بسم الله الرحمن الرحيم

كلية نبتة
NAPATA COLLEGE

Napata College

Pharmacy program

NEONATAL JAUNDICE; PREVALENC AND ITS ASSOCIATED RISK FACTOR AS SEEN IN OMDURMAN MATERNITY HOSPITAL

A graduation project submitted to the Napata College in partial fulfillment of B.pharm

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Declaration

We declare that the subject matter presented in this graduation project is original and has only been submitted to Napata College to obtain B. Pharm.

Dedication

To our mother and fathers

Our lovely brothers and sisters

With love

Researchers

Acknowledgement

Our heartfelt thanks go firstly to God. We express grateful thanks to **Napata College** for offering us this favorable opportunity in a modern academic environment. We would like to express our deep, sincere appreciation and thanks to our supervisor **Dr. Raga Altayeb Osman** for her technical support which added a valuable academic weight to this study, for her kind follow-up and supervision as well as encouragement.

Thanks are extended to **everyone that supported us during this study.**

Abstract

Background and objectives: Neonatal jaundice affects one in two infants globally. The jaundice is the result of an accumulation of bilirubin as fetal hemoglobin is metabolized by the immature liver. High serum levels of bilirubin result in lethargy, poor feeding and kernicterus of the infant. The main aim of this study was to determine the prevalence of neonatal jaundice and to explore its associated risk factors and management

Materials and methods: This institution based cross-sectional study was conducted to at neonatal intensive care unit of Omdurman Maternity Hospital during first 6 months of 2019. A sample of 102 neonates was selected for the study purpose. The data was collected using a data collection sheet. Data was analyzed using SPSS v24.

Results: The majority of the mothers (64.7%) were from urban areas, 82.7% of the births took place in a health facility, and 50% gave birth via spontaneous vaginal delivery (SVD). Mothers were mostly (44.1%) of type AB blood group. The majority of the neonates were males (53.9%). 66.7% were born at 37-42 weeks. The major treatment for increased serum bilirubin were IVIg (48%) and phototherapy (29.4%). The Serum bilirubin levels were high at 10-22 5mg/dl. Having mothers from rural areas (p=0.00), multiple pregnancies(p=0.00), born at home (p=0.01) and caesarean section delivery (p=0.02) were positively associated with neonatal jaundice.

Conclusion: Place of living, multiple pregnancy, place of delivery, and mode of delivery were associated with neonatal jaundice. IVIg and phototherapy were the major treatments for neonatal jaundice. The study recommended provision of access to prenatal and postnatal services, particularly in rural areas, and use of phototherapy as the initial therapy to treat hyperbilirubinemia.

الملخص

الخلفية والأهداف :يصيب اليرقان الوليدي رضيعًا واحدًا من كل طفلين على مستوى العالم . اليرقان هو نتيجة تراكم البيليروبين حيث يتم استقلاب الهيموجلوبين الجنيني عن طريق الكبد غير الناضج .تؤدي المستويات العالية من البيليروبين في المصل إلى الخمول وسوء التغذية واليرقان عند الرضيع .كان الهدف الرئيسي من هذه الدراسة هو تحديد مدى انتشار اليرقان الوليدي واستكشاف عوامل الخطر المرتبطة به وإدارته

المواد والطرق: أجريت الدراسة المقطعية المستندة إلى هذه المؤسسة في وحدة العناية المركزة لحديثي الولادة بمستشفى أم درمان للولادة خلال الأشهر الستة الأولى من عام 2019. تم اختيار عينة من 102 حديثي الولادة لغرض الدراسة. تم جمع البيانات باستخدام ورقة جمع البيانات. تم تحليل البيانات باستخدام .SPSS v24

النتائج: كانت غالبية الأمهات (64.7٪) من المناطق الحضرية ، و 82.7٪ من الولادات تمت في مرفق صحي ، و 50٪تمت ولادتهم عن طريق الولادة المهبلية التلقائية (SVD). كانت الأمهات في الغالب (44.1٪) من فصيلة الدم .ABغالبية الولادات كانت من الذكور (53.9٪). 66.7٪ من الولادات كانت في الأسبوع 37-42. كان العلاج الرئيسي لزيادة مستوى البيليروبين في الدم هو IVIg (48%)والمعالجة الضوئية (29.4٪). كانت مستويات البيليروبين في الدم مرتفعة عند 10-22 5 ملجم / ديسيلتر. وجود أمهات من المناطق الريفية (P=0.00) والحمل المتعدد(P=0.00) والولادة في المنزل(P=0.01) والولادة القيصرية (P=0.02) ارتبطت بشكل إيجابي باليرقان الوليدي.

الاستنتاج: ارتبط مكان المعيشة والحمل المتعدد ومكان الولادة وطريقة الولادة باليرقان الوليدي. كان IVIgوالمعالجة الضوئية من العلاجات الرئيسية لليرقان حديثي الولادة. أوصت الدراسة بتوفير الوصول إلى خدمات ما قبل الولادة وبعدها ، لا سيما في المناطق الريفية ، واستخدام العلاج بالضوء كعلاج أولي لعلاج فرط بيليروبين الدم.

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List of abbreviation

CBC	Complete blood cell
G6PD	Glucose-6 phosphate dehydrogenase
GGTP	Gama glutamyl transferase
UK	United Kingdom
NICU	Neonatal intensive care unit
UTI	Urinary tract infection
SNCU	Special newborn care unit
SPSS	Statistical package for social science
SVD	Spontaneous vaginal delivery
C/S	Cesarean section
IVIG	Intravenous immunoglobulin

Chapter One

Introduction and Literature Review

1.1 Background

Neonatal jaundice is a common phenomenon affecting 60% of full term and 80% of preterm babies in first three days of Life. Over two-thirds of newborn babies develop clinical jaundice and by adult Standard almost all newborn babies are 'jaundiced' during early days of life. Neonatal jaundice may not be a major cause of mortality but it is an important cause of Morbidity in the neonatal period and Beyond. Because of the crippling Complications like kernicterus and other Abnormal psychomotor and neurological Sequelae due to hyperbilirubinemia, early Recognition and adequate management to Prevent these complications are important.[1] The icterus (yellow color) of the skin And whites of the eyes is caused by excess Bilirubin in the blood. Bilirubin is produced by the normal breakdown of red blood cells. Normally, bilirubin passes through the liver and is excreted as bile through the Intestines. Jaundice occurs when bilirubin Builds up faster than a newborn's liver can Break it down and pass it from the body. In Neonates, jaundice tends to develop because of two factors - the breakdown of fetal hemoglobin as it is replaced with adult hemoglobin and the relatively immature hepatic metabolic pathways which are unable to conjugate and so excrete bilirubin as quickly as an adult. This causes an accumulation of bilirubin in the blood (hyperbilirubinemia), leading to the symptoms of jaundice. [2]

Assessment of the causes and risk factors seeks importance for adequate management. Shaheena Kamal et al [3] established that breast feeding/ breast non feeding jaundice emerged as the most common etiology of neonatal jaundice. Other causes include infections, incompatibilities (ABO, Rh incompatibility) etc. But Sinem Akgul et al[4]concluded that blood type has no effect on the severity of hemolytic jaundice. In a study conducted by Dakoru Edoghotu Omekwe et al [5] low birth weight is also another major risk factor for jaundice in newborns. According to C G Scrafford et al[6]summarized the risk factors include several known factors namely sex, birth weight, breast feeding patterns, and difficult feeding. Adel M Zauk [7]concluded that phototherapy is the simple, safe treatment for neonatal jaundice. Other treatments include intravenous gamma globulin, exchange transfusion and exclusive breast feeding.

1.2 Literature Review

1.2.1 Overview of neonatal jaundice

Neonatal jaundice describes a condition in which an infant's skin appears yellow within the first few days of life. The yellowish appearance is a sign of an increased blood pigment called Bilirubin, which then settles in the skin. In many cases this is a normal process and occurs in about 2/3 of all healthy newborns. However, it may at times be a sign of a problem with the baby's feeding, level of hydration or red blood cells lifespan. Other rare causes such as metabolism disorders, gland malfunction or liver disease can also present with jaundice. Only the health care provider can determine if the infant's jaundice is normal and may order a blood test to help with diagnosis. In some cases, a specialist in liver disease or blood disorders may be called in to help take care of the newborn. Treatment can be very simple from increasing the baby's water intake and modifying the feeding to very complex treatment. The choice of treatment is made according to the severity of the jaundice, the cause for the increase of bilirubin or the type of bilirubin [8].

1.2.2 Symptoms

The first symptom is yellow appearance of the skin and the eyes. The infant's skin may appear yellow as early as the 1st or 2nd day of life. The jaundice starts around the head and the face then progresses to the shoulders, arms and the rest of the body including the legs and feet. The appearance may become more yellow when the baby is 3 to 4 days old and then slowly gets better. This is called "physiologic" or normal neonatal jaundice. Most infants have this pattern so no testing is needed.

At times, the yellow appearance may occur earlier (shortly after birth), last longer than 5-6 days or may be much more pronounced. A consultation with your health care provider is then needed to determine if testing is indicated.

Along with the skin becoming more yellow, the color of the baby's urine can change from very light yellow or very dark brown. In the same manner, the color of the baby's stool can vary from a yellow mustard color (normal) to light beige. These 2 color changes in the urine or the stool can indicate that the jaundice is due to different pigments. Although very rare in the first days of life, the presence of a very dark urine or light beige stool should be evaluated by a doctor immediately [8].

1.2.3 Causes

The yellow appearance comes from the accumulation of a yellow pigment called bilirubin in the skin. Right after birth, the infant body has to break down the red blood cells used while in the womb and make new ones now that the baby breathes the ambient air. The red color of the blood comes from a protein called hemoglobin, which carries the oxygen. As cells are being broken down, the hemoglobin gets modified in the liver and becomes bilirubin. Because the infant's liver is so young and immature, it cannot keep up with all the produced bilirubin, which then leaks into the blood stream and settles in the skin [8].

1.2.4 Evaluation and diagnosis

Bilirubin levels may be assessed using a transcutaneous measurement device or taking blood for total serum or plasma level determination. Transcutaneous measurement decreases the frequency of blood tests for bilirubin but is limited by dark skin tone and if the neonate has received phototherapy.[9][10] Also, if the transcutaneous bilirubin level exceeds the 95th percentile on the transcutaneous nomogram or 75% of the total serum bilirubin nomogram for phototherapy, the total serum bilirubin level should be measured.

Recommended labs to identify the hemolytic disease as a cause of unconjugated hyperbilirubinemia are the neonate's blood group, Coombs test, complete blood cell (CBC), reticulocyte count, blood smear, and G6PD. In patients with conjugated hyperbilirubinemia, the serum aminotransferases should be ordered for evidence of hepatocellular injury, gamma-glutamyl transferase (GGTP) levels for evidence of hepatobiliary disease and prothrombin time, and serum albumin to evaluate for hepatic synthetic function.

Imaging studies like ultrasonography and additional tests like Torch titers, urine culture, viral cultures, serologic titers, amino acids, and the a-antitrypsin phenotype may be added depending on the suspected diagnosis for conjugated hyperbilirubinemia [11].

1.2.5 Pathological Jaundice

Pathological jaundice appears within 24 hours, increase in serum bilirubin beyond 5mg/dl (85µmol/l)/24hrs, Bilirubin levels with a deviation from the normal range and

requiring intervention would be described as pathological jaundice which means appearance of jaundice within 24 h due to increase in serum bilirubin beyond 5 mg/dl/day, peak levels higher than the expected normal range, presence of clinical jaundice more than 2 weeks and conjugated bilirubin (dark urine staining the clothes) would be categorized under this type of jaundice[12].

1.2.5 Physiological Jaundice

Jaundice becomes visible on the 2nd-3rd day usually peaking by the 3rd day at 85-102μmol/l and decreasing to below 34μmol/l between 5th and 7th day of life[13]. And Study did in India on predictors of neonatal jaundice the 3rd day serum bilirubin of greater than 10.15 mg/dl was used as early predictors of neonatal jaundice and Serum bilirubin in terms is usually less than 12mg/dl and less than 15mg/dl in preterm infants which resolves spontaneously in the first week in terms and 2nd week in a preterm infant [14]. According to a study conducted in India by Goyal M in showed that the prevalence of pathological jaundice was 55.6% [15].

According to Israel-Aiwa and Omoigberale a associated factors for neonatal jaundice in neonates were showed physiological jaundice with the leading cause were Neonatal sepsis, prematurity, G-6PD deficiency were most associated risk factors of this types of jaundice and also Severe neonatal jaundice can be presented to have modifiable associated factors for jaundice particularly in developing countries[16].

1.2.6 Associated Factors of Neonatal Jaundice

1.2.6.1 Socio-Demographic Factors:

According to a study conducted by Hassan Saud Abdul Hussein and Dr. Afifa Radha Aziz in Holy Karbala City at Pediatric Teaching Hospital were indicated (83%) of neonate within first age group (1-7) days old was developed neonatal jaundice. Whereas study results indicate that most of the neonates (68%) were male neonates. Regarding neonate's ordinal position in a family with Jaundice, the study results indicate (40%) the first neonate ordinal with jaundice. Finally, the study results indicate that the (90%) of the study samples were (1-7) days duration of the disease (jaundice)[17].

1.2.6.2 G-6PD Deficiency

According to a study done by Ezzat Khodashenas and Farnaz Kalani-Moghaddam from Iran, A Total of 452 neonate admitted to the hospital due to neonatal jaundice were

acounts24 (8.5%) infants had G6PD deficiency [18]. According to A study conducted By Hassan Boskabadi, Masoud Omidian, Shahin Mafinejad a total of 1139 admitted infants with neonatal jaundice, who were evaluated for G6-PD enzyme, to 59(5.2%) babies had G-6-PD deficiency from this study should be considered in infants with severe jaundice in a family with a history of significant jaundice or a geographic origin associated with G-6p deficiency [19].

1.2.6.3 Breastfeeding Jaundice

According to a study done by Atkinson LR EG T, JI, I a case of breastfed neonates, mild jaundice may take 10-14 days after birth or may reoccur during the Breastfeeding period and large amounts of Bilirubin rarely accumulate in the blood and cause cerebral lesions, a situation is known as nuclear jaundice, these cuts may be followed by hearing loss, mental retardation, and behavioral disorders. A mild clinical jaundice has been observed in one-third of all breastfed babies in the third week of life, which may persist for 2 to 3 months after birth in a few neonates [20]. According to a study conducted in Iran showed that on severe neonatal jaundice leading to exchange transfusion in 2014, the prevalence of breastfeeding jaundice of neonates was 35% in this study onset of jaundice in 40.5% of 93 neonates was on the 2nd day and 10 of them were on the 1st day after birth [21].

1.2.6.4 Breast Milk Jaundice

A study conducted India the prevalence of breast milk jaundice accounts 4% of neonatal jaundice was occurred and associated to a diagnosis if the serum bilirubin is predominantly unconjugated and late jaundice have been eliminated the infant is in good health and feeding, and vigorous well and gaining weight adequately and mothers should be advised to continue breastfeeding at more frequent intervals and bilirubin levels usually declined gradually discontinuity of breastfeeding is not recommended unless levels exceed 20 mg/dl [21]. A study conducted in America was indicated the late onset of (after 4-7 days) was 2 to 4%. A strong familial predisposition is suggested by the recurrence of breast milk jaundice in sibling family history [22]. A study conducted in Iran in 2014 Magnitude of neonatal jaundice in neonates with a history of jaundice in siblings' family history was reported in 50% of cases [23].

1.2.6.5 Prematurity

A study conducted was done in America indicated Prematurity has been a major associated factor of neonatal jaundice and It is suggested that the term jaundice should be used in preference to physiologic jaundice" when referring to an infant with concentrations of serum bilirubin of over 10 to 15 mg/100 ml this roughly separates a group of infants who are potentially endangered and for whose jaundice some specific cause can frequently be found this study Kernicterus may vary considerably from premature infants to another and within the same unit from time to time [24]. According to a study conducted at Memorial Hospital, Darlington, England, UK The degree of hypoxia at birth and severity of hyperbilirubinemia modulate both bilirubin and hypoxia-related neurologic damage. This paper study the long term neurological injury of hypoxia with the degree of hyper-bilirubinemia and would fit with hypoxia (low Apgar score) and hyper-bilirubinemia were strongly associated [25].

1.2.6.6 Neonatal Infection

A study conducted in the hospital of Nigeria in 2011 prevalence was 35% neonates were admitted to NICU due to neonatal jaundice among those neonates were neonatal infection accounts 27%and 5.2% of them were died due to sepsis and kernicterus. The rest were due to bilirubin encephalopathy [26]. According to a study conducted in Iran indicated that sepsis was a significant cause of unexplained neonatal jaundice. This study recommendation was a screening test for UTI as part of the evaluation in asymptomatic jaundice infants presenting after five days of life and sepsis workup should be requested in symptomatic infant especially in the first week of life. Neonatal sepsis was found in approximately 10% of jaundiced newborns. The most common infection associated with neonatal jaundice was UTI (16.8%), Sepsis (77.8%) and pneumonia (5.3%)[27].

1.2.6.7 ABO-Incompatibility

According to a study was done in Iran a total of 355 (19.7%) of all jaundiced newborn infants were ABO incompatible 98 (27.6%) of the newborns who had ABO incompatibility Indicated ABO-HDN (5.4% of total icteric patients) which indicated the positive direct ant Globulin (direct Coombs' test) and indirect ant globulin (indirect Coombs' test) were diagnostic in 18.2% and 25.5% respectively in affected infant and also the overall prevalence of associated factor with ABO-HDN was 43.7% [28].

1.2.6.8 RH-Incompatibility

According to a study was conducted by Trotman et al in at the university hospital of the West Indian on Magnitude and associated factors of neonatal jaundice showed that 3.5% of neonatal jaundice in all admission due to Rh- incompatibility was significantly associated factor for neonatal jaundice (3.5%) [29].

1.2.7 Treatment

The goal of treating jaundice is to efficiently and safely reduce the level of bilirubin. Babies with mild hyperbilirubinemia may need no treatment at all. Babies with higher bilirubin levels will need brief treatment. Jaundice is common in premature babies (those born before 38 weeks). Premature babies are more vulnerable to hyperbilirubinemia because brain toxicity occurs at lower levels of bilirubin than in term babies. As a result, premature babies are treated at lower levels of bilirubin but with the same treatments discussed below [30].

Frequent feeding — Providing adequate breast milk is an important part of preventing and treating jaundice because it helps in the removal of bilirubin in stools and urine. If the baby is not getting enough milk through breastfeeding, the doctor can talk to the Caregivers/parents about options such as supplementing with formula or donor breast milk. Caregivers/parents will know that the baby is getting enough milk if they have at least six wet diapers per day, the color of their stools changes from dark green to yellow, and they seems satisfied after feeding [30].

Phototherapy — Phototherapy ("light" therapy) is the most common medical treatment for hyperbilirubinemia in babies. In most cases, phototherapy is the only treatment required. The baby's skin surface is exposed to special blue light, which breaks bilirubin into compounds that are easier to eliminate in stool and urine. Treatment with phototherapy is successful for almost all babies. Phototherapy is usually given in the hospital, but in certain cases, it can be done at home if the baby is healthy and at low risk for complications [30].

Babies should have as much skin as possible exposed to the light. Babies are usually naked (or wearing only a diaper) in an open bassinet or warmer, but need to wear patches or a special mask to protect the eyes. Phototherapy should be continuous and stopped only for feeding and skin-to-skin care of the baby. Some hospitals have special

phototherapy blankets that allow treatment to continue while holding or feeding the baby[30].

Exposure to sunlight was previously thought to be helpful but is no longer recommended due to the risk of sunburn unless ultraviolet rays are filtered out. Sunburn does not occur with the lights used in phototherapy.

Phototherapy is stopped when bilirubin levels drop to a safe level. It is not unusual for babies to still appear jaundiced for a period of time after phototherapy is completed. Bilirubin levels may rise again 18 to 24 hours after stopping phototherapy. Although rare, this requires follow-up for those who may need more treatment[30].

Side effects — Phototherapy is very safe, but it can have temporary side effects, including skin rashes and loose stools. Overheating and dehydration can occur if a baby does not get enough breast milk or formula. Therefore, a baby's skin color, temperature, and number of wet diapers should be closely monitored. Unusually, some babies can develop a dark, grayish-brown discoloration of the skin and urine or "bronze baby" syndrome. It is not harmful and gradually goes away without treatment after several weeks[30].

Breastfeeding during phototherapy — It is important for babies receiving phototherapy to drink adequate fluids (ideally breast milk) since bilirubin is excreted in urine and stool. Breastfeeding should continue during phototherapy. Use of oral glucose water is not necessary. In babies with serious dehydration, intravenous (IV) fluids may be necessary to correct the loss of fluid.

Babies who are not able to eat enough breast milk, lose a lot of weight, or are dehydrated may need extra expressed breast milk or medically recommended formula for a short time. Mothers who supplement with formula should continue to breastfeed and/or pump regularly to maintain their milk supply [30].

Exchange transfusion — Exchange transfusion is an emergency, life-saving procedure that is sometimes necessary to rapidly decrease bilirubin levels. The transfusion replaces a baby's blood with donated blood to quickly lower bilirubin levels (2 to 3 hours). Exchange transfusion is performed only for babies who have not responded to other treatments and who have signs of or are at significant risk for brain damage[30].

1.2.8 Prevention of Severe Hyperbilirubinemia

Prevention of severe hyperbilirubinemia is important in avoiding serious complications. Babies who are at risk for hyperbilirubinemia need to have regular follow-up visits with their doctor; these should be scheduled at the time of hospital discharge. The following information only applies to babies who are healthy and born at term or late preterm (within a month of their due date).

Screening — Leading experts recommend that all newborns have their bilirubin levels tested before going home from the hospital, regardless of age. This is especially true for babies who are jaundiced before one day of age, in which case repeated testing is needed.

Monitoring — Parents, other caregivers, and health care providers should watch babies closely if jaundice develops. Hyperbilirubinemia is usually easy to prevent and treat initially. However, complications can be serious and irreversible if treatment is delayed.

Prompt treatment — Babies with high bilirubin levels should be treated by a qualified health care provider to safely reduce bilirubin levels and prevent the risk of brain damage. Parents and health care providers should not delay treatment for any reason[30].

1.2.9 Prevalence of neonatal jaundice

In a study in Soba Hospital, Sudan, neonatal jaundice was the cause of 12.4% of early neonatal morbidity [31].

According to the annual perinatal mortality of Omdurman Maternity Hospital, the total admission in 2001 were 1035 cases, 8.2% of them was due to neonatal jaundice[32]. In another study in Soba University Hospital in the period from December 2003 to June 2004 in early neonatal outcome of preterms. One hundred consecutive live born preterm infants were followed up till their seventh day of birth, it was found that 46% of morbidity among preterms were due to neonatal jaundice [33].

Globally there were studies conducted Magnitude and determinants of neonatal jaundice in different countries. According to a study conducted in India, shows that Magnitude of Neonatal jaundice was 28.6% from those Neonates 21 (0.74%) cases were an account of Bilirubin encephalopathy, and Among these affected cases, 17 (81%) were male and 4 (19%) were female and this major associated factor for neonatal

jaundice was an infection, (71.4%), ABO incompatibility (19.1%), and Glucose 6-phosphate-dehydrogenase (G6PD) deficiency (9.5%) were significantly associated factors for neonatal jaundice [34].

A Study conducted by Narayanan level II Care NICU at Sikkim Mani pal Institute of Medical Sciences at Gunstock, Iran on the pattern of admissions and outcome in NICU, more than half percent, 212(54%) neonates were admitted to NICU due to neonatal jaundice, from these jaundiced neonates were due to physiologic jaundice (48%), breast milk jaundice in 4% and the rest (2%) were due to other cause [35]. A Study conducted Pakistan on the incidence and associated factors of neonatal jaundice the overall incidence was found 27.6% were Diagnosed as neonatal jaundice and neonates who were jaundice were seen between 1-6 days old in 64% in days of life [36].

According to a cross-sectional study conducted at National District Hospital in Bloemfontein, the prevalence of neonatal jaundice was reported 55.2% and the major determinants were a black race, maternal smoking during pregnancy, mode of delivery and prolonged labor was the significance for neonatal jaundice[37].

According to a study conducted by Federal Medical Centre Abakaliki, Nigeria on the proportion and determinants of neonatal jaundice accounted for 35% of all NICU admissions and The leading associated factors of neonatal jaundice were septicemia (32.5%) and prematurity (17.5%) [38].

According to a study done in Nigeria, the proportion of neonates 56 males (21%) and 33 females (12%) neonatal jaundice were 89 (33%) found to be jaundiced and The mothers who were divorced and single had more affected who that neonate (50%) and 35.5%, respectively.

The proportion rate was also more affected among mothers with secondary levels (36.8%) of education and primary (55.1%) and, than those with a tertiary level of education (8.1%), G-6-phosphate dehydrogenize deficiency, ABO incompatibility and previous sibling with jaundice were found to be major predisposing/etiologic factors associated with neonatal jaundice [39].

According to a study conducted on the prevalence of Neonatal Jaundice and determinant factors in Neonatal Intensive Care Units, Northern Ethiopia where the prevalence was 37.3% with the leading associated factor prolonged labor, neonatal

sepsis, ABO incompatibility, and neonatal sex were significance association for neonatal jaundice [40].

According to a study conducted in GB Pant hospital of India, breastfeeding jaundice was the leading factor of jaundice among the identified causes. It accounted for 84 cases of 124 jaundiced neonates, those who had breast milk jaundice and jaundice due to prematurity were 5 cases each, Physiologic and pathologic cases of neonatal jaundice were 24 and 6 respectively[41].

According to a retrospective, a study was conducted in the Department of GOBS Government Medical College Trivandrum, Kerala, North India on Maternal and Neonatal Determinants of Neonatal Jaundice. This study shows that the Majority determinants of neonatal jaundice were low APGAR score< 7, Gestational age <37weeks, birth asphyxia, Premature rupture membrane, low birth weight <2.5kg and malpresentation were a significance with neonatal factors[42].

According to retrospective a study was conducted in Nigeria indicated that the prevalence was 278 (41.8%) and Majority of Neonates was aged between 1-2 days making about 82 (41.2%) of the neonates admitted for neonatal jaundice, there were more cases of NNJ in the males, 121 (60.8%) compared to females 78 (39.2) [43]. According to a study done by Kokeb M and Desta T in Ethiopia Neonatal jaundice and prematurity were among the major reason of Neonatal morbidity and mortality admitted to Gondar University Hospital a total of 325 neonates at this hospital the major problems at admission were cephalohematoma, subgiant hemorrhage Neonatal Sepsis (77.8%),

Hypothermia (57.5%), Low birth weight (32.9%), Jaundice (31.7%), Prematurity (27.4%), birth trauma (16%) were the major contributed factor Neonates were admitted to NICU [44].

1.3 Justification:

This study aims to find out the incidence of, risk factors and management of neonatal jaundice and also the study had made efforts to find out whether any maternal factors have an effect on the occurrence of jaundice. As the rate of jaundiced babies are increasing day by day, it is important to study about the factors influencing jaundice and management outcomes to improve the understanding of jaundice among mothers.

1.4 Objectives:

1.4.1 General objectives:

The main aim of this study is to find out the risk factors of neonatal jaundice (In the time period of first 6 months of 2019)

1.4.2 Specific objectives:

1- To determine the magnitude of neonatal of jaundice among neonates of postnatal mothers in Omdurman maternity hospital

2- To establish the determinants of neonatal of jaundice among neonates of postnatal mothers in Omdurman maternity hospital

3- To identify the management of jaundice among neonates of postnatal mothers in Omdurman maternity hospital

Chapter Two
Materials and Methods

2.1 Study Design:

An institution based cross-sectional study was conducted to determine the factors associated with neonatal jaundice in neonatal intensive care unit of Omdurman Maternity Hospital during first 6 months of 2019

2.2 Study Area and Population

The data was collected from Omdurman Maternity hospital. The source population was all neonates with their mothers' who were admitted to neonatal intensive care unit of Omdurman Maternity Hospital. A total of 102 cases were included in this study

2.3 Study subjects:

Inclusion criteria: All neonates admitted with neonatal jaundice in Special Newborn Care Unit (SNCU) & their mothers.

Exclusion criteria:

- Neonate whose mother critically ill or unable to give informed consent.
- Neonate who was admitted to NICU more than once during data collection time but either interviewed or excluded once by this study.
- Late preterm neonates

The study sample included all the neonates who meet the inclusion criteria (total coverage). The study sample included 102 participants.

2.4 Data collection

The data were collected using a data collection sheet and review of medical records of the mother and her neonate. The sheet was had three parts; the first part was maternal sociodemographic and obstetric characteristics, the second part was neonatal characteristics, and the third part embraces medical factors

2.5 Data management and statistical analysis

Data were stored in Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 24.0 software. Descriptive analysis was performed and the

results were expressed as frequency/percentage and mean values. The association between variables was assessed using ANOVA test with significance P value at <0.05.

2.6 Ethical consideration

A written approval from the hospital administration was obtained before the start of data collection. Also, verbal consent form from the caregivers of the selected children was taken before initiation of data collection. Research purpose and objective were explained to participant in clear simple words. Participant has right to no harm (privacy and confidentiality by using coded questionnaire). Participant has right to benefit from the researcher knowledge and skill. Questionnaire was filled with the participants in their rest time without any interruption Measures of prevention of COVID 19 were applied. The researcher wore face mask and kept 2-meter distance from the participants during data collection,

Chapter Three

Results

Mother characteristics

Table 1. Mothers' age

Categories		Frequency	Percent
	<20	24	23.5
	20-35	56	54.9
	>35	22	21.6
	Total	102	100.0

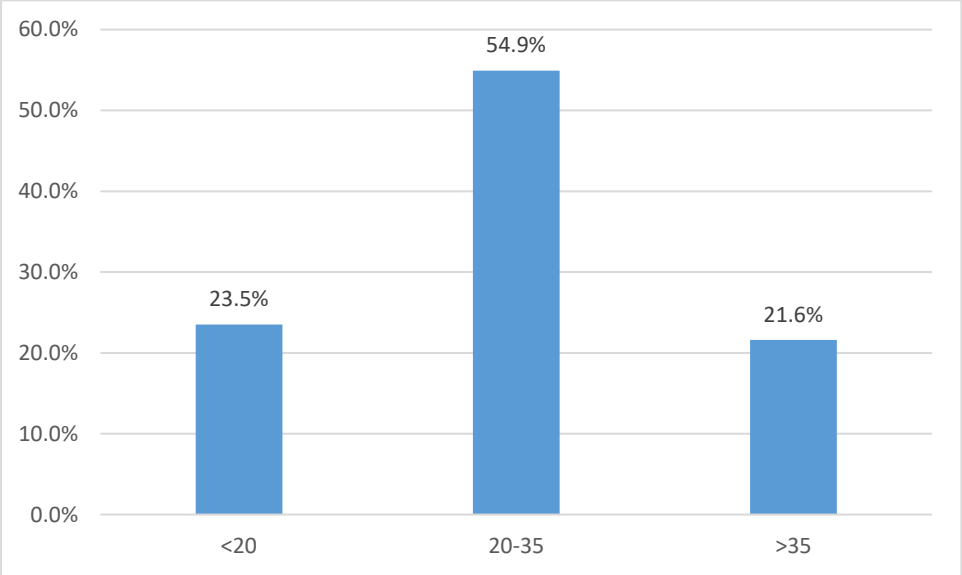

Figure 1. Mothers' age

Table 2. Residence

Categories		Frequency	Percent
	Urban	66	64.7
	Rural	36	35.3
	Total	102	100.0

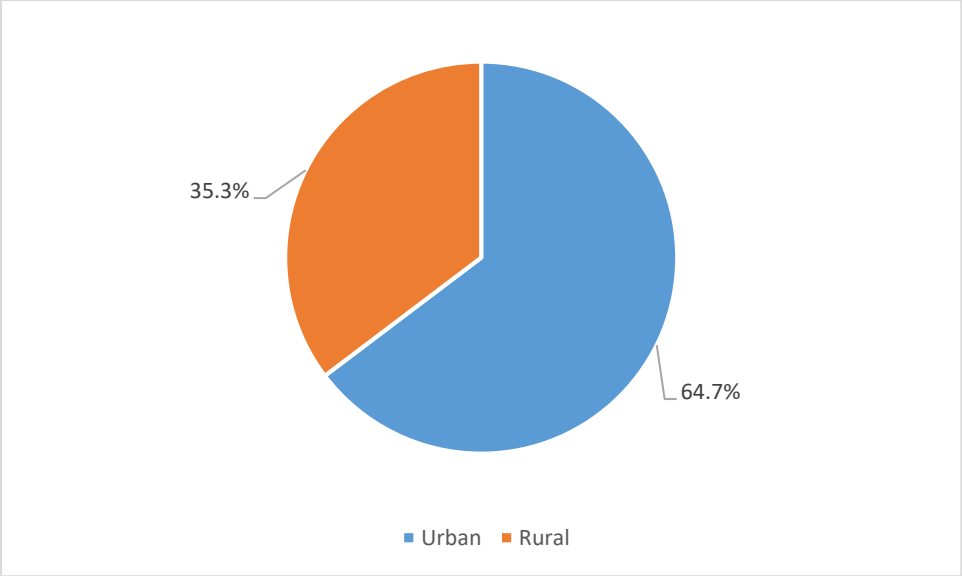

Figure 2. Residence

Table 3. Types of pregnancy

Categories		Frequency	Percent
	Single	69	67.6
	Multiple	33	32.4
	Total	102	100.0

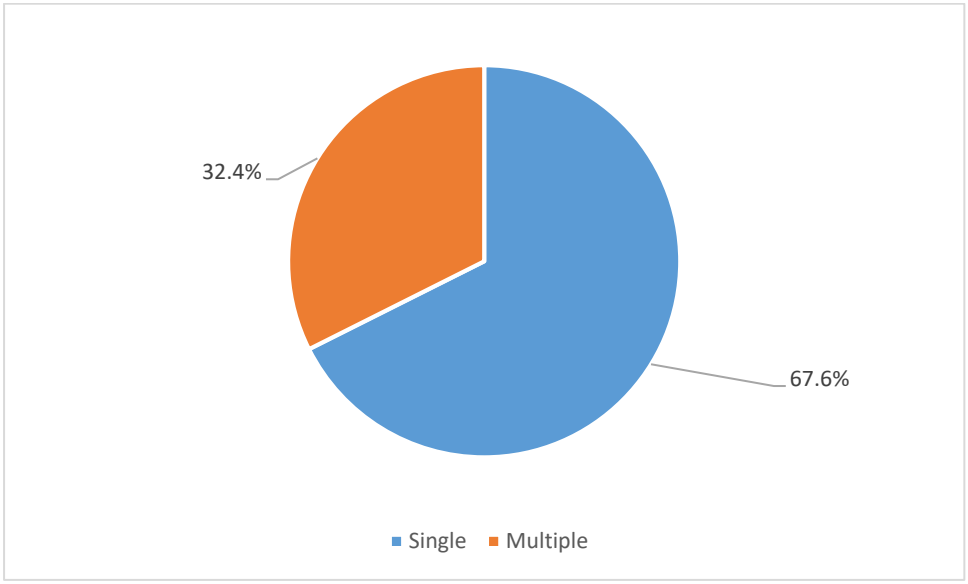

Figure 3. Types of pregnancy

Table 4. Place of delivery

Categories		Frequency	Percent
	Home	20	19.6
	Health centre	27	26.5
	Hospital	55	53.9
	Total	102	100.0

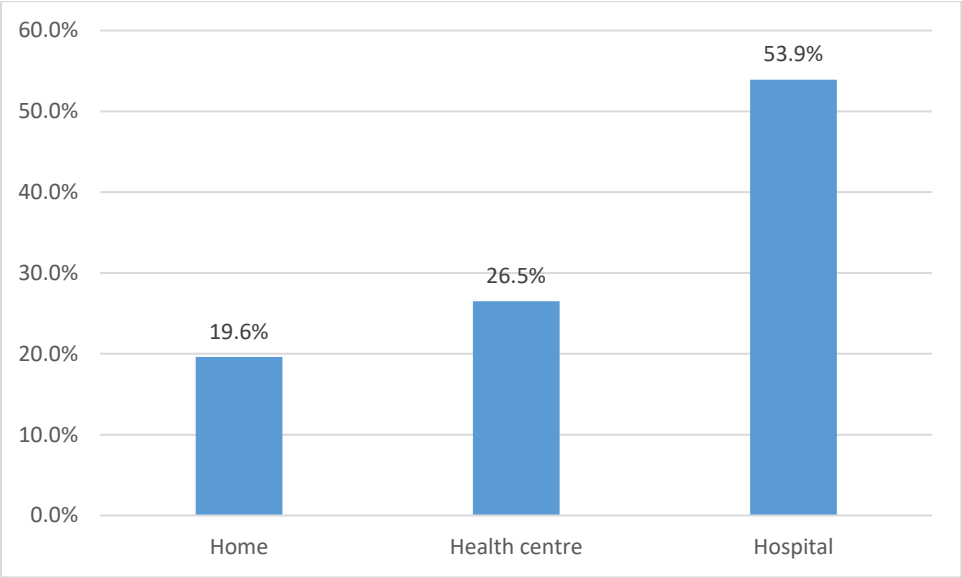

Figure 4. Place of delivery

Table 5. Mode of delivery

Categories		Frequency	Percent
	SVD	51	50.0
	Instrumental	3	2.9
	C/S	48	47.1
	Total	102	100.0

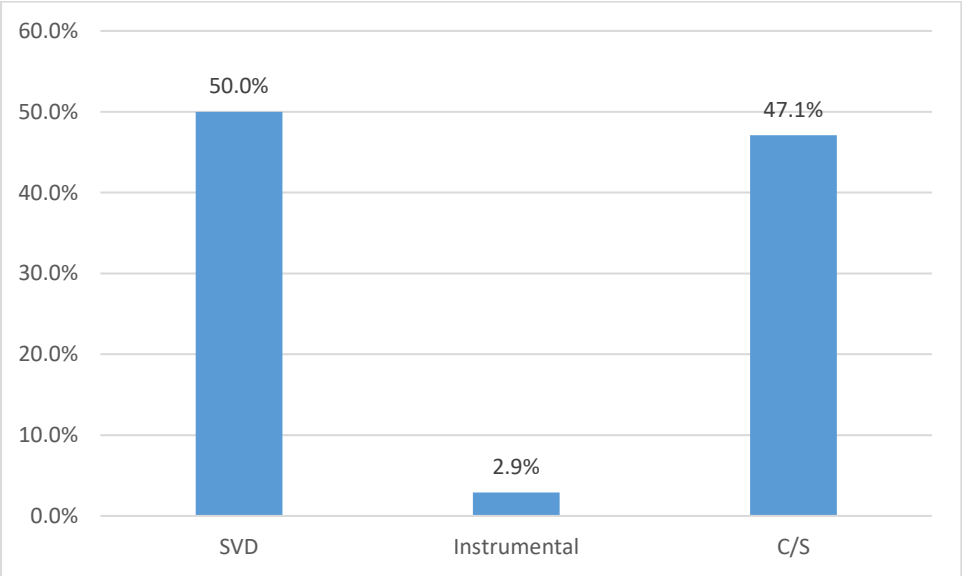

Figure 5. Mode of delivery

Table 6. Blood group of the mother

Categories		Frequency	Percent
	A	15	14.7
	B	27	26.5
	AB	45	44.1
	O	15	14.7
	Total	102	100.0

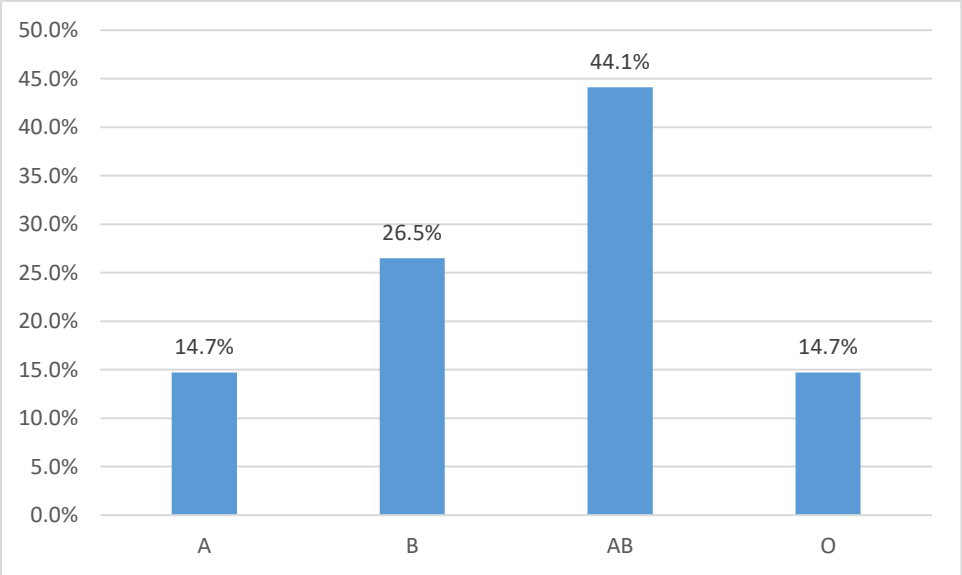

Figure 6. Blood group of the mother

Neonatal characteristics

Table 7. Sex of neonate

Categories		Frequency	Percent
	Male	55	53.9
	Female	47	46.1
	Total	102	100.0

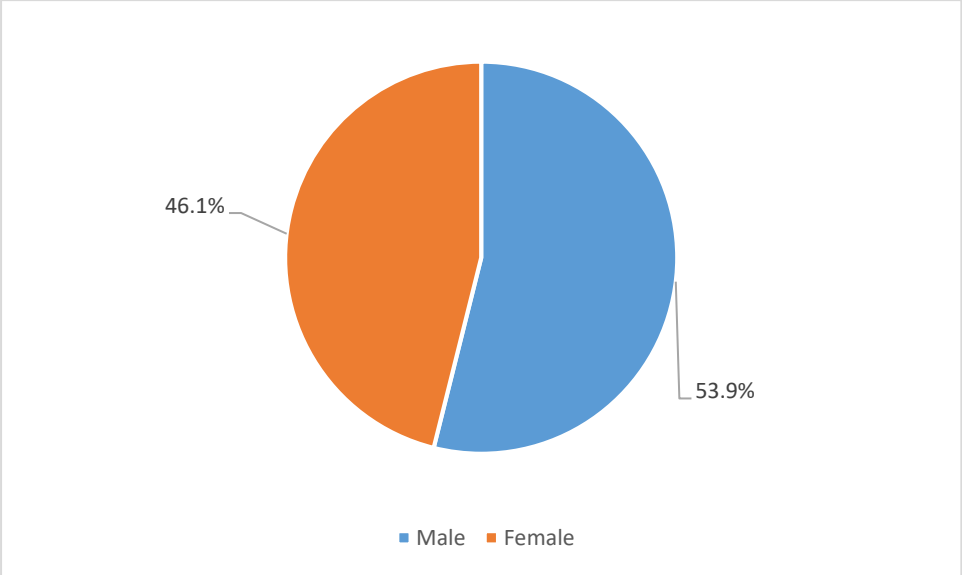

Figure 7. Sex of neonate

Table 8. Blood group of the neonate

Categories		Frequency	Percent
	A	15	14.7
	B	37	36.3
	AB	27	26.5
	O	20	19.6
	Unknown	3	2.9
	Total	102	100.0

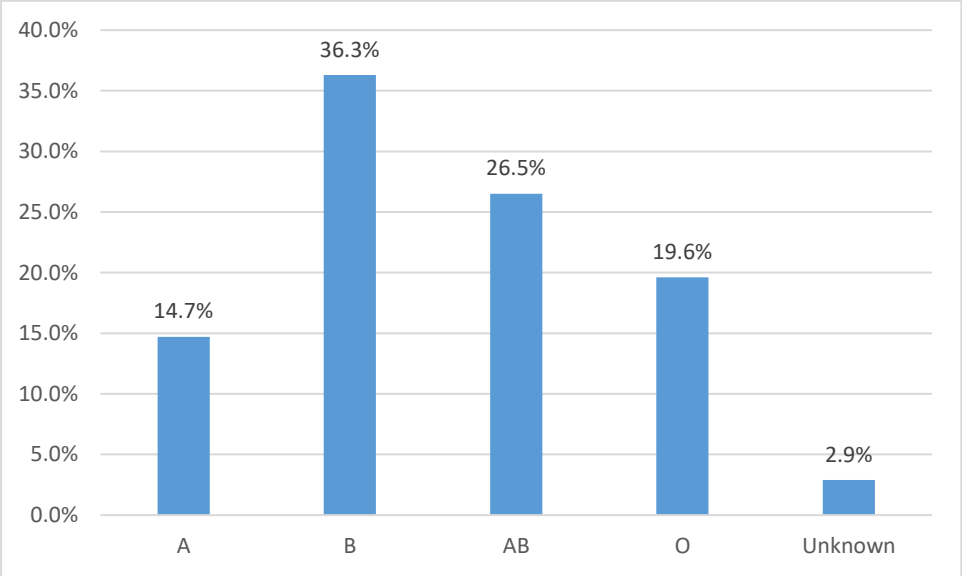

Figure 8. Blood group of the neonate

Table 9. Gestational age at birth (in weeks)

Categories		Frequency	Percent
	<37	15	14.7
	37-42	68	66.7
	>42	19	18.6
	Total	102	100.0

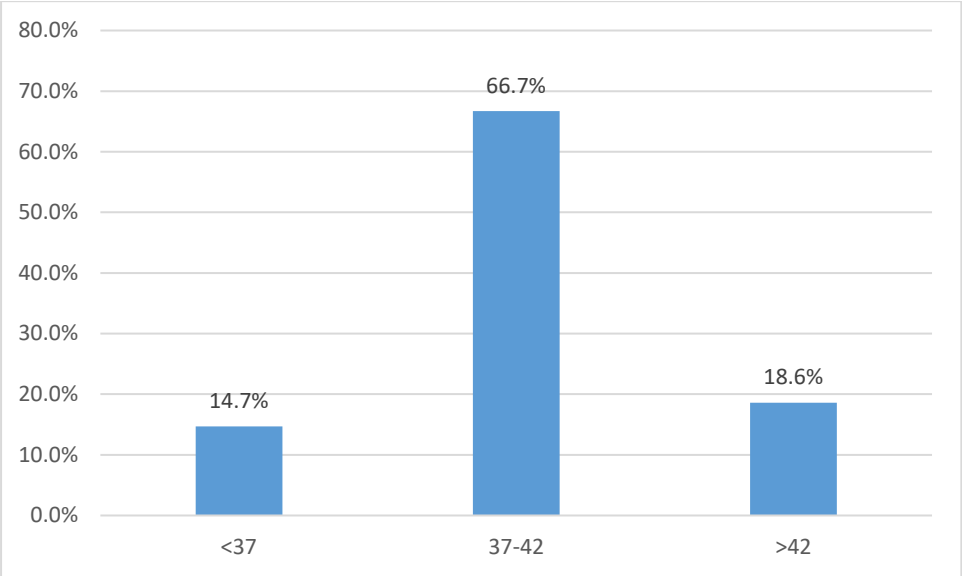

Figure 9. Gestational age at birth (in weeks)

Table 10. Birth weight (kg)

Categories		Frequency	Percent
	<2.5	38	37.3
	>=2.5	64	62.7
	Total	102	100.0

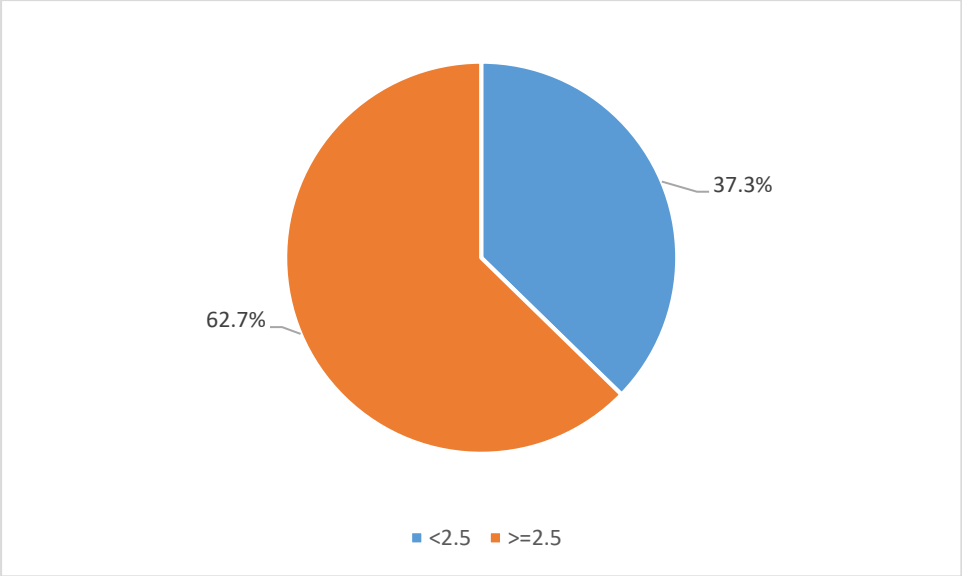

Figure 10. Birth weight (kg)

Manage and treatment

Table 11. Type of treatment

Categories		Frequency	Percent
	phototherapy	30	29.4
	IVIg	49	48.0
	exchange transfusion	23	22.6
	Total	102	100.0

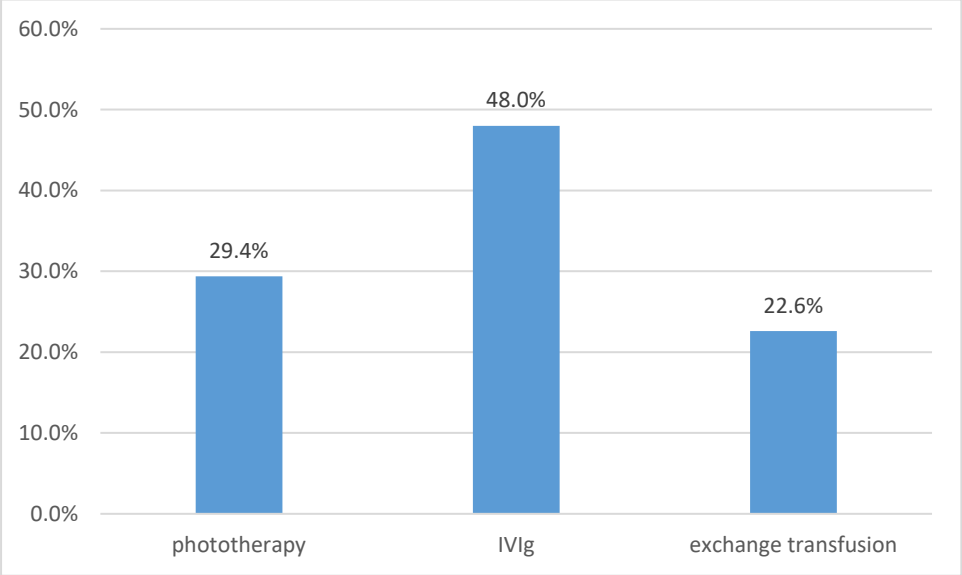

Figure 11. Type of treatment

Table 12. Serum bilirubin level

	Minimum	Maximum	Mean±Std. Deviation
Serum bilirubin	10.00	22.00	17.07±2.11

Table 13. Association between serum bilirubin level and maternal characteristics

	Mean±Std. Deviation	N	%	F	Significance
Mothers age					
<20	17.08±1.89	24	23.5%	1.328	.270
20-35	17.31±2.09	56	54.9%		
>35	16.45±2.36	22	21.6%		
Residence					
Urban	16.45±2.04	66	64.7%	19.299	.000
Rural	18.22±1.77	36	35.3%		
Single	16.46±1.99	69	67.6%	22.045	.000
Multiple	18.37±1.79	33	32.4%		
Place of delivery					
Home	17.93±2.25	20	19.6%	4.529	.013
Health centre	16.17±1.50	27	26.5%		
Hospital	17.21±2.19	55	53.9%		
Mode of delivery					
SVD	16.56±1.80	51	50.0%	3.780	.026
Instrumental	16.33±1.53	3	2.9%		
C/S	17.67±2.32	48	47.1%		
Blood group of the mother					
A	16.94±2.44	15	14.7%	.397	.756
B	17.23±2.01	27	26.5%		
AB	17.20±2.05	45	44.1%		
O	16.57±2.27	15	14.7%		

* Significance at p<0.05

Table 14. Association between serum bilirubin level and neonatal characteristics

	Mean±Std. Deviation		N	%	F	Significance
Sex of neonate						
Male	17.25±2.11		55	53.9%	.839	.362
Female	16.87±2.13		47	46.1%		
Blood group of the neonate						
A	16.73±2.26		15	14.7%	.195	.941
B	17.20±1.82		37	36.3%		
AB	17.21±2.46		27	26.5%		
O	16.98±1.61		20	19.6%		
Unknown	16.67±5.03		3	2.9%		
Gestational age at birth (in weeks)						
<37	17.90±2.45		15	14.7%	1.366	.260
37-42	16.95±2.12		68	66.7%		
>42	16.86±1.75		19	18.6%		
Birth weight (kg)						
<2.5	16.73±16.73		38	37.3%	1.618	.206
>=2.5	17.28±17.28		64	62.7%		
Total	17.0735	2.11459	102	100.0%		

* Significance at p<0.05

Chapter Four

Discussion, Conclusion and Recommendations

4.1 Discussion

The results revealed that the majority of the mothers (54.9%) were in the age range 20-35 years. Mother in younger age and/or older were reported in less portions. The majority (64.7%) resided in urban areas, which can be attributed to the fact that the current study was carried out in Omdurman maternal hospital which is locates in Omdurman city, one of the two major metropolitan areas in Sudan, beside Khartoum, the capital. Yet, many of women from rural areas around Khartoum State seek medical services in the hospital. This is also in line with the fact that the majority (53.9%) gave birth in a hospital, probably Omdurman Maternal Hospital. It worth mentioning here that the hospital provides special newborn care services for children who gave birth in the hospital and/or other health facilities. This is in accordance with Scafford et al. [6] who found that 82.7% of the births took place in a facility. The results have also revealed that the majority of the mothers (67.6%) had single pregnancy. Also, Scrafford et al [6] reported primiparity among the risk factors of neonatal jaundice.

Concerning the mode of delivery, half of the studied mothers (50%) gave birth via spontaneous vaginal delivery (SVD), and 47.1% via caesarean section (C/S). This is in line with Brits et al [37] who found that the majority of neonates with jaundice were born via normal vaginal delivery.

Mothers in this study were mostly (44.1%) of type AB blood group, those with O blood group were 14.7%. Maternal-fetal ABO blood group incompatibility, in which the mother has blood group O and the newborn has blood group A or B, occurs in 15-20% of all pregnancies. Hemolytic disease develops in approximately 10% of such newborns and may be associated with clinically significant neonatal hyperbilirubinemia [4]. However, neonates with type A and B groups were 14.7%, 36.3%, respectively. Heydarian et al. [28] found that (19.7%) of all jaundiced newborn infants were ABO incompatibles.

The majority of the neonates in this study (53.9%) were males. Chime et al. [39] indicated that the proportion of neonates males (21%) and females (12%) neonatal jaundice were (33%) found to be jaundiced.

Concerning gestational age, the majority (66.7%) were born at 37-42 weeks, which is inline with a previous study stating that the e mean gestation was 38.5 weeks[37]. on

another hand, the study found that neonates with 2.5 kg and more at birth were the majority (62.7%), which is also in line with Brits et al. [37] who found that the mean weight of the babies was 3.15 kg.

The main type of treatment for increased serum bilirubin in this study was IVIg (48%) followed by phototherapy (29.4%). Although data are limited, IVIG may be helpful for treatment as it may be considered for non-isoimmune causes of hemolytic anemia such as G6PD deficiency. These results are different from previous data showing that phototherapy is the most common medical treatment for hyperbilirubinemia in babies [30].

The Serum bilirubin levels in this study ranged between 10-22 5mg/dl. A study did in India on predictors of neonatal jaundice the 3rd day serum bilirubin of greater than 10.15 mg/dl was used as early predictors of neonatal jaundice and Serum bilirubin in terms is usually less than 12mg/dl and less than 15mg/dl in preterm infants which resolves spontaneously in the first week in terms and 2nd week in a preterm infant [14].

While none of the characteristics of the neonates neither had found to be associated with increased levels of serum bilirubin ($p>0.05$); neonates of mothers from rural areas, and multiple pregnancies had very high risk ($p=0.00$) of having increased serum bilirubin. Further, neonates born at home and via caesarean section had higher risk ($p=0.02$) of increased serum bilirubin levels compared to their peers. This is quite different from previous results of Brits et al. [37] who found that increased levels of serum bilirubin were associated with Vaginal delivery, and that could not detect a significant association between twins and neonatal jaundice, or place of delivery.

4.2 Conclusion:

From the findings of the current study it can be concluded that urban background, having single pregnancy, non-facility based delivery ,low birth weight , SVD,low gestational age, RH incompatibility and ABO incompatibility were associated with neonatal jaundice. Intravenous Immunoglobulin G (IVIG) and phototherapy were the major types of treatment used for management of neonatal jaundice at Maternity Hospital in Omdurman.

4.3 Recommendations:

- Phototherapy should be the initial therapy to treat hyperbilirubinemia disease of the newborn. IVIG administration should be thought if serum bilirubin level is close to exchange transfusion level in spite of phototherapy.
- Pregnant women, particularly in rural areas, should have access to prenatal and postnatal services to avoid complications on both the mother and the baby.
- Further studies on neonatal jaundice in Sudanese context are necessary due to the huge gap in this regard; and to shed more light on the magnitude of this issue and types of treatment used for management.

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Questionnaire for data collection of a research on:

Neonatal jaundice: prevalence and associated factors as seen in Omdurman Maternity Hospital

Maternal Socio-Demographic

1. Mothers age: <20 □ 20-35 □ >35□

2. Residence: Urban□ Rural□

3. Types of pregnancy:

Single□ Multiple□

4. Place of delivery

Home □ Health center □ Hospital□

5. Mode of delivery:

SVD □ Instrumental □ C/S□

6. Blood group of the mother:

A□ B□ AB□ O□ Unknown□

Neonatal characteristic

7. Sex of neonate:

Male □ Female □

8. Blood group of the neonate:

A□ B□ AB □O□ Unknown□

9. Gestational age at birth(in weeks):

<37□ 37-42□ >42□

10. Birth weight (kg):

<2.5□ ≥2.5□

11. Serum bilirubin: ……..

Treatment:

In case of high serum bilirubin

Type of treatment:

Enhanced nutrition ( ) phototherapy ( )

Intravenous immunoglobulin (IVIg) ( ) Exchange transfusion ( )

Other ……