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KNOWLEDGE, ATTITUDE AND PRACTICE OF MOTHERS ABOUT NEONATAL JAUNDICE ATTENDING PEDIATRIC OUTPATIENT CLINIC IN AL-IMAMMEIN AL-KADHIMEIN MEDICAL CITY IN BAGHDAD /2024

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ABSTRACT

Neonatal jaundice is the yellowish coloration of the sclera, skin or mucous membranes of the neonate due to the accumulation of bilirubin in the blood. Neonatal jaundice is still a primary cause of avoidable brain damage, mental and physical handicaps, and premature mortality in infants. It is crucial that mothers have precise understanding about how to recognize infant jaundice and respond appropriately. Thus, knowledge level, attitude and identifying the practices of mothers are key in improving newborn survival and reducing neonatal mortality rates**. Objectives**: To assess knowledge, attitude, and practice of mothers about neonatal jaundice in Al-Imammein Al-Kadhimein medical city in Baghdad.**method**: this study was a descriptive cross sectional study carried out among 300 mothers who attending outpatient in al-imammein al- kadhimein medical city to assess their knowledge, attitude and practice regarding neonatal jaundice. A designed questionnaire was conducted to included mothers to assess knowledge, attitude and practice towards neonatal jaundice. Analysis of data was carried out using the available version package of SPSS-25 (Statistical Package for the Social Sciences- version 5). Depending on Pearson Chi-square test (X2-test) to test the significance of the results at P value equal or less than 0.05.**Results:** of the 300 participant mothers only (34.3%) of mothers had good knowledge, (60%) fair knowledge and (5.7%) poor knowledge to the neonatal jaundice. (64.3 %) was had positive attitude toward neonatal jaundice and (35.7%) had negative attitude. (52.3%) had good practice toward neonatal jaundice and (47.7%) had poor practice regarding neonatal jaundice. There was significant association between knowledge about neonatal jaundice and children number, marital status, mother's employment status, socioeconomic status and residency. There was significant association between attitude towards neonatal jaundice and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status, socioeconomic status and residency. There was significant association between practice towards neonatal jaundice and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status, socioeconomic status and residency. **Conclusion:** About more than half of participants had fair knowledge toward neonatal jaundice, more than one third of participants had negative attitude toward neonatal jaundice, and less than half had poor practice toward neonatal jaundice. Based on the current study result we recommend further studies on larger scale to assess the exact knowledge, attitude, and practice level of Iraqi mothers toward neonatal jaundice. Improve knowledge, attitude and practice about neonatal jaundice in primary health care center.

1. INTRODUCTION AND AIM OF THIS STUDY

1. Background

Neonatal jaundice is the yellowish coloring of a newborn's skin and mucous membranes caused by an increase in serum bilirubin levels. Worldwide, infant jaundice affects approximately 60% of term newborns and 80% of preterm newborns, with the majority of cases resolving without treatment.

However, in approximately 8-10% of babies, neonatal jaundice can be severe, and is normally identified when total serum bilirubin levels are > 95 percentile for age in hours.[1] The common causes of significant unconjugated hyperbilirubinemia in the first week of life includes sepsis, glucose-6-phosphate dehydrogenase deficiency, blood group incompatibility between the mother and

fetus and cephalo- hematoma.[2] The hazards of high bilirubin levels in newborns have been widely established, and they include cerebral palsy, mental retardation, dental dysplasia, upward gaze paralysis, and hearing loss. As a result, newborns who acquire jaundice must be continuously monitored, and those with severe newborn jaundice require rapid medical attention.[3] The British National Institute for Health and Care Excellence (NICE) guidelines urge that parents and careers learn about newborn jaundice, specifically how to assess their infant for jaundice and what to do if jaundice is detected. Babies at risk of substantial hyperbilirubinemia must undergo an additional visual inspection by a healthcare practitioner during the first 48 hours of life and have bilirubin levels assessed if jaundice is suspected.[4] Neonatal jaundice continues to be one of the top causes of newborn morbidity and mortality in our environment. This is primarily due to a delay in seeking appropriate therapy and/or the administration of inappropriate treatment, which is frequently administered at home. These behaviors or inactions are frequently caused by the level of understanding and perception of neonatal jaundice by moms or elder relatives at home.[5]

The practice of early discharge of mothers and infants after birth causes bilirubin levels to peak at home rather than in hospitals. The upshot is that mothers and family now bear major responsibility for early diagnosis of jaundice. It is crucial that mothers have precise understanding about how to recognize infant jaundice and respond appropriately. Thus, knowledge level, attitude and identifying the practices of mothers are key in improving newborn survival and reducing neonatal mortality rates.[6]

1.2 Aim of the study

This study aimed to assess knowledge, attitude, and practice of mothers about neonatal jaundice in pediatric outpatient clinic in Al- Imammein Al-Kadhimein medical city in Baghdad, assess the association between the knowledge of participant and baseline characteristics, assess the association between attitude of participant and baseline characteristics and assess practice of participant and baseline characteristics.

2. Review of literature

2.1 Definitions

2.1.1 Neonatal jaundice

Neonatal jaundice is one of the most common clinical symptoms in newborn babies. In babies, jaundice appears as yellow discoloration of the skin and sclera, indicating an increased serum bilirubin level, which leads to bilirubin buildup in the tissues, especially skin and mucous membranes.[7]

2.1.2 Bilirubin

Bilirubin is mostly produced from the breakdown of red blood cells. Hemoglobin undergoes a two-stage catabolism to produce bilirubin. This unconjugated (or indirect) bilirubin is transported in the circulation bound with serum albumin. Unconjugated bilirubin combines with glucuronic acid inside the liver to produce water-soluble mono- or diglucuronides of bilirubin, commonly referred as conjugated (or direct) bilirubin.[8]

2.1.3 Hyperbilirubinemia (jaundice)

Jaundice present as yellow discoloration of the skin and sclera in infants, indicating a raised serum bilirubin level especially in the skin and mucous membranes. Jaundice is predicted to appear at bilirubin levels of roughly 20 mg/dL. Jaundice identification is more difficult in babies with dark skin tones, but the sclerae are always white, and inspection of the eyes is a critical element of visual assessment of jaundice.[9] Around 60% of term and 80% of preterm infants develop jaundice in the first week of life and 10% of breastfed infants remain jaundiced up to one month of age.[9] Breastfed newborns are more likely to acquire physiological jaundice in their first week of life. The important problem is to distinguish the uncommon newborn with substantial jaundice, which may develop to bilirubin encephalopathy and kernicterus, from the majority of kids in whom jaundice is safe.[2] The current national guideline from the National Institute for Health and Care Excellence (NICE) (2021) recommends a review of all infants with risk factors for neonatal jaundice within the first 48 hours of life and assessment of serum bilirubin level in any infant with clinical jaundice.[10] The risk factors are outlined in Table 1.

Table 1: Factors related to higher susceptibility of newborn infants to development of physiological jaundice.

High hemoglobin concentration in newborn infants.
Immaturity of hepatic uptake, transport and conjugation system.
Shorter lifespan for neonatal red blood cells compared to those of adults.
Increased level of beta-glucuronidase in the gut, releasing more unconjugated bilirubin to enter the enterohepatic circulation.

Obeagu EI, Katya MC. A Systematic Review on Physiological Jaundice: Diagnosis and Management of the Affected Neonates. Madonna University journal of Medicine and Health Sciences ISSN: 2814-3035, 2022 Sep 26; 2(3): 25-41.

2.2 Classification of Neonatal jaundice

2.2.1 Physiological Jaundice

Physiological jaundice is the most frequently encountered medical issue in the first two weeks of a newborn's life. In most cases, it is mild transient, and self-limiting, resolving without treatment. It reflects the normal transition from fetal to extra uterine life. Most neonates with clinical jaundice have unconjugated

hyperbilirubinemia. Factors include increased bilirubin production, immature liver function, and increased enterohepatic circulation of bilirubin.[12]

2.2.2 Pathological Jaundice

Pathological jaundice is more severe and requires careful evaluation and management. It signifies an underlying medical or surgical condition. Failure to identify and treat pathological jaundice promptly can lead to bilirubin encephalopathy and associated neurological sequelae. Some infants with jaundice have Conjugated Hyperbilirubinemia (CHB), which is always pathological.[13]

2.2.3 Breast milk jaundice

Breast milk jaundice is a type of jaundice that occurs in neonates due to breastfeeding. Breast milk jaundice, which is commonly associated with prolonged unconjugated bilirubin, with typical onset after the fifth day of life and persisting beyond 2 weeks. Pathological causes of unconjugated hyperbilirubinemia should be ruled out before a breast milk jaundice diagnosis can be made.[14]

2.2.4 Classification of neonatal jaundice according to TSB concentration as significant, severe, extreme or hazards as shown in table 2.

Table (2): Categories of clinically significant hyperbilirubinemia.

Significant hyperbilirubinemia	Unconjugated bilirubin concentration requiring treatment with phototherapy that varies with postnatal age and cause of the condition (typically TSB ≥12 mg/dL.
Severe hyperbilirubinemia	Bilirubin concentrations at or near exchange transfusion threshold based on postnatal age and cause of the condition (typically TSB ≥20 mg/dL) or any elevated TSB associated with the early signs of mild acute bilirubin encephalopathy.
Extreme hyperbilirubinemia	Bilirubin concentrations at exchange transfusion threshold (typically TSB ≥25 mg/dL) or any elevated TSB associated with signs of mild to moderate acute bilirubin encephalopathy.
Hazardous or critical hyperbilirubinemia	Bilirubin concentrations at exchange transfusion threshold (typically TSB ≥30 mg/dL) or any elevated TSB associated with signs of moderate to severe acute bilirubin encephalopathy.
Bilirubin encephalopathy	Abnormal neurological signs caused by bilirubin toxicity to the basal ganglia and various brainstem nuclei. Progressing from an acute phase to the chronic form as kernicterus.
Acute bilirubin encephalopathy	Acute manifestations of bilirubin toxicity seen within 14 days of birth. Signs of acute bilirubin encephalopathy are typically classified as mild (poor feeding, lethargy, and tone abnormalities), moderate or intermediate (high-pitched cry, irritability, and increasing hypertonia), or severe or advanced (deep stupor, fever, apnea, inability to feed, retrocollis, opisthotonos, and obtundation).
Chronic bilirubin encephalopathy (or kernicterus)	Permanent or chronic neurological damage, including choreoathetoid cerebral palsy, enamel dysplasia, paralysis of upward gaze, and hearing impairments, including auditory neuropathy spectrum disorders.

Boskabadi H, Sezavar M, Zakerihamidi M. Evaluation of neonatal jaundice based on the severity of hyperbilirubinemia. Journal of Clinical Neonatology, 2020 Jan 1; 9(1): 46-51.

2.3 Epidemiology

2.3.1 Incidence

For the identification of jaundice by visual inspection to be possible, total serum bilirubin (TSB) concentrations need to be greater than 5–6 mg/dL, but even experienced neonatologists might misidentify infants with concentrations much higher than this threshold.[16]

Jaundice affects at least 60% of full-term and 80% of preterm neonates, suggesting that about 84–112 million of the 140 million babies born yearly worldwide will develop this condition in the first 2 weeks of life. About one in ten newborn babies are likely to develop clinically significant jaundice or hyperbilirubinemia, requiring close monitoring and treatment.[2] The precise TSB threshold of clinically significant jaundice is variable and affected by post-natal age, race, comorbid prematurity, sepsis, and hemolytic disorders.[17]

2.3.2 Global disease burden

Bhutani and colleagues were perhaps the first to model the global burden of severe jaundice in 2010. The authors estimated that about 18% (or 24 million) of the 134 million liveborn babies in 2010 developed clinically significant jaundice and 481000 late-preterm and term neonates developed extreme hyperbilirubinemia (TSB >25 mg/dL), with 114000 deaths and more than 63000 survivors who had moderate or severe long-term neurological impairments.[18] Data from the Global Burden of Disease study in 2021 showed that neonatal jaundice accounted for 1309•3 deaths per 100000 livebirths and ranked seventh globally among all causes of neonatal deaths in the early-neonatal period (0–6 days).

The burden of jaundice was highest in south Asia (seventh leading cause of neonatal mortality) and sub-Saharan Africa (eighth leading cause of neonatal mortality).[19] Additionally, jaundice was the 13th leading cause of neonatal mortality in North America and ninth

in western Europe. In the late- neonatal period (7–27 days) jaundice accounted for 187•1 deaths per 100000 and ranked ninth globally.[20] The condition ranked seventh in south Asia and 12th in sub-Saharan Africa, compared with 15th in western Europe and 21st in North America; it was the 16th leading cause of mortality in children younger than 5 years among over 100 causes of child mortality globally.[21] Because survivors of severe jaundice are frequently at substantial risk of life-long neurodevelopmental disabilities, examining the burden of this condition by use of disability-adjusted life-years (DALYs) can be useful. DALYs are the sum of the years of life lost as a result of premature mortality and the years lived with disability.[22] This metric combines mortality and morbidity outcomes for any condition. 1 DALY represents 1 year of healthy life lost because of the condition at the population level. Globally, neonatal jaundice accounted for 113 401 DALYs in 2021 and ranked seventh as the leading cause of DALYs in the early neonatal period. However, in the late neonatal period, the condition dropped to ninth with 16 214 DALYs and was the 17th leading cause of DALYs among children under 5 years globally.[23]

2.4 Pathophysiology

Bilirubin is mostly formed in newborns through the breakdown of red blood cells. The reticuloendothelial system catabolizes hemoglobin,which is released from broken down red blood cells, in two stages to create bilirubin. This unconjugated (or indirect) bilirubin travels in the bloodstream linked to serum albumin. Unconjugated bilirubin reacts with glucuronic acid in the smooth endoplasmic reticulum inside the liver to form water-soluble mono- or diglucuronides of bilirubin, usually known as conjugated (or direct) bilirubin.[24] Conjugated bilirubin is a component of bile and enters the gut via the biliary system. Although a proportion of conjugated bilirubin can be hydrolyzed by beta-glucuronidase to unconjugated bilirubin in the small gut, from where it is reabsorbed (the enter hepatic circulation), the majority is excreted with the stool.[25] Establishing gut motility and a normal pattern of stooling is an important component of reducing the bilirubin load from the enter hepatic circulation in the first few days, which is part of the reason why breastfeeding support is an essential component of the management of neonatal jaundice.[26]

2.5 Clinical picture

2.5.1 Clinical presentation

Most common clinical presentation of neonatal jaundice is yellowish discoloration of the skin and the whites of the eyes. This main sign of infant jaundice usually appears between the second and fourth day after birth.[27]

2.5.2 Physical examination

Physical examination of the newborn for visual assessment of clinical jaundice should be performed in a well-lit room. Visual assessment is unreliable, particularly under artificial light and after phototherapy has begun. It can also be difficult in dark-skinned infants, in whom examination of sclera, gums and pinched skin are also important. For any infant with clinical jaundice, the serum bilirubin level must be measured to allow planning of management. Clinical jaundice usually becomes visually evident at a serum bilirubin level of 20 mg/dl in babies with pale skin.[28]

2.6 Risk factors

Table 3 summarizes the demographic, biological, laboratory, and clinical risk factors for severe jaundice, which include acute bilirubin encephalopathy and kernicterus. Understanding these risk variables and associated epidemiological profiles in various racial communities is beneficial for the early detection and appropriate management of newborns with or at risk of severe jaundice. The most common of these factors are probably preterm, hemolytic illness, prenatal infection, and exclusive breastfeeding.[29]

Table (3): Risk factors for severe neonatal hyperbilirubinemia.

Genetic factors	Gilbert's syndrome
	Crigler–Najjar syndrome
	Alagille's syndrome
	β thalassemia
	Glucose-6-phosphate dehydrogenase deficiency
	Bilirubin glucuronosyltransferase polymorphism
	Pyruvate kinase deficiency
	Erythrocyte structural defects (including hereditary spherocytosis)
	Galactosaemia
Maternal factors	Race or ethnic group (Asian or black race)
	Family history of severe jaundice
	Primiparity
	Teenage pregnancy
	Diabetes
	Rhesus/ABO incompatibility
	Use of drugs during labor (including oxytocin)
	Exclusive breastfeeding

Perinatal factors	Mode of delivery (breech vs vertex, instrumentation)
	Birth trauma
	Birth asphyxia
	Delayed cord clamping
	Congenital infections
	Sepsis
Neonatal factors	Male sex
	Prematurity or low birthweight
	Hypothyroidism
	Polycythemia
	Hypoglycemia
	Low intake of breast milk, dehydration, or weight loss
	Breast milk jaundice
Other risk factors and markers	Previous sibling received phototherapy or exchange transfusion
	Pre-discharge TSB or transcutaneous bilirubin concentration in the high-risk zone
	Use of hemolytic agents
	Folate deficiency
	Aflatoxins
	Hypothermia
	Birth outside of a health-care facility

Devi DS, Vijaykumar B. Risk factors for neonatal hyperbilirubinemia: a case control study. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 2017 Jan 1; 6(1): 198-203.

Preterm infants (<37 weeks gestational age) are more likely to experience severe jaundice with or without bilirubin-induced neurotoxicity than full-term infants (≥37 weeks). This is due to increased bilirubin production, hepatic immaturity in bilirubin uptake and conjugation, and increased enterohepatic circulation of bilirubin due to intestinal immaturity and delayed enteral feeding. Even though this risk reduces with increasing gestational age, late-preterm (34-36 weeks) and early-term (38 weeks) newborn newborns have a higher risk of severe jaundice and neurotoxicity than full-term newborn babies.[30] Hemolysis is a pathological shortening of the lifespan of red blood cells caused by a variety of genetic and non-genetic illnesses, including iso-immune hemolytic disease (blood group incompatibility), G6PD deficiency, and hereditary spherocytosis. Exposure to oxidant chemicals such as sulfonamide compounds, methylene blue, naphthalene, or fava beans consumed by nursing women causes or worsens hemolysis in G6PD-deficient newborn newborns.[31] Rhesus disease has been practically eliminated in high-income nations, but it remains a significant cause of hemolytic hyperbilirubinemia. G6PD deficiency, which was long assumed to be limited to the geographical locations to which it is indigenous, can now be found globally due to migration patterns and accessibility of travel.[31] Sepsis predisposes individuals to severe jaundice because of a combination of excess destruction of red blood cells and hepatocellular dysfunction, including intrahepatic biliary stasis. The contribution of infections to severe jaundice or kernicterus has been reported to vary from 14% in Africa to 31% in Asia, compared with 2% in Europe and North America.[32] In both industrialized and developing countries, newborn babies are encouraged to start nursing within the first hour of life and to nurse exclusively for the first six months of their lives. However, not all breastfed infants will acquire adequate milk intake during their first few days of life. As a result, as many as 10-18% of exclusively breastfed newborns lose more than 10% of their birth weight.[17] Starvation or poor caloric intake in breastfed infants above the age of 5 days may result in higher TSB concentrations due to increased intestinal re-absorption of unconjugated bilirubin. Breastfeeding jaundice should be separated from breast milk jaundice, which is usually linked with persistent unconjugated bilirubin, typically beginning after the fifth day of life and extending for more than two weeks.[11] Furthermore, delayed cord clamping for 30-60 seconds in term infants is generally advised in many countries and backed by WHO since it boosts hemoglobin levels at delivery and enhances iron storage in the first few months of life, among other advantages. However, a delay of one minute before cord clamping could significantly increase the newborn baby's hemoglobin concentration and induce the need for phototherapy.[8]

2.7 Diagnosis

Prompt identification of infants with jaundice in and out of hospital should be incorporated into the care of newborn babies, especially because jaundice could easily be overlooked in settings with an overwhelming burden of more fatal neonatal illnesses.[8] Although TSB is a poor predictor of neurotoxicity compared with unbound bilirubin, it is still the diagnostic tool of choice and the measure for instituting and monitoring treatment efficacy because tools for evaluating unbound bilirubin are not yet routinely available.[33] The use of the ratio of bilirubin to albumin as a surrogate for plasma free bilirubin does not improve

prediction of acute bilirubin encephalopathy or residual encephalopathy over TSB alone. The use of transcutaneous bilirubin as a proxy or pre-screening tool for TSB to reduce the amount of unnecessary and painful blood draws in newborn babies is common.[34] Transcutaneous bilirubin devices are non-invasive and convert the color of the baby's skin into a bilirubin value by use of specific algorithms. The devices are simple-to-use and less costly than TSB bilirubin meters and the measurements are highly associated with TSB regardless of gestational age.[33] The reliability of transcutaneous bilirubin decreases rapidly at increased bilirubin concentrations (typically>12 mg/dL), and most commercially available transcutaneous bilirubin devices cannot measure bilirubin concentrations above approximately 20 mg/dL.[34]

2.8 Complications

Long-term neurodevelopmental disabilities frequently associated with severe jaundice with or without a diagnosis of bilirubin encephalopathy include choreoathetoid cerebral palsy, auditory spectrum disorders, and general developmental delays.[21] A rising number of research are looking into the risk of bilirubin-induced neurotoxicity in children with jaundice using unbound bilirubin rather than serum or plasma bilirubin. Few studies have identified a relationship between severe jaundice and epilepsy, however the association with autism and childhood asthma is still being investigated and debated.[35] The long-term effect of severe hyperbilirubinemia (TSB ≥20 mg/dL) on educational, occupational, and social functioning over a 30-year period was investigated; 45% of infants who had experienced jaundice had cognitive abnormalities in childhood and into adulthood. This finding was reflected in academic achievement and the completion of both secondary and tertiary education. Childhood symptoms of hyperactivity or impulsivity and inattention were more common in the group that experienced jaundice than the control group.[26]

2.9 Management

The management of neonatal jaundice is targeted at identifying the rare baby who has a rapidly rising bilirubin level and is at risk of kernicterus from the majority of term babies whose jaundice will remain harmless.[36]

2.9.1 Phototherapy

Phototherapy is always the first line of treatment, regardless of side- effects including interference with mother–child bonding, imbalance of thermal environment, and water loss. Phototherapy is required even when exchange transfusion is indicated and is used while awaiting preparation of the blood for transfusion. The goal of the intervention is to reduce the concentration of circulating bilirubin or keep it from increasing.[37] The therapy works by use of photons that interact with the predominant bilirubin IXα isomer and change its structure, converting it to isomers that have increased polarity (photo isomers) and that can be excreted in urine and bile without the need for conjugation. Therefore, the bilirubin products produced after phototherapy bypass the inadequate conjugation mechanisms in newborn infants thereby accelerating elimination.[38]

2.9.2 Intravenous immune globulin

Intravenous immune globulin has been shown to substantially reduce the need for exchange transfusion in infants with rhesus or ABO incompatibility. Although it reduces the need for exchange transfusion, the duration of phototherapy and the length of hospital stay, it is mostly used to buy time before starting exchange transfusion in severe cases of unconjugated jaundice.[39]

2.9.3 Exchange transfusion

Immediate exchange transfusion is warranted when phototherapy has failed to effectively reduce the rate of bilirubin rise and the TSB or transcutaneous bilirubin measurement is near or exceeding exchange concentrations, or if the infant has any signs of moderate to advanced acute bilirubin encephalopathy.[40] This invasive procedure reduces the TSB concentration by removing circulating bilirubin. Secondary advantages include removal of antibody coated red blood cells in hemolytic disease (eg, in rhesus and ABO sensitization) or red blood cells that have become vulnerable because of G6PD and other red blood cell enzyme deficiencies.[41] Adverse events associated with exchange transfusion, which can be fatal, include sepsis, electrolyte imbalance, air embolism, portal vein thrombosis, cardiac overload, thrombophlebitis, thrombocytopenia, necrotizing enterocolitis, as well as the transmission of blood-borne diseases, even in settings with advanced clinical care.[41]

2.9.4 Other interventions

The evidence in support of the use of pharmacotherapies such as D- penicillamine, phenobarbital, bile salts, laxatives, and bilirubin oxidase is inconclusive.[42] The therapeutic benefits of infant massage on neonatal hyperbilirubinemia are still debated.[43] Inadequate breast-feeding continues to pose ethical dilemmas between providing the best form of nutrition and reducing the risk of severe jaundice caused by inadequate caloric intake.[21]

2.10 Prevention

Jaundice is a naturally occurring condition that cannot and probably should not be prevented in newborn babies. In the subset of infants at risk of severe jaundice it is important to ensure, as far as practicable, that this risk is promptly recognized and controlled.[44] Education of mothers and health- care practitioners on the difficulty of differentiating jaundice that is innocuous from jaundice that is dangerous to the baby is required. An awareness of the potential risks of severe jaundice with concomitant exposure to home-based hemolytic triggers, such as menthol and naphthalene substances, in populations with a high frequency of G6PD deficiency is also essential.[44]

Assessing the risk of severe jaundice before discharge for infants born in hospitals or other birthing units is an important aspect of primary prevention.[45] Risk factors include jaundice in the first 24 h of life, a history of neonatal jaundice in older siblings, a family history of hemolytic disease, evidence of hematoma or other sequestered blood, birth more than 2–3 weeks before term, and exaggerated postnatal weight loss or inadequate weight recovery.[37] Empowering mothers to seek timely and appropriate referral is a crucial first step in the prevention of potentially hazardous jaundice. Among mothers who give birth outside hospitals and who do not have the services of community health visitors after birth, this step is even more important. Simple-to-use and cost-effective tools such as customized icterometers and smart phone apps to assist mothers with the detection of jaundice in their newborn babies in home-settings. Routine screening and monitoring for G6PD deficiency and rhesus disease sensitization should be emphasized.[44]

2.11 Knowledge, attitude and practice study and its importance towards neonatal jaundice

The implication of good knowledge in the identification of jaundice is that caregivers will detect jaundice immediately after birth and take appropriate steps towards seeking prompt treatment in the hospital. A good knowledge in identifying the cause of jaundice is an indication that mothers will likely put in measures to prevent it and seek prompt treatment.[46] Previous studies reported that caregivers with prior awareness and education on neonatal jaundice were three times more likely to have good knowledge of jaundice than those who have never received education on jaundice.[5, 6] A positive attitude towards neonatal jaundice implies that it will lead to early detection and correct diagnosis as well as prompt treatment with phototherapy or exchange blood transfusion with the ultimate aim of reducing neonatal mortality.[48] The negative attitudes of exposing babies to the sunlight and the use of herbal preparation need to be discouraged through appropriate education as these are inimical to the survival of the babies and may lead to delays in early care-seeking at the hospital which may result in complications and even death.[49] Beliefs and practices regarding neonatal jaundice among the caregivers is affected by several factors. Those who resided in rural areas were less likely to have good practices of neonatal jaundice compared to urban residents.[50] Moreover, level of education of the caregivers is very important. This could probably be explained due to the availability of adequate health facilities and health care professionals in the urban areas who offer frequent education to caregivers at health facilities thereby improving their attitudes.[51] Mothers who had received prior education on neonatal jaundice from medical staffs were more likely to have good practices related to jaundice than other mothers. This was consistent with the 'knowledge,attitude and practices' (KAP) model, which suggests greater knowledge is the basis for good attitudes and practice.[52]

3. Subjects and methods

3.1 Study design: cross-sectional study with analytic elements.

3.2 Study setting: The study was conducted in a sample of mothers who was attended pediatric outpatient clinic in al-imammein al-kadhmein medical city in Baghdad.

3.3 time of Study: The current study was carried out during period from 1st of February 2024 to 30 of July 2024.

3.4 sample

3.4.1 sample size and sampling technique

convenient sample of 300 mothers who were attending the pediatric outpatient in al-imammein al- kadhmein medical city in baghdad during the sixth months. The data collection was done through spending four hours / day, 3 days / week.

3.4.2 Inclusion criteria and exclusion

1- Inclusion: mothers who attending to the pediatric outpatient in Al-Imammein Al-Kadhimein medical city who had neonate diagnosed with neonatal jaundice volunteered to give information about their knowledge attitude and practice toward neonatal jaundice.

2- Exclusion

1- mothers who refused to participate.

2- mothers with mental health problems.

3- mothers who not had neonate diagnosed with neonatal jaundice.

3.5 methods

3.5. 1 Tools of Data collection

Data was collected specially designed written structured questionnaire by the researcher and modified by supervisors and specialized community medicine and specialized pediatric and specialized family medicine and translated to the Arabic language by researcher.the researcher collected the data from mothers through direct interview(appendix 1)

3.5.2 Questionnaire

The applied questionnaire consisted of four parts (Appendix).

Part 1: The mothers' demographical data including age, numbers of children that had,numbers of the neonate previously diagnosed with NJ, gender of neonate with NJ, type of delivery,previous information and source about NJ, marital status of mothers, educational level, socioeconomic status (Appendix 3), residential area and occupation of mothers.

Part 2: Knowledge of mother's contents: How mothers identify the NNJ, Some danger signs of NNJ, Some possible causes of NNJ, Effective hospital treatment toward NNJ and Complications of severe NNJ. Each one has own branches.

Part 3: Mothers' attitude towards NNJ. Some questions of attitude of mothers as the treatment of NNJ, how to manage, how to avoid, general idea about the causes and treatment of NNJ.

Part 4: Mothers' practices regarding NNJ. Some statements of practices of mothers which are: Expose the child to the florescent light, and continue breastfeeding for child.

3.6 Pilot Study: A pilot study was done on 20 mothers in order to assess the practicality, clarity and time consumed to fill the questionnaire (about 10 minutes). These cases were excluded from the main study. No modifications were needed after that.

3.7 Ethical considerations: Formal approvals were obtained from scientific committee of Arab board of health & specializations. Then an official permission was obtained from the directorate of health of Baghdad and from Al- Imammein Al-Kadhimein medical city(appendix- 4). Verbal consent was taken from all participants after explaining the aim of the study and only those who were willing to participate in the study were included.

3.8 Statistical Analysis: Data was analyzed using SPSS (Statistical Package for Social Science) version 27 (IBM, Illinois, USA).The descriptive statistics were presented using tables and graphs measuring frequencies, percentages.`Chi-square test was used to find out significancy of association between related categorical variables.

P-value of less than 0.05 was considered as determination point for significancy.

3.9 Scoring system: Concerning knowledge section, questions were answered by true, false or I don't know. Answers were scored as the following: correct answer '1', incorrect answer and I don't know '0'. If the mother gets more than 75% in the data form of knowledge, she was considered good level. If the mother gets between 50% and 75% in the data form of knowledge, she will be considered fair level. If the mother gets below 50% in the data form of knowledge, she will be considered poor level.[52] Correct answer X100 \18.As regards the attitude, questions were answered by agree, disagree and don't know. Answers were scored as the following: correct answer '1', incorrect answer and I don't know '0'. If the mother gets score above the median value in the data form of attitude, she was considered positive level.[52] Correct answer X100 \11.Regarding the practices, a two – point rating scale issued 0 for incorrect answer, 1 for correct answer. If the mother gets score above the median value in the data form of practices, she was considered good level.[52] Correct answer X 100 \10.

3.10limitation of study

1- The study was done in only one space which was pediatric outpatient of al- imammein al-kadhmein medical city in Baghdad.
2- Duration of the study was short.

4. RESULTS

A total of 300 mothers were recruited in this study.

4.1 Baseline characteristics

As shown in table 4, included mothers had mean age 33.7 ± 9.5 years. The majority of mothers (60.3%) had more than 2 children. All included mothers reported having neonate previously diagnosed with NNJ. Affected neonates were females (51.3%) and males (48.7%). Type of delivery was vaginal in 61% and cesarean in 39%. Previous information on neonatal jaundice was present in 95.7% of included mothers and most reported source of information was family (60%). Included mothers were mostly married (75%), and most common educational level was secondary (26.7%), university (23.3%) and primary (20.7%). About two thirds of mothers were unemployed, 54% of mothers were of medium socioeconomic status and 45% of low socioeconomic status. Sixty percent of mothers were living in rural areas.

Table (4): Distribution of participants by baseline characteristics.

Mothers age (years)	**Mean ± SD**	33.7 ± 9.5	
	Range	17 - 55	
		No	**%**
Children number	**None**	4*	1.3*
	One	26	8.7
	Two	89	29.7
	More than two	181	60.3
Neonate previously diagnosed with neonatal jaundice	**Yes**	300	100
	Numbers of affected neonate	2.41 ± 1.1	
Gender of neonate that affected with jaundice	**Female**	154	51.3
	Male	146	48.7
Type of delivery of the neonate	**Vaginal**	183	61
	Cesarean	117	39
Previous information on neonatal jaundice	**Yes**	287	95.7
	No	13	4.3
Source of information	**Mass media**	1	0.3
	PHC	27	9
	Hospital	11	3.7

	Internet	50	16.7
	Family	180	60
	Others	18	6
Marital status	**Married**	225	75
	Divorce	31	10.3
	Widow	44	14.7
Mother's education level	**Illiterate**	26	8.7
	Read and write	55	18.3
	Primary	62	20.7
	Secondary	80	26.7
	University	70	23.3
	postgraduate	7	2.3
Mother's employment status	**Self/Private**	48	16
	Public Servant	51	17
	Student	11	3.7
	Unemployed	190	63.3
Socioeconomic status	**High**	3	1
	Medium	162	54
	Low	135	45
Residency	**Urban**	120	40
	Rural	180	60

* For children passed away before conducting this study and were not included

1.1 Knowledge response

As shown in table 5, Assessment of knowledge about NNJ revealed that all mothers answered correctly to definition of NNJ, 69.4%, 28.7%, 9.7% and 27.7% answered correctly to the four questions regarding causes of NNJ**,** 90.4%, 90.4% and 78.3% answered correctly to the three questions regarding danger sign of NNJ, 68%, 93.3% and 97% answered correctly to the three questions regarding complications of NNJ, 89%, 98%,71% and 24% answered correctly to the four questions regarding treatment of NNJ, while 98.3%, 47.7% and 19.7% answered correctly to the three questions regarding prevention of NNJ.

Table (5): Distribution of participants responses to neonatal jaundice.

Knowledge questions	True	False	Don't know
What is neonatal jaundice?			
Neonatal jaundice is the yellowish discoloration of the skin and eyes*	300(100%)	0(0%)	0(0%)
What are the causes of neonatal jaundice?			
Disparity between blood groups (of mother and neonate)*	208(69.4%)	28(9.3%)	64(21.3%)
Prematurity of the baby*	86(28.7%)	100(33.3%)	114(38%)
Feeding the neonate with breastmilk*	29(9.7%)	246(82%)	25(8.3%)
Delay passage of meconium+	18(6%)	83(27.7%)	199(66.3%)
What are the danger sign of neonatal jaundice?			
Convulsion*	157(90.4%)	73(24.3%)	70(23.3%)
A jaundiced neonate feeds very poorly*	271(90.4%)	19(6.3%)	10(3.3%)
High pitch cry*	235(78.3%)	38(12.7%)	27(9%)
What are the complications of neonatal jaundice?			
A child physically handicapped*	204(68%)	47(15.7%)	49(16.3%)
Brain damage in the neonate*	280(93.3%)	3(1%)	17(5.7%)
A neonate diagnosed with jaundice can die*	291(97%)	4(1.3%)	5(1.7%)
What is the treatment of neonatal jaundice?			
Used fluorescent*	267(89%)	12(4%)	21(7%)
Phototherapy*	294(98%)	1(0.3%)	5(1.7%)
Exchange blood transfusion*	213(71%)	13(4.3%)	74(24.7%)
Traditional methods like used herbals, used water and sugar+	217(72.3%)	72(24%)	11(3.7%)
What is the prevention of neonatal jaundice?			
Early initiation of breast milk*	295(98.3%)	3(1%)	2(0.7%)
Blood group of the mother*	143(47.7%)	66(22%)	91(30.3%)
Neonatal Jaundice is a common problem and no need to prevent it+	230(76.7%)	59(19.7%)	11(3.6%)

Questions marked by * the correct answer is yes, while questions marked by + the correct answer is false.

The Assessment of knowledge about NNJ showed that included mothers had good knowledge103 (34.3%), fair knowledge180 (60%) and poor 17(5.7%) (figure1).

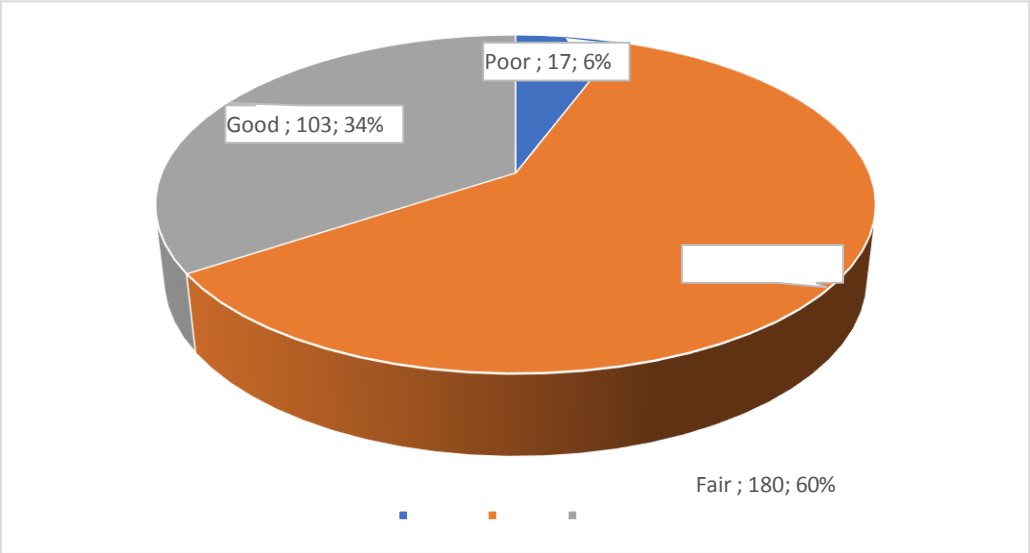

Figure (1): Overall Knowledge score towards NNJ.

there was significant association between knowledge about NNJ and number of children mothers who had more than 2child had good knowledge (39. 2%, p =0. 001), marital status the widow mothers had good knowledge (56.8%,p =0.001), mother's employed in public servant had good knowledge (49%,p =0. 027), mothers who had medium socioeconomic stat (43. 8%, p =0.001) and who live in urban area(46.7%,p =0.001). others variables showed no significant association with knowledge level (Table6).

Table (6): association of participants by knowledge and baseline characteristics.

		Poor No=17	Fair No=180	Good N=103	P value
Children number	**None**	0(0%)	3(75%)	1(25%)	**0.001 [S]**
	One	7(26.9%)	14(53.9%)	5(19.2%)	
	Two	9(10.1%)	54(60.7%)	26(29.2%)	
	More than two	1(0.06%)	109(60.2%)	71(39.2%)	
Gender of neonate that affected with jaundice	**Female**	4(2.6%)	98(63.6%)	52(33.8%)	0.055 [NS]
	Male	13(8.9%)	82(56.2%)	51(34.9%)	
Type of delivery of the neonate	**Vaginal**	11(6%)	107(58.5%)	65(35.5%)	0.789 [NS]
	Cesarean	6(5.1%)	73(62.4%)	38(32.5%)	
Previous information on neonatal jaundice	**Yes**	15(5.3%)	171(60%)	101(34.7%)	0.385 [NS]
	No	2(13.3%)	9(60%)	2(26.7%)	
Source of information (No = 287)	**Mass media**	0(0%)	0(0%)	1(100%)	0.086 [NS]
	PHC	0(0%)	16(59.3%)	11(40.7%)	
	Hospital	0(0%)	5(45.5%)	6(54.5%)	
	Internet	0(0%)	29(58%)	21(42%)	
	Family	16(8.9%)	108(60%)	56(31.1%)	
	Others	0(0%)	14(77.8%)	4(22.2%)	
Marital status	**Married**	17(7.6%)	145(64.4%)	63(28%)	**0.001 [S]**
	Divorce	0(0%)	16(51.6%)	15(48.4%)	
	Widow	0(0%)	19(43.2%)	25(56.8%)	
Mother's education level	**Illiterate**	3(11.5%)	17(65.4%)	6(23.1%)	0.069 [NS]
	Read and write	3(5.5%)	35(63.6%)	17(30.9%)	
	Primary	7(11.3%)	36(58.1%)	19(30.6%)	
	Secondary	4(5%)	52(65%)	24(30%)	
	University	0(0%)	37(52.9%)	33(47.1%)	
	Postgraduate	0(0%)	3(42.9%)	4(57.1%)	

Mother's employment status	**Self/Private**	0(0%)	32(66.7%)	16(33.3%)	**0.027 [S]**
	Public Servant	0(0%)	26(51%)	25(49%)	
	Student	1(9.1%)	8(72.7%)	2(18.2%)	
	Unemployed	16(8.4%)	114(60%)	60(31.6%)	
Socioeconomic status	**High**	0(0%)	3(100%)	0(0%)	**0.001 [S]**
	Medium	2(1.2%)	89(54.9%)	71(43.8%)	
	Low	15(11.1%)	88(65.2%)	32(23.7%)	
Residency	**Urban**	4(3.3%)	60(50%)	56(46.7%)	**0.001 [S]**
	Rural	13(7.2%)	120(66.7%)	47(26.1%)	

Using Chi-square test

Attitude responses

As shown in table 7, assessment of attitude towards NNJ revealed that 75.3% agreed that NNJ is a common physiological phenomenon and will not cause serious consequences, 51% agreed that neonate with jaundice does not need treatment and will self-recover while 49% disagreed, 98.3% agreed that it is important to observe neonatal jaundice after discharged delivery, 92.7% agreed that attending ANC During pregnancy can help to prevent neonatal jaundice, 94.7% agreed that it is necessary for postpartum PHCs visit to assess jaundice condition, 99.3% agreed that neonate with suspected jaundice should go to a health institution center to measure the bilirubin level in a timely manner, 97.3% agreed that continuous and adequate breastfeeding is good for jaundice, 98% agreed that it is necessary to learn knowledge of neonatal jaundice, 53.7% agreed that exposure to morning sunlight is a way of treating neonatal jaundice 57% agreed that poor personal and environmental hygiene causes neonatal jaundice and 85% disagreed that neonatal jaundice is a communicable disease.

Table 7: Distribution of participants' responses to attitude items.

Attitude questions	Agreed	Disagree	Don't know
I think neonatal jaundice is a common physiological phenomenon and will not cause serious consequences	226 (75.3%)	62 (20.7%)	12 (4%)
I think that a neonate with jaundice does not need treatment and will self-recover	153 (51%)	147 (49%)	0 (0%)
I think is very important to observe neonatal jaundice after discharged delivery	295 (98.3%)	2 (0.7%)	3 (1%)
I think attended ANC During pregnancy can help to prevent neonatal jaundice	287 (92.7%)	18 (6%)	4 (1.3%)
I think it is necessary for postpartum PHCs visit to assess jaundice condition	284 (94.7%)	10 (3.3%)	6 (2%)
I think a neonate with suspected jaundice should go to a health institution center to measure the bilirubin level in a timely manner	298 (99.3%)	2 (0.7%)	0 (0%)
I think that continuous and adequate breastfeeding is good for jaundice	292 (97.3%)	5 (1.7%)	3 (1%)
I think it is necessary to learn knowledge of neonatal jaundice	294 (98%)	3 (1%)	3 (1%)
I think is exposure to morning sunlight is a way of treating neonatal jaundice	161 (53.7%)	83 (27.7%)	56 (18.6%)
I think poor personal and environmental hygiene causes neonatal jaundice	171 (57%)	115 (38.3%)	14 (4.7%)
Neonatal jaundice is a communicable disease	40 (13.3%)	255 (85%)	5 (1.7%)

Assessment of attitude toward NNJ showed that included mothers had positive attitude 193(64.3%) and negative attitude107 (35.7%) (figure2).

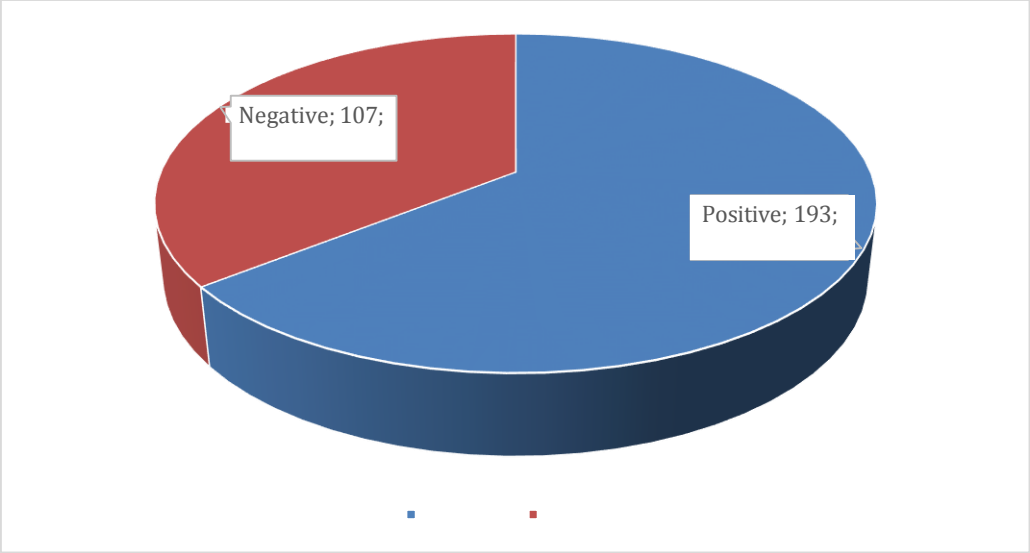

Figure (2): Overall attitude score towards NNJ.

Positive attitude was significant among mothers whose delivered by c\s (76. 1%,p =0.001) and whose the source of her information was from the mass media and hospital (100%,p =0.001)and those divorce (80.6%,p =0.011)and those highly educated (100%,p =0.001)and those who employed in public servant (98%,p =0.001)and who had high socioeconomic stat (100%,p =0.001)and those who live in urban area (86.7%,p =0.001).Others features were with no significant association with attitude score (Table8).

Table (8): association of participants by attitude and baseline characteristics.

		Positive No=193	Negative No=107	P value
Children number	**None**	4(100%)	0(0%)	0.092 [NS]
	One	13(50%)	13(50%)	
	Two	63(70.8%)	26(29.2%)	
	More than two	113(62.4%)	68(37.6%)	
Gender of neonate that affected with jaundice	**Female**	99(64.3%)	55(35.7%)	0.986 [NS]
	Male	94(64.4%)	52(35.6%)	
Type of delivery of the neonate	**Vaginal**	104(56.8%)	79(43.2%)	**0.001 [S]**
	Cesarean	89(76.1%)	28(23.9%)	
Previous information on neonatal jaundice	**Yes**	188(65.9%)	99(34.1%)	0.143 [NS]
	No	5(38.5%)	8(61.5%)	
Source of information (No = 287)	**Mass media**	1(100%)	0(0%)	**0.001 [S]**
	PHC	23(85.2%)	4(14.8%)	
	Hospital	11(100%)	0(0%)	
	Internet	47(94%)	3(6%)	
	Family	94(52.2%)	86(47.8%)	
	Others	10(55.6%)	8(44.4%)	
Marital status	**Married**	147(65.3%)	78(34.7%)	**0.011 [S]**
	Divorce	25(80.6%)	6(19.4%)	
	Widow	21(47.7%)	23(52.3%)	
Mother's education level	**Illiterate**	6(23.1%)	20(76.9%)	**0.001 [S]**
	Read and write	21(38.2%)	34(61.8%)	
	Primary	30(48.4%)	32(51.6%)	
	Secondary	60(75%)	20(25%)	
	University	69(98.6%)	1(1.4%)	
	Postgraduate	7(100%)	0(0%)	
Mother's employment status	**Self/Private**	41(85.4%)	7(14.6%)	**0.001 [S]**
	Public Servant	50(98%)	1(2%)	
	Student	7(63.6%)	4(36.4%)	
	Unemployed	95(50%)	95(50%)	

Socioeconomic status	**High**	3(100%)	0(0%)	**0.001 [S]**
	Medium	132(81.5%)	30(18.5%)	
	Low	58(43%)	77(57%)	
Residency	**Urban**	104(86.7%)	16(13.3%)	**0.001 [S]**
	Rural	89(49.4%)	91(50.6%)	

Using Chi-square test

1.2 Practice responses

As shown in table 9, Assessment of practice responses revealed that 50% of mothers will take the initiative to seek information about neonatal jaundice from health institutions while 48.7% won't, 99.7% of mothers checked their neonate for jaundice such as the color of the skin, color of the sclera, color of the urine, color of the stool, all mothers followed the doctor's instructions to take the neonate to health institution to measure the bilirubin level and 90% exposed the neonate to fluorescent. Regarding use of traditional treatment of neonatal jaundice, 62.7% avoided using yellow color of tools and supplies in a neonate room, 72% gave water and sugar, 48% used the ring on mummy restraint, 9.7% put the neonate in a dark room for 7 days while 45.7% used the necklace with seven of garlic.

Table (9): Distribution of participants' responses to practice items.

Practice questions	Yes	No	I don't know
I take the initiative to seek information about neonatal jaundice from health institutions	150 (50%)	146 (48.7%)	4 (1.3%)
I checked my neonate for jaundice such as the color of the skin, color of the sclera, color of the urine, color of the stool	299 (99.7%)	1 (0.3%)	0 (0%)
I followed the doctor's instructions to take the neonate to health institution to measure the bilirubin level	300 (100%)	0 (0%)	0 (0%)
I breastfed adequately	296 (98.7%)	4 (1.3%)	0 (0%)
I expose the neonate to fluorescent	270 (90%)	19 (6.3%)	11 (3.7%)
I used traditional treatment of neonatal jaundice like;			
avoid using yellow color of tools and supplies in a neonate room	188 (62.7%)	99 (33%)	13 (4.3%)
give water and sugar	216 (72%)	81 (27%)	3 (1%)
use the ring on mummy restraint	144 (48%)	150 (50%)	6 (2%)
put the neonate in a dark room for 7 days		254 (84.7%)	17 (5.6%)
use the necklace with seven of garlic		154 (51.3%)	9 (3%)

Included mothers showed had good practice regarding NNJ 157(52.3%) and poor practice regarding NNJ 143(47.7%) (figure3).

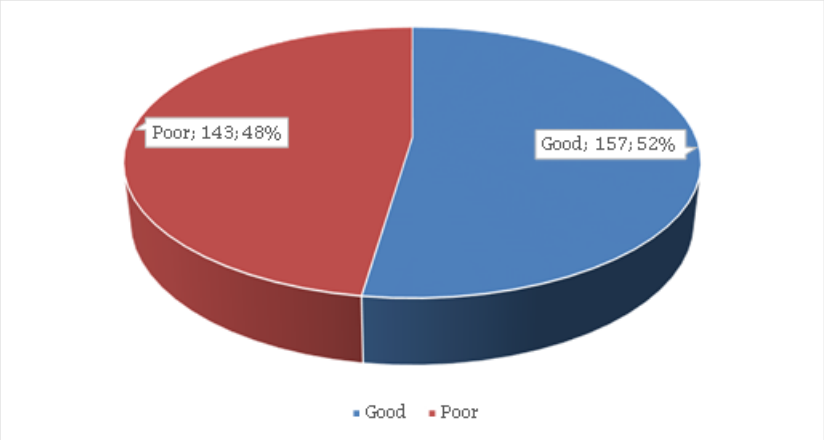

Figure (3): Overall practice towards NNJ.

We found that good practice toward NNJ was significantly higher in mothers delivered by c \s (65.8%,p =0.001)and those who her source of information was mass media (100%,p =0.001)and those who divorce (74.2%,p =0.016)and those highly educated (97.1%,p =0.001)and those who employed in public servant (92.2%,p =0.001)and who had high socioeconomic stat (100%,p =0.001)and who live in urban area (78.3%,p =0.001).Others characteristics revealed no significant association with practice score (Table 10).

As shown in table 10, there was significant association between practice towards NNJ and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status, socioeconomic status and residency.

Table (10): association of participants by practice and baseline characteristics.

		Good No=157	Poor No=143	P value
Children number	**None**	2(50%)	2(50%)	0.127 [NS]
	One	10(38.5%)	16(61.5%)	
	Two	55(61.8%)	34(38.2%)	
	More than two	90(49.7%)	91(50.3%)	
Gender of neonate that affected with jaundice	**Female**	79(51.3%)	75(48.7%)	0.713 [NS]
	Male	78(53.4%)	68(46.6%)	
Type of delivery of the neonate	**Vaginal**	80(43.7%)	103(56.3%)	**0.001 [S]**
	Cesarean	77(65.8%)	40(34.2%)	
Previous information on neonatal jaundice	**Yes**	154(53.3%)	133(46.7%)	0.131 [NS]
	No	3(23.1%)	10(76.9%)	
Source of information (No = 287)	**Mass media**	1(100%)	0(0%)	**0.001 [S]**
	PHC	25(92.6%)	2(7.4%)	
	Hospital	8(72.7%)	3(27.3%)	
	Internet	42(84%)	8(16%)	
	Family	67(37.2%)	113(62.8%)	
	Others	9(50%)	9(50%)	
Marital status	**Married**	116(51.6%)	109(48.4%)	**0.016 [S]**
	Divorce	23(74.2%)	8(25.8%)	
	Widow	18(40.9%)	26(59.1%)	
Mother's education level	**Illiterate**	8(30.8%)	18(69.2%)	**0.001 [S]**
	Read and write	10(18.2%)	45(81.8%)	
	Primary	16(25.8%)	46(74.2%)	
	Secondary	50(62.5%)	30(37.5%)	
	University	68(97.1%)	2(2.9%)	
	Postgraduate	5(71.4%)	2(28.6%)	
Mother's employment status	**Self/Private**	37(77.1%)	11(22.9%)	**0.001 [S]**
	Public Servant	47(92.2%)	4(7.8%)	
	Student	6(54.5%)	5(45.5%)	
	Unemployed	67(35.3%)	123(64.7%)	
Socioeconomic status	**High**	3(100%)	0(0%)	**0.001 [S]**
	Medium	119(73.5%)	43(26.5%)	
	Low	35(25.6%)	100(74.1%)	
Residency	**Urban**	94(78.3%)	26(21.7%)	**0.001 [S]**
	Rural	63(35%)	117(65%)	

Using Chi-square test

4. DISCUSSION

Baseline characteristics

In the current study, included mothers had mean age 33.7 ± 9.5 years. This was agreed by **Altraide et al., (2021)**[48] in Nigeria who reported that the majority of mothers (61.7%) were aged 26-34 years. Similarly, **Saddozai et al., (2022)**[49] in Pakistan reported that 50.2% of mothers were aged 26-35 years. **Salia et al., (2021)**[5] in Ghana reported that the majority of mothers (56.9%) were aged 26-35 years. Contradicting to our results, **Al-ezzi et al., (2022)**[53] in Iraq (Diyala governorate) reported that the majority of mothers were younger than 25 years old, which can be attributed to different sociodemographic characteristics.

The majority of mothers (60.3%) had more than 2 children. Different results were reported by **Salia et al., (2021)** [5] in Ghana as only 21.3% of mothers had more than 2 children which can be also attributed to different sociodemographic characteristics.

All included mothers reported having neonate previously

diagnosed with NNJ. Contradicting to our results, **Demis et al., (2021)** [54] in Ethiopia reported that only 9.7% of mothers had neonate previously diagnosed with NNJ. This could be explained by the inclusion of 78.2% of mothers as primiparous. **Huang et al., (2022)** [6] in China reported similar results as 13.9% of mothers had neonate previously diagnosed with NNJ, again the study included 55.6% of mothers as primiparous.

Affected neonates nearly equal in both, females (51.3%) and males (48.7%). Different results were reported by **Huang et al., (2022)** [6] in China as 52.1% of infants were males and 47.9% were females. **Saddozai et al., (2022)** [49] in Pakistan reported that 44.5% of infants were males and 55.5% were females.Type of delivery was mostly vaginal (61%) and cesarean (39%). In agreement with our results, **Zainel et al., (2022)** [55] in Iraq reported that 71.5% of infants were delivered by vaginal delivery. **Demis et al., (2021).**[54] in Ethiopia reported that 69.5% of infants were delivered by vaginal delivery. Different results were reported by **Saddozai et al., (2022)**[49] in Pakistan as vaginal delivery was reported in only 45.25% of mothers. This can be attributed to several factors as maternal preferences, obstetric complications or infant factors.Previous information on neonatal jaundice was present in 95.7% of included mothers and most reported source of information was family (60%). In the same context, **Khound, (2021)** [56] in India had reported that 92% of mothers had previous information on neonatal jaundice. **Huang et al., (2022)** [6] in China reported that 80.6% of mothers had previous information on neonatal jaundice. The most reported source of information was health education programs. Different results were obtained by **Altraide et al., (2021)** [48] in Nigeria as only 55% of mothers had previous information on neonatal jaundice.Included mothers were mostly married (75%). **Seneadza et al., (2022)**[45] in Ghana reported similar results as 60.1% of mother were married. Moreover, **Salia et al., (2021)** [5] in Ghana reported that 64.9% of mother were married.Most common educational level was primary (20.7%) secondary (26.7%)and university (23.3%). A bit similar to our results, **Fadil et al.,(2021)** [57] in Iraq reported that 33.5% of mothers had primary education, 26.2% had secondary education while 22% had university education. **Al- ezzi et al., (2022)** [53] in Iraq reported that 27.9% of mothers had primary education, 50.9% had secondary education while 21.2% had university education. Contradicting to our results, **Altraide et al., (2021)** [48] in Nigeria reported that most common educational level was university education (67.1%) which may be attributed to presence of majority of mothers (78.5%) living in urban areas.About two thirds (63.3%) of mothers were unemployed. **Fadil et al., (2021)** [57] in Iraq reported similar findings as 78.7% of mothers were unemployed. Furthermore, **Al-ezzi et al., (2022)** [53] in Iraq reported that 62.4% of mothers were unemployed. **Saddozai et al., (2022)** [49] in Pakistan reported that 64.25% of mothers were unemployed.In the current study, 60% of mothers were living in rural areas. Different results were reported by **Fadil et al., (2021)** [57] **and Al-ezzi et al., (2022)** [53] in Iraq as 83.5% and 69.1% of mothers were living in urban areas respectively.

Knowledge response and related associations

Assessment of knowledge about NNJ revealed that all mothers answered correctly to definition of NNJ. This result was comparable to results reported by **Fadil et al., (2021)** [57] in Iraq**, Salia et al., (2021)** [5] in Ghana, **Saddozai et al., (2022)** [49] in Pakistan as correct answers were reported by 81.9%, 89.6%, 80.25% of mothers respectively. On the other hand, **Altraide et al., (2021)** [48] in Nigeria reported correct answers in only 55% of mothers.

Of the included mothers 69.4%, 28.7%, 9.7% and 27.7% answered correctly to the four questions regarding causes of NNJ. **Huang et al., (2022)** [6] in China reported that the five questions regarding causes of NNJ were answered correctly in 56.6%, 29%, 69.7%, 41.4% and 37% of included mothers which came in agreement with most of our results. On the other hand, **Altraide et al., (2021)** [48] in Nigeria reported only 10.7% of mothers mentioned at least one correct answer.

Of the included mothers the majority(90.4%, 90.4%) and 78.3% answered correctly to the three questions regarding danger sign of NNJ. Lower level of knowledge was reported by **Salia et al., (2021)** [5] in Ghana as the six questions regarding danger sign of NNJ were answered correctly in 64.9%, 50%, 49%, 39.6%, 32.2% and 31.7%. Moreover, **Huang et al., (2022)** [6] in China reported that the three questions regarding danger sign of NNJ were answered correctly in 65.8%, 37% and 36.2%.In included mothers, more than half(68%),majority(93.3%) and majority(97%) answered correctly to the three questions regarding complications of NNJ. In the same context, **Huang et al., (2022)** [6] in China reported that 80.6% of mothers answered correctly to the question regarding complications of NNJ. Lower level of knowledge was reported by **Salia et al., (2021)** [5] in Ghana as the four questions regarding complications of NNJ were answered correctly in 77.7%, 55.5%, 45.5% and 41.1% of mothers.In the current study, the majority(89%, 98%,71%) and some (24%) of mothers answered correctly to the four questions regarding treatment of NNJ. In agreement with our results, **Huang et al., (2022)** [6] in China reported that 91.1% of mothers answered correctly to the question regarding treatment of NNJ. Lower level of knowledge was reported by **Salia et al., (2021)** [5] in Ghana as the four questions regarding treatment of NNJ were answered correctly in 55%, 45.5%, 38.6% and 32.7% of mothers.Of the included mothers, majority(98.3%),less than half(47.7%) and some(19.7%) answered correctly to the three questions regarding prevention of NNJ. A bit similar tour results, **Salia et al., (2021)**

[5] in Ghana reported that the three questions regarding prevention of NNJ were answered correctly in 84.7%, 61.9% and 15.8% of mothers.In the present study,

included mothers about one third had good knowledge, more than half had fair knowledge and some mothers had poor knowledge. Various results were reported in previous studies, **Fadil et al., (2021)** in Iraq reported that 51.2% of mothers had good knowledge while 48.8% had poor knowledge. **Zainel et al., (2022)** [55] in Iraq reported that some(7.5%) of mothers had good knowledge,near one third(30%) had moderate level and more than half(62.5%) had poor knowledge. **Demis et al., (2021)** [54] in Ethiopia reported that 39.2% of mothers had good knowledge while 60.8% had poor knowledge.There was significant association between knowledge about NNJ and children number, marital status, mother's employment status, socioeconomic status and residency. **Fadil et al., (2021)** [57] in Iraq and **Demis et al., (2021)** [54] in Ethiopia reported significant association between knowledge about NNJ and residency.

Attitude responses

In the present study, three quarter(75.3%) of mothers agreed that NNJ is a common physiological phenomenon and will not cause serious consequences. This was disagreed by **Saddozai et al., (2022)** [49] in Pakistan (17%) and **Huang et al., (2022)** [6] in China (10.9%).

Moreover, more than one half of mothers agreed that neonate with jaundice does not need treatment and will self- recover while 49% disagreed. In study of **Saddozai et al., (2022)** [49] in Pakistan, 36% of mothers agreed while 64% disagreed while in study of **Huang et al., (2022)**[6] in China 88% of mothers disagreed.Of the included mothers,the majority of mothers agreed that it is important to observe neonatal jaundice after discharged delivery which was agreed by **Huang et al., (2022)** [6] in China (97.3%).Most of the included mothers (94.7%) agreed that it is necessary for postpartum PHCs visit to assess jaundice condition. In addition, nearly all of included mothers (99.3%) agreed that neonate with suspected jaundice should go to a health institution center to measure the bilirubin level in a timely manner. This was similar to results of **Huang et al., (2022)** [6] in China and **Seneadza et al., (2022)** [45] in Ghana (94.6% and 92.7% respectively).The majority of the included mothers (97.3%) agreed that continuous and adequate breastfeeding is good for jaundice. This was agreed by **Saddozai et al., (2022)** [49] in Pakistan (93%). Different results were reported by **Salia et al., (2021)** [5] in Ghana (only 15.8%).In included mothers, 92.7% agreed that attending ANC During pregnancy can help to prevent neonatal jaundice. Moreover, 98% of mothers agreed that it is necessary to learn knowledge of neonatal jaundice. In agreement with our results, **Huang et al., (2022)** [6] in China reported that 97% of mothers agreed that it is necessary to learn knowledge of neonatal jaundice.Nearly half (53.7%) of mothers agreed that exposure to morning sunlight is a way of treating neonatal jaundice. Different results were reported by, **Fadil et al., (2021)** [57] in Iraq and **Saddozai et al., (2022)** [49] in Pakistan (73.2% and 96.7% respectively).In included mothers, nearly half of mothers (57%) agreed that poor personal and environmental hygiene causes neonatal jaundice. This was agreed by **Fadil et al., (2021)**[57] in Iraq (68.9%) and disagreed by **Salia et al., (2021)**[5] in Ghana (37.1%).Most of the included mothers (85%) disagreed that neonatal jaundice is a communicable disease. Different results were reported by **Saddozai et al., (2022)**[49] in Pakistan (59.25%).Included mothers, more than half of mothers had positive attitude towards NNJ and nearly one third had negative attitude.

Similar results were reported by **Fadil et al., (2021)** [57] in Iraq as 73.8% of mothers had positive attitude towards NNJ. However**, Zainel et al., (2022)** [55] in Iraq reported that only 5.5% of mothers had good attitude, 25.5% moderate attitude and 69% had poor attitude.There was significant association between attitude towards NNJ and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status, socioeconomic status and residency. **Seneadza et al., (2022)** [45] in Ghana reported significant association between attitude towards NNJ and mother's education level.

Practice Responses

Of the included mother,half of mothers (50%) will take the initiative to seek information about neonatal jaundice from health institutions while 48.7% won't,. This was agreed by **Huang et al., (2022)** [6] in China (41.7% of mothers will take the initiative). **Al-ezzi et al., (2022)** [53] in Iraq and **Altraide et al., (2021)** [48] in Nigeria reported different results as 93.3% and 80% of mothers will refer to health institutions respectively.Nearly all (99.7%) of mothers checked their neonate for jaundice such as the color of the skin, color of the sclera, color of the urine, color of the stool. Same results were reported by **Huang et al., (2022)** [6] in China (96%).All mothers followed the doctor's instructions to take the neonate to health institution to measure the bilirubin level. Similarly, **Huang et al., (2022)** [6] in China reported that 93.3% of mothers followed the doctor's instructions.The majority of the included mothers (90%) exposed the neonate to fluorescent to treat NNJ which was similar to **Al-ezzi et al., (2022)** [53] in Iraq (86.1%). Differently, **Seneadza et al., (2022)** [45] in Ghana reported that only 24.4% of mothers exposed the neonate to fluorescent to treat NNJ.Regarding use of traditional treatment of neonatal jaundice, 62.7% avoided using yellow color of tools and supplies in a neonate room, 72% gave water and sugar, 48% used the ring on mummy restraint, 9.7% put the neonate in a dark room for 7 days while 45.7% used the necklace with seven of garlic. **Seneadza et al., (2022)** [45] in Ghana reported that 5.2% of mothers gave water and sugar. **Salia et al., (2021)** [5] in Ghana reported that 70.8% of mothers put the neonate in a dark room7 days.Included mothers,showed more than half had good practice regarding NNJ and less than half had poor practice regarding NNJ.There was significant association between practice towards NNJ and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status,

socioeconomic status and residency. **Salia et al., (2021)** [5] in Ghana reported significant association between practice towards NNJ and residency. **Farouk et al., (2021)** [58] in Nigeria and **Huang et al., (2022)** [6] in China reported significant association between practice towards NNJ and mother's education level.

5. CONCLUSION AND RECOMMENDATION

CONCLUSION

1- All mothers had newborn diagnosed with neonatal jaundice previously.
2- All mothers knew the correct definition of neonatal jaundice.
3- Included more than one third of mothers had good knowledge about neonatal jaundice, more than half had fair knowledge and few had poor knowledge about neonatal jaundice.
4- There was significant association between knowledge about neonatal jaundice and children number, marital status, mother's employment status, socioeconomic status and residency.
5- Included more than half of mothers had positive attitude towards neonatal jaundice and more than one third had negative attitude.
6- There was significant association between attitude towards neonatal jaundice and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status, socioeconomic status and residency.
7- Included more than half of mothers had good practice regarding neonatal jaundice and less than half had poor practice regarding neonatal jaundice.
8- There was significant association between practice towards neonatal jaundice and type of delivery of the neonate, source of information, marital status, mother's education level, mother's employment status, socioeconomic status and residency.

Recommendation

Based on the current study results, we recommend

1- Further studies on larger scale to assess the exact knowledge, attitude and practice levels of Iraqi mothers towards neonatal jaundice.
2- Larger studies will also us to determine the main factors controlling and affecting mothers knowledge, attitude and practice about neonatal jaundice.
3- Thes studies will allow health authorities plan to increase maternal knowledge, enhance positive attitudes and good practices to lessen the effect of neonatal jaundice.
4- Enhance mass media and social media about neonatal jaundice awareness.
5- All families should be informed verbally and in writing about neonatal jaundice before discharge from hospital.
6- The British national institute for health and care excellence (NICE) guidelines urge that parents and careers learn about neonatal jaundice.
7- Improve knowledge,attitude and practice about neonatal jaundice in primary health care center.
8- Increase health promotion by health promotion unit in hospital.

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Appendix

Knowledge, attitude and practice of mother about neonatal jaundice attending outpatient clinic in AL_IMMAMEIN AL_KADHIMEIN medical city in Baghdad

No. Of questionnaire.

I- socio-demographical data

1-How old are you?		
2-How many children do you have?	1-None	
	2-One	
	3-Two	
	4-More than two	
3-Do you have neonate previously diagnosed with neonatal jaundice?	1-Yes	
	numbers of affected neonate	
	2-No	

4-what is the gender of neonate that affected with jaundice ?	1-female	
	2-male	
5-what is the type of delivery of the neonate ?	1-normal vaginal delivery	
	2- c/s	
6- Do you have previous information on neonatal jaundice	1-Yes	
	2-No	
7-What is the source of information	1-mass media	
	2-PHC	
	3-hospital	
	4-internet	
	5-family	
	6-others	
8-what is your marital status?	married	
	divorce	
	widow	
9-What is the mother's education level	1-Illiterate	
	2-Read and write	
	3-Primary	
	4-Secondary	
	5-University	
	6-post graduate	
10- What is the mother's employment status	1-Self/Private	
	2-Public Servant	
	3-Student	
	4-unemployed	
11-what is your socioeconomic status ?	1-high	
	2-medium	
	3-low	
12-Where do you live?	1-Urban	
	2-Rural	

II- Knowledge about neonatal jaundice

	True	Fals e	Don't know
1-What is neonatal jaundice?			
Neonatal jaundice is the yellowish discoloration of the skin and eyes			
2- What are the causes of neonatal jaundice?			
disparity between blood groups (blood group of mother and neonate)			
Prematurity of the baby			
Feeding the neonate with breastmilk			
Delay passage of meconium			
3- What are the danger sign of neonatal jaundice?			
Convulsion			
A jaundiced neonate feeds very poorly			
High pitch cry			
4- What are the complications of neonatal jaundice?			
A child physically handicapped			
Brain damage in the neonate			
A neonate diagnosed with jaundice can die			
5- What is the treatment of neonatal jaundice?			
Used fluorescent			
Phototherapy			
Exchange blood transfusion			
Traditional methods like used herbals, used water and sugar			
6- What is the prevention; of neonatal jaundice?			
Early initiation of breast milk			
Blood group of the mother			

Neonatal Jaundice is a common problem on newborns and no need to prevent it			

III- - Attitude towards neonatal jaundice

	Agree d	**Disagre e**	**Don't know**
1-I think neonatal jaundice is a common physiological phenomenon and will not cause serious consequences			
2-I think that a neonate with jaundice does not need treatment and will self-recover			
3-I think is very important to observe neonatal jaundice after discharged delivery			
4-I think attended ANC During pregnancy can help to prevent neonatal jaundice			
5-I think it is necessary for postpartum PHCs visit to assess jaundice condition			
6-I think a neonate with suspected jaundice should go to a health institution center to measure the bilirubin level in a timely manner			
7-I think that continuous and adequate breastfeeding is good for jaundice			
8-I think it is necessary to learn knowledge of neonatal jaundice			
9-i think is exposure to morning sunlight is a way of treating neonatal jaundice			
10-i think poor personal and environmental hygiene causes neonatal jaundice			
11- neonatal jaundice is a communicable disease			

V- Practice towards neonatal jaundice

	Yes	**No**	**I don't know**
1-I take the initiative to seek information about neonatal jaundice from health institutions			
2-I checked my neonate for jaundice such as the color of the skin, color of the sclera, color of the urine, color of the stool			
3-I followed the doctor's instructions to take the neonate to health institution to measure the bilirubin level			
4-I breastfed adequately			
5-I expose the neonate to fluorescent			
6-I used traditional treatment of neonatal jaundice like;			
a-avoid using yellow color of tools and supplies in a neonate room			
b-give water and sugar			
c-use the ring on mummy restraint			
d-put the neonate in a dark room for 7 days			
e-use the necklace with seven of garlic			