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Magnitude of Neonatal Jaundice and Its Predictors among Neonates Admitted in NICUs in Ethiopia: A Facility-Based Cross-Sectional Study

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Abstract

Background: Jaundice in neonates is one of the most common clinical problems. Neonatal jaundice is a yellowish discoloration of the white part of a newborn baby's eyes and skin caused by high bilirubin levels. Across the world, in each year around 1.1 million newborns develop neonatal jaundice and the majority of this occurs in sub-Saharan Africa and South Asia. There are limited studies on the magnitude and predictors of neonatal jaundice, in Ethiopia. So, this study aimed to assess the magnitude of neonatal jaundice and its predictors among neonates admitted in Neonatal Intensive Care Units (NICUs).

Methods: This Facility-based cross-sectional study was conducted, from December 2020 to April 2021, on 394 participants. Simple random sampling techniques were used to select hospitals; and samples were allocated proportionally to each hospital based on the number of women who gave birth. Methods of data collection used in this study were both interview and chart review. Chart review was applied for variables which are found on the patient charts. Interviews were used for variables which are not found on the patient chart. Data was entered in Epi-info version-7 software and exported to SPSS version 23 for editing, cleaning, and analysis. Bivariate and multivariate logistic regression analyses were used to identify predictors of neonatal jaundice. Variables with a p-value <0.2 in the bivariate analysis were entered into a multivariable model at a 95 % confidence level to identify predictors of neonatal jaundice while controlling for potential confounding factors. The significance of the association was determined using a P-value < 0.05.

Result: This study involved 394 mothers with their neonates. The response rate of this study was 100%; following. The magnitude of neonatal jaundice was 20.8% [95% CI: (6.32-27.64]. Being male neonate [AOR=1.52, 95 CI (1.32-8.54)], Prolonged labor [AOR=2.31; 95% CI (1.05-11.05)], primiparous mother [AOR=1.99; 95% CI (1.08-10.64)], neonatal sepsis [AOR=1.15; 95% CI (1.00-13.2)], and instrumental delivery [AOR=1.78; 95% CI (2.15-17.11)] were found to be the predictors of neonatal jaundice. It is recommended to practice essential obstetrical interventions such as following the laboring mothers in the active stage of labor with partograph to prevent prolonged labor, using aseptic technique during intrapartum and postpartum periods to prevent neonatal sepsis, and revising prerequisites and indications before the application of instrumental delivery.

Key Words: Ethiopia, Magnitude, Neonatal jaundice, Predictors, South Gondar.

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1- INTRODUCTION

Neonatal jaundice is the yellowish discoloration of the skin, sclera, and mucous membranes due to accumulation of unconjugated, nonpolar, and lipid-soluble bilirubin pigment in the skin (1). Neonatal jaundice is the clinical condition which needs hospital readmission, evaluation, and appropriate treatment in newborns (2). If attention is given, neonatal jaundice is an easily treatable and preventable clinical condition; otherwise it leads to morbidity and mortality (1).

The term "neonatal era" is a period between birth and twenty-eight days of neonatal life, and at this time, neonates might develop physiological or pathological jaundice (3). Bilirubin is not merely a nuisance molecule that has dire consequences, but a bilirubin such as uric acid is an important antioxidant circulating in the biologic system of neonates (4). However, high bilirubin levels can be toxic for central nervous system development and may cause behavioral and neurological impairment (Neurotoxicity or Kernicterus) even in term newborns (4). Five to ten percent of newborns develop jaundice which requires the management of hyperbilirubinemia (5).

Neonatal jaundice plays a major role in neonatal morbidity and mortality across the world. In the first week of life, neonatal jaundice affects up to 60% of term newborns and 80% of preterm newborns worldwide (6). In developing regions, neonatal jaundice contributes to 70% and 10% of neonatal morbidity and mortality, respectively (7). The prevalence of neonatal jaundice was 64% in India (8), 35% in Nigeria (9), 2.93% in Nepal (10), 16.6% in Egypt (11), and 26.45% in Ethiopia (12). Prematurity, blood type incompatibility, pronged labor, and neonatal sepsis were known as predictors of neonatal sepsis (1). Neonatal jaundice has socio-economic, and psychological impacts on the society due to medical costs in relation to this health condition. Phototherapy and blood transfusion are the mainstay of treatment for neonatal jaundice with significant hyperbilirubinemia (13). Ensuring babies have Eight to twelve times exclusive breastfeeding in a day is helpful to reduce neonatal jaundice (14). Even though neonatal jaundice is one of the most common causes of neonatal morbidity and mortality, it is not well studied in Ethiopia. This study assessed the magnitude and predictors of neonatal jaundice in selected hospitals of the south Gondar Zone.

2- MATERIALS AND METHODS

2-1. Design and Setting

This facility-based cross-sectional study was conducted to assess the magnitude of neonatal jaundice and its predictors at neonatal intensive care units of selected hospitals in the south Gondar zone From December 2020 to April 2021. Debre Tabor is the capital city of the south Gondar zone, located 666 kilometers from Ethiopia's capital city, Addis Abeba. Based on the 2007 census conducted by the Central Statistical Agency of Ethiopia (CSA), the total population projection value of 2020 at South Gondar zone was 4,554,201 of whom 2,156,786 were females. In selected hospitals of south Gondar zone, general surgery, obstetric and gynecological surgery, Neonatal intensive care unit and pediatrics, and Medical services are provided. Medical doctors, Nurses, Midwives, Anesthetist, Emergency surgery specialty, and optometrist give services in selected hospitals of south Gondar zone. Annually in the selected hospitals, there are totally 96,868 neonatal admissions in the selected hospitals of south Gondar zone. Monthly, on average, there are around 34 neonatal admissions in each hospital.

2-2. Population and Sampling

Source populations comprised all neonates admitted to Neonatal Intensive Care Unit

(NICU) of South Gondar zonal Hospitals, Ethiopia. Study populations consisted of Neonates admitted to NICU in selected hospitals of south Gondar zone during the data collection period.

2-2-1. Inclusion and exclusion criteria

Inclusion criteria encompassed Neonates admitted to NICU during the data collection time. Exclusion criteria included Neonates admitted more than once in NICU during the data collection time.

2-2-2. Sample size and sampling technique

The sample size was determined by using a single population proportion formula with the assumptions of 95% CI, P-37% from a previous study, 5% margin of error, and 10% non-response rate. Sample size was estimated based on a study conducted in the neonatal intensive care unit of Mekelle public hospitals, which revealed that the prevalence of neonatal jaundice was 37% (5).The final sample size after adding 10% none response rate was 394. Study hospitals (Debre Tabor, Addis zemene, Nefasmewucha, Mekane eysus, and Ebinat) were selected by simple random sampling techniques. Proportional allocation of samples was done for each hospital based on the number of neonates admitted in the NICUs. Finally, a systematic sampling technique was used to select each study participant from selected hospitals.

2-3. Data collection techniques and tools

Chart review and patient interviews were applied for data collection. Chart review was applied for variables found on the patient charts and interviews were implemented for variables which were not found on the patient charts. Pretest was done on 5% of the sample to evaluate the reliability and validity of the questionnaire (tool) prior to actual data collection. Training was given for data collectors and supervisors for two days about the importance of this study, its objectives, how to collect information from the respondents, and how to fill out a structured questionnaire. On a daily basis, supervisors and investigators checked completed questionnaires for completeness and consistency. Questionnaires used for this study were adapted from previous articles (2, 15-17).

2-4. Data Analysis

Data was entered into the Epi info version 7.1 software and exported to the SPSS version 23 software for editing, cleaning, and analysis. Percentages of each variable with tables, and descriptive statistics were used to describe the characteristics of the study participants. To identify predictors of neonatal jaundice, bivariate and multivariate logistic regression analyses were used. In order to identify factors associated with neonatal jaundice, variables with a p-value <0.2 in the bivariate analysis were entered into a multivariate model. Adjusted Odds Ratio (AOR) was used to identify factors associated with neonatal jaundice. A p-value of <0.05 in the multivariate model was used to identify statistically significant variables in multivariate analysis.

2-4-1. Variable measurement

a) Neonate: An infant between the ages of birth and 28 days (5).

b) Neonatal Jaundice: Neonates diagnosed as jaundiced by the physician (5).

c) Physiological Jaundice: Neonates who meet one or more of the established IMNCI criteria (yellow skin on the face or eyes and infants aged 2-13 days) and have a total bilirubin value of 12mg/100ml in term babies and less than 15 mg/100 ml in preterm babies (5).

d) Pathological Jaundice: Neonates who meet one or more of the established IMNCI criteria (palms and/or soles yellow, skin and eyes yellow when the baby is 24

hours old, skin and eyes yellow when the baby is 14 days old) as well as total bilirubin greater than 12mg/100ml in term and greater than 15 mg/100ml in preterm babies (5).

3- RESULTS

3-1. Socio-demographic characteristics of the mothers

A total of 394 neonates with their mothers were involved with a 100% response rate. The average age of the mothers was 28 years with a standard deviation of ±4.213. Two hundred ninety-two (74.1%) of the participants aged 20-35 years. Three hundred seventy-eight (95.9%) mothers were married. Two hundred sixty-six (52.3%) of the mothers came from rural areas, while one hundred eighty-eight (47.7%) came from urban areas. Three hundred seventy-six (95.4%) participants were from Amhara (Table 1).

Table-1: Maternal Socio-demographic characteristics of mothers at NICUs of the selected hospitals in south Gondar zone, Amhara region, 2020.

Variables	Category	Frequency	Percent (%)
Age of mothers	<20	32	8.1
	20-35	292	74.1
	>35	70	17.8
Religion of mothers	Orthodox	357	90.6
	Muslim	29	7.4
	Protestant	8	2.0
Marital status	Single	16	4.1
	Married	378	95.9
Residence	Urban	188	47.7
	Rural	206	52.3
Ethnicity	Amhara	376	95.4
	Oromo	8	2.0
	Tigray	5	1.3
	Others	5	1.3
Occupation	Housewife	300	76.1
	Governmental employee	86	21.8
	Merchant	8	2
Educational status	Unable to read and write	177	44.9
	Able to read and write	61	15.5
	Primary school	23	5.8
	Secondary school	31	7.9
	College and above	102	25.9

3-2. Obstetric and Neonatal related characteristics

Two hundred ninety-one (73.9 %) of the mothers who took part in the study were multipara. The vast majority of mothers (73.9 %) had vaginal births on their own. Almost all of the mothers (95.9%) received antenatal care. The vast majority (92.9 %) of the neonates were born at normal birth weight. The majority of the neonates (73.1 %) were breastfed exclusively. Neonatal sepsis was diagnosed in nearly two-thirds of the neonates (64.47%) (Table 2).

Table-2: Obstetric and Neonatal characteristics of neonates admitted in NICUs of south Gondar zone selected hospitals, Amhara region, 2020

Variables	Category	Frequency	Percent%
Parity	Primipara	103	26.1
	Multipara	291	73.9
Mode of delivery	Spontaneous	298	75.635
	Instrumental	20	5.076
	Cesarean section	76	19.289
ANC follow-up	Yes	378	95.9
	No	8	2
Place of delivery	Home delivery	8	2
	Health center	100	25.4
	Hospital	286	72.6
Sex of neonates	Female	247	62.7
	Male	147	37.3
Birth weight (KG)	<2.5	28	7.1
	≥2.5	366	92.9
Gestational age at birth(in a week)	<37	225	57.1
	37-42	156	39.6
	>42	13	3.3
Five minutes APGAR score	≤6	101	25.6
	6-10	293	74.4
Neonatal times of duration on admission (in days)	≤7	387	98.2
	>7	7	1.8
Neonatal jaundice	Yes	82	20.8
	No	312	79.2
Neonatal sepsis	Yes	254	64.47
	No	140	35.53
Feeding status of neonates	EBF	288	73.1
	Formula feeding	31	7.9
	No feeding at all	75	19
Neonatal blood group	A	154	44%
	B	43	11%
	AB	23	6%
	O	174	44%
Maternal blood group	A	132	33.5%
	B	67	17%
	AB	36	9.14%
	O	159	40.36%
Rh incompatibility	Yes	44	12.088%
	No	350	87.912%
Had PROM*	Yes	38	10%
	No	356	90%

*PROM (Premature Rupture of Membrane)

3-3. Magnitude of Neonatal jaundice

The magnitude of neonatal jaundice in selected hospitals of the south Gondar zone was 20.8% (95% CI: 6.32, 27.64). Also, 50 (60.97%) were affected with pathological jaundice, and 32 (39.03%) were affected with physiological jaundice. Phototherapy and blood transfusion were the mainstays of management for pathological jaundice in the selected hospitals of the south Gondar zone.

3-4. Predictors of neonatal jaundice among neonates admitted in the selected hospitals of south Gondar

This study revealed that neonates born with prolonged labor had a 2.31 times greater risk of neonatal jaundice than those delivered with a normal duration of labor (AOR=2.31; 95% CI: 1.05-11.05). Odds of neonatal jaundice among male neonates were 1.52 times higher than those of female neonates (AOR=1.52, 95CI: 1.32, 8.54). Odds of neonatal jaundice among primiparous mothers were 1.99 higher than among multiparous mothers (AOR=1.99; 95% CI: 1.08-10.64). Odds of neonatal jaundice among neonates who had neonatal sepsis were 1.15 times higher than those among their counterparts (AOR=1.15; 95%CI: 1.00-13.2). Odds of neonatal jaundice among neonates delivered by instrumental delivery were 1.78 higher than those among their counterparts (AOR=1.78; 95%CI: 2.15, 17.11) (Table 3).

Table-3: Bivariate and multivariate analyses of different independent variables with neonatal jaundice among selected hospitals of south Gondar zone, Amhara region, 2021(n=394).

Variables	Category	Jaundice		COR (95%CI)	AOR (95%CI)
		Yes N (%)	No N (%)		
Sex of neonate	Female	42 (17%)	209 (83%)	1	1
	Male	40 (27.21%)	107 (72.79%)	1.86 (1.13-5.56)	1.52 (1.32-8.54)*
Duration of labor	Normal duration	74 (22.8%)	251 (77.2%)	1	1
	Prolonged labor	8 (11.6%)	61 (88.4%)	2.25 (1.03-4.91)	2.31 (1.05-11.05)*
Number pregnancy	Primiparous	31 (30.1%)	72 (69.9%)	2.03 (1.21-3.40)	1.99 (1.08-10.64)*
	Multiparous	51 (17.5%)	240 (82.5%)	1	1
Neonatal Sepsis	Yes	62 (24.41%)	192 (75.59%)	1.94 (1.14-8.56)	1.15 (1.00-13.2)*
	No	20 (14.29%)	120 (85.71%)	1	1
Mode of delivery	Spontaneous	45 (6.71%)	278 (93.29%)	1	1
	Instrumental	12 (60%)	8 (40%)	9.27 (1.98-11.23)	1.78 (2.15-17.11)*
	Cesarean section	25 (33%)	51 (67%)	3.02 (0.65-23.31)	1.01 (0.34-38.11)

CI: Confidence Interval; COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; * Significant at the multivariable model

4- DISCUSSION

This study aimed to assess the magnitude and predictors of neonatal jaundice among neonates admitted in the selected hospitals of the south Gondar zone. The magnitude of neonatal jaundice among neonates admitted in the selected hospitals was 20.8% (95% CI: 6.32, 27.64). This finding is in line with that those of the studies done in Ethiopia (26.45%)(12), Nigeria (17.9%)(18), Egypt (16.6%)(11), Nepal(2.93%)(10), and Croatia(24.8%)(8). This finding is lower than that of Ethiopia (37.3 %) (5), and India (64%) (4). This variation might be due to the study setting, study design used, and study population. In addition, the difference could be due to the variation in socio-cultural and economic conditions, level of maternity care, and awareness about maternal and child health care among the study population.

This study showed that prolonged labor was one of the predictors of neonatal jaundice. The odds of neonatal jaundice among women who had prolonged labor was 2.31 times more likely than among women who had a normal duration of labor. This finding is supported by research studies conducted in Ethiopia (5), and Nepal (10). This might be attributed to bruising and swelling of the scalp of newborns due to the excessive pressure applied by birth attendants as a solution for prolonged labor, which increases the risk of jaundice by increasing bilirubin level in blood. Beside this, when women have prolonged labor, their pelvis is faced with multiple vaginal examinations, which inoculates bacteria from the external environment and vagina; and this might lead to neonatal jaundice (4).

This study revealed that being a male neonate is the predictor of neonatal jaundice. The odds of jaundice among male neonates were 1.52 times more likely than those among female neonates. This finding was supported by studies done in Ethiopia (5), Nigeria (19), and Nepal (10). This could be related to the fact that male neonates have relatively immature livers, which may not process all bilirubin formed from red blood cells (20).

This study showed that instrumental delivery is the predictor of neonatal jaundice. The odds of neonatal jaundice among neonates who had instrumental delivery were 1.78 times more likely than among neonates who had a spontaneous vaginal delivery. This study aggregates with the studies done in South Africa (21), and Israel (22). This could be attributed to the fact that instrumental delivery sometimes has bleeding under the scalp, and this leads to the higher concentration of bilirubin in the neonate's body (22).

Moreover, this study reported that neonatal sepsis is the predictor of neonatal jaundice. The odds of neonatal jaundice among neonates diagnosed with sepsis were 1.78 times more likely than those among their counterparts. This finding was supported by studies done in Ethiopia (5), Nigeria (19), India (3, 4, 20), and Iran (23, 24). The possible explanation could be the fact that neonatal sepsis might have impacts on the destruction of red blood cells and the accumulation of bilirubin in the body of neonates (5).

This study reported that being primiparous is the predictor of neonatal jaundice. The odds of neonatal jaundice among primiparous women were 1.99 times more likely than those among their counterparts. This finding is aggregated with the study done in Tehran, Iran (25). This could be explained by newborns delivered from primiparous women sometimes exposed for scalp trauma and bleeding due to untested pelvis. This might lead to the accumulation of bilirubin in the body of the neonate (5).

5- CONCLUSION

The magnitude of neonatal jaundice is high in the selected hospitals of the south

Gondar zone. Male neonate, neonatal sepsis, prolonged labor, instrumental delivery, and primiparous women were the predictors of neonatal jaundice in this study.

It is recommended to practice essential obstetrical interventions, such as following laboring mothers in the active stage of labor with partograph to prevent prolonged labor, following aseptic technique during intrapartum and postpartum periods to prevent neonatal sepsis, and revising prerequisites and indications before the application of instrumental delivery.

6- ABBREVIATIONS

AOR: Adjusted odds ratio

CI: Confidence interval

COR: Crude odds ratio

NICU: Neonatal intensive care unit

PROM: Premature rupture of membrane

7- ETHICAL CONSIDERATIONS

The research ethics committee of Debre Tabor University's College of Medicine and Health Science approved the study. To obtain permission, a written official letter was submitted to the study facility.

Furthermore, the study's purpose was disclosed to study participants, and written consent was obtained from each study participant prior to the start of the data collection process. The study participants' privacy and autonomy were protected.

8- CONSENT FOR PUBLICATION

Not applicable

9- AVAILABILITY OF DATA AND MATERIALS

The data set used in this study is available from the corresponding author and can be accessed through reasonable request at any time.

10- COMPETING INTERESTS

We declare that there is no competing interest in this study.

11- FUNDING

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12- AUTHORS' CONTRIBUTION

All authors contributed to the study design, data collection, analysis, and write-up. Finally; all authors read and approved the final manuscript.

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14- REFERENCE

1. Bhutani VK, Zipursky A, Blencowe H, Khanna R, Sgro M, Ebbesen F, et al. Neonatal hyperbilirubinemia and Rhesus disease of the newborn: incidence and impairment estimates for 2010 at regional and global levels. Pediatric research. 2013 Dec;74(1):86-100.

2. Azar AT, Inbarani HH, Kumar SU, Own HS. Hybrid system based on bijective soft and neural network for Egyptian neonatal jaundice diagnosis. International Journal of Intelligent Engineering Informatics. 2016;4(1):71-90.

3. Paridhi G, Nilesh D, Sumit A, Vinit W, Garg P. Study of Etiology of Neonatal Jaundice at tertiary care centre in Maharashtra. SJAMS ISSN. 2015;2320:6691.

4. Bahl LA, Sharma RA, Sharma JA. Etiology of neonatal jaundice at Shimla. Indian pediatrics. 1994 Oct;31(10):1275-8.

5. Lake EA, Abera GB, Azeze GA, Gebeyew NA, Demissie BW. Magnitude of neonatal jaundice and its associated factor in neonatal intensive care units of Mekelle city public hospitals, Northern Ethiopia. International journal of pediatrics. 2019;2019(1):1054943.

6. Karayalcin G. Sickle cell anemia in the neonatal period. Southern Medical Journal. 1979 Apr 1;72(4):492-3.

7. Austin CR. The mammalian fetus in vitro. Springer; 2013 Dec 14.

8. Mesić I, Milas V, Međimurec M, Rimar Ž. Unconjugated pathological jaundice in newborns. Collegium antropologicum. 2014 Mar 31;38(1):173-8.

9. Onyearugha CN, Onyire BN, Ugboma HA. Neonatal jaundice: Prevalence and associated factors as seen in Federal medical centre Abakaliki, Southeast Nigeria. J Clin Med Res. 2011 Mar 31;3(3):40-5.

10. Scrafford CG, Mullany LC, Katz J, Khatry SK, LeClerq SC, Darmstadt GL, et al. Incidence of and risk factors for neonatal jaundice among newborns in southern N epal. Tropical Medicine & International Health. 2013 Nov;18(11):1317-28.

11. Abdel-Aziz T, Azab N, Odah M, El-deen IM. Factors and assays identifying babies at riskto develop significant hyperbilirubinemia. International Journal of Innovative Research in Science, Engineering and Technology. 2014;3(2):9804-9.

12. Worku B, Kassie A, Mekasha A, Tilahun B, Worku A. Predictors of early neonatal mortality at a neonatal intensive care unit of a specialized referral teaching hospital in Ethiopia. Ethiopian Journal of Health Development. 2012;26(3):200-7.

13. Edmond KM, Zandoh C, Quigley MA, Amenga-Etego S, Owusu-Agyei S, Kirkwood BR. Delayed breastfeeding initiation increases risk of neonatal mortality. Pediatrics. 2006 Mar 1;117(3):e380-6.

14. World Health Organization. Postpartum care of the mother and newborn: a practical guide: report of a technical working group. World Health Organization; 1998.

15. ADAM NAI. Nurses' knowledge and Practice regarding Management of Neonatal Jaundice under Phototherapy in Jafar Ibn Auf Pediatric Specialized Hospital, Khartoum State, Sudan: University of Gezira; 2013.

16. Williams MS, Weiss EJ, Sabatine MS, Simon DI, Bahou WF, Becker LC, et al. Genetic regulation of platelet receptor expression and function: application in clinical practice and drug development. Arteriosclerosis, thrombosis, and vascular biology. 2010 Dec 1;30(12):2372-84.

17. Kleigman B. Jonson and Stanton. Nelson TextBook of Pediatrics. Elsevier, Philadelphia, Pa, USA; 2008.

18. Omekwe DE, George MD, Kennis BT, Fakuma BN, Evdence CC, Destiny EF, et al. Survey and management outcome of neonatal jaundice from a developing tertiary health centre, Southern Nigeria. IOSR Journal of Dental and Medical Sciences. 2014;13(4):35-9.

19. Olusanya BO, Akande AA, Emokpae A, Olowe SA. Infants with severe neonatal jaundice in Lagos, Nigeria: incidence, correlates and hearing screening outcomes. Tropical Medicine & International Health. 2009 Mar;14(3):301-10.

20. Ali A, Tomar A. Etiological profile of neonatal hyperbilirubinaemia in the rural area of Rajasthan. Indian Journal of Basic and Applied Medical Research. 2015;4(2):223-32.

21. Brits H, Adendorff J, Huisamen D, Beukes D, Botha K, Herbst H, et al. The prevalence of neonatal jaundice and risk

factors in healthy term neonates at National District Hospital in Bloemfontein. African Journal of Primary Health Care and Family Medicine. 2018 May 3;10(1):1-6.

22. Arad I, Fainmesser P, Birkenfeld A, Gulaiev B, Sadovsky E. Vacuum extraction and neonatal jaundice.

23. Najib KS, Saki F, Hemmati F, Inaloo S. Incidence, risk factors and causes of severe neonatal hyperbilirubinemia in the South of iran (fars province). Iranian Red Crescent Medical Journal. 2013 Mar;15(3):260.

24. Boskabadi H, Ashrafzadeh F, Azarkish F, Khakshour A. Complications of neonatal jaundice and the predisposing factors in newborns. Journal of Babol University of Medical Sciences. 2015 Sep 10;17(9):7-13.

25. Tavakolizadeh R, Izadi A, Seirafi G, Khedmat L, Mojtahedi SY. Maternal risk factors for neonatal jaundice: a hospital-based cross-sectional study in Tehran. European journal of translational myology. 2018 Jul 7;28(3).