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Nutrition practices of neonatal intensive care units in the African Neonatal Network

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Abstract: *Background:* Optimal and adequate nutrition provision and standard nutritional practice is mandatory for critically ill infants in the neonatal intensive care unit. Poor nutrition in early life is associated with problems that increase risk of mortality and morbidity in preterm newborns. Preterm infants are at high risk of having inadequate nutrition in low-resource settings due to lack of resources and trained health workers.
Methods: Fourteen hospitals in the African Neonatal Network responded to an annual facility survey and a health facility survey co-developed by faculty in the African Neonatal Network and Vermont Oxford Network. All analyses use descriptive statistics.
Results: Almost all the units (94%) had guidelines for initiation and advancement of feeding. Ten hospitals (71%) reported complying with Baby-Friendly Hospital initiatives. Among the 14 hospitals, only one (7%) had access to pasteurized donor milk. There was significant variation in use of breast milk fortifiers; only three (21%) hospitals reported using it consistently for more than 90% of their preterm newborns. There was also variation in human resources related to neonatal NICU nutrition with only four (29%) of the hospitals having a dedicated dietitian and one with 24/7 access to a lactation consultant.
Conclusion: Dedicated dietitian or lactation support team were limited in the network hospitals. There was only one hospital with access to pasteurized donor milk, and use of breast milk fortifiers was not optimal. Optimising nutrition should be prioritised to improve opportunities for infants to go home meeting growth standards.

Keywords: Infant, Premature; Infant, Newborn; Nutritional Support; Neonatal Intensive Care Units; Lactation Support; Diet, Infant; Milk, Human; Human Milk Banking; Africa South of the Sahara; Global Health

Résumé: *Contexte:* Une nutrition optimale et adéquate, ainsi que des pratiques nutritionnelles standardisées, sont indispensables pour les nourrissons gravement maladies en unité de soins intensifs néonatals (USIN). Une mauvaise nutrition au début de la vie est associée à des complications qui augmentent le risque de mortalité et de morbidité chez les nouveau-nés prématurés. Dans les contextes à faibles ressources, ces nourrissons sont particulièrement exposés à

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une nutrition inadequate en raison du manque de ressources et de personnel de santé formé.
Méthodes: Quatorze hôpitaux du Réseau Néonatal Africain ont répondu à une enquête annuelle sur les établissements et à une enquête sur les structures de santé, co-développées par des membres du Réseau Néonatal Africain et du Vermont Oxford Network. Toutes les analyses ont été réalisées à l'aide de statistiques descriptives.
Résultats: Presque toutes les unités (94%) disposaient de protocoles pour l'initiation et la progression de l'alimentation. Dix hôpitaux (71%) déclaraient se conformer à l'initiative des Hôpitaux Amis des Bébés. Parmi les 14 hôpitaux, un seul (7%) avait accès à du lait de donneuse pasteurisé. Une variation importante a été observée dans l'utilisation des fortifiants du lait maternel :seulement trois hôpitaux (21%) déclaraient les utiliser systématiquement pour plus de 90 % de leurs nouveau-nés prématurés. La disponibilité en ressourceshumaines spécialisées dans la nutrition neonatal étaitégalementvariable : seuls quatre hôpitaux (29%) disposaient d'un·ediététicien· ne dédié·e, et un seul avait un accès 24 h/24 à un·econsultant·een lactation.
Conclusion: Le soutien nutritionnel spécialisé par un· ediététicien· neou une équipe de lactation était limité dans les hôpitaux du réseau. Un seul hospital avait accès à du lait de donneusepasteurisé, et l'utilisation des fortifiants du lait maternel restait sous-optimale. L'optimisation de la nutrition doit être une priorité afin de maximiser les chances pour les nourrissons de sortir de l'hôpital en atteignant les normes de croissance.

Introduction

Critically ill infants in neonatal intensive care units require appropriate nutrition for survival, growth and development.[1] Inadequate nutrition in the first postnatal week results in poor growth, especially in very low birth weight (VLBW) infants.[2] Faltering growth of VLBW infants during postnatal hospitalization is associated with impaired neurodevelopmental outcomes, increased risk of retinopathy of prematurity, persistent growth deficits and increased risk for cardiovascular disease in adulthood.[2,3]

Early and adequate nutrition for critically ill infants improves growth, shortens length of hospital stay, and decreases development of late onset neonatal sepsis, necrotising enterocolitis, and chronic lung disease, especially in preterm infants.[4] Current recommendations suggest that the goal of postnatal nutrition in preterm newborns should be to replicate the needs of the foetus in the same gestational age.[5] Poor or inadequate nutrition postnatally resulting in extrauterine growth restriction (EUGR) has commonly been considered as growth values <10th percentile of expected intrauterine growth or as a decrease in z-scores between birth and a defined postmenstrual age (PMA).[6]
Optimizing nutrition for these vulnerable small and/or sick newborns in low-resourced settings worldwide is challenging given the lack of human and physical resources including availability of parenteral nutrition and its macronutrients. Thus, it is not surprising that publications have demonstrated high rates of EUGR among preterm newborns.[7,8] For example, among preterm newborns, 86.2% discharged from Ethiopian NICUs and up to 85.7% in South Africa had EUGR.[7,8]

Additionally, ensuring ideal growth in preterm newborns requires optimization of both parenteral fluids (for those that require intravenous fluids) and enteral feeds. Timely initiation of enteral feeds, ideally via breastfeeding within 1 hour after birth, is a current recommendation by the World Health Organization.[9] Furthermore, early initiation and advancement of enteral feeding is recommended for VLBW infants.[10] However, feeding initiation and advancement is a challenge in VLBW infants due to acute illnesses and functional immaturity of gastrointestinal system, along with limited availability of total parenteral nutrition, breastfeeding support, and donor milk.[11] Having standard feeding protocols, using mother's own milk, and engagement of a multidisciplinary team are recommended methods to reduce feeding challenges in the neonatal intensive care unit.[12]

There is paucity of data in low- and middle-income countries on nutritional practices and nutritional outcomes of preterm newborns discharged from NICUs in these settings. There has never been a review of the current nutritional practices within NICUs within the African continent. The African Neonatal Network (ANN) includes 14 hospitals across five countries: Ethiopia, Nigeria, Rwanda, Uganda, and Zimbabwe. Leveraging the ANN, we aimed to assess the nutritional practices and discharge weight of preterm newborns across sub–Saharan Africa to provide an overview of current practices and identify areas of potential improvements to optimize nutritional outcomes for small and sick newborns in these settings.

Methods

Data collection was conducted in 14 African Neonatal Network (ANN) member hospitals across five countries: Ethiopia, Nigeria, Rwanda, Uganda, and Zimbabwe.
Vermont Oxford Network (VON) conducts an annual survey for members that was co-developed with ANN faculty members, which includes information on the hospital setting, number of beds and admissions, staffing, obstetric service, follow-up clinic, resuscitation and essential newborn care, transfers and transport, family-centred care, services provided by the neonatal unit, guidelines in the neonatal unit, quality assurance/ continuous quality improvement, and level of neonatal care. Participation in the membership survey is mandatory. The responses used for this manuscript are from 2023.

In October 2023, the ANN conducted a health facility assessment to collect more detailed information on buildings and facilities, medications, diagnostics and consumables, equipment, staffing, governance, thermal regulation and foetal transition, nutrition, family-centred care and kangaroo mother care, infection prevention and control, and perceived priorities.

Tables of hospital-level measures include data from both the membership survey and the health facility assessment. All analyses are descriptive. The collaborative QI project and subsequent assessments received individual and hospital institutional research and ethics review approvals at the start of the collaborative and learning initiative.

Results

Among the 14 hospitals, four (29%) had dedicated paediatric nutritionists or dieticians. Ten hospitals (71%) had nurses trained on lactation support. However, only one hospital reported that a lactation consultant was available 24 hours per day, two (14%) hospitals reported one was available most days during work hours, three (21%) reported one was occasionally available but not on the ward every day, and eight (38%) reported that lactation support was not generally available.

Ten (71%) hospitals complied with the Baby Friendly Hospital initiative, and guidelines for initiation of breastfeeding and advancement of feeding were used consistently in 13 (93%) hospitals. All hospitals reported that weight scales and nasogastric or orogastric tubes were consistently available. Ten (71%) reported the availability of refrigerators for expressed milk, sterilized cups, and electrolyte diagnostics but only four (29%) had total parenteral nutrition (Table 1).

Table 1: Supplies consistently available at 14 African Neonatal Network member hospitals

	#	%
Weight scale	14	100
Nasogastric or orogastric tubes for feeding	14	100
Hypoglycemia diagnostics	11	79
Refrigerator for expressed milk	10	71
Sterilizable cups for complementary feeding	10	71
Nursing staff trained in supporting lactation	10	71
Electrolyte diagnostics	10	71
Infusion pumps	9	64
Term and preterm formula on formulary	7	50
Human milk fortifier	4	29
Total parenteral nutrition	4	29

A dedicated area for preparing or mixing milk/feeds was found in eight (57%) and seven (50%) had a separate space within the neonatal unit to allow mothers to express milk privately (Table 2). Only one hospital provided electrical breast milk pumps, and none provided mothers with manual breast pumps. Ten hospitals (71%) provided containers for mothers to express milk. Only one hospital had regular access to donated and pasteurized breast milk from a formal breast milk bank. However, two units utilized donated breast milk from persons other than mother but not through a formal breast milk bank.

Breastfeeding counselling for mothers during the antenatal care was practiced more than 60% of the time at 10 (71%) hospitals, while three (21%) hospitals had no practice of antenatal counselling on breastfeeding and two hospitals (14%) did not know whether antenatal counselling was available. Five hospitals (36%) reported that over 90% of mothers received lactation encouragement, support and education in the immediate postnatal period, while seven hospitals (50%) reported that 41-90% of mothers received such help and two hospitals reported that 40% or fewer mothers received such help. Most hospitals provided regular vitamin D fortification (64%) and iron supplementation (71%) to infants born <32 weeks, but only one hospital (7%) had zinc supplementation (Table 3).

Eight hospitals (57%) reported providing special preterm formula for preterm infants when clinically indicated. Three (21%) reported that some infants receive preterm formula while some receive term formula. One (7%) hospital reported that most preterm infants received term formula. Provision of preterm formula was reported as unknown by two (14%) hospitals.
Two hospitals reported that >90% of nurses and physicians received training on breastfeeding support after qualification while five (36%) hospitals reported that no more than 10% of nurses received training, and six (43%) reported that no more than 10% of physicians received training (Table 4).

Table 2: Institutional support for breastfeeding at 14 African Neonatal Network member hospitals

	#	%
Refrigerated storage space for mothers to store expressed milk	10	71
Hospital provides containers for mothers to express milk	10	71
Dedicated area (not at bedside) for preparing or mixing milk/feeds	8	57
Separate space within neonatal unit that allows mothers to express milk privately	7	50
Unit utilizes donated breast milk from person other than mother but not from formal breast milk bank	2	14
Regular access to donated and pasteurized breast milk from formal breast milk bank	1	7
Hospital provides electric breast pumps	1	7
Hospital provides manual breast pumps	0	0

Table 3: Hospital fortification and supplementation practices for infants at 14 African Neonatal Network member hospitals

	Preterm infants receiving breast milk fortification		<32 weeks receiving regular vitamin D fortification		<30 weeks receiving iron supplementation		<32 weeks receiving zinc supplementation		<32 weeks receiving suitable multivitamin	
	#	%	#	%	#	%	#	%	#	%
None	2	14	1	7			9	64	5	35
≤10%	3	21	1	7	1	7	1	7		
11% to 40%	2	14			1	7				
41% to 60%	2	14							1	7
61% to 90%	2	14	3	21	2	14	1	7	1	7
>90%	3	21	9	64	10	71	1	7	7	50
Unknown							2	14		

Table 4: Percentage of staff trained on breastfeeding support after qualification at 14 African Neonatal Network member hospitals

	Nurses		Physicians	
	#	%	#	%
≤ 10%	5	36	6	43
11%-40%	3	21	2	14
41%-60%	1	7	3	21
61%-90%	3	21	1	7
>90	2	14	2	14

Discussion

This survey evaluated the current nutritional practices of 14 neonatal intensive care units in five countries that are members of the African Neonatal Network. Multidisciplinary team involvement, including dietitians in American NICUs showed improvement in weight gain.[13] However only 4 (29%) NICUs had dedicated dietitians in the network hospitals.

Ten hospitals reported having nurses trained in lactation support. Training of lactation support for NICU nurses has demonstrated improvement in lactation knowledge and attitudes, creating a lactation supportive atmosphere in the NICU and improving breastfeeding rates.[14,15] Although counselling of mothers during pregnancy about breastfeeding has improved early initiation and exclusive breastfeeding rate,[16,17] only four hospitals among the 14 had mothers counseled on exclusive breast feeding during antenatal care.

Baby-Friendly Hospital initiatives practiced by 71% of network hospitals empower early and continued breastfeeding, skin-to-skin, and kangaroo mother care practices. Nutritional guidelines help provide clinicians with standard of feeding practices. Our findings demonstrated that 93% of the participating NICUs are using guidelines for feeding. Standardized feeding and nutrition guidelines and protocols have demonstrated multiple benefits including lesser use of parenteral nutrition, facilitate early enteral nutrition, improved weight gain and reduced rates of necrotising enterocolitis.[18,19]

Only one hospital reported practicing pasteurized donor milk for admitted infants, St Francis Hospital Nsambya.[20] All other units reported using formula milk if breast milk is not available from the mother. Early initiation of feeding with mother's breast milk is the recommended feeding for all newborn, including VLBW babies. In scenarios where breast milk is not available, pasteurized donor breast milk is a superior alternative to infant formula or any other breast milk substitute.[10] At three hospitals, more than 90% of qualifying infants received breast milk fortifier; however, three hospitals have never used it. Breast milk fortification for infants on mothers

or donor breast milk is recommended for all very low birth weight infants.[10,21]

Conclusions

There is significant variation among network hospitals on nutritional practices and availability of staff to support nutrition in the NICU. Many potential areas for better practices were identified, including improving the number of specialist dieticians, improving lactation and nutrition training for doctors and nurses and improving access to both fortification and donated breast milk.

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