Original Article

# The Influence of Method, Timing of Onset and Duration of Enteral Feeding on the Duration of Hospitalization of Newborn Infants in a Nigerian Special Care Baby Unit

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## Abstract

**Background:** Feeding practices among high-risk newborn babies have not been extensively studied in the resource-constrained parts of the world. **Aim:** To describe the pattern of milk use among infants in a resource-poor special care baby unit (SCBU) and relate these to the outcome of hospitalization. **Subjects and Methods:** Setting – SCBU of Olabisi Onabanjo University Teaching Hospital, Sagamu. Design – Prospective study of consecutively admitted inborn babies within the first 24 h of life. The data analyzed included the weight and estimated gestational age (EGA) of the babies, the age at the onset of and duration of feeds (breast milk and artificial milk [AM]). **Results:** Out of the 118 infants studied, (78.8%) 93/118 received breast milk and 16.1% (19/118) received AM. The mean age at the commencement of enteral feeding was 3.9 days. The age at the onset of suckling was negatively correlated with the EGA and body weight. The age at the onset and duration of enteral feeding were directly related to the duration of admission. **Conclusion:** More than three-quarter of the infants hospitalized in the unit received breast milk, but commencement was mostly delayed beyond the 3rd day of life. The duration of admission may be related to the timing of onset and duration of milk use.

**Keywords:** Artificial milk, Breastfeeding, Breast milk, Intravenous fluid therapy, Newborn feeding, Resource-poor setting

## Introduction

The purpose of the Baby Friendly Hospital Initiative (BFHI)[1] is to promote, protect, and support breastfeeding. The commencement of good breastfeeding practices within the birthing facility has been shown to influence other aspects of infant feeding practices.[2] When hospital-delivered infants require hospitalization for further care, such infants are separated from the mothers and early commencement of breastfeeding may be difficult in such situations.[3] These infants are also frequently kept *nil per os* (NPO) to avoid further complications.

In the technologically-advanced parts of the world, infants managed in Neonatal Intensive Care Units (NICU) or special care baby units (SCBUs) have the advantage of parenteral nutrition (total and partial) for as long as such is required[4] unlike the situation in the resource-poor parts of the world.

In technologically-advanced areas of the world, efforts are being made to improve the practice of breastfeeding in the SCBU and NICU.[5] These efforts may be related to the

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observation that prolonged hospitalization of very low birth weight infants adversely affects postdischarge exclusive breastfeeding rate among them.[6] Neonatal units caring for preterm babies and sick babies generally have management protocols (including NPO) to prevent morbidities arising from enteral feeding. Therefore, most neonatal care facilities are not able to operate well within the tenets of the BFHI particularly with respect to early commencement of breastfeeding.[7] This may be worse in the resource-poor settings of the world. It is plausible that the delay in milk feeding may have nutritional and immunoprotective implications for sick babies and may ultimately affect the clinical course of hospitalized sick babies. Studies describing the pattern of breast milk feeding in non-nursery neonatal units in resource-poor settings are not available from this part of the world, hence the need for this study. The aim of the study was to describe the pattern of milk feeding (in terms of type, age at commencement, and duration) among hospitalized infants in a Nigerian SCBU setting and relate it to the duration of hospitalization.

## Subjects and Methods

This is a prospective, descriptive study conducted at the SCBU of the Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu in Ogun State, Southwest Nigeria. The hospital was designated "Baby-Friendly" in 1992. The hospital has a Breastfeeding Committee, which coordinates its BFHI activities. The SCBU provides care for acutely ill infants delivered at the maternity unit of the hospital (referred to as inborn babies) as well those referred to the hospital for continued management. The average admission rate in this unit was previously documented to be about 300/annum with an average neonatal mortality rate of 263/1000 admissions and 14–30% of these deaths occurred among inborn infants.[8] In the SCBU, mothers have regulated access to their infants during feeding and routine cleaning and are educated on the preference for exclusive breastfeeding. Skin-to-skin contact and the Kangaroo mother care are only practised for very low birth weight infants with feeding difficulties or poor weight gain and preterm infants with temperature instability. Early colostrum and breast milk feeding are not routinely practised in the SCBU since the infants are mostly critically ill and are not to be fed as per the unit protocol.

The study was conducted between September 2012 and November 2013, by obtaining the relevant data from the hospital records of consecutively admitted critically ill inborn babies within the first 24 h of life. This was a time-limited study with purposive sampling. Critical illness was defined as poor cardio-respiratory functions, life-threatening hematological derangements, seizures, metabolic disorders, electrolyte derangements, and major gross congenital malformations. Referred babies, babies with minor congenital malformations, and inborn babies who had been commenced on feeding prior to hospitalization were excluded from the study. Institutional ethical approval was obtained for the study and informed written consents were obtained from the available parents and/or caregivers. According to the unit protocol, all babies < 48 h of age are assessed at the point of admission for the estimated gestational age (EGA) using the modified Ballard method.[9] Sick babies are put on NPO when they have diseases of the digestive system or when enteral feeding may increase the risk of significant morbidities in conditions not exclusively limited to the digestive system. Preterm infants (EGA < 37 completed weeks) are not allowed enteral feeding within the first 24–48 h while term infants are only allowed enteral feeds in the absence of cardio-respiratory instability and intestinal stasis. Facilities for total parenteral nutrition (TPN) are not available in the unit. Thus, dextrose-containing intravenous fluids (IVFs) fortified with the maintenance doses of electrolytes, are delivered at the calculated maintenance rates. After the initial delay, enteral feeding is commenced with 2-hourly (2 ml/kg) aliquots of expressed breast milk (EBM) or artificial milk (AM) either by intermittent nasogastric tube feeding or by cup and spoon method. The use of AM is highly regulated in the unit and only prescribed by the highest cadre of physicians when it is absolutely indicated in situations of severe maternal illness, maternal absence, and maternal death. Preterm babies are allowed to suckle when the postconceptional age of at least 34 weeks is reached or when the babies weigh at least 1500 g.

The data obtained from the hospital records of the infants included the weight and EGA of the babies, duration of NPO as well as the age at the onset of IVF, EBM, sucking, or AM. The duration of use of each type of fluid or feed was recorded and expressed as a percentage of the overall duration of admission. Clinical diagnoses or reasons for hospitalization were also recorded. Groups of preterm and term infants were compared for the age at onset and duration of feed and fluid use. The data were managed with the SPSS version 18.0 software (SPSS Inc., Chicago, IL, USA) using descriptive and inferential statistics (Student's *t*-test was used to compare the mean values of continuous data while the Chi-squared test with the Yate's correction and Fishers' exact tests compared proportions and ratios of categorical data as appropriate). The Pearson correlation was used to describe the trend of relationship (direct or inverse) between two sets of continuous data. Statistical significance was defined using $P < 0.05$.

## Results

### General description

During the study, there were 386 deliveries in the hospital out of which 133 were hospitalized in the SCBU; 118 within the first 24 h and 15 after 24 h. There were 412 total admissions (279 out-born and 133 inborn infants) into the SCBU. The 118 infants in the study were inborn infants recruited within the first 24 h of age. The subjects comprised 55.9% (66/118) males and 44.1% (52/118) females. Of the 118 babies, 13/118 (11.0%) infants had EGA < 34 weeks, 26 (22.0%) were between 34 and 36 weeks of gestation while 79 (66.9%) had gestational age of at least 37 weeks. The infants comprised 92.4% (109/118)

singletons (single births) and 7.6% (9/118) multiple births. The main clinical diagnoses include perinatal asphyxia (43.2%; 51/118), prematurity/low birth weight (26.3%; 31/118), presumed sepsis (16.1%; 19/118), perinatal exposure to the HIV (5.1%; 6/118), meconium aspiration syndrome (4.2%; 5/118), perinatal exposure to hepatitis B (3.4%; 4/118), and infants of diabetic mother (1.7%; 2/118).

## Types of milk use

One hundred and eight (91.5%) infants (38 preterm and 70 term) were put on NPO from birth while 8.5% (10/118) had been put to breast but the mothers were yet to establish lactation at the time of admission hence they had not been fed in the real sense. Seventy-two (61.0%) infants were on NPO for at least 48 h while 36 (30.5%), comprising 13/39 (33.3%) preterm and 23/70 (32.9%) term infants, were on NPO for <48 h.

Overall, 78.8% (93/118) infants received breast milk either by suckling, by EBM or both at some point during the hospitalization. The remaining 21.2% (25/118) comprised of 64.0% (16/25) whose care ended before feeding was commenced and 36.0% (9/25) who received AM throughout. The onset of enteral feeding ranged from 1 to 10 days with the mean of 3.9 (1.9) days. One hundred and two out of 118 (86.4%) babies had a form of enteral feeding while 16/118 (13.6%) did not have enteral feeding. These 16 babies who did not receive enteral feeding comprised 68.7% (11/16) who died before the commencement of enteral feeding and 31.3% (5/16) who were discharged prematurely before the commencement of enteral feeding. Of the 102 infants who received enteral feeding, 46 (45.1%) and 56 (54.9%) infants had early and late feeding, respectively. Of the 32 preterm infants, who received enteral feeding, 12 (37.5%) had early feeding compared with 34 (48.6%) of the 70 term infants. Most of the infants received different forms of enteral feeding at different times during hospitalization hence, overall, 73.7% (87/118), 46.6% (55/118), and 16.1% (19/118) infants had suckling, EBM feeding, and AM feeding, respectively. The reasons for AM use were as follows: Severe maternal illness particularly eclampsia (6/19; 31.6%), lactation failure (6/19; 31.6%), maternal death (4/19; 21.1%), and maternal retroviral infection (3/19; 15.8%).

## Pattern (age at onset and duration) of feed and fluid use

NPO: The mean duration of NPO among preterm and term infants (3.7 days vs. 3.2 days) as well as the percentage of the total duration of admission formed by the period on NPO (46.1% vs. 46.2%) were statistically similar [Table 1].

IVF use: A total of 111 (94.1%) infants had IVF therapy on the 1st day of life. All the 39 preterm infants and 72/79 (91.1%) of term infants had IVF therapy. The mean duration of IVF use was significantly longer for preterm compared to term infants (6.8 days vs. 4.5 days).

Suckling: A total of 87 (73.7%) infants (26 preterm and 61 terms) suckled at the breast. The mean age at commencement of suckling was significantly greater among preterm than term infants (8.5 days vs. 4.8 days). The immature and smaller infants started suckling significantly later ($r = -0.42$, $P < 0.01$ and $r = -0.45$, $P < 0.01$, respectively).

EBM: A total of 46.6% (55/118) infants (26 preterm and 29 terms) had EBM. The mean age at commencement of EBM feeding was similar among preterm and term infants (4.6 days vs. 4.4 days). The mean duration of EBM feeding was significantly longer among preterm compared to term infants (10.1 days vs. 5.7 days).

## Correlation of estimated gestational age and body weight with the duration of the use of feeds and fluid

Table 2 shows that the smaller and more immature infants had longer durations of NPO, IVF, EBM, and suckling. Only the duration of EBM was significantly correlated with the EGA whereas all the variables, with the exception of the duration of suckling, were significantly related to the body weight on admission.

## Duration of hospitalization

The duration of admission ranged from 1 to 44 days with the mean (standard deviation) of 9.4 (6.4) days. The mean durations of admission for infants with EGA <34 weeks, 34–36 weeks and >37 weeks were 11.0 (7.1) days, 15.1 (8.8) days and 8.3 (5.1) days, respectively.

**Table 1: Comparison of the characteristics of IVF and milk use among term and preterm infants**

| Characteristics of feed/fluid use | Preterm (*n*=39) | Term (*n*=79) | Test of significance* |
|---|---|---|---|
| Mean duration of NPO | 3.7 (2.0) days | 3.2 (1.4) days | *t*=1.52; *P*=0.13 |
| Mean percentage of total stay on NPO | 46.1 (32.9) | 46.2 (24.7) | *t*=0.02; *P*=0.98 |
| Mean duration of IVF use | 6.8 (4.0) days | 4.5 (2.9) days | *t*=3.48; *P*=0.01 |
| Mean percentage of total stay on IVF | 68.4 (27.4) | 70.6 (23.5) | *t*=0.44; *P*=0.66 |
| Mean age at onset of sucking | 8.5 (5.7) days | 4.8 (2.9) days | *t*=4.01; *P*<0.001 |
| Mean duration of sucking | 7.6 (7.7) days | 4.8 (3.9) days | *t*=2.25; *P*=0.02 |
| Mean percentage of total stay on sucking | 48.3 (27.9) | 55.9 (25.6) | *t*=1.23; *P*=0.22 |
| Mean age onset of EBM use | 4.6 (1.9) days | 4.4 (1.9) days | *t*=0.39; *P*=0.69 |
| Mean duration of EBM use | 10.1 (5.4) days | 5.7 (3.8) days | *t*=3.52; *P*<0.01 |
| Mean percentage of total stay on EBM | 66.8 (15.8) | 55.1 (18.9) | *t*=2.47; *P*<0.01 |

*Done with the Student's *t*-test. NPO: *Nil per os*, IVF: Intravenous fluid, EBM: Expressed breast milk

The longer the duration of NPO ($r$ = 0.31; $P$ < 0.01), IVF ($r$ = 0.62; $P$ < 0.01), EBM ($r$ = 0.89; $P$ < 0.01), and suckling ($r$ = 0.78; $P$ < 0.01), the longer the duration of admission. The earlier the onset of suckling, the shorter the duration of admission among both term ($r$ = 0.48; $P$ < 0.01), and preterm infants ($r$ = 0.39; $P$ = 0.04). The earlier the onset of EBM feeding for term infants, the shorter the duration of admission ($r$ = 0.43; $P$ = 0.02). The relationship between onset of EBM feeding and duration of admission was not significant for preterm infants ($r$ = 0.20; $P$ = 0.32).

Table 3 shows that among term infants, IVF therapy for <2 days, NPO for <2 days and early commencement of enteral feeding were significantly associated with duration of admission <7 days. Among preterm infants, there was no significant association between IVF use for <2 days, NPO for <2 days, early commencement of enteral feeding among preterm infants and duration of admission <14 days.

## Discussion

In the present study, the relatively small contribution of very preterm and moderate preterm infants to the total admission reflects the selection criteria for enrolment into the study rather than a policy of admission into the SCBU. Most of the preterm infants managed in this facility must have been excluded from this study on account of the referred status and age older than 24 h. In addition, the preponderance of term infants with birth asphyxia can be ascribed to the fact that most of the infants with birth asphyxia were products of high-risk pregnancies delivered in our hospital following a referral from other facilities.

In the course of hospitalization, more than three-quarters of the infants in the present study eventually had breast milk feeding either by direct suckling, EBM, or both. The remaining quarter inevitably could not be fed breast milk under our care. Nevertheless, the willingness of the mothers to breastfeed their infants except when impossible or medically contraindicated is universal as previously documented.[10] Therefore, the tenets of the BFHI are adhered to in this neonatal unit within the existing limitations.

In the present study, 16.1% of the infants studied received AM for various reasons. Except in cases of maternal death, it is standard practice during follow-up clinic visits to counsel mothers and caregivers on how to stop AM feeding.

The mean age of the infants at the commencement of enteral feeding was 3.9 days. This is expected as almost two-third of the infants studied were on NPO for more than 2 days. The implication of this observation is that some of the infants hospitalized in this unit may not be fed colostrum, and this has nutritional and immunological implications.

**Table 2: Correlation of EGA and body weight with the duration of IVF and milk use**

| Independent variables | Dependent variables | Correlation co-efficient ($r$) | $P$ |
|---|---|---|---|
| EGA | Duration of NPO | −0.13 | 0.19 |
| | Duration of IVF use | −0.16 | 0.09 |
| | Duration of EBM use | −0.41 | <0.01 |
| | Duration of sucking | −0.19 | 0.07 |
| Weight | Duration of NPO | −0.24 | 0.01 |
| | Duration of IVF use | −0.31 | <0.01 |
| | Duration of EBM use | −0.38 | <0.01 |
| | Duration of sucking | −0.04 | 0.67 |

EGA: Estimated gestational age, NPO: *Nil per os*, IVF: Intravenous fluid, EBM: Expressed breast milk

**Table 3: Comparison of duration of admission and IVF and milk use**

| Term infants | | | |
|---|---|---|---|
| **Parameters** | **Admission ≤7 days** | **Admission >7 days** | **Tests of significance*** |
| IVF use | | | |
| Yes | 31 (88.6) | 41 (93.2) | $\chi^2$=0.10; $P$=0.75** |
| No | 4 (11.4) | 3 (6.8) | |
| Duration of IVF use | | | |
| <2 days | 6 (19.4) | 0 (0.0) | $\chi^2$=7.75; $P$<0.01† |
| >2 days | 25 (80.6) | 41 (100.0) | |
| Duration of NPO | | | |
| <2 days | 14 (48.3) | 9 (22.0) | $\chi^2$=5.33; $P$=0.02 |
| >2 days | 15 (51.7) | 32 (78.0) | |
| Commencement of feeding | | | |
| Early | 19 (73.1) | 15 (34.1) | $\chi^2$=9.94; $P$<0.01 |
| Late | 7 (26.9) | 29 (65.9) | |
| Breast milk use | | | |
| Yes | 25 (71.4) | 38 (86.4) | $\chi^2$=2.69; $P$=0.10 |
| No | 10 (28.6) | 6 (13.6) | |
| **Preterm infants** | | | |
| **Parameters** | **Admission ≤14 days** | **Admission >14 days** | **Tests of significance*** |
| IVF use | | | |
| Yes | 28 (100.0) | 11 (100.0) | Not computed |
| No | 0 (0.0) | 0 (0.0) | |
| Duration of IVF use | | | |
| <2 days | 5 (17.9) | 1 (9.1) | $\chi^2$=0.03; $P$=0.84** |
| >2 days | 23 (82.1) | 10 (90.9) | |
| Duration of NPO | | | |
| <2 days | 10 (37.0) | 3 (27.3) | $\chi^2$=0.04; $P$=0.89** |
| >2 days | 17 (63.0) | 8 (72.7) | |
| Commencement of feeding | | | |
| Early | 9 (42.9) | 3 (27.3) | $\chi^2$=0.23; $P$=0.63** |
| Late | 12 (57.1) | 8 (72.7) | |
| Breast milk use | | | |
| Yes | 19 (67.9) | 11 (100.0) | $\chi^2$=4.59; $P$=0.04† |
| No | 9 (32.1) | 0 (0.0) | |

*Test of significance done with the Pearson Chi-squared test, **Yate's correction applied, †Fishers exact test. IVF: Intravenous fluid, NPO: *Nil per os*, EBM: Expressed breast milk, Breast milk use: Sucking + EBM

The inverse relationship between EGA and body weight on the one hand and duration of NPO, duration of IVF, duration of EBM, and duration of sucking on the other hand points to the fact that preterm infants tended to require IVF and other forms of enteral feeding for longer period compared to term infants. This practice puts preterm infants at risk of the various complications of IVF administration, particularly, nosocomial infections and ultimately, prolonged hospitalization. The mean duration of EBM feeding was considerably longer among preterm infants compared to term infants. This can be explained in terms of the practice of delaying direct suckling among preterm infants until the postconceptional age of about 34 weeks that may take several weeks depending on the gestational age at birth.

The negative correlation between the age at commencement of suckling and EGA or birth weight can be explained by our practice of delaying suckling in the smaller infants until they are 34 weeks postconception or 1.5 kg body weight. Prior to the postconceptional age of 34 weeks, preterm infants are fed by nasogastric tubes. However, tube feeding has been previously documented to be associated in our center with the occurrence of nosocomial infections.[11]

It was observed that despite the restrictions imposed by the subsisting feeding protocols in the SCBU, the earlier suckling or EBM feeding was commenced, the shorter the duration of hospitalization. This observation lends credence to the practice of early commencement of breast milk feeding in the SCBU. The practice appears safe enough as it has not been shown to increase the risk of necrotizing enterocolitis.[12]

It is attractive to recommend that in the absence of TPN, critically ill infants, term or preterm, should receive small aliquots of colostrum and breast milk early in life, preferably within the 1st days of life even when such babies must be kept on IVF therapy. The practice of minimal enteral nutrition has been suggested to improve weight gain, growth and is associated with less risk of necrotizing enterocolitis or hypoglycemia among critically ill infants.[13,14] However, most centers in the developing world are yet to adopt the practice of minimal enteral nutrition for low birth weight babies. Further, early initiation of breastfeeding in the NICUs has been demonstrated to result in higher rate of exclusive breastfeeding postdischarge from the NICU in more technologically-advanced countries.[15]

## Conclusion

The findings in this study establish the relationship between the age at the commencement of enteral feeding and the duration of admission. The latter can be adopted to provide better clinical management of critically ill infants hospitalized in the SCBU in resource-poor settings. Although, the small sample size in the present study is acknowledged as a limitation, the study has established that the pattern of milk use in the SCBU needs to be improved, particularly with respect to the commencement of aliquots of breast milk within an hour of life and by extension, to shorten the duration of hospitalization.

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### Conflicts of interest

There are no conflicts of interest.

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