ORIGINAL RESEARCH

Prevalence of Neonatal Jaundice and its Associated Risk Factors in Babies Born At Westend Hospital In Harare, Zimbabwe

Chiwoniso Mitchelle Kahiya; Abdoul Razak Mahaman Yacoubou; Mahamane Salissou Maibouge Tanko

Abstract

Introduction: Neonatal jaundice is a common condition worldwide occurring in up to 60% of healthy term babies and 80% of preterm babies within the first week of life. Its risk factors are mainly demographic, maternal, and neonatal. Zimbabwe currently lacks sufficient data on these. **Objective:** The present report aimed to determine the prevalence and risk factors of neonatal jaundice in babies born at Westend Hospital Zimbabwe in 2021. **Methods**: This was an analytical cross-sectional study of secondary data from the year 2021. Out of 1172 babies delivered, only 611 babies met the inclusion criteria for the study; all babies on medication and pregnant women under the age of 18 years were excluded. Case notes of babies admitted from January 2021 to December 2021 were retrieved through information on bio data. Using convenient sampling, 611 babies were found to meet the criteria for the study, through an assessment of their demographic profiles, clinical outcomes, and laboratory data. Additionally, descriptive statistics were used. Maternal and fetal risk factors were assessed, $P< 0.05$ set as statistically significant. **Results**: This study showed that 281 babies presented neonatal jaundice, yielding a 45.99% prevalence rate. A significant relationship was found between neonatal jaundice and the predisposing risk factors, namely, low birth weight (p=<0.0001), prematurity (p=<0.0001), neonatal gender (p=0.028), blood group incompatibility (p=<0.001), G6PD deficiency (p=0.001), black race (P<0.0001), maternal diabetes (P<0.0001) lack of breastfeeding and history of jaundice in the family (P<0.002). **Conclusions:** The prevalence of neonatal jaundice was found to be high and risk factors were found to be predominantly demographic, maternal, and neonatal. **Keywords:** Neonatal, Jaundice, Risk, Maternal, Prevalence

1.introduction

One of the common causes of neonatal admissions to hospitals is neonatal jaundice. Neonatal jaundice is a common condition worldwide occurring in up to 60% of healthy term babies and 80% of preterm babies within the first week of life [1]. Globally, neonatal jaundice is the seventh global cause of neonatal death and is considered a “global disease burden”, as the percentage of both morbidity and mortality are high. Global statistics show that 18% of the 134 million live born babies developed neonatal jaundice, with 114,000 fatalities. Fifteen of the 20 countries with the highest risk of neonatal jaundice are in Africa, making it a hotspot for the condition[2]. Previous studies have shown

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Zimbabwe to be a country characterized by a high neonatal mortality rate of 24 per 1000 live births [3]. Several maternal and neonatal risk factors such as preeclampsia, G6PD deficiency, ABO incompatibility, prematurity, birth weight, intrauterine growth retardation, metabolic abnormalities, the neonate's gender, birth weight, and nutrition have been identified as risk factors for neonatal mortality. The data collected by Global Burden of Disease study showed that for every 100,000 live births, 1,309 babies succumbed to neonatal jaundice; the highest number of fatalities corresponded to Sub-Saharan Africa [4]. According to research carried out by Zvinavashe (2017) in Zimbabwe, neonatal jaundice is the most prevalent condition affecting newborn babies, especially during the first week of life, with a prevalence of 62.4%[5]. Approximately 50-60% of full-term newborns and up 80% of preterm newborns in the first week of life were affected. The burden is likely to be substantially higher in Africa, South Asia, and the Middle East, where Glucose-6-Phosphate Dehydrogenate (G6PD) deficiency is prevalent. [1] Current intervention strategies covering early detection of risk factors, measurement and monitoring of serum bilirubin levels and treatment regimens are designed for clinical settings and are thus difficult to implement in communities where high proportions of births occur outside hospitals or where access to health facilities is limited. Although the rate of severe jaundice among neonates is high, and is associated with severe complications, data on this issue is lacking, particularly in counties with low resources, such as Zimbabwe. Data on the incidence and associated causes and risk factors is almost nonexistent in health institutions, particularly in Zimbabwe. The aim of the present study is to find the prevalence of neonatal jaundice and associated risk factors in babies delivered at Westend Hospital in Harare, Zimbabwe from January to December 2021, hence filling in the knowledge gap on the different risk factors associated with neonatal jaundice.

2. Materials and methodos

2.1 Research design

Once the population was defined, an analytical cross sectional study design was used to evaluate prevalence, demographic, maternal and neonatal risk factors related to neonatal jaundice. This design is the most appropriate and economic to conduct when dealing with quantitative data for a descriptive study at a single point of time. In addition, the analytical method was used, being the most appropriate for risk factor assessment. Hence, the prevalence of neonatal jaundice at a single point of time was determined. Furthermore, the analytic method was used to evaluate the association between neonatal jaundice and various risk factors in a retrospective manner.

2.2 Study Setting

The study was carried out at Westend Hospital in Harare. All related laboratory tests were conducted at Premier Service Medical Investments (PSMI) Clinical Laboratory between January and December 2021.

2.3 Study population

The study population of this study are babies delivered at Westend Hospital from January to December 2021, estimated at 1172, and their mothers.

2.4 Inclusion and Exclusion Criteria

Exclusion criteria: All babies on medication were excluded, as well as all babies born from mothers under 18.

Inclusion criteria: We included full-term babies after 37 weeks of gestation and pre-term babies, defined as neonates, born before 37 weeks of gestation. The categories were defined based on the WHO criteria. In addition, none of the babies were on medication and all were born from mothers 18 years old above. Babies that had a serum bilirubin level greater than 18mg/dl 72 hours postpartum and presented yellowing of eyes, sclera and skin were cetegorized as jaundiced.

2.5 Sample Size

A total of 1172 babies delivered at Westend Hospital between January and December 2021 were enrolled in this study. Of these, 611 babies met the inclusion criteria.

2.6 Sampling Procedure

A convenient sampling was used for all the babies delivered at Westend Hospital between

January and December 2021, in which all babies meeting the inclusion criteria were sampled.

2.7 Data Analysis

Relevant data was extracted from the neonates' and mothers' folders. It was then input into a predesigned check list. Results were summarized by frequencies and percentages (categorical variables), and means and percentiles (numerical variables, based on data distribution). Associations between risk factors and neonatal jaundice were assessed by a Chi Square test using GraphPad (Prism version 6) software, in which a p value of ($P < 0.05$) was considered to be statistically significant.

2.8 Ethical Considerations

Ethical approval was obtained from Africa University Research, Ethics Committee (AUREC) with reference code: ***Ref AU2359/22*** and clearance letter obtained from Westernd Hospital to collect data from their archives. To secure confidentiality, serial numbers were assigned instead of names. Data being secondary informed consent from participants was not applicable.

3. RESULTS

3.1 Maternal demographics and obstetrics-related characteristics of study participants

The observation of the distribution of neonatal jaundice amongst different maternal demographics and obstetrics-related characteristics shows that 42.29% of babies born to mothers aged 18-24, 38.89% of babies born to mothers aged 25-30, 45.78% of babies born to mothers aged 31-35, 53.09% of babes born to mothers aged 35-40, and 63.16% of babies born to mothers aged 41-45, constituted cases of neonatal jaundice. With regards to the prevalence in percentage (Table 1), mothers between 41 and 45 years of age recorded the highest prevalence of jaundice (63.16% of the 76 babies that were born). Mothers between 25 and 30 years exhibited the lowest prevalence rate (38.89%) (Table1). The greatest number of cases recorded were of black babies, a total of 470, with a prevalence of neonatal jaundice of 43.83%. There was only one Asian baby, which was born jaundiced, thus yielding a 100% prevalence of neonatal jaundice. There was an even distribution of jaundiced and non-jaundiced neonates among the mixed-race babies. A total of 324 babies were born to mothers that were diabetic and, of these, 184 were jaundiced, showing a prevalence of neonatal jaundice of 56.79%. Ninety-seven babies out of the 287 babies born to non-diabetic mothers appeared jaundiced, yielding a prevalence of 33.80%. Of the 611 babies that were found suitable for this study, 367 babies were born to mothers that had previous babies, and, of these, 185 babies were jaundiced, yielding a prevalence of 50.41%. A prevalence of neonatal jaundice of 39.34% was recorded in first-time mothers, with a total of 96 babies that were jaundiced.

3.2 Prevalence of Neonatal Jaundice

In 2021, a total of 1172 babies were delivered at Westend Hospital in Harare, Zimbabwe. Of these, only 611 babies met the study's inclusion criteria, and their blood samples were taken to Premier Service Medical Investments Clinical Laboratory. It was found that only 281 samples appeared to be icteric, meaning that 281 babies had neonatal jaundice. As revealed in Table 2, the prevalence of neonatal jaundice at Westend Hospital in 2021 from January to December was 45.99%.

3.3 Prevalence of neonatal jaundice by blood group and rhesus status

Neonatal jaundice is more common in rhesus negative blood groups as compared to the rhesus positive, yielding the highest prevalence of neonatal jaundice among the blood groups (Table 3). The highest prevalence of neonatal jaundice (80.00%) was found among B- mothers and the lowest (37.16%) among O+ mothers.

Table 1: Prevalence percentages of neonatal jaundice by maternal demographics and obstetrics characteristics (N=611)

Characteristics	Number of babies (n=611)	Percentage of babies (n=611)	Number of jaundiced babies (n=281)	Percentage of jaundiced babies (n=281)	Number of non-jaundiced babies (n=330)	Percentage of non-jaundiced babies (n=330)	Percentage of babies with neonatal jaundice N=611
Age							
18-24	227	(37.15)	96	(34.16)	131	(39.69)	42.29
25-30	144	(23.56)	56	(19.92)	88	(26.66)	38.89
31-34	83	(13.58)	38	(13.52)	45	(13.63)	45.78
35-40	81	(13.25)	43	(15.3)	38	(11.51)	53.09
41-45	76	(12.43)	48	(17.08)	28	(8.48)	63.16
Race							
Black	470	(76.92)	206	(73.3)	264	(80)	43.83
White	42	(6.87)	25	(8.89)	17	(5.15)	59.52
Asian	1	(0.16)	1	(0.35)	0	0	100.
Mixed Race	98	(16.04)	49	(8.01)	49	(14.84)	50.
Diabetic Status							
Positive	324	(53.02)	184	(65.48)	140	(42.42)	56.79
Negative	287	(46.97)	97	(34.51)	190	(57.57)	33.80
Previous Pregnancies							
Present	367	(60.06)	185	(65.83)	182	(55.15)	50.41
Absent	244	(39.94)	96	(34.16)	148	(44.85)	39.34

Table 2: Prevalence of neonatal jaundice from January to December 2021

Month	Number of babies born	Number of jaundiced babies	Number of non-jaundiced babies	Percentage of babies with neonatal jaundice
January	65	26	39	40.00
February	53	20	33	37.74
March	69	24	45	34.78
April	56	28	28	50.00
May	43	11	32	25.58
June	44	24	20	54.54
July	39	10	29	25.64
August	57	30	27	52.63
September	20	4	16	20.00
October	68	46	22	67.65
November	72	49	23	68.06
December	25	9	16	36.00
Total	611	281	330	45.99

Table 3: Chi square test on association of neonatal jaundice with blood group and rhesus status (N=611)

Blood group + Rh	Number of babies	Number of jaundiced babies	Number of non-jaundiced babies	Percentage of babies with neonatal jaundice	OR	CI	P value Two sided
A+	133(21.76)	53 (18.86)	80 (24.24)	39.85	0.726	0.491-1.074	0.108
A-	44(7.2)	34 (12.1)	10 (3.03)	77.27	4.405	2.134-9.091	0.0001*
B+	107(17.51)	45 (16.01)	62 (18.78)	42.06	0.824	0.54-1.257	0.368
B-	25(4.09)	20 (7.11)	5 (1.51)	80.	4.981	1.844-13.45	0.0005*
AB+	58(9.49)	22 (7.82)	36 (10.9)	37.93	0.693	0.397-1.21	0.195
AB-	7(1.14)	6 (2.13)	1 (0.3)	85.71	1.883	1.37-2.57	0.0339*
O+	183(29.95)	68 (24.2)	115 (34.84)	37.16	0.596	0.418-0.851	0.0042*
O-	54(8.83)	33 (11.74)	21 (6.36)	61.11	1.958	1.105-3.47	0.0195*
Total	611(100)	281	330	45.99			

3.4 Neonatal Demographics and Characteristics

Of the 281 jaundiced babies, a total of 148 male babies had neonatal jaundice, yielding a prevalence of 52.86%. Although there were more female babies (331), compared to the 280 males, they exhibited a lower prevalence of the condition at 40.18% (Table 4). Babies born between 26 to 30 weeks of gestation (119) exhibited the highest prevalence (57.49%) of neonatal jaundice. A total of 8 babies were born after 40 weeks of gestation and only one had neonatal jaundice, making it the lowest prevalence (12.50%). Also, babies between 36 and 40 weeks of gestation accounted for the highest number of births (217) and yielded a neonatal jaundice prevalence rate of 32.72% (Table 4). Neonatal jaundice was most prevalent in babies born by caesarean section, with a rate of 63.23%. All babies born instrumentally were found to have neonatal jaundice, yielding a 100% prevalence rate. Most babies (317) were born vaginally, of which only 94 appeared jaundiced, yielding a 29.65% prevalence rate. The data gathered showed that the number of jaundiced babies, as well the prevalence of neonatal jaundice, decreased as the birth weight increased from <2.00kg to >4.00kg. Of the 281 jaundiced babies, 105 babies had a birth weight of less than 2.00kg, yielding the highest prevalence (91.30%). Only 24 babies were over 4.00kg and only 6 of them had neonatal jaundice, yielding a 25.00% prevalence rate.

A total of 35 babies were noted to have G6PD deficiency and, of these, 26 babies developed neonatal jaundice, yielding the highest prevalence (74.29%) among babies with the deficiency. 576 babies were born without G6PD deficiency and, of these, only 255 developed neonatal jaundice, yielding a 44.27% prevalence rate. Babies that were given colostrum after birth had a prevalence rate of 34.34%, lower than the 57.38% rate of those that did not receive colostrum.

3.5 Multivariate analysis of risk factors of neonatal jaundice

Table 5, below, is a representation of the relationship between neonatal jaundice and the different risk factors associated with it. A p-value of 0.05 or lower is generally considered statistically significant. Prematurity, blood group and rhesus incompatibility, low birth weight, G6PD deficiency and gender of the baby were found to be significant in this study, showing a relationship between these factors and neonatal jaundice. Race, maternal diabetes, lack of colostrum and history of previous births were also found to have a significant relationship with neonatal jaundice.

Table 4: Prevalence of neonatal jaundice by neonatal demographics and clinical characteristics (N=611)

Characteristics	Number of babies (N=611)	Number of jaundiced babies (n=281)	Number of non-jaundiced babies (n=330)	Percentage of babies with neonatal jaundice
Sex				
Male	280 (45.8)	148(52.66)	132(40)	52.86
Female	331(54.17)	133(47.33)	198(60)	40.18
Gestational Age				
26-30	179(29.29)	119(42.34)	60(18.18)	57.49
31-35	207(33.87)	90(32.02)	117(35.45)	43.48
36-40	217(35.51)	71(25.26)	146(44.24)	32.72
>40	8(1.3)	1(0.35)	7(2.12)	12.50
Mode of delivery				
Normal vaginal	317(51.88)	94(33.45)	223(67.57)	29.65
Caesarean section	291(47.62)	184(65.48)	107(32.42)	63.23
Instrumental	3(0.49)	3(1.06)	0	100.00
Birth weight (kg)				
<2.00	115(18.82)	105(37.36)	10(3.03)	91.30
2.00-2.99	240(39.27)	126(44.83)	114(34.54)	52.50
3.00-3.99	232(37.97)	44(15.65)	188(56.97)	18.97
>3.99	24(3.92)	6(2.13)	18(5.45)	25.00
G6PD Deficiency				
Present	35(5.72)	26(9.25)	9(2.72)	74.28
Absent	576(94.27)	255(90.74)	321(97.27)	44.27
Colostrum				
Given	428(70)	147(52.51)	281(85.15)	34.34
Not given	183(30)	105(37.36)	78(23.64)	57.38

Table 5: Chi square test for others risk factors of Neonatal Jaundice (N=611)

Risk Factors	Number of jaundiced babies	Number of non-jaundiced babies	Odd Ratio (95% CI)	P-value Two sided
Prematurity	209	177	2.5 (1.77 ; 3.54)	<0.0001
Low Birth Weight	105	10	2.57 (2.25; 2.93)	0.0001
G6PD deficiency	26	9	1.6 (1.57;1.67)	<0.001
Gender of the baby				
Male	148	132	1.4 (1.36;1.44)	0.028
Female	133	198		
Race				
Black	140	206	0.76 (0.64;0.9)	0.0017
White	42	25		
Asian	1	1		
Mixed Race	98	49		
Presence of maternal diabetes	184	140	2.57 (1.85;3.57)	0.0001
Lack of breastfeeding and colostrum	105	78	1.92 (1.35;2.73)	0.002
History of jaundice in the family	185	182	1.56 (1.12;2.17)	0.0072

4. Discussion

The total prevalence of neonatal jaundice in this study was 45.99%, which was found in accordance with previous literature and guidelines, where the prevalence is quoted to be between 45% and 60% for healthy term neonates. The findings of this study are confirmed by previous studies that found a neonatal jaundice prevalence of 47% [6]. Burman (2010) found a prevalence of 50%[7], and Porter (2002) found a prevalence of 52% [8]. The prevalence found in this study was higher than the results of Tikmani et al. (2010), which found a prevalence of 16.5% [9]. A total of 281 babies presented neonatal jaundice at 72 hours postpartum. This is in accordance with the natural progression of physiological jaundice, which usually peaks between days 3 and 5 after birth, after which bilirubin levels return to normal during the treatment process. In a study carried out by Khan (2015), 28 of 80 babies studied showed a peak in their serum bilirubin levels at 72 hours postpartum, which supports the findings of this study [10]. The variation in the prevalence of neonatal jaundice in previous literature over the years has shown that neonatal jaundice is caused by different factors that can be addressed to in order to curb its prevalence. The prevalence was found to be higher in males (52.86%), as compared to females (40.18%). The higher prevalence of males with neonatal jaundice corroborates literature reviews indicating that there are more male cases of neonatal jaundice than female cases, due to the fact that the enzyme level of the activity of G6PD was significantly lower in males than in females. Previous studies discuss the relationship between ABO incompatibility and neonatal jaundice [11]. Surabaya also revealed that ABO incompatibility increased the incidence of neonatal jaundice by 6.833 times, compared to neonates who did not experience ABO incompatibility. This coincides with the findings of this study, which showed that $p<0.001$, and that there is a significant relationship between this variable and neonatal jaundice. ABO incompatibility occurs when a mother with blood type O becomes pregnant with a fetus that has a different blood type (type A, B, or AB). Some mothers have relatively high levels of anti-A or anti-B Immunoglobulin G (IgG) that cross the placenta, and which have the potential to cause erythroblastosis (Özcan et al. 2017). In this study, there was a prevalence of neonatal jaundice of 54.15% in babies born between 26 and 35 weeks of gestation. This finding is in line with the results of the study reported by Weng, Yi Hao and colleagues, which found increased prevalence of neonatal jaundice amongst babies with a gestational age of 25-33 weeks[12] . This study showed that gestational age has a significant relationship with neonatal jaundice as $p<0.0001$ (Table 5). Preterm infants are more likely to experience neonatal jaundice. Neonatal jaundice in premature infants is caused by excessive destruction of red blood cells because of an immature liver. In this study, babies that were not given colostrum had a 57.38% prevalence of neonatal jaundice. Other reports have indicated that decreases in the frequency of breastfeeding are related to increases in jaundice [13], coinciding with this study's findings. The prevalence of neonatal jaundice was high (45.65%) is babies born with a birth weight under 3.00kg, which concurred with the findings of another study in which 47.7% of babies under 2.99kg developed neonatal jaundice. This is often due to prematurity, which is also related to a high prevalence of neonatal jaundice [14]. This study found that low birth weight has a significant relationship with neonatal jaundice as $p<0.0001$ (Table 5). A neonatal jaundice prevalence of 56.79% was recorded amongst babies born to diabetic mothers. This finding is supported by a study carried out by Mohammad-Beigi and colleagues, which found that the chance of developing jaundice in neonates of diabetic mothers was three times higher in comparison with the control group [15]. In several studies, 16.7%–75% of neonates with jaundice were naturally delivered, while 40% of them were born through cesarean section. A study by Hamadi in 2013[16] found the highest prevalence of neonatal jaundice (68.4%) amongst babies born via caesarean section, which concurs with the findings of this study (63.23% prevalence of neonatal jaundice amongst c-section babies).

5. Conclusions

The total prevalence of neonatal jaundice was 45.99%, which is fairly high. A significant relationship was found between prematurity, blood group and rhesus incompatibility, low birth weight, G6PD deficiency, gender of the baby, and neonatal jaundice. There was also a significant relationship between the presence of neonatal jaundice and the administration of colostrum, race, maternal diabetes, and a history of previous pregnancies.

Author contributions

Conceived and designed the experiments analyzed data: CMK, M.TMS. Contributed materials and analysis tools, wrote the paper: CMK, MTMS, MYAR. All authors have read and approved the manuscript.

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