

## The Role of Nutrition in the Prevention and Management of Neonatal Jaundice in Ghana

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### Abstract

*Despite the well-established importance of nutrition in health and wellness, nutrition's involvement in the management and prevention of neonatal jaundice varies greatly from one guideline to another, to the extent that some guidelines do not include the role of nutrition in the prevention and management of neonatal jaundice. In addition, mothers typically translate their nutrition knowledge into the care of their babies. Hence, it is prudent for mothers to have the requisite knowledge needed to prevent any health condition, including neonatal jaundice. This study, therefore, sought to investigate and consolidate practices that elucidate the role nutrition plays in the prevention and management of neonatal jaundice in Ghana. The study was a multi-center nested, case-control study involving 120 cases and 120 controls of neonates in three referral hospitals in Ghana. Assessment of nutrition knowledge showed that with regards to the WHO (2004 & 2017) infant feeding recommendations, mothers of babies with neonatal jaundice had a higher nutrition score than mothers with healthy babies. During treatment of neonatal jaundice, babies were mostly fed breastmilk only, and, in a few cases, extra fluids were given if the baby is not exclusively breastfed or there is a risk of dehydration during phototherapy. No probiotic supplements were given, and micronutrient supplementation may or may not be given, depending on the prevailing health conditions of the neonate. It is recommended that further assessment should be carried out to identify the effectiveness of the nutrition education given during antenatal and postnatal education sessions at hospitals, clinics, and health centers.*

**Keywords** *Breastfeeding, Malnutrition, Neonatal jaundice, nutrition education, World Health Organisation (WHO).*

### Introduction

The body turns hemoglobin, a protein on the surface of red blood cells that binds to oxygen, into bilirubin, which is not water-soluble (characterized as unconjugated) and hence difficult to expel [1]. Bilirubin binds to albumin to become water-soluble and is transported to the liver, where it is absorbed by the cells. It is transformed into a water-soluble (conjugated) form in the liver and delivered to the small intestines by bile secretion. Excess bilirubin in the skin and mucous membranes causes jaundice, which is characterized by a yellow-

orange coloring of the skin and sclera. It is critical to prevent and, if that fails, diagnose and treat jaundice, especially in neonates, because it may not be harmful if treated promptly and is sometimes a self-limiting condition; however, extremely high levels of bilirubin can cause permanent brain damage, a condition known as kernicterus [2]. Research and cross-disciplinary partnerships are still underway to improve treatment options and develop methods to prevent infant jaundice. In addition, many health associations have made Neonatal Jaundice a public health education

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priority. For instance, the Paediatric Society of Ghana has set aside the month of May each year to promote awareness and support for the fight against newborn jaundice through evidence-based interventions, protocols, best practices, and guidelines. Thus, new research is continually being examined to enhance the odds of preventing neonatal jaundice, reducing the dangers associated with developing neonatal jaundice and increasing the success rates for therapies and management of neonatal jaundice. Many guidelines for managing newborn jaundice, however, do not provide in-depth and specific nutritional regimes. This is of concern because nutritional interventions have proven to be invaluable in the prevention and treatment of a wide range of infectious and chronic illnesses [3].

Neurodevelopmental problems such as intellectual deficiencies, athetosis, and hearing loss may occur in rare cases of physiologic hyperbilirubinemia, in which bilirubin levels reach dangerously high levels [4]. However, whether jaundice is physiological or non-physiological, the baby must be in the health state that offers the greatest chance of speedy recovery. Thus, if the baby is malnourished, for instance, recovery becomes more challenging.

Healthcare providers are concerned about acute malnutrition because it causes biochemical changes in the body that are mediated by metabolic, hormonal, and glucoregulatory processes. With nutrition-specific therapies, most children with primary acute malnutrition can be managed at home through thorough counseling of parents and ensuring household food security. Inpatient treatment is however recommended in cases of severe acute malnutrition and consequences such as growth limitation.

Other types of jaundice connected to breastfeeding can develop in newborns and infants who are exclusively breastfed [5]. Some researchers have also linked inadequate early feeding to baby jaundice. “Newborn newborns who do not feed enough probably have a higher

enterohepatic circulation of bilirubin, because fasting promotes increased bilirubin buildup in animals” [6]. Because increasing the number of oral feedings allows for faster bilirubin elimination, early, frequent breastfeeding or supplemental feedings with formula may be useful in decreasing blood bilirubin concentrations in breast-fed infants undergoing phototherapy” [6].

Gartner and Arias described the clinical history of 20 breast-fed neonates with persistent unconjugated hyperbilirubinemia [7]. Severe jaundice began in the second or third week of life, and maximal quantities of unconjugated bilirubin in the serum ranged from 9.0 to 26.0 mg per 100 ml, according to the researchers. In vitro, milk from the mothers of the jaundiced babies significantly reduced hepatic glucuronyl transferase activity. Pregnane-3( $\alpha$ ), 20( $\beta$ )-diol was recovered from the milk of four mothers of children suffering from persistent jaundice, but not from normal human milk. Two-thirds of the newborns’ breast-fed siblings had a history of persistent jaundice, but none of the artificially fed siblings had. Within the first three weeks of life, it is anticipated that up to 30% of breastfed newborns will have moderate jaundice, and this jaundice might last up to three months in some cases [8]. The causes of the link between breastfeeding and neonatal jaundice are unknown, however, they could include insufficient breastfeeding support resulting to lower intake, sluggish stomach action leading to increased entero-hepatic bilirubin circulation, or unknown substances in breast milk [9]. This is explicated by Almeider and Drake who found that neonatal jaundice is linked to breastfeeding in three primary clinical situations exclusively breastfed healthy term newborns during the first postnatal week, newborns who receive inadequate breastfeeding and have high indirect bilirubin concentrations during the first postnatal week (“non-feeding” jaundice), and breastfed infants who experience prolonged unconjugated hyperbilirubinemia (breast milk jaundice) [10].

Starting at birth, several guidelines recommend feeding neonates at least 8 times per day [11]. Feedings should be based on cues, with at least three tries every three hours. Even if feeding the baby is challenging, it is important to keep breastfeeding. In some cases, supplementing with expressed breast milk or formula may be necessary. Unless there is evidence of dehydration or weight loss greater than the 95th percentile according to the newborn weight assessment, feeding supplementation is not recommended for drowsy infants during the first 24-48 hours [12]. If a patient is critically ill and enteral feeds are being withheld, feeding recommendations are irrelevant.

Various problems, such as a lack of information about jaundice among mothers and family members, especially in rural regions, may affect medical care [13]. They go on to say that the situation is exacerbated by healthcare workers' "why worry" attitude, particularly in the absence of critical data. As a result, insufficient understanding among care providers, restricted facilities for clinical tests, and a lack of a structured management protocol frequently led to ineffective therapy [14]. Therefore, when women visit antenatal and postnatal services in hospitals and medical centers in Ghana, healthcare providers provide essential education to promote optimum growth, health, and wellness. An integral part of the education given includes the World Health Organisation recommendations on maternal and infant nutrition [15, 16]. Furthermore, large sections of the world's population are undernourished, have poor vitamin and mineral status, or are overweight and obese, with large differences among population groups due to a lack of availability or access to food of adequate nutritional quality or exposure to conditions that impair absorption and use of nutrients [15].

These disorders are frequently present at the same time and are linked. In order to bring together evidence and perspectives to inform

practice, the WHO guideline, therefore, evaluates each of the practices in the Ten Steps to Successful Breastfeeding [16]. The guideline's scope is restricted to specific practices that could be applied in maternity and infant care facilities to protect, promote, and support breastfeeding.

In many health centers and clinics, health workers teach antenatal and postnatal women about these guidelines, together with salient topics such as neonatal jaundice. Extant empirical studies, however, elucidate some of the prevailing knowledge, attitudes, and practices of mothers.

In a cross-sectional study, parents' knowledge, attitude, and practice concerning neonatal jaundice in various Saudi Arabian locations were evaluated [17]. From July to September 2017, 4413 pregnant parents took part in the study. To acquire information from respondents, a self-administered questionnaire was devised. For the majority (52.6%) of the participants, relatives and friends were the most reliable sources of information, followed by the treating doctor (29.8%).

When they enquired about the stage at which they learned about neonatal jaundice, 34% of the individuals learned about neonatal jaundice after their child had it, whereas 42.1% learned about it before their child had it. Awareness about the necessity and effectiveness of treatment were dependent on older age, occupation, and place of residence ( $p < 0.01$ ). These results demonstrate that older women tend to have a better understanding of neonatal jaundice, probably due to past experiences and a higher level of formal education helps with a better understanding of neonatal jaundice. That notwithstanding, education about neonatal jaundice and factors associated with it (such as the role nutrition plays in its management), should be done in a language and in a format that all parents or potential parents can comprehend fully, irrespective of their formal educational status.

## **Providing Intravenous (IV) Fluids**

Fluid intake is critical to treatment success; thus, this is a vital consideration while caring for a jaundiced child. Increased blood bilirubin concentrations are linked to dehydration, and IV medication may be required to achieve appropriate hydration [18]. However, the University of Michigan opines that IV supplementation is not necessary for most infants with hyperbilirubinemia and that dehydration in neonates with hyperbilirubinemia should be managed similarly to dehydration in any hospitalized infant [19]. Nonetheless, IV fluid treatment is sometimes suggested for neonates with severe hyperbilirubinemia. Dehydration can theoretically reduce bilirubin excretion in urine by lowering gastrointestinal motility and boosting bilirubin recirculation via the enterohepatic system.

At least three randomized controlled trials have been conducted to compare IV fluid supplementation to no supplementation. Supplementing with IV fluids for the first 8 hours of phototherapy, followed by enteral supplementation, was linked to fewer exchange transfusions [20]. In randomized, controlled research with 100 healthy neonates, it was discovered that IV supplementation resulted in a larger mean decrease in TCB after 24 hours of phototherapy [21]. Fluid supplementation, either solely enteral or as a combination of enteral and IV fluids, was the focus of another study. There were no variations in indirect serum bilirubin, implying that either oral or enteral supplementation is as effective as IV supplementation (or there is no efficacy to either) [22]. This study sought to assess the level of nutrition knowledge of mothers with babies with neonatal jaundice in Ghana with regard to the WHO-recommended infant feeding practices [15, 16]. It also sought to assess the nutrition recommendations, protocols, and interventions involved in the

management (treatment) of neonatal jaundice in Ghana.

## **Materials and Methods**

This study was a multi-center nested, case-control study. The study sites were the Korle-bu Teaching Hospital (KBTH), Greater Accra Regional Hospital (GARH), and the Tamale Teaching Hospital (TTH). The first population comprised of the mothers and their babies diagnosed and on admission in any of the three referral hospitals at the time of the study. This population was chosen to obtain data that directly provided the requisite answers to research objectives (to assess the level of knowledge of mothers with babies with neonatal jaundice in Ghana, with regard to the WHO-recommended infant feeding practices). The three hospitals at the time of the study received an average of 90 cases of neonatal jaundice in a month. The second population from which respondents were sampled was made up of mothers of otherwise healthy neonates without any nutritional deficiencies and no diagnosed or suspected jaundice. This population was chosen to serve as the control. Using a random numbers table, the respondents were selected by picking 20 folders randomly, and the mothers were approached to obtain consent. Mothers who declined were replaced.

The third population comprised of the health workers who manage and treat neonates with jaundice in the three hospitals. These healthcare professionals were better suited to describe the evidence-based best practices, protocols, and interventions being implemented to manage neonatal jaundice in the hospitals. The sample size was calculated using Epi Info 7.0 software. In the case of this study, the cases were not in the same population as the controls, and so the variables used included 95% confidence interval, Power of 90%, the ratio of control to cases of 1, percent of controls exposed 1% and percent of cases exposed 99%. This resulted in a required

sample size of 5 cases and 5 controls. However, a total sample size of 120 cases and 120 controls were recruited (40 cases and 40 controls from each of the three hospitals) over a period of 3 months. With regard to the healthcare professionals who attend to babies with neonatal jaundice, key informant interviews were conducted in each of the three hospitals. Key informant interviews are in-depth, qualitative interviews with people who know what's going on in their study population. The snowball sampling technique was used to identify the requisite Health care professionals to interview. Snowball sampling is a method of recruiting in which volunteers are requested to help researchers find more possible subjects. With their specific knowledge and understanding, these specialists in their industry could provide insight into the nature of protocols and prevailing practices and make invaluable recommendations. Hence, at each hospital, a Paediatrician, a Nurse, and a Dietitian were purposively sampled based on recommendations.

At the Korle-bu Teaching Hospital and the Greater Accra Regional Hospital, about 30% of the interviews were conducted in English language, while the rest were conducted in Twi or Ga languages. At the Tamale Teaching Hospital, about 20% of the interviews were conducted in the English language while the rest were conducted in Dagbaani or Twi language.

To assess the nutrition practices of the research participants, they were asked both open-ended and close-ended questions based on their current infant feeding practices as well as the WHO-recommended feeding practices from birth. In addition, key informant interviews were conducted, using interview guides in each of the three hospitals, with the health care professionals who volunteered to participate in the study. Data was also obtained with permission, from the treatment folders of the babies and from hospital records. This included information on the anthropometry,

Haemoglobin (Hb) levels, Total Serum Bilirubin (TSB) levels, feeding practices, and jaundice diagnoses of the babies. Peer-reviewed publications were also relied on for secondary data. The primary data was analysed using Statistical Package for Social Sciences (SPSS) version 25.0 as well as a Microsoft Excel datasheet. Results were summarised by frequencies and percentages (categorical variables) and means, standard deviations or percentiles (numerical variables based on data distribution). Associations between variables were assessed using chi-square tests. Pearson's Chi-square analysis was also used to determine if the differences between categorical variables between the cases and controls were statistically significant.

In terms of the qualitative data, the results from the interview guide were first assessed before being organized into themes depending on the specific research objectives they aimed to achieve. As a result, thematic analysis was used. There were three parallel flows of actions data reduction, data display, and forming conclusions. Based on the study questions, the qualitative data was evaluated throughout the data reduction stage, with a focus on patterns, linkages, and pertinence. The information was then presented and discussed based on themes gleaned from the research questions.

With regards to the assessment of the nutrition knowledge of the mothers in both the case and control groups, 10 questions based on the WHO recommendations on infant feeding were presented to them. A correct answer was scored one grade and an incorrect zero. The score of each question was then summed up and then converted into a percent score (good/pass = 71% - 100%). This scoring method was preferred overuse of a Likert or ranking scale since as part of the antenatal education women receive at hospitals in Ghana, nutrition education is an essential component. Hence, all the research participants were expected to achieve a score of 100%, ideally. Ethical clearance was obtained, and permission was

also sort from the Central Research Units of the Korle-bu Teaching Hospital, Greater Accra Regional Hospitals, and the Tamale Teaching Hospital. In addition, participation in the study was voluntary. All research participants gave informed consent for the use of any records, interviews, and participation in this study. No invasive test or procedure was carried out on the research respondents, and interviews that lasted less than 10 minutes were conducted only during times that were convenient to the study participants. There was no conflict of interest of any kind.

## Results and Discussions

### Background Information

#### Background Information of Mothers of Cases and Controls

The majority (53.3%) of the mothers of the cases were within the age range of 19 – 30 years while those of the controls were mostly within the age range of 31 – 40 years (56.7%). The difference in ages between the mothers of the cases and those of the controls was, however not statistically significant ( $p=0.275$ ).

There was no statistically significant difference between the average number of children of the mothers of cases and controls. The minimum number of children was one, the

maximum number was 5 children, and the mean was 2.47 children for both the cases and control mothers. To establish family history of jaundice, mothers were asked if any of their other children had ever had jaundice. This was important since mothers who had experience managing or dealing with neonatal jaundiced would have more experience and knowledge on the education and interventions to prevent and manage neonatal jaundice. The majority (70%) said they had no family history of neonatal jaundice, 16.7% indicated they did, and a few (13.3%) were not certain since they could not remember.

#### Assessment of the Nutrition Knowledge of Mothers with Regards to the WHO (2004, 2017) Recommended Infant Feeding Practices

Irrespective of their educational level, when women visit antenatal and postnatal services in hospitals and medical centers in Ghana, healthcare providers provide essential education to promote optimum growth, health, and wellness. An integral part of the education given includes the World Health Organisation’s recommendations on maternal and infant nutrition. It was, therefore, imperative to assess this knowledge of the respondents.

**Table 1.** Total Nutrition Score of Respondents

	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>P-value</b>
Mothers of cases	4.00	10.00	8.05	1.59	0.01
Mothers of controls	4.00	10.00	7.65	1.55	

For both mothers of cases and controls, the minimum score was 4 out of 10 questions. However, there was a statistically significant difference between the mean scores of the cases (8.05/10) and that for the controls (7.65/10). To contextualize the nutrition scores, the score of each question was summed up and converted into percent score. To this study, the criteria set by Ragab, and colleagues was modified as that, Nutrition scores of 70% or more was

considered pass and scores below 70% were considered fail [23]. This scoring method adapted from Ragab, and colleagues was preferred overuse of a Likert or ranking scale since as part of the antenatal education women receive at hospitals in Ghana, nutrition education is an essential component, and it is expected that they retain and utilise this education on infant feeding for the wellbeing of their children.

**Table 2.** Proportions of Respondents that had Above 70% (Pass) or Below 70% (fail) Nutrition Scores

	Frequency		Percent	
	Case	Control	Case	Control
Fail	36	52	30.0	43.3
Pass	84	68	70.0	56.7
<b>Total</b>	<b>120</b>	<b>120</b>	<b>100.0</b>	<b>100.0</b>

Basically, more respondents in the case group (70%) passed compared with respondents in the control group (56.7%). This observation could probably be because the respondents in the case group were in the hospital for medical intervention for their babies and so would be reminded of salient infant feeding recommendations.

It was also observed that even though, all questions were translated into and explained in the language the respondents were fluent in, the specific nutrition questions with the lowest scores include the following:

*“Breastfeeding should start within what duration/period after birth?”* Only 40% of respondents were able to answer this question. This is a question that sort to determine the awareness of the respondents about the WHO recommendation that breastfeeding should be initiated at least 1 hour after delivery [16]. Healthcare professionals should therefore reinforce this during education at antenatal services so that immediately.

*“What food or nutrients can you give to a baby while doing exclusive breastfeeding?”*. Only 56.7% of the respondents were able to answer this question. The WHO recommends that during exclusive breastfeeding, no other food or water should be given to the baby unless medically determined by a health care professional [16]. Hence, respondents that named various foods and liquids failed the question. It is important to discourage mothers who do optimum exclusive breastfeeding from adding food or nutrient supplements, to prevent over nutrition.

*“What nutrient supplements should you give a baby less than 6 months of age while doing exclusive breastfeeding?”* Only 63.7% of the

respondents passed this specific question. The WHO recommends that during exclusive breastfeeding, no additional nutrient supplements should be given to the baby [16]. This is because the nutritional quality and quality of breastmilk is adequate to meet the needs of a baby less than 6 months of age. Giving additional nutrient supplements while doing exclusive breastfeeding may result in malnutrition (over nutrition) of the baby less than 6 months.

It is important to take cognizance of the fact that in some cases, the quantity of breastmilk may not be enough to meet the nutritional requirements of the baby, because of specific factors. In such cases, healthcare professionals assist mothers in resolving the problem or recommend alternative suitable feeding methods.

### **Assessment of Nutrition During the Management of Neonatal Jaundice in the Case Hospitals**

Based on the interviews granted by the Health Care Professionals who cater for infants, this section reviews six main aspects pertinent to the prevention and management of neonatal jaundice. This includes a review of the protocols used to assess and manage neonatal jaundice, and the Nutrition protocols followed to prevent neonatal jaundice, the feeding methods of cases while on admission, an assessment of feeding adequacy of the jaundiced neonate, another feeding, and nutritional considerations during treatment of neonatal jaundiced and finally, a review of how the nutritional status of neonates is assessed in the case hospitals.

## **Protocols used to Assess and Manage Neonatal Jaundice**

To begin with, about 95% of neonatal jaundice cases presented at case hospitals are usually treated successfully and discharged. The 5% of the cases that are not successfully treated, is usually because those cases are brought to the hospital too late, according to the study respondents. Each hospital, therefore, follows established treatment protocols. At the time of the study, only the Greater Accra Regional Hospital confirmed or provided a documented protocol or algorithm for managing neonatal jaundice in the hospital. The study respondents added the caveat that these guidelines should however not be interpreted as encompassing all appropriate ways of care or as excluding other acceptable methods of care that are properly geared toward achieving the same outcomes. Considering the patient's circumstances, the physician must make the final decision regarding any specific clinical procedure or therapy. One of the respondents therefore gave an account of how a case was managed.

*“During her pregnancy, a woman had been a primipara and was in good health. A girl was born by easy vaginal delivery at 38 weeks gestation, with an Apgar score of 91/105 and a birthweight of 3.31kg. The infant was nursed and went home three days following an uneventful stay in the maternity unit. After a day at home, she began to vomit, and her parents saw that she was turning cyanotic and jaundiced. On the day of her arrival, she was hypotonic and experienced a backward arching of the neck and torso that lasted 10-15 seconds. She was transferred to the maternity unit, where a TSB of 486 micromoles/L was discovered. Her TSB was 458 micromoles/L and her entrance weight was 2.94 kg, therefore she was sent to the NICU for treatment. Initially, the attending physician feared ABO incompatibility, and she was effectively treated with phototherapy and breastmilk expression. On the ninth day after hospitalization, she*

*required phototherapy again, which she got until her TSB levels were enough”.*

An assessment of the protocol for the management of neonatal jaundice in the case hospitals showed that, even though various nutrition protocols were practically applied at various stages of the prevention and management of neonatal jaundice, they were not documented. These are further discussed in this ensuing sections.

## **Nutrition Protocols to Prevent Neonatal Jaundice**

The case hospitals reported implementing evidence-based nutrition strategies for preventing or ameliorating jaundice. To begin with, all three hospitals in this study were accredited with the Baby-Friendly Hospital Initiative (BFHI) status. They, therefore, adhered to the ten steps of the baby-friendly hospital initiative. The BFHI helps implement ten steps to successful breastfeeding and guidelines on the International Code of Marketing of Breastmilk Substitutes, as well as training, monitoring, assessment, and re-assessment. Thus, all three hospitals implement protocols in accordance with the recommendations by the World Health Organization for mother-infant pairs with term newborns, as well as preterm, low-birthweight, or ill infants, including those admitted to neonatal intensive care units. Each of the three hospitals had a clearly documented breastfeeding policy that is conveyed to staff and parents on a regular basis.

Healthcare workers who provide baby feeding services, including breastfeeding support, are trained through seminars held on a regular basis, particularly during the annual World Breastfeeding Week in August. Furthermore, all hospitals provide antenatal care, which includes counseling for pregnant women and their families on the benefits and management of breastfeeding. Breastfeeding is more likely to succeed if the decision to breastfeed is established early in the pregnancy



[24]. Prenatal education at the hospitals, therefore, covers the importance of exclusive breastfeeding for the first 6 months, as well as breastfeeding for the next 12 months and beyond (covering the nutritional and protective benefits), basic breastfeeding care, and proactive counseling for small difficulties, according to the health care workers interviewed.

Furthermore, the hospitals offer maternal and newborn care, allowing women and their babies to stay together and practice rooming in during the day and night. When infants need to be transported for specialist medical care, this may not be the case. At the Labour Wards, as soon as the baby is born, the Midwives recommend and implement the following techniques to keep TSB levels below those suggested for therapy while promoting successful breastfeeding establishment.

*“Start breastfeeding right away. Breastfeed as soon as possible after birth, particularly within the first hour, even if the baby was born by cesarean section. Breastfeeding should begin within the first hour after a baby’s birth in the great majority of cases”.*

*“Mothers receive hands-on help to start and maintain breastfeeding, as well as to deal with typical breastfeeding issues including inverted nipples”.*

*“Encourage frequent exclusive breastfeeding (8–12 times or more in 24 hours)”.*

Frequent breastfeeding is critical for increasing infant enteral intake and maximizing breast emptying, both of which are necessary for milk supply establishment. Feeding anything before starting to breastfeed hinders the development of excellent breastfeeding habits and may impede milk production, raising the risk of lower enteral intake and hyperbilirubinemia [5]. There is a link between the number of breastfeeds per day and decreased TSB levels [25]. As part of nurturing care, mothers are encouraged to practice responsive feeding. Unless medically advised, mothers avoid feeding anything other than

breast milk to their babies. According to the National Health and Medical Research Council, if a mother chooses not to breastfeed, she may suffer feelings of grief or loss [26]. A mother’s informed decision not to breastfeed should therefore be honored, and assistance from a health worker and/or other multidisciplinary team members should be provided.

*“Pump or hand express breastmilk when necessary to augment feeding”.*

Mothers are taught how to express breast milk in order to keep their breastfeeding going if they are separated from their babies for an extended period of time. For preterm newborns who are unable to breastfeed directly, health personnel rely on feeding interventions such as the mother’s expressed breastmilk or infant formula formulated specifically for preterm infants. Hand expression or pumping of colostrum or breast milk can offer more milk to boost intake in some infants at risk of inadequate intake, jaundice, and excessive hyperbilirubinemia, as well as help establish a good milk supply. Although pumping is widespread, it is worth noting that moms may tolerate hand expression better in the initial postpartum period. If term newborns require expressed breast milk or other feeds, cups, spoons, or syringes are utilized during their stay in the hospital. In Ghana, supplementation with donor milk is not commonly practiced.

*“A healthcare provider trained in breastfeeding management (e.g., nurse, lactation consultant, midwife, or physician) should evaluate position and latch from the start to ensure comfortable positioning (that avoids nipple compression or rubbing), effective latch, and adequate milk transfer (swallowing)”.*

*“Encourage all mothers and infants to have skin-to-skin contact (in a safe manner when the mother is awake and alert)”.*

Encouraging skin-to-skin contact, especially for those who are breastfeeding, immediately after birth and continued throughout the postpartum period, aids milk supply and makes

mother’s milk readily available to the infant in the first days and weeks of life [27].

*“Provide early feeding cues instructions and teach the mother to respond to the earliest signs of newborn hunger, such as restlessness or movement, lip smacking, hand gestures toward the mouth, and vocalization”.*

Most newborns require feeding every two to three hours. Because crying is a late symptom of hunger and often results in a bad start to the breastfeeding episode, infants should be put to the breast before they cry. Infants who are sleepy or show no symptoms of hunger should also be monitored.

*“Identify hyperbilirubinemia-prone moms and infants”.*

*“If risk factors are recognized, seek breastfeeding help as soon as possible after birth to promote effective breastfeeding management”.*

Certain maternal variables (such as diabetes, Rh sensitization, and a history of jaundiced newborns in the family) raise the risk of hyperbilirubinemia in the newborn. Primiparous moms, as well as those who give birth via cesarean section or have a maternal BMI of more than 27 kg/m<sup>2</sup>, are at risk for delayed secretory activation. As a result, the infants of these moms are at danger of receiving inadequate nutrition.

After discharge from any of the case hospitals, parents and their infants have access to continuous assistance and receive appropriate care as part of protecting, promoting, and sustaining breastfeeding. Most infants discharged from the hospital before 72 hours of age should be examined by a healthcare

provider within two days after discharge. This is especially crucial for infants who are exclusively breastfed. Close monitoring of a breastfeeding newborn helps to prevent excessive weight loss, which can lead to hyperbilirubinemia and ensures that elevated bilirubin levels are handled promptly. Individual clinical discretion can be applied when it comes to follow-up, such as in the instance of a multiparous woman who has breastfed prior kids and is going home with a newborn who has no hyperbilirubinemia risk factors.

### **Feeding method of cases whiles on admission**

It is important to encourage women to increase their breastfeeding frequency until their bilirubin levels return to normal. This is because increasing the frequency of breastfeeding decreases the likelihood of subsequent significant hyperbilirubinemia in breastfed infants [27]. However, if bilirubin levels are higher than 20 mg/dl, breastfeeding should be stopped since it may cause lasting neurological issues [28].

Physicians may consider providing additional feedings at bilirubin levels approaching those suggested for commencing phototherapy in situations when phototherapy is not easily available and mother-infant separation is unavoidable. Individualized decisions should therefore be made with the goal of keeping mother and child together, sustaining and optimizing breastfeeding, and effectively preventing or treating hyperbilirubinemia.

**Table 3.** Feeding Method of Cases Whiles on Admission

<b>Method</b>	<b>Frequency</b>	<b>Percent</b>
Exclusive breastmilk	96	80.0
Breastfeeding and formula feed	24	20.0
<b>Total</b>	<b>120</b>	<b>100.0</b>

Because infant formula reduces bilirubin reabsorption in the intestine [29], it can be used

to reduce TSB in breastfeeding infants [30]. To maintain frequent breastfeeding and maintain

high mother milk supply, a small volume (10–15 mL) formula feedings immediately following a breastfeeding may be preferred to intermittent large-volume (30–60 mL) supplementing. If the infant is not receiving enough milk at the breast, larger amounts of formula may be required. Hospital use of a particular formula does not mean that formula is the ‘best’ and interchange between formulas within the same generic group is optional, but frequent changes can cause confusion and increase the risk of inaccurate preparation/distribution [31].

Temporary breastfeeding interruption may be explored in some clinical settings where a rapid reduction in TSB is required, and phototherapy is unavailable, even though this was not the situation in the case hospitals. Phototherapy and exchange transfusions for jaundice, as well as IV glucose or glucose gel with hospital monitoring for hypoglycemia, are invasive, expensive, and potentially stressful for neonates and their families. These therapies may be important to limit brain harm and disability in infants who are already medically endangered due to poor milk intake, for

example, by quickly correcting severely low glucose since time is critical. However, most of these cases can be avoided by supplementing with formula as soon as signs of persistent infant hunger appear [32]. Formula feeding is well-established as safe in areas with clean water, high literacy, and consistent formula access [33].

If breastfeeding must be temporarily interrupted due to acute clinical needs, it is vital to sustain the maternal milk supply by teaching the mother to express milk properly. When breastfeeding is resumed, the newborn must have access to a sufficient supply of milk, otherwise the TSB concentrations may rise again.

### Assessment of Feeding Adequacy of the Jaundiced Neonate

Early infant feeding practices and guidelines recommend that all newborns be given enough milk within two hours of birth and continued until the supply is established as adequate, such as through ideal infant weight gain, behavior, and waste output [32].

**Table 4.** Assessment of Feeding Adequacy of the Jaundiced Neonate by the Hospitals

Parameter	Normal
Urine output	At least 5-6 heavy wet nappies in 24 hours
Baby’s colour, alertness and tone	Normal skin colour, alert, good tone
Appearance and frequency of stool	At least 2 in 24 hours; normal appearance
Weight	Weight loss not more than 10% of birth weight
Number of feeds in the last 24 hours	At least 8 – 12 feeds
Baby’s behaviour during feeding	Generally calm and relaxed
Sucking pattern during breastfeeds	Initial rapid sucks changing to slower sucks with pauses and soft swallowing
Length of breastfeed	Feeding for 5 – 40 minutes at most feeds
End of breastfeed	Baby lets go spontaneously, or does so when breast is gently lifted
Baby’s behaviour after the feed	Content after most feeds

The Table 4 is used to assess the adequacy or otherwise of the feeding of the neonates in the referral hospitals. This helps to prevent suboptimum breastfeeding and caloric deficits

in the baby. This reference guide can therefore be adapted and used by all other health care institutions.

## How the Nutritional Status of Neonates is Assessed

Infants under the age of six months are vulnerable to acute severe malnutrition, regardless of whether they are breastfed [34], and should be included in national guidelines for early detection and care of undernutrition. The case hospitals gave similar accounts of how they assess the nutritional status of neonates. Their accounts are synergized and presented as follows:

*“The first step in recognizing malnutrition is to conduct a nutrition screening, which is usually done in coordination with the on-duty doctors and nurses. Even though it is done in different ways at different institutions, nutrition screening has the common goal of diagnosing malnutrition risk in a timely manner so that a nutrition care plan can be devised to prevent further worsening in nutrition status and associated poor effects. Nurses, nutrition officers, Medical Officers or Dietitians contact frequently and early with pediatric and neonatal patients and their families since their role in nutrition screening, identification, recording, and implementation of malnutrition treatment techniques can not be underestimated. When signs and symptoms of muscle wasting and subcutaneous fat loss are seen, they begin a physical examination and assist with food, bathing, dressing, and other activities of daily living. They coordinate consults and recommendations for clinical nutrition services and keenly observe caregivers’ moods and interactions with their children during bedside treatment. They frequently build relationships with families while acquiring and documenting precise anthropometric measurements for use in malnutrition assessment, monitoring, and evaluation of the care plan. They also guarantee that nutrition protocols and/or therapies are administered in a timely and suitable manner”.*

It has been established that, nutritional assessment and maintaining adequate nutrient

intake are critical components of health care for sick infants and children [35]. It is, therefore great that the referral hospitals have in place succinct protocols for assessing the nutritional status of babies so as to offer the requisite interventions.

## Other Feeding and Nutritional Considerations during Treatment of Neonatal Jaundice

The respondents were asked if additional IV fluid or water is given during phototherapy. All the hospitals indicated that they do and gave the following reasons.

*“To prevent the loss of fluids and dehydration through phototherapy”.*

*“Sometimes to hydrate the baby to ensure the excretion of the bilirubin. If the baby is not very sick, we rather encourage breastfeeding only”.*

*“IV fluids are added for neonates that are not breastfeeding adequately, dehydrated, have hypoglycemia or those whose mothers are not available to breastfeed”.*

Water or glucose water supplementation is not recommended during the treatment of neonatal jaundice because it does not lower serum bilirubin levels, interferes with breastfeeding, and may cause hyponatremia [5].

The respondents were then asked if probiotic supplementation is given during the treatment of neonatal jaundice. They all said no and gave these reasons:

*“There are probiotics already in the breast milk but in a case where it demands a supplementation of prebiotic that will be given”.*

*“There is no available protocol for that, especially as the focus is mainly on breastmilk”.*

When asked if micronutrients are given during treatment of neonatal jaundice, one hospital said yes, they do because *“they help in bilirubin clearance”*. They, however clarified that the need and prescription for nutrient supplements will depend on other factors,

including the type of other comorbidities present. The other hospitals said they do not give micronutrient supplements since “*it is not indicated*” and that “*additional micronutrients are not given because exclusive breastfeeding is encouraged, and breastmilk contains the needed micronutrients for these neonates*”.

## Summary

This study assessed the nutritional knowledge of the mothers as well as a review of the nutritional protocols involved during the management of neonatal jaundice in the case hospitals. The mothers of both the controls and cases, whose ages ranged between 19 and 40 years were mostly para 2, with neonates who were about 5 days old at the time of the study.

Assessment of the nutritional knowledge of the mothers, with reference to the infant feeding recommendations and guidelines by the WHO showed there was a statistically significant difference between the mean scores of the cases (80.05%) and that for the controls (76.5%). This was probably attributed to the fact that the mothers of the cases as part of the interventions to treat the jaundice of their babies also received more infant feeding education at the hospitals. It was also observed that even though all questions were translated into and explained in the language the respondents were fluent in, the specific nutrition questions with the lowest scores were “*Breastfeeding should start within what duration/period after birth?*” “*What food or nutrients can you give to a baby while doing exclusive breastfeeding?*” and “*What nutrient supplements should you give a baby less than 6 months of age while doing exclusive breastfeeding?*” From birth till the time of the study (average of 5 days), more control mothers (88.3%) reported to do exclusive breastfeeding, compared with mothers of cases (76.7%). This difference was however not statistically significant.

Based on the interviews granted by the Health Care Professionals who cater for infants in the case hospitals, all three hospitals have

specific protocols for treating neonatal jaundice. However, when it comes to the role nutrition plays in these protocols, the hospitals implement the BFHI ten steps to successful breastfeeding, and so breastfeeding is the preferred feeding method (80%), even though formula feeding is sometimes prescribed (20%). Babies are assessed after delivery for signs of malnutrition and monitored to ensure feeding sufficiency while on admission.

All the hospitals give additional fluids if the baby is not being breastfed, to prevent fluid loss and ensure excretion of the bilirubin during phototherapy. No probiotic supplementation is given since the majority of the babies are adequately breastfed, and breastmilk contains probiotics. Only one hospital indicated that micronutrient supplements are given during treatment “to help in bilirubin clearance”.

## Conclusions

Based on the study results, the following conclusions are made.

1. With regards to the WHO infant feeding recommendations, mothers of babies with neonatal jaundice had a higher nutrition score than mothers with healthy babies.
2. Three referral hospitals in Ghana implement the BFHI ten steps to successful breastfeeding as a measure to prevent suboptimal feeding, which could lead to an increase in bilirubin levels. During treatment of neonatal jaundice, babies are mostly fed breastmilk only, and extra fluids are given if the baby is not exclusively breastfed or there is a risk of dehydration during phototherapy. No probiotic supplements are given, and micronutrient supplementation may or may not be given, depending on the prevailing health conditions of the neonate.
3. Further assessment should be carried out to identify the effectiveness of the nutrition education given during antenatal and postnatal education at hospitals, clinics, and health centers.

## Conflict of interest

There is no conflict of interest for this study.

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