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Prevalence and risk factors for neonatal jaundice: a multicentre analytical cross-sectional study at neonatal intensive care units, Mogadishu, Somalia

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ABSTRACT

Objectives To determine the prevalence and risk factors for neonatal jaundice among neonates admitted in three large hospitals in Mogadishu, Somalia.

Design Hospital-based analytical cross-sectional study.

Setting Neonatal intensive care units (NICUs) of three tertiary hospitals in Mogadishu, Somalia.

Participants 423 neonates admitted in NICUs and their mothers.

Results The overall prevalence of neonatal jaundice was 30.26%. Results of multiple logistic regression indicated that the risk of neonatal jaundice was highest for neonates of mothers aged more than 35 years (adjusted OR (AOR): 6.03, 95% CI: 2.46 to 15.13), mothers who had prolonged labour (AOR: 3.29, 95% CI: 1.79 to 6.08) and those delivered vaginally (AOR: 2.75, 95% CI: 1.56 to 4.97) compared with caesarean section. The risk of neonatal jaundice was lower for male neonates (AOR: 0.47, 95% CI: 0.28 to 0.76) and higher for neonates who had ABO incompatibility (AOR: 22.26, 95% CI: 3.54 to 249.62), rhesus (Rh) incompatibility (AOR: 14.10, 95% CI: 1.11 to 2021.73) and neonatal sepsis (AOR: 1.96, 95% CI: 1.15 to 3.39).

Conclusions Higher maternal age, prolonged labour, blood group ABO incompatibility, Rh incompatibility and neonatal sepsis are significant risk factors for neonatal jaundice. Efforts for prevention and timely management of ABO and Rh incompatibility, prolonged labour and neonatal sepsis are required to reduce cases of neonatal jaundice. Special attention should be given to newborns of older mothers and those born through vaginal delivery as they are at higher risk of developing neonatal jaundice. Further research is needed to conclusively identify the role of neonatal sex as a risk factor for neonatal jaundice.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study gathered diverse participant experiences from public and private hospitals.
⇒ Translation of the questionnaire to the local language enhanced comprehension and data accuracy.
⇒ A cross-sectional study design was used and thus results may not be used to infer causality.
⇒ Use of non-probability sampling techniques which limits the generalisability of findings.

INTRODUCTION

Neonatal jaundice remains a major cause of neonate's hospitalisation globally within the first week of life. It refers to the yellowish discolouration observed in a neonate's skin, sclera and mucus membranes and is usually an indication of elevated levels of unconjugated bilirubin in the blood.[1] Severe neonatal jaundice leads to acute bilirubin encephalopathy or kernicterus with a significant risk of neonatal mortality and long-term neurological damage such as cerebral palsy, sensory neural hearing loss, intellectual difficulties or gross developmental delays[2]

The risk factors for neonatal hyperbilirubinaemia are diverse, complex and interconnected. A previous study by Thielemans *et al* among populations residing along the Thai–Myanmar border associated neonatal hyperbilirubinaemia with maternal–fetal ABO blood group incompatibility and glucose-6-phosphate dehydrogenase (G6PD) deficiency, both contributing to haemolysis. According to this study, the primary risk factors for early neonatal jaundice include ABO blood group incompatibility, G6PD enzyme deficiency, premature delivery, scalp haematoma and rhesus (Rh) blood group incompatibility.[3]

Approximately 60% of full-term infants and up to 80% of preterm infants experience the onset of jaundice within the first week of life. Furthermore, it is noteworthy that around 10% of infants who are exclusively breastfed continue to exhibit jaundice even at the age of 1 month.[4] Estimates indicate that approximately 1.1 million infants globally may experience severe hyperbilirubinaemia annually, with a higher prevalence

in sub-Saharan Africa and South Asia.[5] Severe neonatal jaundice impacts about 481 000 late-preterm and term newborns worldwide each year, leading to 114 000 deaths and more than 63 000 survivors facing long-term disabilities.[6] Sub-Saharan Africa bears the greatest burden of neonatal jaundice-related morbidity and mortality[5] thus warranting intervention.

In Somalia neonatal mortality rate was estimated at 36.0 per 1000 live births in 2021[7] with neonatal jaundice indicated as one of the major contributing factors to this mortality rate. However, there is limited data on the morbidity and mortality due to neonatal jaundice over the past three decades in Somalia. The lack of studies could be attributed to the civil war that has been going on in the country since 1991. Limited data on the prevalence and risk factors of neonatal jaundice could be a hindrance to preventive and curative efforts that could help reduce the morbidity and mortality associated with it. The aim of this study was to provide data on the prevalence and risk factors for neonatal jaundice among neonates admitted to neonatal intensive care units (NICUs) of three hospitals in Mogadishu, Somalia. The findings of this study would help design measures to reduce morbidity and mortality associated with neonatal jaundice among the Somali people.

METHODS

Study design and setting

A hospital-based analytical cross-sectional study was conducted at the NICUs of three hospitals (Banadir hospital, Kalkaal hospital and Yardimeli hospital) in Mogadishu. Mogadishu is the capital city of Somalia with an estimated population of 2 726 815 as of 2024 according to the United Nations World Urbanization Prospects.[8] Banadir hospital is a teaching maternity and children's hospital located in the Wadajir district of Mogadishu. Kalkaal hospital is located in Digfeer Road Wadajir district, Mogadishu. Yardimeli hospital is located in Afisioni Road, Hamar Jajab District of Mogadishu. Banadir and Yardimeli are public hospitals while Kalkaal is a private hospital. The three hospitals have the largest NICUs in Mogadishu city.

Operational definitions

Neonatal jaundice: Yellowish discolouration of the skin and sclera in a neonate accompanied by serum bilirubin levels ≥5 mg/dL.[9]

Neonate: A newborn child who is below 28 days of age.[10]

Study population

Neonates admitted in the NICUs of the three selected hospitals between March and July 2024 were included in the study. Mothers of these neonates were invited to participate in the study together with their neonates. A total of 423 mothers and 423 neonates were included in the study.

Inclusion and exclusion criteria

Only neonates admitted in the three study hospitals between March and July 2024 and whose mothers consented were included in this study. All mothers of the included neonates were also enrolled for the study. Mothers had to be 18 years and above for them and their neonates to be enrolled in the study.

Sample size and sampling technique

The sample size was calculated using a single population proportion formula, assuming a 95% CI, a 5% margin of error and an estimated prevalence of neonatal jaundice at 50%, due to the unknown actual prevalence. With an additional 10% added for potential non-response, the final sample size was 423. The study used a purposive sampling technique to select three hospitals in Mogadishu city, where the study would be conducted, based on their characteristics. Banadir and Yerdimeli were selected because they are the main public and referral hospitals that offer the largest NICU services in the city. Additionally, Kalkaal was selected because it is the largest private hospital with highly equipped and spacious NICU facilities. Convenience sampling was used to recruit all neonates admitted to the NICUs of the three facilities, based on availability, between March and July 2024. Mothers of the selected neonates were also included in the study. The participants were recruited consecutively until the required sample size was obtained. A total of 423 neonates and their mothers were included in the study.

Data collection

Data collection was done by interviewing mothers using a researcher-administered structured questionnaire. The research instrument was developed by the researchers and reviewed by experts in the field. It was used to gather data on demographic characteristics for both mothers and neonates, obstetrical characteristics for the mother and clinical characteristics for the neonate (online supplemental file 1). Additionally, secondary data on clinical characteristics of the neonates including serum bilirubin levels was abstracted from their medical records. Serum bilirubin testing was performed at the time of diagnosis by the clinical teams managing the neonates. To ensure comprehension by respondents, the questionnaire was translated from English to the local language (Somali). Following this, the Somali questionnaires were subjected to back-translation into English to ensure accuracy and validity were not lost during translation. Data collection was conducted between March and July 2024. Data was collected by a pretrained research assistant and one of the researchers.

Data analysis

Data entry, coding and analysis were conducted using R statistical software. Descriptive analysis was conducted for both neonatal and maternal characteristics. Maternal and neonatal age were summarised using medians and IQR while categorical variables were summarised using

frequencies and percentages. The prevalence of neonatal jaundice across the variables was compared using the χ^2 test. To identify the risk factors for neonatal jaundice, univariable and multivariable logistic regression were performed. In the initial analysis, univariable logistic regression was done for each of the variables. Variables with a p value of<0.05 were then fitted in a multivariable logistic regression model to obtain adjusted ORs (AORs). A penalised multivariable logistic regression model using Firth's method was used to reduce bias because Rh incompatibility presented with a quasi-complete separation phenomenon and extreme imbalance. Generalised variance inflation factors (GVIF) were calculated for the model to determine whether the assumption of no multicollinearity was met. Statistical significance was considered at a p value of<0.05 in this study.

Participant consent

Written informed consent was obtained from each respondent prior to participation in the study. During data collection, trained research assistants explained details of the study to the mothers, including the purpose, the voluntary nature of participation, anonymity, the confidentiality of the information provided by the participant, the benefits of the study to the community and that no harm would result from participation.

Patient and public involvement

It was not possible to involve the patients or the public in designing, conducting and reporting plans for this research study.

RESULTS

A total of 423 mothers and 423 neonates were enrolled in the study between March and July 2024. The ages of the mothers were between 18 and 45 years (median: 28 years; IQR: 24–31.5). The majority of the mothers (69.50%) had term pregnancy when they delivered and the majority of the mothers (94.33%) also experienced the spontaneous onset of labour. The normal duration of labour was reported for the majority of the mothers (80.14%) and the majority of them (61.47%) delivered through vaginal delivery. Most of the mothers (92.20%) delivered in a hospital and the majority (70.92%) did not require augmentation of labour with oxytocin. Demographic and obstetrical characteristics of the mothers are summarised in table 1.

Neonates included in this study had ages ranging from 0.25 to 20 days (median: 3 days; IQR: 1–6). The number of male and female neonates in the study was almost equal with 49.17% and 50.83%, respectively. Most of the neonates (57.21%) had a birth weight of<2500 g. In terms of clinical characteristics, ABO and Rh incompatibility occurred in only a small portion of the neonates (4.02% and 2.84%, respectively) while birth asphyxia occurred in 30.50% of the neonates. A significant portion of the neonates (48.94%) developed neonatal sepsis.

Table 1 Demographic and obstetrical characteristics of the mothers included in the study

Variable	Categories	Frequency n=423 (%)
Maternal age	<25 years	120 (28.37)
	25–35 years	258 (60.99)
	>35 years	45 (10.64)
Gestational age	Term	294 (69.50)
	Preterm	109 (25.77)
	Post-term	20 (4.73)
Onset of labour	Spontaneous	399 (94.33)
	Induced	24 (5.67)
Duration of labour	Normal	339 (80.14)
	Prolonged	84 (19.86)
Mode of delivery	Vaginal	260 (61.47)
	C/S	160 (37.83)
	Instrument-assisted	3 (0.71)
Place of delivery	Hospital	390 (92.20)
	Home	33 (7.80)
Received oxytocin in labour	Yes	123 (29.08)
	No	300 (70.92)
Experienced prom	Yes	101 (23.88)
	No	322 (76.12)

C/S, caesarean section; prom, premature rapture of membranes.

Demographic and clinical characteristics of the neonates are summarised in table 2.

Prevalence of neonatal jaundice

Among the 423 neonates included in the study, 128 had neonatal jaundice (30.26%). Prevalence of neonatal jaundice was significantly associated with maternal age (p value=0.000), duration of labour (p value=0.000), mode of delivery (p value=0.001) and the mother having received oxytocin during labour (p value=0.009). The association of maternal characteristics and neonatal jaundice is summarised in table 3. As summarised in table 4, the prevalence of neonatal jaundice was significantly associated with neonatal age (p value=0.001), neonatal sex (p value=0.004), ABO incompatibility (p value=0.000), Rh incompatibility (p value=0.000) and neonatal sepsis (p value=0.000).

Risk factors for neonatal jaundice

In univariable logistic regression, maternal factors that had a significant relationship with neonatal jaundice included; age, duration of labour, mode of delivery (only vaginal vs caesarean) and the mother having received oxytocin in labour. Neonatal risk factors that had significant relationship with neonatal jaundice in the univariable analysis included; age 3–10 days, sex, ABO incompatibility, Rh incompatibility and neonatal sepsis. Table 5 summarises the results of univariable logistic regression.

Table 2 Demographic and clinical characteristics of neonates included in the study

Variable	Categories	Frequency (n=423) (%)
Neonatal age (days)	<3	165 (39.01)
	3–10	241 (56.97)
	>10	17 (4.02)
Neonatal sex	Male	208 (49.17)
	Female	215 (50.83)
Birth weight (g)	<2500	242 (57.21)
	2500–3500	161 (38.06)
	>3500	20 (4.73)
Birth asphyxia	Yes	129 (30.50)
	No	294 (69.50)
ABO incompatibility	Yes	17 (4.02)
	No	406 (95.98)
Rhesus incompatibility	Yes	12 (2.84)
	No	411 (97.16)
Feeding type	Breastfeeding	339 (80.14)
	Formula feeding	63 (14.89)
	Others	21 (4.96)
Feeding frequency	<5	179 (42.32)
	5–8	238 (56.26)
	>8	6 (1.42)
Total bilirubin	<5	296 (69.98)
	5–10	44 (10.40)
	10–15	43 (10.17)
	>15	40 (9.46)
Sepsis	Yes	207 (48.94)
	No	216 (51.06)

Feeding frequency: Number of times a neonate was fed in a day.

During multivariable logistic regression, maternal factors that had a significant relationship with neonatal jaundice included; age, duration of labour and mode of delivery (only vaginal vs caesarean). The odds of developing neonatal jaundice were 4.47 times higher in neonates of mothers aged 25–35 years (95% CI: 2.37 to 9.04, p value=0.000) and 6.03 times higher in neonates of mothers aged>35 years (95% CI: 2.46 to 15.13, p value=0.000), compared with those of mothers aged<25 years. The odds of developing neonatal jaundice were 3.29 times higher in neonates of mothers who had prolonged labour compared with those of mothers who had normal labour duration (95% CI: 1.79 to 6.08, p value=0.000). Additionally, the odds of neonatal jaundice were 2.75 times higher in neonates of mothers who delivered vaginally compared with those of mothers who had a caesarean section (95% CI: 1.56 to 4.97, p value=0.000). Instrument delivery did not show significant relationship with neonatal jaundice.

Neonatal factors that had significant relationship with neonatal jaundice during multivariable logistic regression included; sex, ABO incompatibility, Rh incompatibility and neonatal sepsis. The odds of developing neonatal jaundice were 53% lower for male neonates compared with female neonates (AOR: 0.47, 95% CI: 0.28 to 0.76, p value=0.002). For neonates who had ABO incompatibility, the odds of neonatal jaundice were 22.26 times higher compared with neonates who did not have ABO incompatibility (95% CI: 3.54 to 249.62, p value=0.001). The odds of neonatal jaundice were 14.10 times higher for neonates who had Rh incompatibility compared with those who did not have Rh incompatibility (95% CI: 1.11 to 2021.73, p value=0.040). Additionally, the odds of neonatal jaundice were 1.96 times higher for neonates who had neonatal sepsis compared with those who did not have neonatal sepsis (95% CI: 1.15 to 3.39, p value=0.014). Table 6 summarises the results of multivariable logistic regression.

Checking for multicollinearity

All the predictor variables had a GVIF that was close to 1 indicating very low multicollinearity. Rh incompatibility had a GVIF of 1 indicating no multicollinearity. The analysis could thus be performed without concerns of multicollinearity affecting the model estimates. Table 7 summarises the GVIF results.

DISCUSSION

Among 423 neonates admitted to the NICUs and included in this study during the period from March to the end of July 2024, the prevalence of neonatal jaundice was 30.26%. The study identified 128 neonates with clinical jaundice and a serum bilirubin level above 5 mg/dL. These prevalence is relatively comparable to another study conducted in 2020 by Tessema *et al* in Ethiopia which indicated prevalence of neonatal jaundice was 28.4%.[11] A similar study conducted by Scrafford *et al* in Nepal indicated a higher prevalence rate of 55.8%.[12] The difference in prevalence rates across studies could be attributed to variations in determinants of health as this study populations are in different countries. However, the prevalence in this study, similarly to the other studies, is relatively high warranting intervention.

ABO and Rh incompatibility were identified as significant risk factors for neonatal jaundice. The odds of neonatal jaundice were 22.27 higher for neonates with ABO incompatibility and 14.10 higher for those with Rh incompatibility. These findings are consistent with findings from studies conducted by Chime *et al* in Nigeria[13] and by Tessema *et al* in Ethiopia[11] which reported ABO incompatibility as a significant risk factor for neonatal jaundice. Additionally, the findings are in line with a study conducted by Patel *et al* in India which found both ABO and Rh incompatibility as significant risk factors for neonatal jaundice.[14] To enhance prevention and early detection of neonatal jaundice, blood group testing

Table 3 Association of maternal characteristics with neonatal jaundice

Variable	Categories	Prevalence of NJ (%)	X^2	P value
Maternal age	<25 years	12.5	25.04	0.000
	25–35 years	37.21		
	>35 years	37.78		
Gestational age	Post-term	25.00	3.84	0.147
	Preterm	37.61		
	Term	27.89		
Onset of labour	Spontaneous	29.32	2.19	0.139
	Induced	45.83		
Duration of labour	Normal	25.07	20.54	0.000
	Prolonged	51.19		
Mode of delivery	Vaginal	36.15	14.15	0.001
	C/S	20.00		
	Instrument	66.67		
Place of delivery	Hospital	30.00	0.04	0.839
	Home	33.33		
Received oxytocin in labour	Yes	39.84	6.91	0.009
	No	26.33		
Experienced prom	Yes	22.77	3.07	0.080
	No	32.61		

C/S, caesarean section; NJ, neonatal jaundice; Prom, premature rapture of membranes.

Table 4 Association of neonatal characteristics with neonatal jaundice

Variable	Categories	Prevalence of NJ (%)	X^2	P value
Neonatal age	<3 days	20.61	13.38	0.001
	3–10 days	37.34		
	>10 days	23.53		
Neonatal sex	Male	23.56	8.10	0.004
	Female	36.74		
Birth weight (g)	<2500	28.51	2.51	0.285
	2500–3500	34.16		
	>3500	20.00		
Birth asphyxia	Yes	31.78	0.11	0.736
	No	29.59		
ABO incompatibility	Yes	94.12	31.14	0.000
	No	27.59		
Rhesus incompatibility	Yes	100.00	25.16	0.000
	No	28.22		
Feeding type	Breastfeeding	29.50	0.77	0.680
	Formula feeding	34.92		
	Others	28.57		
Sepsis	Yes	40.10	17.68	0.000
	No	20.83		

NJ, neonatal jaundice.

Table 5 Univariable logistic regression analysis of risk factors for neonatal jaundice

Variable	Categories	Unadjusted OR	95% CI	P value
Maternal age	<25 years	1		
	25–35 years	4.15	2.34 to 7.79	0.000
	>35 years	4.25	1.90 to 9.68	0.000
Gestational age	Post-term	1		
	Preterm	1.81	0.65 to 5.89	0.284
	Term	1.16	0.43 to 3.66	0.780
Onset of labour	Induced	1		
	Spontaneous	0.49	0.21 to 1.15	0.093
Duration of labour	Normal	1		
	Prolonged	3.13	1.91 to 5.15	0.000
Mode of delivery	C/S	1		
	Vaginal	2.27	1.44 to 3.64	0.001
	Instrument	8.00	0.74 to 175.33	0.094
Place of delivery	Home	1		
	Hospital	0.86	0.41 to 1.89	0.689
Received oxytocin in labour	Yes	1.85	1.19 to 2.88	0.006
	No	1		
Experienced prom	Yes	0.61	0.36 to 1.01	0.062
	No	1		
Neonatal age	<3 days	1		
	3–10 days	2.30	1.46 to 3.67	0.000
	>10 days	1.19	0.32 to 3.60	0.778
Neonatal sex	Male	0.53	0.35 to 0.81	0.003
	Female	1		
Birth weight	<2500	1		
	2500–3500	1.30	0.85 to 2.00	0.229
	>3500	0.63	0.17 to 1.78	0.418
Birth asphyxia	Yes	1.11	0.71 to 1.73	0.652
	No	1		
ABO incompatibility	Yes	42.00	8.42 to 762.51	0.000
	No	1		
Rhesus incompatibility	Yes	63.41	8.24 to 8149.45	0.000
	No	1		
Feeding type	Breastfeeding	1		
	Formula	1.28	0.72 to 2.24	0.391
	Others	0.96	0.33 to 2.43	0.928
Sepsis	Yes	2.54	1.66 to 3.93	0.000
	No	1		

C/S, caesarean section; Prom, premature rapture of membranes.

should be conducted for all pregnant women as part of antenatal care followed by an investigation of neonatal blood group, especially for neonates of mothers with blood group O. Mothers of neonates who are at risk of ABO incompatibility should be advised on the possibility of jaundice occurrence, early detection and prompt healthcare seeking if it occurs. Administration of anti-D immunoglobulin to Rh negative pregnant women as part of routine antenatal care can also help prevent Rh incompatibility reactions.

Neonatal sepsis was identified as another significant risk factor for developing neonatal jaundice. Neonates

Table 6 Multivariable logistic regression analysis of risk factors for neonatal jaundice

Variable	Categories	Adjusted OR	95% CI	P value
Maternal age	<25 years	1		
	25–35 years	4.47	2.37 to 9.04	0.000
	>35 years	6.03	2.46 to 15.13	0.000
Duration of labour	Normal	1		
	Prolonged	3.29	1.79 to 6.08	0.000
Mode of delivery	C/S	1		
	Vaginal	2.75	1.56 to 4.97	0.000
	Instrument	3.27	0.33 to 44.69	0.311
Received oxytocin in labour	Yes	0.83	0.45 to 1.48	0.525
	No	1		
Neonatal age	<3 days	1		
	3–10 days	1.55	0.89 to 2.74	0.125
	>10 days	0.69	0.18 to 2.28	0.554
Neonatal sex	Male	0.47	0.28 to 0.76	0.002
	Female	1		
ABO incompatibility	Yes	22.26	3.54 to 249.62	0.001
	No	1		
Rhesus incompatibility	Yes	14.10	1.11 to 2021.73	0.040
	No	1		
Sepsis	Yes	1.96	1.15 to 3.39	0.014
	No	1		

C/S, caesarean section.

with sepsis were approximately 1.96 times more likely to develop neonatal jaundice compared with those without a sepsis diagnosis. This finding is consistent with the findings of previous studies conducted by Oteikwu *et al* in Nigeria[15] and by Tessema *et al* in Ethiopia.[11] During the study, it was observed that some babies did not have jaundice on admission to the NICU. However, during their stay, they developed sepsis followed by neonatal jaundice. Factors that could lead to neonatal sepsis include a poor hygienic environment in the NICU coupled with a premature neonatal immune system. Sepsis can cause haemolysis of red blood cells and hepatic dysfunction. This leads to the accumulation of serum bilirubin within the body. Additionally, drugs used to treat neonatal sepsis can have an effect on liver function leading to hyperbilirubinaemia. Practicing aseptic techniques and maintaining high standards of hygiene when handling newborns can help prevent neonatal sepsis and thus prevent neonatal jaundice.

Table 7 Generalised variance inflation factor results

Variable	GVIF	Df	Adjusted GVIF
Mothers' age	1.07	2	1.02
Duration of labour	1.20	1	1.09
Mode of delivery	1.27	2	1.06
Received oxytocin in labour	1.30	1	1.14
Neonatal age	1.29	2	1.07
Neonatal sex	1.04	1	1.02
ABO incompatibility	1.03	1	1.01
Rhesus incompatibility	1.00	1	1.00
Sepsis	1.26	1	1.12

Df, degrees of freedom; GVIF, generalised variance inflation factor.

This study demonstrated that prolonged labour is a significant risk factor for neonatal jaundice with the odds being 3.29 times higher compared with neonates of mothers who had normal labour duration. This finding align with a study conducted by Lake *et al* in public hospitals in Mekelle City, Northern Ethiopia.[16] The increased risk of jaundice may be attributed to bruising and scalp swelling in newborns due to excessive pressure applied by birth attendants during prolonged labour, which raises bilirubin levels in the blood. Additionally, this study found that caesarean section delivery reduced the risk of neonatal jaundice with the odds being 2.75 higher for neonates born through vaginal delivery. This is consistent with the findings of another study conducted by Najib *et al* in Iran.[17] The increased risk for neonates delivered vaginally may be due to birth trauma and physical strain that sometimes occur leading to bleeding and haemolysis.[18]

Effective monitoring of labour using a partograph can help make timely decisions to prevent prolonged labour. Also, antenatal follow-up with indicated obstetrical scans can help determine the necessity of a caesarean delivery in advance thus avoid exposing the newborn to physical strain and birth trauma.

Female sex and higher maternal age were also identified in this study as risk factors for neonatal jaundice. The odds of neonatal jaundice were 53% lower for male neonates compared with female neonates. This finding is contrary to other studies in Nepal,[12] Malaysia[19] and Ethiopia[18] which reported the male sex to be at higher risk of neonatal jaundice. Further studies are required to ascertain the role of neonatal sex as a risk factor for neonatal jaundice among neonates in Somalia. Higher maternal age was associated with an increased risk for neonatal jaundice in this study. This finding is consistent with a population-based study conducted in Sweden,[20] a study conducted in Bahrain,[21] and another conducted in Ethiopia.[18] Close monitoring and follow-up of neonates born to mothers of higher age can help in early detection and prompt intervention to prevent complications of neonatal hyperbilirubinaemia.

Strengths and limitations of the study

To the best of the author's knowledge as of the time of writing this paper, no other study focusing on risk factors for neonatal jaundice in Mogadishu, Somalia, has been published. Another strength is that this was a multicentre study with a mix of both public and private hospitals. Limitations of this study include that data on clinical characteristics of the neonates was secondary and thus its accuracy depended on a third party. The use of non-probability sampling techniques may have introduced selection bias which limits the generalisability of this study's results. The study also shares the limitations of a cross-sectional study.

CONCLUSION

The prevalence of neonatal jaundice is significantly high among neonates in Somali populations. Neonatal jaundice is a significant contributor to newborn morbidity and mortality in Somalia, and measures to address it are needed. ABO and Rh incompatibility are key contributors to neonatal jaundice. Interventions that emphasise measures such as the administration of anti-D immunoglobulin to pregnant Rh negative mothers and investigation of maternal and neonatal blood groups are needed. Additionally, interventions to ensure effective pregnancy and labour monitoring are needed to reduce the risk associated with prolonged labour or birth injuries that occur during normal labour. Close monitoring and postnatal follow-up of neonates born to older mothers can ensure timely interventions to reduce the risk of neonatal jaundice. Measures to reduce the risk of neonatal sepsis such as adherence to aseptic techniques when handling the neonate are needed. Further research should be conducted to conclusively identify whether neonatal sex is a significant risk factor for neonatal jaundice and which sex could be at a higher risk. We also recommend further research on this topic using alternative study designs and probability sampling techniques as well as community-level studies to compare findings between rural and urban populations.

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