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Determinants of Neonatal Jaundice among Neonates Admitted to Neonatal Intensive Care Unit at Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital in Sulaymaniyah City/Iraq

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Abstract

Background: Neonatal jaundice is a common condition that affects between 60% and 80% of newborns. It has been associated with significant morbidity and death and is one of the most prevalent causes of hospitalization in a neonatal unit.

Aim: To assess risk factors associated with neonatal jaundice among neonates admitted to the NICU at Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital in Sulaimani City.

Method: A quantitative design (descriptive study) case-control approach was used. Data were collected from the period 5th of January 2023 to 5th of April 2023 among neonates admitted to the neonatal intensive care unit at Dr. Jamal Ahmed Rashid pediatric teaching hospital in Sulaymaniyah city, using a non-probability purposive sample technique to select (50) neonates diagnosed with jaundice as case group and (50) non-jaundiced as a control group in the same unit. The researcher collected the data by directly interviewing mothers; data was analyzed using the statistical package (21).

Result: The majority of the neonates, 70%, were male, 62% were low birth weight, and 58% were between 2 and 7 days old, with mean ages of 3.06 ± 2.24. Most of the mothers' ages ranged between 20 and 35 years. There was a significant association between previous child history of neonatal jaundice (p = 0.017) blood group (p = 0.037), neonatal sex (p=0.05), birth weight (p=0.000), and feeding option (p=0.049) with neonatal jaundice.

Conclusion: Neonatal sex, birth weight, feeding options, previous child history of NJ, and blood group were associated risk factors with neonatal jaundices, the study brought attention to the necessity of integrating mental health services within hospitals.

What is already known about the topic?

- ***Neonatal jaundice*** *is one of the most common clinical conditions affecting newborns, particularly during the first week of life.*
- *It is primarily caused by elevated serum bilirubin levels, which can result from physiological processes or pathological conditions such as* ***hemolytic disease, infections, prematurity, and breastfeeding difficulties****.*

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Introduction

Neonatal jaundice (NJ) is an excessive buildup of bilirubin in the neonatal body which causes, a yellow coloring of the skin, sclera, and mucosa (Lake et al., 2019). It is one of the most prevalent illnesses affects up to 60% of full-term and 80% of preterm neonates (Slusher et al., 2004). Neonatal have a significantly greater bilirubin level than adults due to the erythrocytes' shorter lifespan and less ability to eliminate bilirubin; however, hyperbilirubinemia, often known as jaundice, is a potentially fatal condition in newborns (Ullah et al., 2016). Although NJ is a clinical issue that may be avoided and managed, it can cause infant death if treatment is not received (Sharrow et al., 2022).

Globally, NJ impacts 1.1 million neonates annually (Adugna, & Ado 2023). The burden was greatest in low- and middle-income countries located in Sub-Saharan Africa and South Asia (Olusanya, & Slusher 2015). A study conducted in Nigeria revealed that NJ constituted 35.0% of total NICU admissions. Ethiopia ranks among the top ten countries for neonatal mortality associated with jaundice (Greco et al., 2016). Research from Addis Ababa, Ethiopia, and the University of Gonder revealed that the prevalence of NJ was 13.3% and 24.6%, respectively (Adugna, & Ado 2023).

The primary risk factors for NJ include Rh incompatibility, ABO, and diabetes mellitus, which are maternal risk factors. NJ is known to be caused independently by low birth weight, sepsis, birth injury, prematurity, glucose-6-phosphate dehydrogenase deficiency (G6PD), polycythemia, male sex, breastfeeding, and a family history of jaundice (Zauk, 2015). According to a study done in developed countries, the primary cause of neonatal jaundice is blood incompatibilities; however, in developing countries, the primary causes of neonatal jaundice were low birth weight, infection, prematurity, and glucose 6-phosphate deficiency (Ip et al., 2004).

Numerous measures have been taken to lower the morbidity and fatality rates related to newborn jaundice. These interventions include blood group screening during antenatal care (ANC) with the provision of Anti D for mothers who have Rh negative status during pregnancy and postpartum, genetic screening to identify enzymatic deficiencies, and teaching mothers to recognize the early signs of jaundice and seek timely healthcare services (Birhanu et al., 2022).

Aim of the study

- To identify socio-demographic characteristic of the neonates and their mothers
- To identify obstetric and neonatal risk factors of neonatal jaundice
- To find out association between socio-demographic characteristic of study samples with obstetric and neonatal risk factors of neonatal jaundice

Material and Methods

Design and Participants: A quantitative, descriptive case-control study design was employed to achieve the study's objectives.

A non-probability purposive sampling technique was used to select 50 cases diagnosed with jaundice in the NICU at Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital as the case group, and 50 neonates were selected as the control group in the same unit who were not suffering from jaundice. The samples were selected based on the following criteria: neonates diagnosed with jaundice and mothers who were willing to participate in the study.

Methods of data collection: Before interviewing the mothers, an introduction was provided, and the researcher explained the study's purpose to the subjects personally to obtain verbally informed consent. The researcher conducted face-to-face interviews, collecting data using a constructed questionnaire from January 5, 2023, to April 5, 2023.

Tools and Measurement: To collect the proper data, a questionnaire form was developed by the researcher based on a review of literature and previous studies to measure the variables underlying the present study. The study questionnaire consists of three parts, which are distributed as follows:

Part 1: Socio-demographic characteristics of mothers consist of five items, which include age, marital status, level of education, occupation, and residency.

Part 2: Obstetric and social-related characteristics of mothers consist of nine items, which include a history of neonatal jaundice in previous children, antenatal care follow-up, complications during pregnancy, blood group, Rh incompatibility, gestational age, prolonged labor, mode of delivery, and gravidity.

Part 3: Socio-demographic characteristics of neonates consist of four items, which include age, gender, birth weight, and feeding options.

Administrative arrangement: An official letter has been submitted from the College of Nursing to Sulaymaniyah General Directorate of Health (DOH) in order to obtain facilitation and cooperation during data collection of the study. Consequently, an agreement letter has been submitted from DOH to Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital.

Ethical Considerations: Ethical approval for the study was granted by the Scientific Committee of the pediatric Nursing department at the College of Nursing and the Ethical Committee of the College of Medicine, University of Sulaimani.

Statistical Analysis: To achieve the stated objectives, the study data were analyzed using the Statistical Package for the Social Sciences (SPSS) through descriptive analysis (frequency and percentages) for all variables. The inferential statistical method, chi-square, was used to determine the association between socio-demographic characteristics and neonatal jaundice. (P value ≤ 0.05) was considered the level of significance.

RESULTS

Socio-demographic characteristics

The study included a total of 100 mothers and their neonates, comprising 50 cases and 50 controls. Mothers aged 20 to 35 had the highest proportion of cases, at 78%, compared with controls at 60%. The mean ages of cases and controls were 29.44 ± 6.04 and 31.06 ± 6.98, respectively. The vast majority of mothers in both the case and control groups were married, which accounted for 96% and 94%, respectively. In both cases and controls, the highest percentages of mothers graduated from an institute or university, which accounts 54% and 50%, respectively. About mothers' occupations, the proportion of unemployed mothers in both case and control groups records the highest percentage, which accounts 72% and 60%, respectively. Regarding residency, in both case and control groups, the highest percentage of families were living in urban areas, which accounts 76% and 62% respectively, and very few percentages in both groups were living in rural areas (Table 1).

Obstetrics characteristics

Approximately three quarter 74% of cases and 92% of controls have no previous child history of neonatal jaundice. Regarding follow-up of antenatal care, majority 82% of cases and 86% of controls had ANC follow-up. Less than two-thirds

72% of cases and 82% of controls have no complications during pregnancy. The blood group of mothers was assessed and recorded as A, B, AB, and O; the highest proportion 36% of cases were O group, and the highest proportion 54% of controls did not know their blood groups. The proportion of mother who had no Rh incompatibility with their neonates was 82% for cases and 92% for controls. According to gestational ages, the proportion of term neonates was lower among cases 58% compared to controls 74%. Concerning prolonged labor, 70% of cases and 80% of the controls had normal labor during delivery. Concerning the mode of delivery, 70% of cases and 82% of controls were delivered through C/S. Regarding gravidity, 54% of cases and 70% of controls were multigravida.

Neonatal characteristics

Table (3) represents some of the demographic characteristics of neonates in both the case and control groups. About the neonate age 58% of cases and 66% of controls were between 2-7 days, and the mean ages of cases and controls were 3.06 ± 2.24 and 6.74 ± 4.840 respectively. In case group, the highest percentage of samples 70% were male and the rest of the neonates were female, but in the control group, the proportion of males was 52%. The proportion of low birth weight was higher among cases 62% compared with controls 18%. The proportion of neonates who had formula feed was higher among cases 50% compared with controls 32%. Risk factors associated with neonatal jaundice Table (4, 5, and 6) displays the association between maternal, obstetrics and neonatal risk factors with neonatal jaundice. Regarding maternal demographic factors, there was no significant association between maternal demographic factors and neonatal jaundice. Regarding obstructive factors, there was a significant association between previous child history of NJ ($p = 0.017$) and neonatal jaundice. There was a significant association between blood group ($p = 0.037$) and neonatal jaundice. For neonatal risk factors, there was a significant association between sex ($p=0.05$), birth weight ($p=0.000$), and feeding option ($p=0.049$) with neonatal jaundice.

Table (1) Distribution of sample according to maternal sociodemographic characteristics in cases and controls

Variable	Item	Case	Control
		N (%)	N (%)
Maternal age (years)	<20	4(8)	6(12)
	20-35	39(78)	30(60)
	>35	7(14)	14(28)
	Mean ±SD	29.44±6.04	.3106±6.98
Marital status	Married	48(96)	47(94)
	Widowed	2(4)	3(6)
Level of education	Illiterate	3(6)	7(14)
	Primary school	7(14)	7(14)
	Secondary school	13(26)	11(22)
	Institute or university	27(54)	25(50)
Occupation	Employee	14(28)	20(40)
	Unemployed	36(72)	30(60)
Residency	Urban	38(76)	31(62)
	Suburban	9(18)	17(34)
	Rural	3(6)	2(4)
Total		**50(100)**	**50(100)**

Table (2) Distribution of sample according to obstetrics related characteristics in both cases and control groups

Variable	Items	Case	Control
		N (%)	N (%)
Previous child history of NJ	Yes	13 (26)	4(8)
	No	37(74)	46 (92)
Antenatal care follow-up	Yes	41(82)	43(86)
	No	9(18)	7(14)
Complication during pregnancy	Yes	14(28)	9(18)
	No	36(72)	41(82)
Blood group	A	9(18)	6(12)
	B	7(14)	4(8)
	AB	4(8)	1(2)
	O	18(36)	12(24)
	Unknown	12(24)	27(54)
RH incompatibility	Yes	9(18)	4(8)
	No	41(82)	46(92)
Gestational age	Preterm	17(34)	10(20)
	Term	29(58)	37(74)
	Post term	4(8)	3(6)
Prolonged labor	Yes	15(30)	10(20)
	No	35(70)	40(80)
Mode of delivery	C/S	35(70)	41(82)
	NVD	10(20)	8(16)
	Instrumental	5(10)	1(2)
Gravidity	Primigravida	23(46)	15(30)
	Multigravida	27(54)	35(70)
Total		**50(100)**	**50(100)**

Table (3) Distribution of sample according to neonatal characteristics in both cases and control groups

Variable	Item	Case	Control
		N (%)	N (%)
Age (days)	<2	17(34)	12(24)
	2-7	29(58)	33(66)
	>7	4(8)	5(10)
	Mean ±SD	3.06±2.24	6.74±4.840
Sex	Male	35(70)	26(52)
	Female	15(30)	24(48)
Birth weight	Low	31(62)	9(18)
	Normal	19(38)	41(82)
Feeding option	Breast feeding	11(22)	8(16)
	Formula	25(50)	16(32)
	Mixed	14(28)	26(52)
Total		**50(100)**	**50(100)**

Table (4) association between cases & controls group in relation to maternal sociodemographic characteristics

Variable	Item	Case N=50	Control N=50	Total	χ2-square (P- value)
		N (%)	N (%)		
Maternal age (years)	<20	4(40)	6(60)	10	χ2=3.907 (0.142)
	20-35	39(56.5)	30(43.5)	69	
	>35	7(33.3)	14(66.7)	21	
Marital status	Married	48(50.5)	47(49.5)	95	χ2=0.211 (0.646)
	Widowed	2(40)	3(60)	5	
Level of education	Illiterate	3(30)	7(70)	10	χ2=1.844 (0.605)
	Primary school	7(50)	7(50)	14	
	Secondary school	13(54.2)	11(45.8)	24	
	Institute or university	27(51.9)	25(48.1)	52	
Occupation	Employee	14(41.2)	20(58.8)	34	χ2=1.604 (0.205)
	Unemployed	36(54.5)	30(45.5)	66	
Residency	Urban	38(55.1)	31(44.9)	69	χ2=3.372 (.0176)
	Suburban	9(34.6)	17(65.5)	26	
	Rural	3(60)	2(40)	5	

Table (5) association between cases & controls group in relation to obstetrics characteristics

Variable	Items	Case N=50 N (%)	Control N=50 N (%)	Total	χ2-square (P- value)
Previous child history of NJ	Yes	13 (56.5)	4 (43.5)	17	χ2=5.741 (0.017)
	No	37(44.6)	46(55.4)	83	
Antenatal care follow-up	Yes	41(48.2)	43(51.2)	84	χ2=0.298 (0.585)
	No	9(56.3)	7(43.8)	16	
Complication during pregnancy	Yes	14(60.9)	9(39.1)	23	χ2=1.412 (0.235)
	No	36(46.8)	41(53.2)	77	
Blood group	A	9(60)	6(40)	15	χ2=10.187 (0.037)
	B	7(63.6)	4(36.4)	11	
	AB	4(80)	1(20)	5	
	O	18(60)	12(40)	30	
	Unknown	12(30.8)	27(69.2)	39	
RH incompatibility	Yes	9(69.2)	4(30.8)	13	χ2=2.210 (.0137)
	No	41(47.1)	46(52.9)	87	
Gestational age	Preterm	17(63)	10(37)	27	χ2=2.927 (.0231)
	Term	29(43.9)	37(56.1)	66	
	Post term	4(57.1)	3(42.9)	7	
Prolonged labor	Yes	15(60)	10(40)	25	χ2=1.333 (0.356)
	No	35(46.7)	40(53.3)	75	
Mode of delivery	C/S	35(46.1)	41(53.9)	76	χ2=3.363 (0.186)
	NVD	10(55.6)	8(44.4)	18	
	Instrumental	5(83.3)	1(16.7)	6	
Gravidity	Prim gravida	23(60.5)	15(39.5)	38	χ2=2.716 (0.099)
	Multigravida	27(43.5)	35(56.5)	62	

Table (6) association between cases & control groups in relation to neonatal characteristics

Variable	Item	Case N=50 N (%)	Control N=50 N (%)	Total	χ2-square (P- value)
Age (days)	<2	17(58.6)	12(41.4)	29	χ2=1.231 (0.540)
	2-7	29(46.8)	33(53.2)	62	
	>7	4(44.4)	5(55.6)	9	
Sex	Male	35(57.4)	26(42.6%)	61	χ2=3.405 (0.05)
	Female	15(38.5)	24(61.5%)	39	
Birth weight	Low	31(77.5)	9(22.5)	40	χ2=20.167 (0.000)
	Normal	19(31.7)	41(68.3)	60	
Feeding option	Breast feeding	11(57.9)	8(42.1)	19	χ2=6.049 (0.049)
	formula	25(61)	16(39)	41	
	Mixed	14(35)	26(65)	40	

DISCUSSION

This study found that mothers between the ages of 20 and 35 made up 78% of cases compared to 60% of controls. This is similar to the results of a study by Sisay et al. (2023) which also found that 83.33% of mothers were between the ages of 20 and 35. The vast majority of mothers in both case and control groups were married. This finding is in agreement with the results of a study done by (Adugna & Ado, 2021) found that the majority of parents in their study were living together. In both cases and controls, most of mothers graduated from an institute or university, which accounts 54% and 50%, respectively. The findings in present study disagree with findings of Hamad& Khalil (2019) in Soran city reported that highest percentage 31% of mothers was illiterate followed by 23% and 23% were university/institute and secondary respectively. Concerning mothers' occupation, the highest proportions of mothers were unemployed. This result is consistent with a previous study conducted by Belay et al. (2023) that showed 76.1% of mothers were unemployed. Regarding residency in both case and control groups, the highest percentage of families were living in urban areas, this finding is consistent with a previous study conducted by Asefa et al. (2020), which reported that 65.7% of samples lived in urban areas and 34.3% in rural areas.

The vast majority of controls and approximately three quarter of cases have no previous history of newborn jaundice. This finding is in line with another study that found 93.6% of controls and 85.9% of cases had no previous history of neonatal jaundice (Bizuneh et al., 2020). In terms of prenatal care follow-up, the majority of cases and controls had prenatal care follow-up during pregnancy. This finding is consistent with study by Adugna & Ado (2021), which revealed that 77.2% of cases and 93% of controls were have prenatal care follow-ups. Less than three quarter 72% of cases and 82% of controls do not have any obstetric complication, this is in line with Asefa et al. (2020) findings, which show that the highest percentage 78% of cases and 82% of controls do not have complications during pregnancy. More than one third of cases were O blood group, and more than half of controls did not know their blood groups. According to prolonged labor, 70% of cases and 80% of controls have normal labor and the majority of cases and controls had no Rh incompatibility, these results are confirmed by Kiros et al. (2023), who found that 26.7% of cases were O blood group, 83.3% of cases and 76.7% of controls were normal labor, and 91.7% of cases and 99.2% of controls do not have Rh incompatibility. In regard to

gestational ages, the proportion of term neonates was lower among cases 58% compared to controls 74%. A cross-sectional study conducted in Bahrain by Isa et al. (2022) found that 21.8% of jaundiced neonates were preterm and 78.2 % were term. Concerning the mode of delivery, 70% of cases and 82% of controls were delivered through C/S. This is in line with Abd Elmoktader et al. (2019) found in their study neonates delivered by NVD was 28.1 % and 71.9 % in neonates delivered by CS. more than two-thirds of controls and more than half of cases was multigravida, this finding agrees with the study done by Tessema et al. (2024), they found that 67% of the respondents were multigravida.

Regarding neonatal socio-demographic characteristics, 58% of cases and 66% of controls were between 2 and 7 days, This result is consistent with a study conducted by Bizuneh et al. (2020), which revealed that 67.1% of cases and 66.8% of controls were between 2-7 days. Regarding neonatal gender, more than two-thirds of the samples in the case group and whereas over half of the samples in the control group were male. This result is in line with a study by Bante et al. (2024) that showed that 70% of the study samples were male. The proportion of low birth weight was higher among cases 62% compared to controls 18%. Regarding feeding practices, the case group had the highest percentage of formula-fed neonates 50% compared to the control group 32%.This finding is in agreement with the results of a study done by Adugna & Ado (2021) found that 67.1% of neonates were low birth weight and 49.4% were formula-fed. Neonatal gender, birth weight, feeding options, previous child history of NJ, and blood group were associated risk factors with neonatal jaundice. In this study, there was a positive relationship between jaundice and gender. This finding in line with previous study in Zakho city conducted by Mohammad et al. (2024) found that male neonates presented with jaundice at higher rates. In fact, male newborns are always more susceptible to neonatal jaundice, although the cause remains unknown (Garosi et al., 2016). According to this study, one of the determinants of NJ was the neonates' birth weight. This finding was in line with a study conducted by Murekatete et al. (2020), who found a significant association between newborn sex and jaundice and confirmed it as risk factors associated with neonatal jaundice, this might be due to the fact that most of the time low birth weight is common in newborns with prematurity who present with immature organs, particularly immature livers, which fail to conjugate normally and produce bilirubin from red blood cells, which results in jaundice (Bizuneh et al., 2020). The result of this study revealed that neonatal jaundice

was positively associated with mixed feeding. The study found that the ratio of breastfed to artificially fed newborns in both groups is nearly equal; hence, this non-significant difference might be referred to as a fact (Abdelgader et al., 2022). In this study, the history of jaundice in previous children was a factor related to jaundice.

Saber et al. (2013) conducted studies to determine the risk factors for jaundice. The findings of their study revealed a significant association among neonatal jaundice and a history of jaundice in previous infants. In this study, there was a positive relationship between jaundice and the AB blood group. In contrast, the previous study in Ethiopia conducted by Asefa et al. (2020) found that maternal O blood group was the determinant of neonatal jaundice among the neonates who were admitted to the NICU.

CONCLUSION

Neonatal gender, birth weight, feeding options, previous child history of NJ, and blood group were crucial risk factors with neonatal jaundice. Further investigation into the prevalence and risk factors of newborn jaundice in other Kurdistan areas is necessary because it remains a common health problem. Therefore, early prevention and rapid treatment of neonatal jaundice are essential to prevent long-term effects and infant mortality.

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CONFLICT OF INTEREST

The writers announce that there is no conflict of interest between them.

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