grams.

Exclusion Criteria

Stillbirths, Incomplete or missing medical records.

Variables to be Collected

Maternal characteristics: parity, abortions, and medical history

Neonatal characteristics: date of birth, gestational age, birth weight, sex, multiple births, Apgar score, mode of delivery, congenital anomaly, and neonatal morbidity/mortality causes

This study design and data collection approach will provide valuable insights into the incidence, risk factors, and outcomes of low birth weight in the study population.

Statistical analysis

The incidence of LBW was calculated as the number of LBW cases divided by the total number of NICU admissions during the study period, expressed as a percentage. The association between maturity and birth weight was assessed by calculating the odds ratio (OR) with a chi-square test. A p-value below 0.05 was considered statistically significant. Categorical variables are presented as frequencies and percentages, and birth weight is presented as a mean value.

This study design and data collection approach provide valuable insight into the incidence, risk factors, and outcomes of low birth weight in the study population.

3. ETHICAL APPROVAL

Approval of the ethical medical committee of the Faculty of Medicine, Tobruk University, was obtained. Also, approval from the manager of the Tobruk Medical Center was obtained before starting. We also worked according to the international ethical guidelines for research

This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies to ensure methodological rigor, transparency, and completeness in reporting.[23]

4. RESULT

Incidence of low birth weight

During 2024, a total of 654 neonates were admitted to the NICU at Tobruk Medical Center, of whom 163 had a birth weight below 2500 g. The incidence of LBW was therefore (number of LBW cases / total admissions) × 100 = (163 / 654) × 100 = 24.9%. About one quarter of all NICU admissions in 2024 were low birth weight neonates, which represents a substantial proportion of the unit's workload.

Multiple pregnancy

Single births accounted for 121 of the 163 cases (74.2%), and multiple pregnancies accounted for 42 cases (25.8%), a single-to-multiple ratio of approximately 3:1. Multiple pregnancy therefore contributed to about one in four LBW cases.

Maturity

Seventy-three neonates (44.8%) were born at term (≥ 37 weeks), and 90 (55.2%) were preterm (< 37 weeks), giving a term-to-preterm ratio of approximately 1:1.23. The distribution of LBW and normal-weight admissions by maturity is shown in Table 1.

Table 1 Distribution of NICU admissions by maturity and birth weight

Maturity	LBW	Normal weight	Total
Preterm (< 37 weeks)	90	136	226
Term (≥ 37 weeks)	73	355	428
Total	**163**	**491**	**654**

By use of table 1, we can calculate the odds ratio (OR) and p-value using a chi-square test.

OR = (90/136) / (73/355) ≈ 3.22

Chi-square test: - $\chi^2 \approx 32.1$, $p < 0.001$ (significant association)

- Preterm births have a higher likelihood of LBW (OR ≈ 3.22, $p < 0.001$).

Gender Distribution

Male: 73/163 ≈ 44.8%, Female: 89/163 ≈ 54.6%, Ambiguous: 1/163 ≈ 0.6%. Female LBW babies were slightly more common in this cohort.

Mean Birth weight

The mean birth weight is approximately 2.065 kg (2065 grams).

Congenital anomaly

12/163 (7.4%) had a congenital anomaly**;** about 1 in 14 LBW babies had a congenital anomaly.

6. Premature rupture of membranes (PROM)

28/163 (17.2% of cases had PROM**,** so PROM was a factor in about 17.2% of LBW cases, as seen in Figure 1.

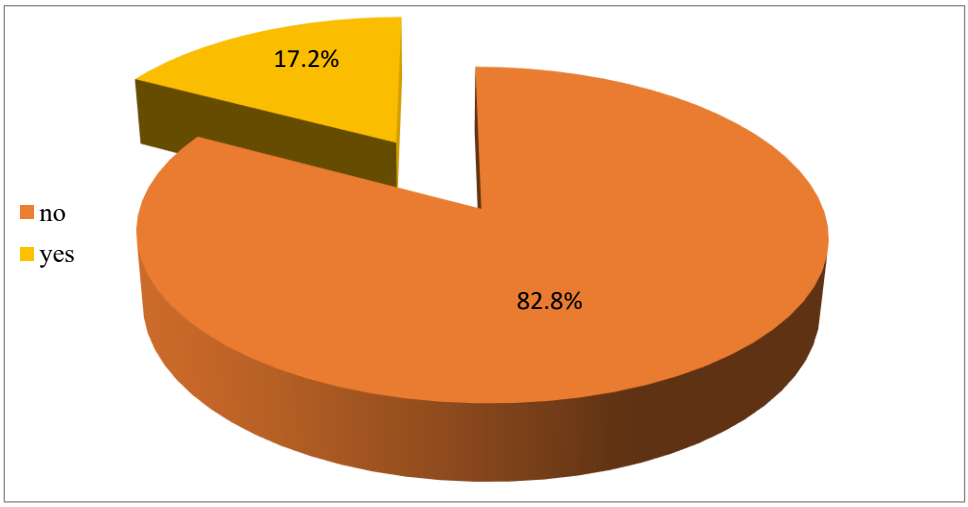

Fig. 1 Frequency of premature rupture of membranes among LBW cases (n = 163)

Maternal health status

Seventy-four mothers (45.4%) had at least one health problem, 86 (52.8%) were healthy and the medical history was unknown for 3 (1.8%), as shown in Table 2. The most frequent conditions were urinary tract infection (10.4%), anaemia (6.7%), vaginitis (4.3%), infertility (3.7%), abruptio placentae (3.7%) and diabetes mellitus (3.1%).

Table 2. Distribution of LBW cases by maternal medical history (n = 163)

Medical history	No.	%
Urinary tract infection	17	10.4
Anaemia	11	6.7
Vaginitis	7	4.3
Infertility	6	3.7
Abruptio placentae	6	3.7
Diabetes mellitus	5	3.1
Hypertension	4	2.5
Hypothyroidism	4	2.5
Placenta praevia	4	2.5
Gestational diabetes mellitus	2	1.2
Bronchial asthma	2	1.2
Epilepsy	1	0.6
Thyrotoxicosis	1	0.6
Oligohydramnios	1	0.6
Heart disease	1	0.6
Raised liver enzymes	1	0.6
Cervical cerclage	1	0.6
Unknown medical history	3	1.8

Mothers with at least one health issue: 74 (45.4%)**; healthy** mothers: 86 (52.3%**,** with unknown medical history: 3 (1.8%), as seen in Table 2.
Top conditions: UTI 10.4%, anemia 6.7%, Vaginitis 4.3%, Infertility 3.7%, Abrptio placenta 3.7 and DM 3.1%. 45.4% of LBW cases had mothers with underlying health issues

Multigravida 118/163 72.4%); most LBW babies were from multigravida mothers.

Mode of delivery
Cesarean section (C/S) 101/163 (62%); normal vaginal delivery 62 (38%, as seen in Figure 2. Out of 101 cesarean section were 65/101, 64.1% urgent.

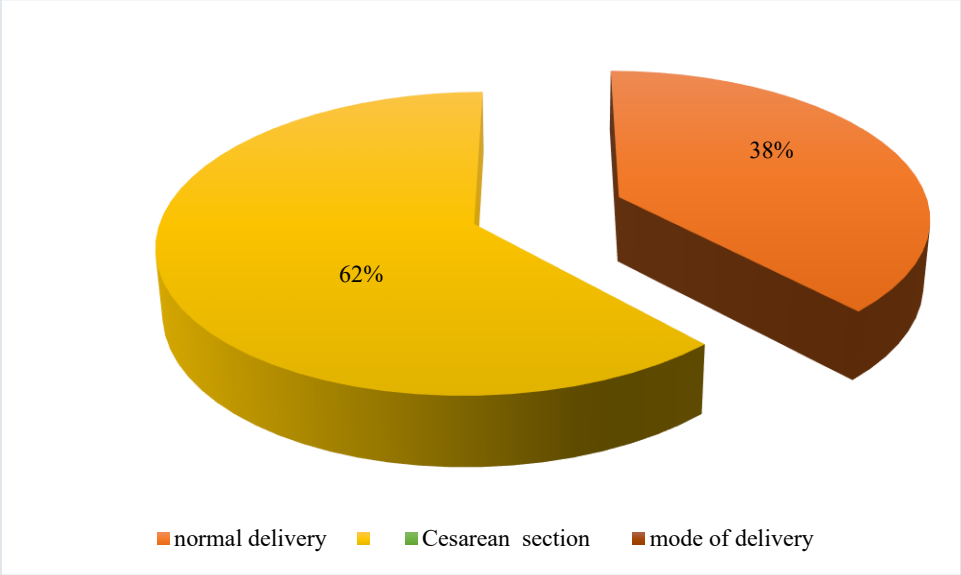

Fig. 2 Mode of delivery in LBW cases (n = 163)

The causes of urgent Cesarean section are labelled in Table 3. 22, 13.5% out of urgent C/S due to multiple birth with prematurity 15, with abnormal presentation 4 or with history of Infertility 3.

Table 3 Indications for urgent caesarean section

Cause of urgent C/S	No.	%
Multiple birth	22	13.5
Preterm labour	15	9.2
Abruptio placentae	6	3.7
Previous scar in labour	6	3.7
Pathological CTG	5	3.1
Placenta praevia	4	2.5
History of infertility	2	1.2
Pre-eclampsia	2	1.2
Oligohydramnios	2	1.2
Breech presentation	1	0.6
Total	**65**	**39.9**

The elective cesarean sections were 36 (15 of them due to previous C/S), as seen in Table 4.

Table 4 Indications for elective caesarean section

Causes of elective C/S	No.	%
Previous Scar	15	9.2%
Twins	6	3.7%
Pre-term labour	3	1.8%
Congenital anomaly	2	1.2%
Cephalo-pelvic disproportion	1	0.6%
Breech presentation	1	0.6%
Mother's Eye OP	1	0.6%
Previous scar + oligohydramnios	1	0.6%
Mother request	2	1.2%
Unknown cause	4	2.5%

The majority of LBW babies were delivered via C/S, with 65/101 (64.4% urgent C/S as seen in Figure 3, which reflect the majority of LBW neonates delivered urgently due to underlying serious maternal-neonatal health issues.

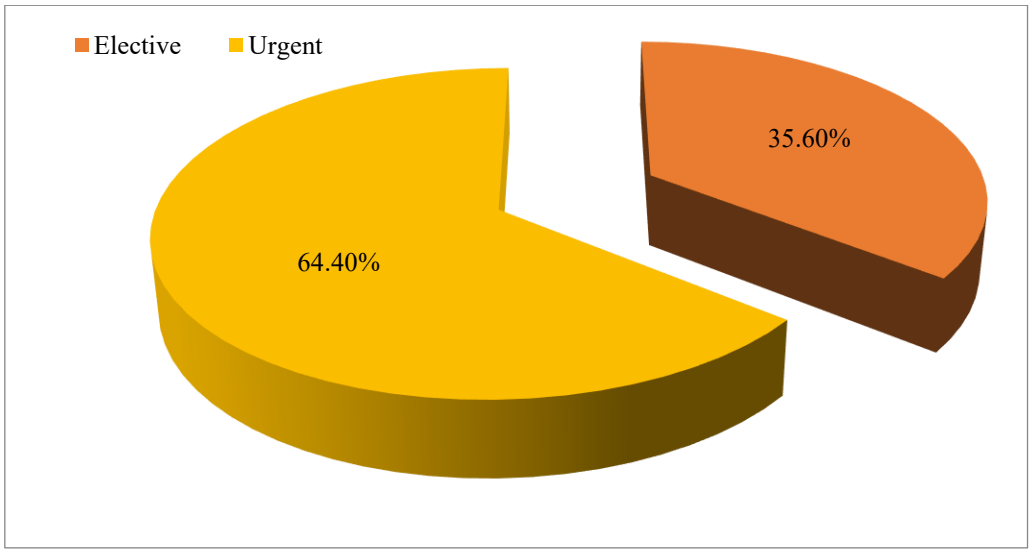

Figure 3: Distribution of Cesarean section (urgent and elective).

Table 5. Distribution of documented complications among LBW neonates

Complication	Frequency (n)	Percentage (%)
Respiratory distress	86	71.7
Neonatal sepsis	13	10.8
Neonatal jaundice	9	7.5
Flaccid baby	3	2.5
Transient tachypnoea of the newborn	2	1.7
Bradycardia	2	1.7
Cyanotic baby	1	0.8
Elevated renal function tests	1	0.8
Hypothermia	1	0.8
Intraventricular haemorrhage	1	0.8
Anaemia	1	0.8
Total documented cases	**120**	**100.0**

Respiratory Distress (R.D) represents the most prevalent complication among LBW neonates, accounting for (71.7%) of the total cases recorded (n = 86)
Neonatal Jaundice and Sepsis: These metabolic & infectious complications follow with frequencies of 13 (10.8%) and 9 (7.5%), respectively, highlighting critical areas for postnatal monitoring.

As seen in Figure 3, out of 163 LBW cases, 40 (24.5%≈ 25%) died. About a quarter of LBW babies didn't survive. Out of them, 24 were LBW, 11 VLBW, and 5 were extreme LBW

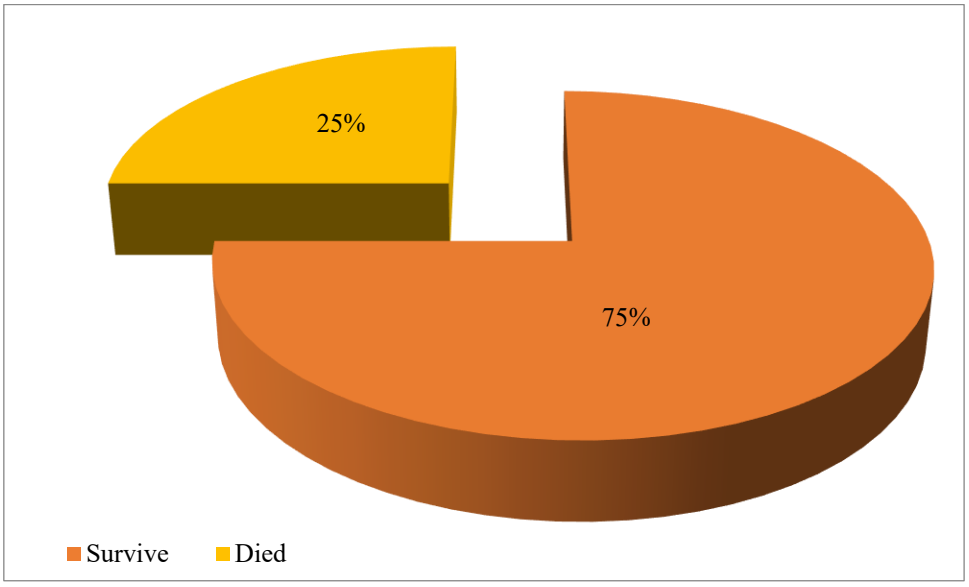

Figure 3: Mortality percentage of LBW in YEAR 2024

5. DISCUSSION

The observed incidence of Low Birth Weight (24.9%) at Tobruk Medical Center is a significant finding that warrants considerable attention. This rate is comparable to the 27.5% reported in Sirte [3] but is substantially higher than the 16.2% documented in Tripoli [4], suggesting significant regional variations in perinatal health outcomes within Libya. The neonatal mortality rate of 24.5% in our cohort is deeply concerning and aligns with recent global reports indicating mortality rates for LBW infants ranging from 24.8% to 33.6% [6]. The established association between preterm birth and LBW (OR ≈ 3.22) in our study is a cornerstone finding, consistent with a vast body of international literature [5]. This reinforces the inextricable link between gestational age and birth weight. Furthermore, our finding that 45.4% of mothers of LBW infants presented with underlying health issues, such as urinary tract infections and anemia, is corroborated by other studies in Libya and globally, which have identified these conditions as significant contributors to adverse pregnancy outcomes [7, 8]. Interestingly, our study identified that 72.4% of LBW infants were born to multigravida mothers. This contrasts with a recent studies from another center in Libya, which found primigravidity to be a significant risk factor [7,]. This discrepancy may reflect differences in population demographics or referral patterns and merits further investigation. Additionally, the aforementioned study highlighted the significant impact of irregular antenatal care and passive smoking on LBW risk [7], factors that were not explicitly analyzed in our cohort but represent crucial areas for future public health interventions. The high rate of Cesarean sections (62%) among LBW deliveries, with the majority being urgent procedures, reflects the high-risk nature of these pregnancies. The primary indications for urgent C-sections, such as multiple gestation and abruptio placentae, are themselves independent risk factors for LBW, creating a complex clinical picture that necessitates a high level of obstetric vigilance.
The mortality rate among LBW infants in this study was 24.5%. This figure is considerably higher than rates reported in high-income countries but remains comparable to some LMIC NICU-based reports. Global evidence demonstrates that LBW infants have up to 20-fold increased risk of neonatal death compared to normal-weight infants.

A recent regional epidemiological study in Qatar (19) highlighted that LBW remains a central contributor to neonatal mortality even in better-resourced settings. In our cohort, mortality is largely driven by complications; specifically . Respiratory distress (R.D) was the most common complication among LBW neonates, accounting for an overwhelming majority of 71.7%, followed by Neonatal Jaundice as the second (10.8%) and Sepsis as the third most common complication (7.5%). The relatively high mortality observed in Tobruk may reflect resource constraints, delayed referral, or limited availability of advanced neonatal technologies. Strengthening neonatal intensive care capacity, infection prevention protocols, and antenatal risk screening could substantially improve survival.
Most LBW infants (72.4%) were born to multigravida mothers, while some international studies associate primiparity with LBW; others, particularly in LMIC contexts, report increased risk among high-parity mothers, possibly due to maternal nutritional depletion, short interpregnancy intervals, or cumulative obstetric stress. This variation underscores the importance of context-specific analysis [19,20,21,22].

The findings from Tobruk align with contemporary global evidence indicating that LBW is strongly associated with prematurity, multiple gestation, maternal comorbidities, and obstetric complications. The high mortality rate emphasizes the urgent need for improved antenatal surveillance, early identification of high-risk pregnancies, nutritional support programs, infection screening, and strengthening of NICU infrastructure. Given the multifactorial etiology of LBW, interventions must be multidisciplinary, combining maternal health optimization, community education, socioeconomic support, and neonatal critical care enhancement. Addressing preventable maternal conditions such as anemia and infections could significantly reduce LBW incidence and improve neonatal outcomes.

6. Conclusion

The study highlights a significant incidence of Low Birth Weight (LBW) neonates in Tobruk Medical Center, Libya, with approximately 25% of NICU admissions being LBW babies. The key risk factors identified include preterm birth, multiple births, and maternal health issues such as urinary tract infection or Abruptio placenta, which contribute to a mortality rate of 25% among LBW babies. Clinical findings obtained from the study demonstrate that Respiratory Distress (R.D (. emerged as the most prevalent complication, presenting the primary clinical challenge in the acute management of LBW infants.

To address LBW in Libya, targeted interventions focusing on high-risk pregnancies, improving maternal nutrition, and increasing access to antenatal care are crucial to help with early detection of clinical health problems that may lead to LBW.
Specialized care for preterm and multiple births, as well as promoting maternal education and economic empowerment, can help reduce LBW incidence and improve neonatal outcomes.

Conflicts of Interest: There are no conflicts of interest

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