

NEWBORN NUTRITION AND ITS RELATIONSHIP TO JAUNDICE

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التغذية عند حديثي الولادة وعلاقتها باليرقان

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Abstract

Background : Neonatal jaundice (NNJ) Is a Common condition affecting newborns worldwide, often influenced by feeding practices, maternal health, and familial risk factors. Understanding the interplay between newborn nutrition and the occurrence of NNJ is critical. **Objective:** To investigate the relationship between newborn nutrition and neonatal jaundice (physiological and pathological) and to identify maternal and familial factors associated with its incidence and duration.

Methods: A cross-sectional study was conducted from January to November 2024 in two hospitals in Tripoli, Libya. A total of 200 neonates diagnosed with NNJ were included. Maternal and neonatal data, including feeding patterns, health history, and demographic characteristics, were collected using a structured questionnaire validated by experts. Reliability was confirmed using Cronbach's alpha (0.85). Descriptive and inferential statistics were analyzed using SPSS.

Results: The majority of infants (88.5%) developed jaundice within the first five days of life. Exclusive breastfeeding, mixed feeding, and bottle-feeding accounted for 37.5%, 37.5%, and 25% of infants, respectively. Maternal health conditions, including gestational diabetes (49%), hypothyroidism (42%), and high stress levels (73.5%), were significantly associated with NNJ. A positive family history of jaundice or splenectomy was reported in 39.5% and 22.5% of cases, respectively. Infants with low birth weight (1–3 kg) exhibited higher NNJ prevalence.

Conclusion: Maternal health, newborn feeding practices, and family history significantly influence the development of NNJ. Early breastfeeding support, maternal health monitoring, and targeted neonatal screening are essential strategies to reduce the incidence and severity of NNJ

الملخص:

الخلفية: يُعد اليرقان الوليدي حالة شائعة تصيب حديثي الولادة في جميع أنحاء العالم، وغالبًا ما تتأثر بممارسات التغذية، وصحة الأم، وعوامل الخطر العائلية. يُعد فهم التفاعل بين تغذية حديثي الولادة وحدوث اليرقان الوليدي أمرًا بالغ الأهمية. الهدف: دراسة العلاقة بين تغذية حديثي الولادة واليرقان الوليدي (الفسيولوجي والمرضي)، وتحديد العوامل الأمومية والعائلية المرتبطة بحدوثه ومدته.

المنهجية: أُجريت دراسة مقطعية في الفترة من يناير إلى نوفمبر 2024 في مستشفيين بمدينة طرابلس، ليبيا. شملت الدراسة 200 مولود جديد تم تشخيص إصابتهم باليرقان الوليدي. جُمعت بيانات الأمهات والمولود، بما في ذلك أنماط التغذية، والتاريخ

الصحي، والخصائص الديموغرافية، باستخدام استبيان مهيكل تم التحقق من صحته من قبل خبراء. تم التأكد من موثوقية الاستبيان باستخدام معامل ألفا لكرونباخ (0.85). تم تحليل الإحصاءات الوصفية والاستدلالية باستخدام برنامج SPSS. النتائج: أصيب غالبية الرضع (88.5%) باليرقان خلال الأيام الخمسة الأولى من حياتهم. شكلت الرضاعة الطبيعية الخالصة، والرضاعة المختلطة، والرضاعة بالزجاجة 37.5%، و37.5%، و25% من الرضع على التوالي. وارتبطت الحالات الصحية للأمهات، بما في ذلك سكري الحمل (49%)، وقصور الغدة الدرقية (42%)، وارتفاع مستويات التوتر (73.5%)، ارتباطاً وثيقاً بظهور اليرقان الوليدي. وسُجل وجود تاريخ عائلي إيجابي لليرقان أو استئصال الطحال في 39.5% و22.5% من الحالات على التوالي. كما لوحظ ارتفاع معدل انتشار اليرقان الوليدي لدى الرضع ذوي الوزن المنخفض عند الولادة (1-3 كجم).

الخلاصة: تؤثر صحة الأم، وممارسات تغذية حديثي الولادة، والتاريخ العائلي بشكل كبير على تطور اليرقان الوليدي. ويُعد الدعم المبكر للرضاعة الطبيعية، ومراقبة صحة الأم، والفحص الموجه لحديثي الولادة استراتيجيات أساسية للحد من حدوث اليرقان الوليدي وشدته

Keywords: Neonatal jaundice, breastfeeding, newborn nutrition, maternal health, hyperbilirubinemia

Introduction

Neonatal jaundice (NNJ) is one of the most common clinical conditions affecting newborn infants worldwide. It is estimated that approximately 60–80% of term newborns and nearly 80% of preterm infants develop some degree of jaundice during the first week of life. The condition occurs due to elevated levels of bilirubin in the blood, resulting from increased breakdown of fetal red blood cells combined with immature hepatic metabolism in neonates. Although most cases are physiological and resolve spontaneously, severe hyperbilirubinemia may lead to serious complications such as acute bilirubin encephalopathy and kernicterus if not recognized and treated promptly (Kemper et al., 2022; Par & Hughes, 2023).

The pathophysiology of neonatal jaundice involves increased bilirubin production, limited hepatic uptake and conjugation capacity, and enhanced enterohepatic circulation during the early neonatal period. Bilirubin levels typically rise within the first few days after birth as fetal hemoglobin is rapidly replaced by adult hemoglobin. As the neonatal liver matures, bilirubin metabolism improves and serum bilirubin levels gradually decline during the first two to three weeks of life (Slusher et al., 2023). Feeding practices during the early neonatal period play an important role in bilirubin metabolism and excretion. Inadequate feeding, particularly insufficient breastfeeding, may lead to decreased caloric intake and delayed intestinal transit, which increases enterohepatic circulation of bilirubin and contributes to elevated serum bilirubin levels. Conversely, frequent and effective breastfeeding promotes bilirubin elimination through increased stool production and improved hydration of the newborn.

Current clinical guidelines recommend that newborns breastfeed at least eight to twelve times per day during the first days of life in order to ensure adequate nutritional intake and reduce the risk of hyperbilirubinemia (American Academy of Pediatrics, 2022; Diaz, 2025).

Maternal health conditions may also contribute to the development of neonatal jaundice. Gestational diabetes, hypothyroidism, pregnancy-induced hypertension, and maternal stress have been associated with increased bilirubin levels in newborns. These conditions can influence fetal metabolism, red blood cell turnover, and neonatal liver function, thereby increasing susceptibility to hyperbilirubinemia (Slusher et al., 2023).

In addition to maternal and nutritional factors, genetic predisposition and familial history may play a role in the occurrence of neonatal jaundice. Conditions such as inherited red blood cell disorders, enzymatic deficiencies, and family history of neonatal jaundice can increase bilirubin production or impair bilirubin metabolism. Blood group incompatibilities, particularly ABO and Rh incompatibility, are also recognized as significant risk factors for neonatal hyperbilirubinemia (Kemper et al., 2022).

Despite the high global prevalence of neonatal jaundice, limited studies have examined the combined influence of newborn nutrition, maternal health status, and familial factors in the

Libyan population. Understanding these relationships is essential for improving neonatal healthcare practices, early screening strategies, and preventive interventions. Therefore, the present study aims to investigate the relationship between newborn nutrition and neonatal jaundice and to identify maternal and familial factors associated with its occurrence among newborns in Tripoli, Libya.

Materials and Methods

Study Design and Setting

This study was designed as a cross-sectional observational study conducted between **January 1, 2024, and November 30, 2024**. The research was carried out at two major healthcare institutions in Tripoli, Libya: **Al-Jalaa Maternity and Gynecology Hospital** and the **Medical Hospital**. These hospitals serve as referral centers for maternal and neonatal care and receive a large number of newborn cases.

Study Population

The study included a total of **200 neonates diagnosed with neonatal jaundice (NNJ)**. The participants were selected from newborns admitted to the participating hospitals during the study period. Demographic and clinical data were collected from the infants and their mothers to examine factors potentially associated with the occurrence of neonatal jaundice.

Data Collection Tool

Data were collected using a **structured questionnaire** developed specifically for this study. The questionnaire consisted of several sections designed to gather information related to:

- Neonatal demographic characteristics (gender, age, birth weight, blood group)
- Feeding practices (breastfeeding, bottle feeding, or mixed feeding)
- Birth-related factors (type of delivery)
- Maternal demographic and health characteristics (maternal age, blood group, gestational diabetes, gestational hypertension, hypothyroidism, and maternal stress)
- Family history factors (history of neonatal jaundice among siblings and family history of splenectomy)

The questionnaire was distributed to the mothers of the participating neonates after obtaining their consent.

Validity and Reliability of the Questionnaire

To ensure **content validity**, the questionnaire was reviewed by a panel of experts in neonatal health and medical laboratory sciences. Based on their recommendations, modifications were made to improve the clarity and relevance of the questions.

The reliability of the questionnaire was assessed using **Cronbach's Alpha coefficient** through **SPSS statistical software**. The reliability coefficient for the questionnaire dimensions was **0.85**, indicating a high level of internal consistency and reliability for the data collection instrument

Statistical Analysis

All collected data were entered and analyzed using the **Statistical Package for the Social Sciences (SPSS)** software. Descriptive statistical methods were used to summarize the data. Frequencies and percentages were calculated to describe the distribution of demographic characteristics, feeding practices, maternal health conditions, and family history variables among the study participants

The results were presented in the form of **tables and figures** to illustrate the distribution of variables and highlight patterns related to neonatal jaundice among the study population

Results:

Demographic Characteristics of the Neonates

A total of **200 neonates diagnosed with neonatal jaundice** were included in this study. The demographic characteristics of the infants are summarized in Tables 1–4.

Gender Distribution

Among the study population, **105 infants (52.5%) were female**, while **95 infants (47.5%) were male**, indicating a slightly higher proportion of female neonates.

Table (1) Distribution based on the Gender

Gender	Frequency	Percent
Male	95	47.5
Female	105	52.5
Total	200	100

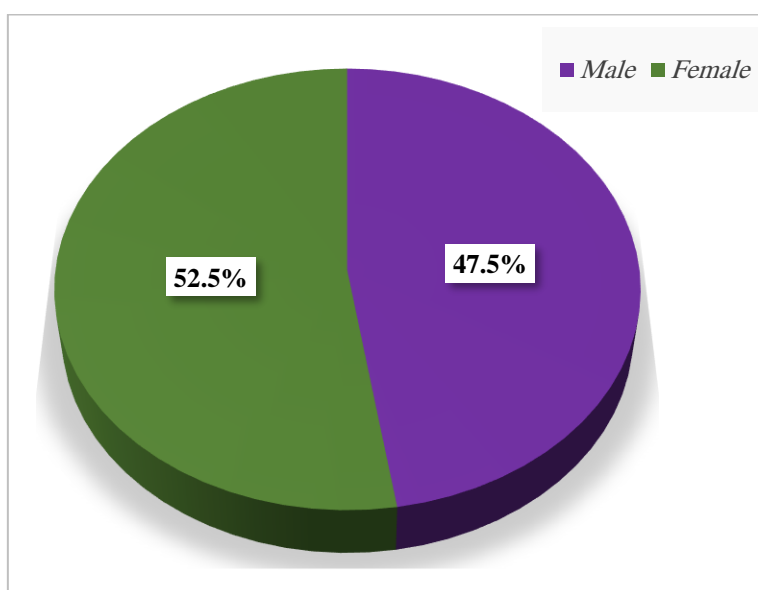


Figure (1) Shows distribution based on the Gender

Age of Neonates

The majority of infants (**89.5%**) were between **0 and 28 days old**, reflecting the typical neonatal period when jaundice commonly occurs.

Table: (2) Distribution of participants based on Age.

Age	Frequency	Percent
0-28	179	89.5
28-56	10	5
56-84	11	5.5
Total	200	100

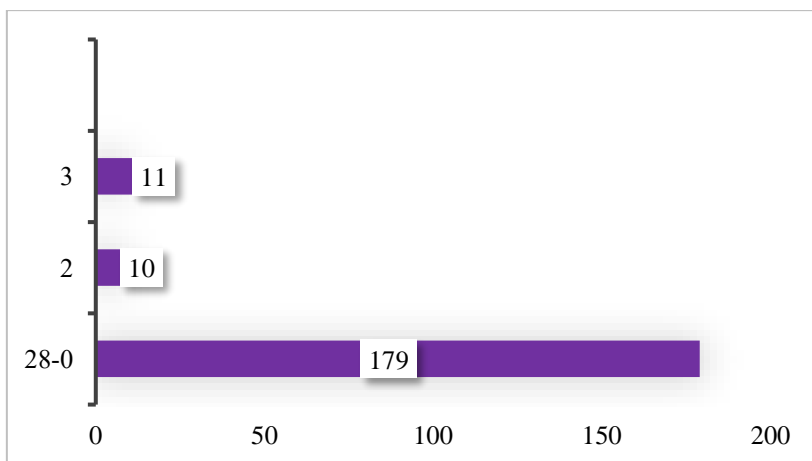


Figure: (2) Shows distribution based on Age.

Blood Group Distribution

The most common neonatal blood group was O+ (33.5%), followed by A+ (24%) and O- (11%).

Table (3) Distribution based on Blood Type

Blood group	Frequency	Percent
O+	67	33.5
O-	22	11
A+	48	24
A-	12	6
AB+	12	6
AB-	9	4.5
B+	20	10
B-	10	5
Total	200	100

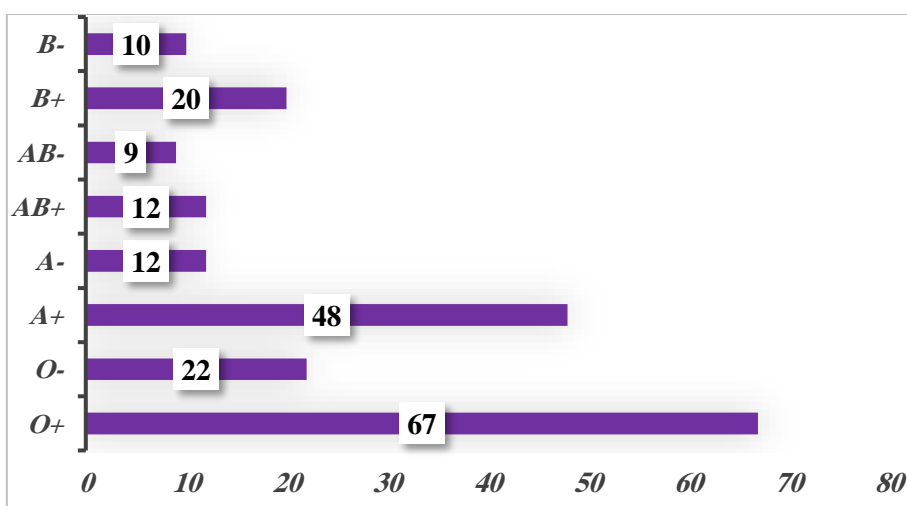


Figure (3) Shows distribution based on Blood Type

Birth Weight of Neonates

Most infants (81%) had a birth weight between 1–3 kg, while 19% weighed 4–5 kg.

Table (4) distribution based on Weight of the infant

Weight	Frequency	Percent
1-3	162	81
4-5	38	19
Total	200	100

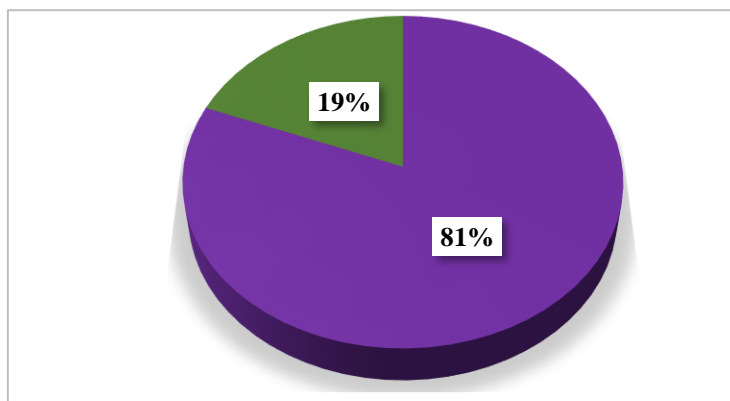


Figure (4) shows the distribution based on Weight of the infant

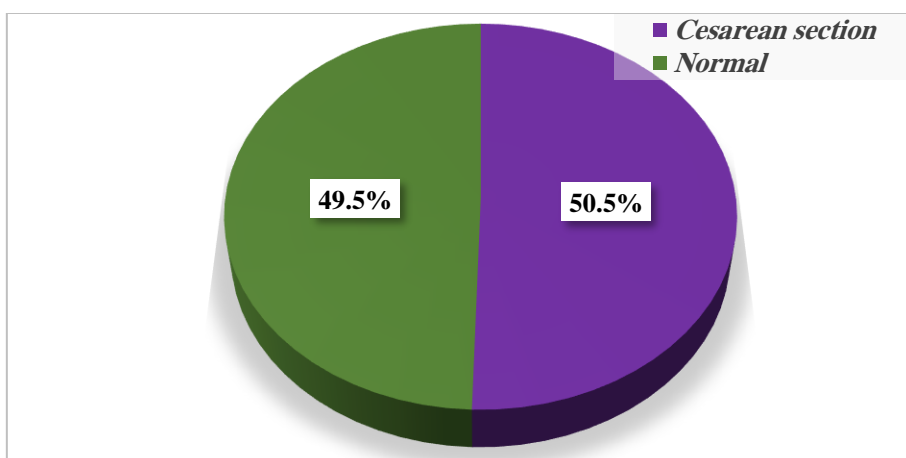
Birth and Feeding Characteristics

Mode of Deliver

The distribution of delivery types was nearly equal. Cesarean section accounted for 50.5% of births, while 49.5% were vaginal deliveries.

Table (5) Distribution by Type of Delivery

Type of Birth	Frequency	Percent
Cesarean section	101	50.5
Normal	99	49.5
Total	200	100



Feeding Practices

Regarding feeding patterns, 37.5% of infants were exclusively breastfed, 25% were bottle-fed, and 37.5% received mixed feeding.

Table (6) Distribution by Feeding Type

Type of Feeding	Frequency	Percent
Breast feeding	75	37.5
Bottle-feeding	50	25
Both	75	37.5
Total	200	100

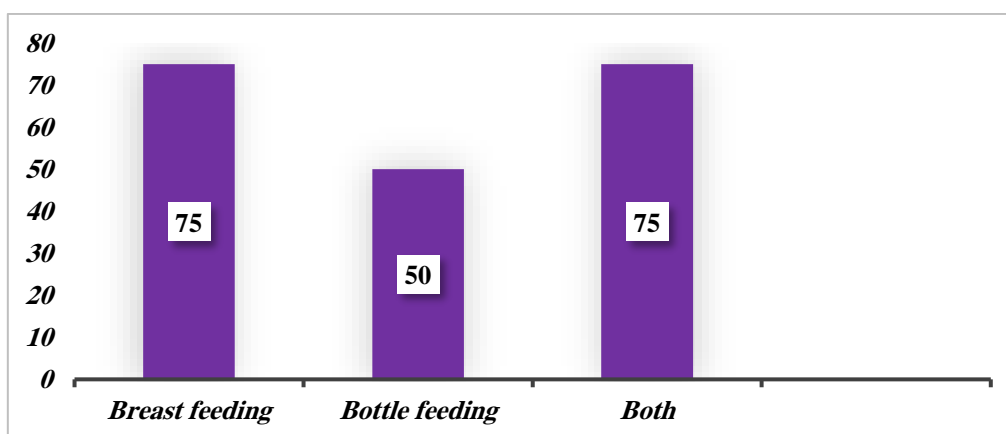


Figure (6) Feeding practices among neonates with jaundice.

Age of Onset of Jaundice

Most infants (88.5%) developed jaundice between 1 and 5 days after birth, while 11.5% developed jaundice between 6 and 10 days.

Table (7) Age of Onset of Neonatal Jaundice

Age of the infant when he was jaundiced	Frequency	Percent
1-5 Days	177	88.5
6-10 Days	23	11.5
Total	200	100

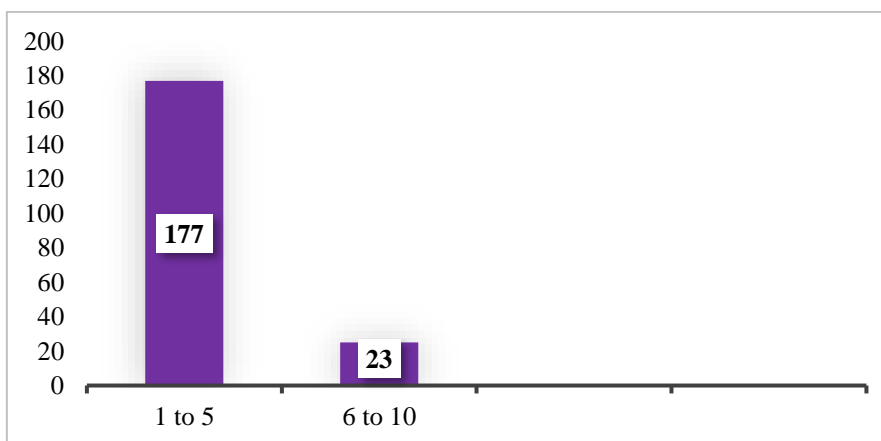


Figure (7) Age of Onset of Neonatal Jaundice

Maternal Characteristics

Maternal Age

Most mothers (77.5%) were between 25 and 35 years old, while 22.5% were between 36 and 46 years old.

Table: (9) Distribution by Maternal Age.

Mothers age.	Frequency	Percent
25-35	155	77.5
36-46	45	22.5
Total	200	100

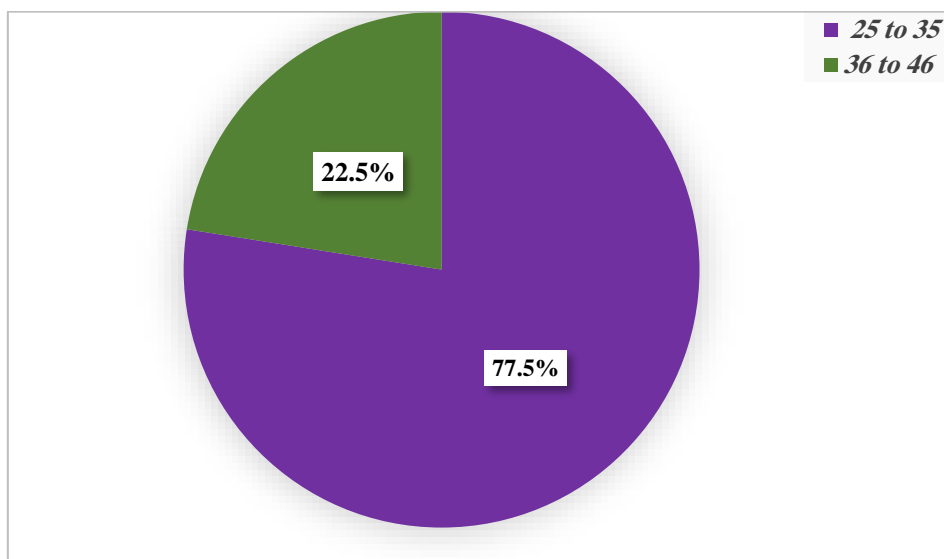


Figure: (8) Maternal age distribution.

Maternal Blood Group

The most common maternal blood group was O+ (36%), followed by A+ (17.5%) and O- (16%).

Table (9): Distribution by Maternal Blood Group.

Mother blood group	Frequency	Percent
O+	72	36
O-	32	16
A+	35	17.5
A-	12	6
AB+	12	6
AB-	11	5.5
B+	12	6
B-	14	7
Total	200	100

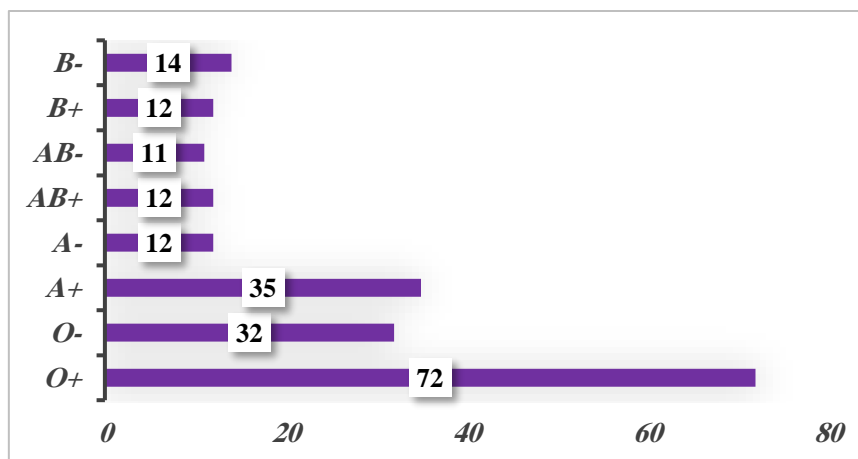


Figure (9): Distribution of maternal blood groups

Maternal Health Conditions

Gestational Hypertension

More than half of the mothers (58.5%) reported gestational hypertension.

Table (10) Gestational Hypertension

Gestational Hypertension	Frequency	Percent
Yes	117	58.5
No	83	41.5
Total	200	100

Gestational Diabetes Mellitus (GMD)

Nearly half of the mothers (49%) reported having gestational diabetes.

Table (11) distribution based on Does she suffer from gestational Diabetes

Response	Frequency	Percent
Yes	98	49%
No	102	51%
Total	200	100%

Maternal Stress

A large proportion of mothers (73.5%) reported experiencing maternal stress during pregnancy.

Table (12) the distribution based on was the mother in a state of Stress

Response	Frequency	Percent
Yes	147	73.5%
No	53	26.5%
Total	200	100%

History of Hypothyroidism

Approximately 42% of mothers had a history of hypothyroidism.

Table (13) History of Hypothyroidism

History of Hypothyroidism	Frequency	Percent
Yes	84	42
No	116	58
Total	200	100

Family History Factors

Siblings with Neonatal Jaundice

A family history of neonatal jaundice among siblings was reported in 39.5% of cases.

Table (14) Sibling History of Neonatal Jaundice

Siblings with Neonatal jaundice	Frequency	Percent
Yes	79	39.5%
No	121	60.5%
Total	200	100%

Family History of Splenectomy

A family history of splenectomy was reported in 22.5% of participants.

Table (15): Family History of Splenectomy

Splenectomy	Frequency	Percent
Yes	45	22.5%
No	155	77.5%
Total	200	100%

Discussion

The present study investigated the relationship between newborn nutrition and neonatal jaundice and examined maternal and familial factors associated with its occurrence among neonates in Tripoli, Libya. The findings highlight several demographics, nutritional, and maternal factors that may contribute to the development of neonatal jaundice.

In the present study, a slightly higher proportion of affected neonates were female (52.5%) compared with males (47.5%). Although neonatal jaundice occurs in both sexes, previous studies have reported inconsistent findings regarding sex differences. Some studies suggest that male neonates may have a slightly higher susceptibility due to differences in bilirubin metabolism; however, sex is generally considered a weak predictor of neonatal hyperbilirubinemia (Annisa et al., 2023). Therefore, the small difference observed in the current study may reflect the distribution of births rather than a true biological risk factor.

The majority of neonates in this study developed jaundice during the early neonatal period, particularly within the first five days of life. This finding is consistent with the well-known physiological pattern of neonatal jaundice, where bilirubin levels typically peak between the second and fifth days after birth due to increased red blood cell breakdown and immature hepatic conjugation mechanisms. Similar patterns have been reported in several clinical studies, which indicate that early-onset jaundice is common among otherwise healthy newborns.

Birth weight also appears to play an important role in the occurrence of neonatal jaundice. In this study, most affected neonates had a birth weight between 1 and 3 kg. Low birth weight has been frequently reported as a significant risk factor for neonatal hyperbilirubinemia because

premature or smaller infants often have immature liver function and increased bilirubin production. A recent case-control study reported that neonates with birth weights below 2500 g had significantly higher odds of developing jaundice compared with those with normal birth weight.

Feeding practices represent one of the most important modifiable factors influencing neonatal jaundice. In the present study, breastfeeding and mixed feeding were the most common feeding patterns among affected infants. Previous research indicates that inadequate or delayed breastfeeding may increase the risk of neonatal

Hyperbilirubinemia occurs because reduced milk intake delays meconium passage and increases enterohepatic circulation of bilirubin. A systematic review and meta-analysis identified exclusive breastfeeding as a factor associated with an increased likelihood of neonatal hyperbilirubinemia, although this relationship is complex and often related to insufficient early feeding rather than breastfeeding itself.

Recent studies have also demonstrated that breast milk composition may influence bilirubin metabolism in newborns. Certain beneficial bacteria and metabolites present in breast milk can promote the development of healthy intestinal microbiota, which may reduce bilirubin reabsorption and decrease the risk of jaundice. These findings highlight the importance of effective breastfeeding practices and early lactation support rather than discouraging breastfeeding itself.

The current study also found that the mode of delivery was nearly equally distributed between cesarean section and vaginal delivery. Some recent studies have suggested that cesarean delivery may increase the likelihood of neonatal jaundice due to delayed initiation of breastfeeding and altered neonatal adaptation after birth. Machine-learning analyses of large neonatal datasets have identified cesarean delivery and feeding indicators as significant predictors of jaundice requiring phototherapy.

Maternal health conditions were also observed to play a role in the occurrence of neonatal jaundice in the present study. A considerable proportion of mothers reported gestational hypertension, gestational diabetes, stress, or hypothyroidism. These maternal conditions may affect fetal metabolism, placental function, and neonatal hepatic activity, which can contribute to increased bilirubin levels after birth. Previous research has similarly reported that maternal medical conditions during pregnancy can increase the risk of neonatal hyperbilirubinemia through effects on neonatal red blood cell turnover and liver function.

Family history was another important factor observed in this study. Approximately 39.5% of neonates had siblings with a history of neonatal jaundice. This finding supports previous studies showing that a family history of jaundice is a strong predictor of hyperbilirubinemia in newborns. Genetic factors, including enzymatic deficiencies affecting bilirubin metabolism, may contribute to this familial tendency. For example, studies have shown that neonates with a history of jaundice in previous siblings have significantly higher odds of developing the condition themselves.

Overall, the findings of this study emphasize the multifactorial nature of neonatal jaundice. Neonatal characteristics such as birth weight and feeding practices, maternal health conditions during pregnancy, and familial predisposition all appear to contribute to the development of hyperbilirubinemia in newborns. Early identification of these risk factors is essential for improving neonatal care, enabling timely monitoring of bilirubin levels, and preventing severe complications associated with untreated hyperbilirubinemia.

Below is a strengthened Discussion section with additional recent references (2022–2025) inserted inside the text and listed afterward. This version links your findings more clearly to current scientific literature, which is important for journal publication.

Conclusions

This study aimed to explore various factors associated with neonatal jaundice (N.N.J) and its relationship to maternal health and demographics. The findings indicate that several factors, including maternal blood type, stress levels, and a history of gestational diabetes, play a significant role in the occurrence and duration of jaundice in newborns. The majority of participants reported a between duration of jaundice (1-27 days), and the predominant feeding methods were breastfeeding and bottle-feeding. Furthermore, a significant portion of the sample had mothers who experienced stress during pregnancy, which could have influenced the health of the newborn

The study also found that a history of hypothyroidism, siblings with neonatal jaundice, and family members with splenectomy were relevant to the occurrence of jaundice in some cases, though these factors were less widespread. Overall, the analysis highlights key maternal and familial factors that can contribute to the development and progression of neonatal jaundice.

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