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Assessment of the Nutritional Status of Babies with Neonatal Jaundice in Ghana

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Abstract

Neonatal jaundice is a public health concern responsible for a relatively high rate of infant morbidity and mortality. Therefore, it is prudent to put in place effective risk-reduction strategies and detect and treat new born jaundice effectively. Optimum nutrition has been shown to be crucial to health and well-being. This study, therefore, sought to investigate the nutritional status of babies that report to three referral hospitals in Ghana (Korle-bu Teaching Hospital, Greater Accra Regional Hospital and the Tamale Teaching hospital). It was a multi-center nested, case-control study involving 120 cases and 120 controls of neonates in the three referral hospitals in Ghana. The study revealed that babies with neonatal jaundice in Ghana mostly have a normal nutritional status, even though they lose about 5% of their birth weight. More mothers of healthy babies (88.3%) did exclusive breastfeeding, compared with mothers of babies with neonatal jaundice (76.7%). It was also revealed that the three referral hospitals implemented the Baby Friendly Hospital Initiative's ten steps to successful breastfeeding as a measure to prevent suboptimal feeding, which could lead to an increase in bilirubin levels. Assessment and interventions to prevent weight loss should therefore be paramount for babies with neonatal jaundice.

Keywords: *Malnutrition, Neonatal jaundice.*

Introduction

As a result of advances in science, evidence-based medicine, research, and ongoing public health activities and collaborations, the management of neonatal jaundice has evolved over time. For instance, for many centuries, babies were frequently discharged immediately after birth, leaving physicians with insufficient time to identify jaundice during the "window of opportunity" (that is, the period when serum bilirubin concentration is likely to increase can be detected and intervention given) [1]. Consequently, in the late eighteenth century, in Paris, France, a study into the causes of jaundice and kernicterus began [2]. However, scientists did not develop interventions that successfully treated new-borns with the illness until the middle of the twentieth century. Furthermore, recent research has led to the creation of novel ways to prevent and detecting neonatal jaundice. Hence, the likelihood of an infant getting kernicterus has decreased as a result of modern therapies, even though it is still a public health problem.

This is of concern because nutritional interventions have proven to be quite useful in the prevention and treatment of a wide range of infectious and chronic illnesses. Salient questions, therefore, linger, viz-a-viz the extent to which nutrition plays a role in the treatment of neonatal jaundice. It is imperative that caregivers utilize all available evidence-based interventions, including those that involve nutrition, to manage jaundice to maintain the infant's best growth, health, and development.

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Thus, as part of the standard protocols for managing neonatal jaundice, it is prudent to have effective nutrition solutions.

This is crucial because several schools of thought believe that early childhood nutritional experiences through metabolic programming play a role in the development of metabolic illnesses later in life [3]. Metabolic programming occurs when an organism is exposed to a nutritional stimulus during early development, resulting in significant adaptations in target organs through epigenetic processes to enable the organism to survive the nutritional challenge, resulting in permanent changes in the organism's physiology and metabolism [4]. Infants under the age of 3 months are physiologically less well adapted to digest, absorb, and metabolize specific nutrients compared to older children and adults [5]. This can result in clinical issues, which are more prevalent in premature babies and the requirements for very rapid growth in the early infant exacerbate these issues [6]. Extant literature stipulates that the first 1,000 days of life are the most important for growth and development, and it is dependent on good nutrition. According to research, there are important moments in brain development when specific nutrients are not available, and later replenishment cannot compensate for the loss [7].

There is therefore a substantial link between malnutrition and neurodevelopmental consequences. "An imbalance between dietary demand and intake results in cumulative deficits of energy or nutrients that may negatively affect growth, development, and other related outcomes," and this is referred to as paediatric malnutrition [8].

Some empirical data suggest a significant role of nutrition in preventing the buildup of bilirubin. Weng and his colleagues wanted to see if there was a link between Chinese herbal medicine in the maternal diet and extended jaundice in breast-fed infants [9]. This prospective study only accepted healthy newborns between the ages of 25 and 45 days. A transcutaneous bilirubin (TcB) reading of 5 mg/dL was considered jaundice. At the time of TcB measurement, a questionnaire survey was undertaken, asking about feeding type, stool pattern, and maternal nutrition. There were 1148 infants in all, with 151 formula-fed, 436 combination-fed, and 561 breast-fed babies. Jaundice was found in 4 percent of formula-fed babies, 15.1 percent of combination-fed babies, and 39.8 percent of breast-fed babies. In addition, 37.1 percent of preterm infants and 25.0 percent of term infants had jaundice. Additionally, jaundice was more likely in breastfed newborns whose mothers did not take traditional Chinese herbal remedies than in breast-fed infants whose mothers did. The relevant variables for persistent jaundice in apparently healthy infants were discovered in this cohort analysis as late-preterm birth and breast feeding. According to the findings, a postpartum diet containing Chinese herbal medications has a link to breast milk jaundice.

The above study findings notwithstanding, it is important for caregivers to take cognizance of the feeding frequencies and practices to ensure optimum growth and development. Starting at birth, several guidelines recommend feeding neonates at least 8 times per day [2]. 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 are evidence of dehydration or weight loss greater than the 95th percentile according to the new-born weight assessment, feeding supplementation is not recommended for drowsy infants during the first 24-48 hours [10]. If a patient is critically ill and enteral feeds are being withheld, feeding recommendations are irrelevant.

This study, therefore, sought to assess the nutritional status of babies with neonatal jaundice in Ghana and also compare the infant feeding practices of babies with neonatal

jaundice with babies without 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). Convenience sampling was used to sample babies diagnosed with jaundice at the child health outpatient departments (OPD) or those admitted to the Neonatal Intensive Units (NICU) for neonatal jaundice. However, the neonates who served as controls were sampled using simple random sampling when their mothers attended the hospital for postnatal services. The folders of the babies that met the inclusion criteria were then obtained and assigned numbers 1 to 50 or more, depending on the total number present during the day of sampling. Using a random numbers table, the respondents were randomly selected by picking 20 folders, and the mothers were approached to obtain consent. Mothers who declined were replaced.

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, so variables used included 95% confidence interval, Power of 90%, 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. The nutritional status of all babies was assessed by experienced Health Care providers using Clinical Assessment of Nutritional Status (CANS) and the CANS score. Evidence of loss of subcutaneous tissue and muscle was looked for; Examination of hair, cheeks, chin, neck, back, chest and abdomen, arms, buttock and legs were done and scored. Each indicator was rated on a scale of 1–4, and the ultimate total score ranged from 9 to 36. Using an electronic weighing scale, the nude birth weight was measured to the nearest 10 grams. An infant meter was used to measure length, to the nearest 0.1cm. Babies with CANS score 25 and above were considered normal, whiles those with scores less than 25 were considered to have malnutrition [11].

The primary data was analyzed using Statistical Package for Social Sciences (SPSS) version 25.0 as well as Microsoft Excel data sheet. 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. The controls and cases' CANS scores and nutrition scores were compared using a two-sample T-test to determine the significance level at 95% confidence level. Pearson’s Chi-square analysis was also used to determine if the differences between categorical variables between the cases and controls were statistically significant.

Results and Discussions

Background Information

At the time of the study, there was no statistically significant difference between the mean ages of the cases (5.34 days) and that of the controls (5.40 days). This was particularly important since age of babies have been shown to be associated with the levels of TSB. For instance, Physiological jaundice normally begins 24 hours after delivery and peaks four to five days afterwards, then after around two weeks of existence, it vanishes [12]. In addition, breastfeeding jaundice begins after one or two days of delivery and peaks in the first week of life, similar to physiological jaundice [10]. It can, however, remain longer than physiological jaundice and does not normally go away until the third or fourth week of life. The birthweight of the neonates was also assessed.

Table 1. Ages of Babies at the Time of Study

	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**		**P-Value**
					Statistic	Std. Error	
Age of cases (days)	1.00	27.00	5.34	4.90	10.65	0.44	0.93
Age of controls (days)	1.00	26.00	5.40	4.72	10.17	0.44	

There was no statistically significant difference between the mean birthweights of cases (2.87 kg) and that of the controls (2.88 kg). The average weight of both cases and controls was, therefore, normal for their age.

Table 2. Birthweight of Cases and Controls

	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**		**P-value**
					Statistic	Std. Error	
Birth Weight of cases (Kg)	1.63	4.00	2.87	0.68	-0.97	0.44	0.322
Birth Weight of controls (Kg)	1.70	3.80	2.88	0.64	-1.10	0.44	-

The mean gestation of cases was 254.23 days, whiles that for the controls was 233 days. There was no statistically significant difference between the proportion of late Preterm amongst the cases (5%) and the controls (3.3%).

Table 3. Gestation Classification of Cases and Controls

Classification	**Frequency**		**Percent**		**P-Value**
	Cases	Controls	Cases	Controls	
Normal (>148 days)	114	116	95.0	96.7	0.85
Late Preterm (148-136 days)	6	4	5.0	3.3	
Total	120	120	100.0	100	

The single most prominent clinical risk factor for hyperbilirubinemia in new-borns is decreasing gestational age, with the exception of infants with pathologic diseases such as Rh or ABO hemolytic illness or glucose-6-phosphate dehydrogenase (G6PD) deficiency [13]. They add that the risk of acquiring a TSB 428 umol/ L increases by a factor of 1.7 (95 percent CI 1.4–2.5) for each week of gestation below 40 weeks. That is why it is significant that there was not statistically significant ss between the gestation days of the cases and controls.

The majority (70%) of the cases were diagnosed with Physiologic jaundice. A few (10%), however had not been diagnosed with a specific type of jaundice but rather classified generally as jaundiced. This is consistent with the observation by other researchers [12] that the majority of occurrences of hyperbilirubinemia in new-borns are physiologic and may not have significant consequences.

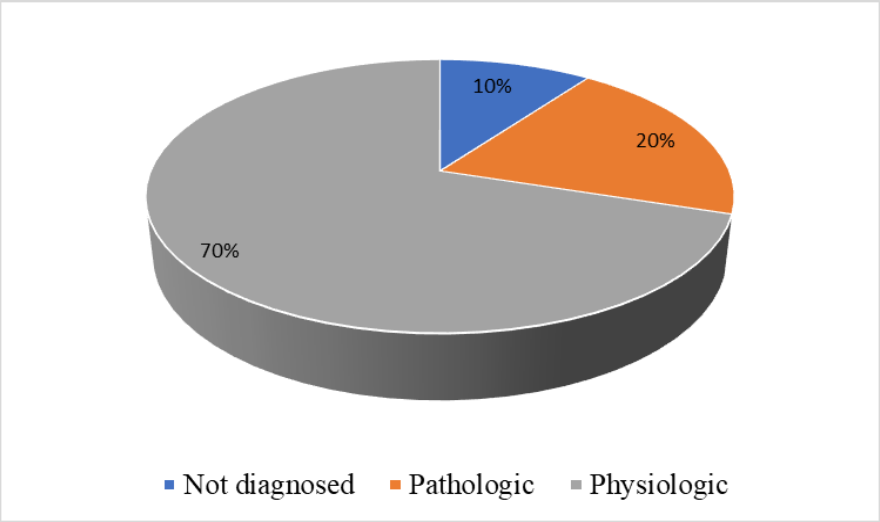

Figure 1. Type of Jaundice Diagnosed

Assessment of the Nutritional Status of Babies

Growth limitation, loss of fat, muscle, and visceral mass, reduced basal metabolic rate, and reduced total energy expenditure are all physiologic adaptations of insufficient energy intake [14]. It was also observed that a jaundice management guide reduced a medical center's neonatal jaundice readmission rate from 2.6 percent to 0.8 percent by adding standardized new-born weight collection at 24 hours of life, a change they claim "improved neonatal care, even for those without jaundice," suggesting that weighing all neonates at 24 hours of life identified more neonates in need of supplementation [15].

Table 4. Weight Difference of Cases at Birth and during the Time of the Study

	Mean	Std. Deviation	Std. Error Mean	P-Value
Birth Weight of cases (Kg)	2.87	0.68	0.062	0.001
Weight at time of study of cases (Kg)	2.72	0.63	0.057	

The average weight of the cases was statistically significantly lower at the time of the study (2.72 Kg), compared to their birthweight (2.87 Kg). That is about 5% weight loss. This was on average, 5 days after birth. Some signs of poor energy intake in infants according to other scholars [16] include peak weight loss of 7% from birth weight, a maximum being 10% by around 5 days old, and regaining birth weight by 10 days of life. The cases can therefore be described as infants who had poor energy intake at the time of the study. The CANS scores of the babies were therefore assessed to determine their nutritional status. The CANS score is a grading system based on nine' superficial' easily identifiable signs of malnutrition in new-born babies that was created to distinguish malnourished from properly nourished babies. The average CANS score of the controls (35.3) was statistically significantly higher than the CANS score of the cases (33.6). However, all the controls had normal CANS scores (above 25) while only 8 out of the 120 cases (6.7%) had CANS scores lover than 25 (malnutrition). Amongst the 6.7% of cases with malnutrition however, one had neonatal sepsis, one had cleft palate, one had duodenal atresia, one had severe acute malnutrition and the other four had malaria. These are all conditions that could account for their relatively low CAN Scores.

Table 5. CANS Scores of Cases and Controls

				Minimum	**Maximum**	**Mean**	**Std. Deviation**			**P-value**
Total CANS score of cases				22.00	36.00	33.60	4.63			0.001
Total CANS score of controls				27.00	36.00	35.30	2.25			
	Hair	**Cheeks**	**Chin**	**Neck**	**Back**	**Chest & Abdomen**	**Arms**	**Buttocks**	**Legs**	**Average**
Cases	3.62	3.68	3.80	3.78	3.80	3.72	3.80	3.80	3.65	33.60±4.65
Control	3.85	3.95	3.93	3.93	3.93	3.93	3.93	3.93	3.93	35.30±2.25

The reference ranges for hemoglobin concentrations in 0-2 weeks old babies is 14-20 g/dL [17]. Based on this, 31.8% of the cases had low Hb levels. This is in spite of the fact that the mean haemoglobin level of the cases was 14.58.

Table 6. Haemoglobin Levels of Cases

	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Hb at admission of cases (mmol/L)	9.90	18.70	14.58	2.37

At the time of the study, about 23.4% of the cases were reported to be or had experienced dehydration. That is, about 1 out of 5 of the neonates with jaundiced experienced dehydration. In a case-control study, the prevalence of new-born dehydration that results in rehospitalization was investigated [18]. They found that Rehospitalization for dehydration was shown to occur in 2.1 per 1000 live births (95 percent confidence interval, 1.8–2.6. It is therefore, prudent that priority is placed on rehydration during the treatment of neonates. Researchers add that, rehydration and supplementation of fluids result in large decrease in serum bilirubin levels [19,8].

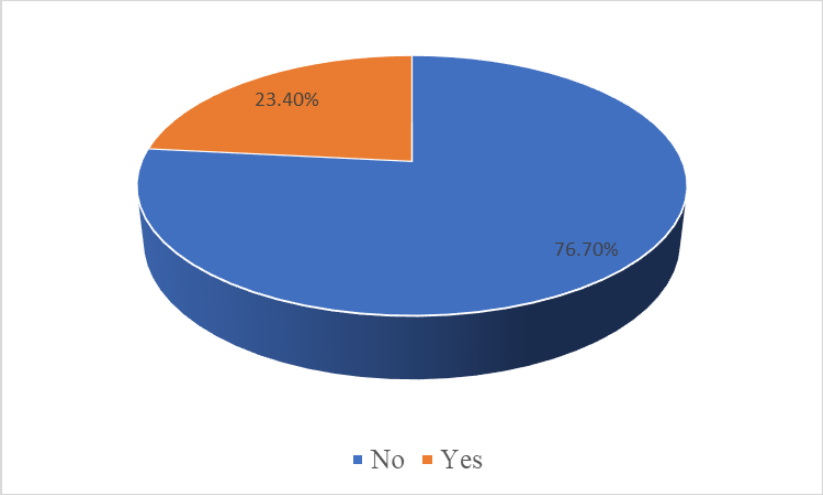

Figure 2. Dehydration Status

At the time of the study, 10% of the cases experienced hypoglycemia. This is consistent with the initial observation that about 5% experienced some weight loss compared with their birth weight. Some recommendations for high-risk neonates (such as the cases), suggest evaluation of glucose levels when the infant is 48 hours old [20]. However, evidence suggests that moderate neonatal hypoglycemia beginning within six hours of birth increases the risk of developmental delay at 2-6 years [1]. Hence, monitoring to prevent hypoglycemia should be a priority in the management of neonatal jaundice.

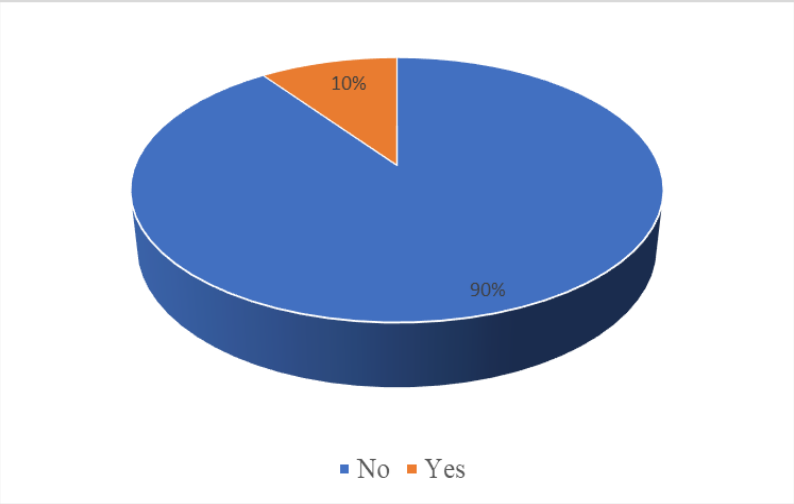

Figure 3. Status of Hypoglycemia of Cases

Assessment of the Infant Feeding Practices

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%). Consequently, more mothers of cases (23.3%) reported to do mixed feeding of breastmilk and formula, compared with the mothers of controls (8.3%). The mothers who practiced exclusive breastfeeding gave several reasons why they do exclusive breastfeeding. The most common responses included the following:

"Breast milk is best food for baby".

"Provide child with lots of health benefits".

"Breastfeeding makes babies healthy".

"To strengthen baby".

"Because breast milk is flowing".

"Because it is recommended by health professionals".

Those who gave formula and breastmilk gave common responses, and they include the following:

"Blood sugar of baby was running low".

"Breast was not flowing after 3 days of delivery".

"Breast milk was not flowing few days after delivery".

Respondents were then asked if they had ever given their neonates water.

Table 7. Feeding Method from Birth till Time of Study

Feeding method	**Frequency**		**Percent**		**P-value**
	Cases	**Control**	**cases**	**control**	
Breastmilk only	92	106	76.7	88.3	0.317
Formula and breastmilk	28	10	23.3	8.3	
Only Formula	0	4	0.0	3.3	
Total	**120**	**120**	**100.0**	**100.0**	

There was no statistically significant difference between the proportion of case mothers (10%) and control mothers (6.7%) who reported having given water to their neonates. All the respondents that reported having given water, indicated that they did so because they introduced Infant formula in addition to breastfeeding.

Table 8. Giving Neonates Water

Response	Frequency		Percent		P-value
	Controls	Cases	Controls	Cases	
No	112	108	93.3	90.0	0.183
Yes	8	12	6.7	10.0	0.183
Total	120	120	100.0	100.0	

Summary

The current study assessed the nutritional status of the neonates, the nutritional knowledge of the mothers as well as their infant feeding practices. The cases had lost about 5% of their birthweight at the time of the study, and this was an indication of poor feeding. However, the further assessment showed that only 8 out of the 120 cases (6.7%) had CANS scores lover than 25 (malnutrition). These cases had some comorbidities in addition to the jaundice. About 1 out of 5 of the cases were reported to be or had experienced dehydration, whiles about 1 out of 12 cases experienced hypoglycemia. Furthermore, the haemoglobin levels of the babies with neonatal jaundice were normal, on average, and very few had hypoglycemia or dehydration. Based on these results, management of neonatal jaundice should include measures to prevent weight loss.

Conclusions

Based on the study results, the following conclusions are therefore made:

1. Babies with neonatal jaundice in Ghana mostly have a normal nutritional status, even though they lose about 5% of their birthweight.
2. More mothers of healthy babies (88.3%) do exclusive breastfeeding, compared with mothers of babies with neonatal jaundice (76.7%).
3. Future research should therefore focus on the non-referral hospitals in Ghana so as to identify gaps or best practices with regard the role of nutrition in the prevention and management of neonatal jaundice.

Conflict of Interest

There is no conflict of interest in this study.

Acknowledgements

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