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Mode of Delivery: Effect on Blood Glucose Levels and Age at Initiation of Breastfeeding Among Healthy Newborns in Obio Cottage Hospital, Rivers State, Nigeria

Chukwuma Chidiebere Adaku*, Petronilla Tabansi, Peace Opara

Department of Paediatrics and Child Health, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria

Email address:

adachukwuma1@gmail.com (Chukwuma Chidiebere Adaku)

*Corresponding author

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Abstract: Early initiation of breastfeeding is giving newborns breastmilk within the first hour of life. This ensures that the newborn receives colostrum. Colostrum is rich in calorie, immunoglobulins, antimicrobials and growth factors, which are essential for nutrition, growth and development. Despite this knowledge, the proportion of mothers who initiate breastfeeding early remains low. The objectives of this study were to determine the effect of mode of delivery on the age at initiation of breastfeeding and blood glucose levels of the newborns as well as to determine the relationships between maternal characteristics and age at initiation of breastfeeding of the newborns. This study was carried out over six weeks. The study population were 240 exclusively breastfed newborns delivered at Obio Cottage Hospital. A questionnaire was used to obtain relevant maternal information. The ages at which breastfeeding was initiated as well as measured blood glucose values were obtained and recorded on the study proforma. Blood glucose measurements were done at the bedside, using the Finetest glucometer at birth, three, 12 and 24 hours of life. Early initiation of breastfeeding was recorded among 96 (50.5%) and six (12%) newborns born by spontaneous vertex delivery (SVD) and elective Caesarean Section (CS) respectively, with an overall rate of 42.5%. Newborns delivered by SVD had significantly higher mean blood glucose at birth and 24 hours of life (p=0.000 and 0.015 respectively). The rate of early initiation of breastfeeding is low among newborns delivered by elective CS.

Keywords: Glucose, Blood, Breastfeeding, Newborns, Initiation, Delivery

1. Introduction

Breastfeeding has no equal in providing ideal food and optimal glucose levels in the newborn [1, 2]. It protects against metabolic disorders such as type 2 diabetes mellitus, reduces obesity and improves scores on intelligence tests in children by 3.5 points [3], as well as protecting against pneumonia and diarrhoea diseases [4]. The World Health Organisation (WHO), through the baby friendly hospital initiative (BFHI) recommends that infants be given only breastmilk for the first six months of life, as a key tool to reducing morbidity and mortality in childhood [5]. The success of the BFHI is hinged on the fact that establishment of breastfeeding within the hospital is essential for the continuity of later breastfeeding [6]. Early initiation of breastfeeding (EIBF), a key component of the BFHI, means giving newborns breast milk within the first hour of life [7]. This practice has been shown to prevents about 22.3% of neonatal deaths [8] and ensures that the newborn receives colostrum. Colostrum is very rich in substances such as calorie, immunoglobulin, antimicrobials and growth factors, which are essential for nutrition, growth and development [9]. These provide passive immunity to newborns and is an important strategy of the BFHI to reducing childhood mortality [7].

The importance of the age at which breastfeeding is initiated is in the prompt availability of colostrum and its benefits to the newborn and not necessarily blood glucose levels, as breastmilk has been shown to provide about one-fifth of glucose requirements in the first days of life [10]. The

remaining glucose is gotten through endogenous metabolic processes that occurs after birth [11]. This finding has also been corroborated by studies that documented normal blood glucose levels in the first 24 hours of life among healthy newborns in whom breastfeeding was inadvertently delayed for six to eight hours after birth [10, 12].

Despite the documented benefits of EIBF, care givers and healthcare workers routinely give pre-lacteal feeds to healthy newborns who are considered not to have fed optimally due to poor maternal lactation and fatigue following labour and delivery [13, 14], for fear of them developing hypoglycaemia [13, 15]. Use of these pre-lacteal feeds is a major barrier to EBF [16], and impacts negatively on EBF rates [17] as it affects its initiation and duration [16], delays lactation [18] and limits the frequency of suckling by the infant [Riva 19]. According to the Nigeria Demographic and Health Survey (NDHS), the practice of pre-lacteal feeding increased from 58% [14] in 2008 to 59% [20] in 2013, with rates being as high as 58.1% [21] in Rivers State. Studies have reported low EIBF rates between 34 and 34.7% among newborns, irrespective of their mode of delivery [22]. Furthermore, studies have revealed that the odds of giving pre-lacteal feeds to newborns was increased in mothers who delivered by Caesarean Section (CS) [23, 24] possibly due to the stress of surgery.

The objectives of the study were to determine the effect of mode of delivery on blood glucose levels and the age at initiation of breastfeeding among healthy newborns, as well as the relationship between maternal characteristics and age at initiation of breastfeeding of the newborns, in Obio Cottage Hospital, Rivers State.

2. Materials and Methods

This study was conducted over six weeks at Obio Cottage Hospital, a primary level, health centre. Obio Cottage Hospital is situated in Rumuobiakani community in Rivers State, Nigeria. Sample size was calculated using the formula [25] for comparison of means, resulting in a minimum sample size of 232. Two hundred and forty (240) healthy term normal birth weight newborns aged 0-24 hours, born by unassisted vaginal delivery (spontaneous vertex or induction of labour) or elective Caesarean Section and receiving only breastmilk were recruited into the study. Exclusion criteria included mothers with conditions that could influence their babies' blood glucose values, such as elevated blood pressure, hypergycaemic states or those on drugs such as propranolol for the management of hypertension and/salbutamol for prevention of preterm labour and delivery. Furthermore, neonates with any degree of perinatal asphyxia, birth defects, risk for sepsis or those who received pre-lacteal feeds within the first 24 hours of life were also excluded. Babies receiving only breastmilk in the course of the study were considered to be exclusively breastfed while those delivered at any gestational age between 37-42 weeks were term. Any birth weight between 2.5kg and 3.9kg and Apgar score of <7 in the first minute of life were normal. Approval for the study was sought and obtained from the Institution Review Board of the University of Port-Harcourt Teaching Hospital (UPTH). A list of mothers who gave written informed consent during antenatal visits was drawn up and was used to identify them, when they presented in labour or were admitted for elective CS. Information such as mothers' age, level of education, occupation, parity, last menstrual period, mode of delivery, gestational age at delivery, Apgar score, birth weight, blood glucose values and age at initiation of breastfeeding of the newborns were recorded in the study proforma. Blood samples for measurement of blood glucose were collected at birth using cord blood and at 3, 12 and 24 hours of life via heel prick. The Fine test glucometer, produced by Infopia Co. Ltd was used to measure blood glucose by the bedside. We measured newborn's blood glucose levels, irrespective of the age at initiation and frequency of breastfeeding. We considered any newborn with blood glucose values less than 2.2mmol/L [26] as hypoglycaemic. Any neonate with hypoglycaemia at any time was breastfed, as part of the initial therapy and a repeat blood glucose measurement was taken 30 minutes later. Babies in whom hypoglycaemia persisted were excluded from the study and admitted. Quality control was done at regular intervals, through standardisation of the Fine test glucometer to accuracy, using the manufacturer's glucose control solution.

Data were analysed using the Statistical Package for Social Science (SPSS) for Windows version 20 software. Quantitative variables such as age at initiation of breastfeeding and blood glucose values were summarised as means and standard deviations and the differences between means were compared using Student's t test. Categorical variables such as maternal characteristics and mode of delivery were presented as proportions and their differences compared using Chi square test or Fishers exact test as applicable. Relationship between age at initiation of breastfeeding and blood glucose levels was determined using Pearson's correlation. Association between maternal characteristics and age at initiation of breastfeeding was done using bivariate analysis. Statistically significant variables on bivariate analysis were entered into multivariate analysis model to control for any confounding influence and identify predictors of early initiation of breastfeeding. A p value of less than 0.05 was considered statistically significant.

3. Results

3.1. Characteristics of the Newborns

The study subjects comprised 240 newborns, delivered by 231 mothers; nine (3.9%)} of the mothers who met the study inclusion criteria had a set of twins. One hundred and thirty-seven (57.1%) were males and 103 (42.9%) were females (M: F= 1.3:1). The mean and median gestational ages at delivery were 39.13± 1.17 and 39 weeks respectively. Their birth weights ranged from 2.50 to 3.95kg (mean = 3.3±0.41kg). Fifty (20.8%) of the newborns were delivered by elective CS, compared to 190 (79.2%) newborns delivered vaginally (SVD).

3.2. Newborn's Blood Glucose Levels Versus Mode of Delivery

Table 1. *Comparison of Blood Glucose Levels between Newborns Delivered by CS and SVD.*

Timing of Sample Collection	Mode of delivery		T	p value
	SVD (n=190) Mean RBG±SD (mmol/L)	Caesarean Section (n=50) Mean RBG±SD (mmol/L)		
Cord blood	4.64±1.10	3.88±0.80	4.552	0.000*
3 hours of life	3.64±0.65	3.83±0.63	1.855	0.065
12 hours of life	3.71±0.56	3.70±0.50	0.062	0.951
24 hours of life	4.13±0.50	3.93±0.51	2.442	0.015*

3.3. Age at Initiation of Breastfeeding and Mode of Delivery of the Newborns

The mean age at initiation of breastfeeding of the newborns was 102.05±96.83 minutes, ranging from 15minutes to 720minutes (12 hours). Table 2 compares mode of delivery with the ages at initiation of breastfeeding in the subjects.

Table 2. *Association between Mode of Delivery and Ages at Initiation of Breastfeeding.*

Mode of delivery	Initiation of breastfeeding		
	Early (<1 hour) n (%)	Late (>1 hour) n (%)	Total n (%)
CS	6 (12.0)	44 (88.0)	50 (100.0)
SVD	96 (50.5)	94 (49.5)	190 (100.0)
Total	102 (42.5)	138 (57.5)	240 (100.0)

$X^2 = 24.042$; p = 0.000*

3.4. Comparison of Blood Glucose Levels and Ages at Initiation of Breastfeeding in the Newborns

Figure 1 shows the plot of blood glucose levels against ages at initiation of breastfeeding and the best fitted line. The strength of the relationship between the ages at initiation of breastfeeding and mean blood glucose values of the newborns was weakly positive (r = 0.028) and was not statistically significant (p = 0.669).

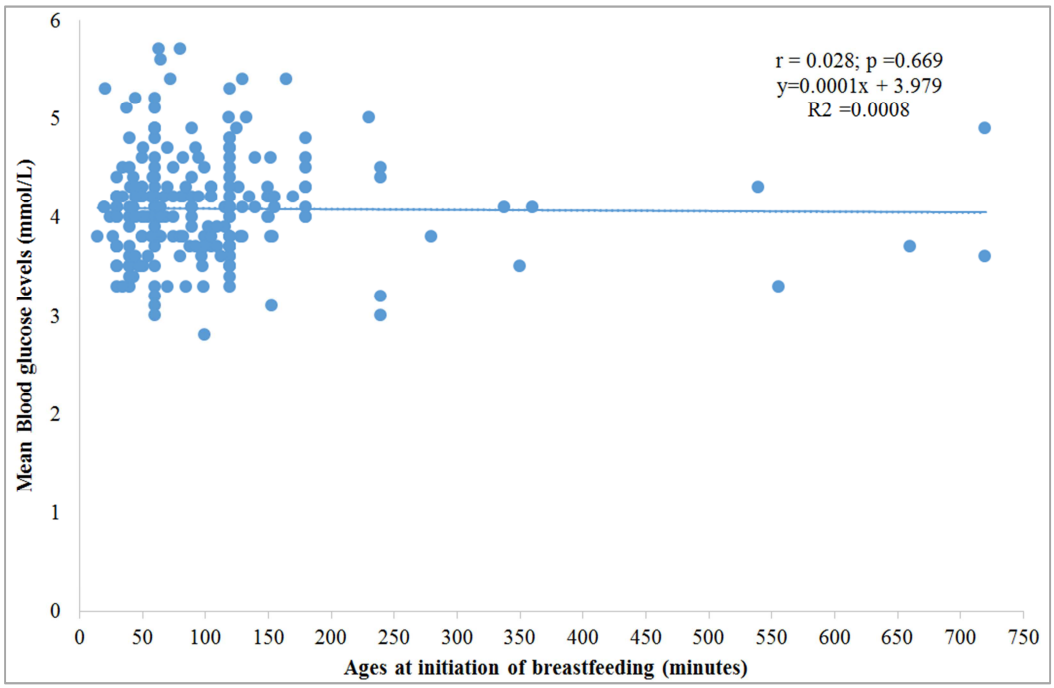

Figure 1. *Blood Glucose Levels against the Ages at Initiation of Breastfeeding among the Newborns.*

3.5. Maternal Characteristics Versus Newborns Ages at Initiation of Breastfeeding

Tables 3 show the relationship between maternal characteristics such as age, parity, level of education, occupation and age at initiation of breastfeeding in the newborns.

Table 3. *Relationship between Maternal Characteristics against Age at Initiation of Breastfeeding in the Newborns.*

Variables	Initiation of breastfeeding		Total n (%)
	Early (N=100) n (%)	Late (N=131) n (%)	
Age of mothers (years)			
20 – 29	38 (45.8)	45 (54.2)	83 (100.0)
30 – 39	60 (42.0)	83 (58.0)	143 (100.0)
40 – 49	2 (40.0)	3 (60.0)	5 (100.0)
	Fisher's exact test = 0.428; p-value = 0.855		
Parity			
Para 1	19 (28.8)	47 (71.2)	66 (100.0)
Para 2 – 4	80 (49.4)	82 (50.6)	162 (100.0)
> Para 4	1 (33.3)	2 (66.7)	3 (100.0)
	*Fisher's exact test = 8.394; p-value = 0.009**		
Educational level			
Primary	2 (50.0)	2 (50.0)	4 (100.0)
Secondary	28 (50.9)	27 (49.1)	55 (100.0)
Tertiary	70 (40.7)	102 (59.3)	172 (100.0)
	Chi square = 1.986; p-value = 0.397		
Occupational status			
Unemployed	55 (44.4)	69 (55.6)	124 (100.0)
Employed	32 (39.5)	49 (60.5)	81 (100.0)
Self employed	13 (50.0)	13 (50.0)	26 (100.0)
	Chi square = 1.006; p-value = 0.605		

3.6. Sub-analysis of Maternal Characteristics and Newborn's Age at Initiation of Breastfeeding

Table 4 shows logistic regression analysis of maternal factors associated with age at initiation of breastfeeding of the newborns. Mothers with a parity of two and above were more likely to initiate breastfeeding within one hour of birth than primiparous mothers (Odds Ratio=2.688; 95% confidence interval: 1.42 - 5.11; p = 0.003). Mothers who had Spontaneous Vertex Delivery were nine times more likely to initiate breastfeeding within one hour of birth than those who delivered by Caesarean Section (p = 0.000).

Table 4. *Maternal Factors Associated with Age at Initiation of Breastfeeding in the Newborns.*

Independent variables	Coefficient (β)	Odds ratio	95% Confidence Interval		p value
			Lower	Upper	
Parity					
Para 2 or more	0.989	2.688	1.42	5.11	0.003*
Para 1 [R]		1			
Mode of delivery					
Spontaneous Vertex	2.208	9.101	3.40	24.36	0.000*
Caesarean Section [R]		1			
Constant	-0.325	0.722	-	-	0.063

R – Reference Category

4. Discussion

The mean cord blood glucose values obtained among newborns delivered by SVD was significantly higher than that in babies born by elective CS, similar to findings by other studies [27, 28]. This similarity may be accounted for by stress-induced catecholamine that is higher during SVD, compared with Caesarean deliveries [29]. Diwakar *et al* [12] and Hawdon *et al* [30] followed up newborns for a longer period (three days and a week respectively) and found no significant difference between the two groups. This was not surprising as the effect of catecholamine on blood glucose seen at birth might have waned in the hours following delivery. In contrast to the finding in the present study, Srinivasan *et al* [31] observed significantly lower mean cord plasma glucose values among babies born by SVD, compared to those delivered by CS. The reason for this difference in their observation may be because mothers who had SVD received dextrose infusions during labour and delivery, resulting in rebound lower plasma glucose levels in the newborns at birth. Furthermore, the significantly higher glucose estimates at 24 hours of life among newborns delivered by SVD, compared to those delivered by elective CS may be because newborns born by SVD commenced breastfeeding earlier. This may have led to more frequent suckling, thereby improving maternal lactation and breastmilk intake in them. It is pertinent to note that though the blood glucose levels among newborns delivered by SVD and CS showed significant difference at birth and also at 24 hours in the present study, the blood glucose levels of both groups of newborns were well within normal values throughout the study period, possibly due to the high calorie content of colostrum, irrespective of volume of breastmilk ingested or age at initiation of breastfeeding. This questions the clinical relevance of this finding as no newborn delivered

by CS had hypoglycaemia. However, it is noted in literature that newborns delivered by CS were five times more likely to be given pre-lacteal feeds than those delivered by SVD. Thus, the import of the finding can potentially be used as scientific evidence that healthy newborns delivered by CS do have comparable blood glucose levels with those delivered by SVD and also have a successful metabolic adaptation irrespective of the breastfeeding pattern in the first 24 hours of life, and should not be given pre-lacteal feeds for fear of hypoglycaemia.

Similar to observations from other studies [32-36], this study reported a lower rate of EIBF among babies delivered by CS compared to those born by SVD, probably due to the stress of surgery and longer recovery time. Awi *et al* [37] had attributed this lower rate of EIBF to be due to anaesthetic effects related to CS, as well as delays in transferring mothers to the wards following surgery. Late initiation of breastfeeding has shown the potential to increase the use of pre-lacteal feeds [24, 38], a key determinant to early cessation of exclusive breastfeeding. The finding of lower rates of EIBF among mothers who deliver by CS is very important because such mothers that are likely to have CS deliveries can be targeted during antenatal for the purpose of appropriate exclusive breastfeeding counseling and support, especially in the first 24 hours of life as discussed above. Overall, the higher rate of EIBF seen in this study, compared to other studies is probably because mothers received lactation counselling during antenatal and breastfeeding support at birth.

When subjected to further statistical analysis, the present study did not show any correlation between the ages at initiation of breastfeeding and blood glucose values in the newborns. Even the neonate whose mother delayed breastfeeding until 12 hours of life in the present study, had normal glucose values throughout the study period. This may be a solace for mothers who have CS deliveries and are anxious about suboptimal breastfeeding of their newborns, either due to maternal fatigue or other factors following delivery.

In addition to mode of delivery, maternal characteristics such as increasing parity was significantly associated with EIBF compared to primiparous mothers, as has also been reported by other studies [35]. This may be due to the experience of having had and breastfed a child in the past. Therefore, primiparous mothers should be targeted during antenatal visits and at delivery for proper education and lactation support as a means to improving EIBF rates and successful breastfeeding in general.

5. Conclusion

Irrespective of mode of delivery, healthy babies had normal blood glucose levels in the first 24 hours of life, even though most mothers who delivered by CS initiated breastfeeding late, compared to those who had SVD. Increased parity was significantly associated with EIBF. Despite its documented benefits, the overall rate of EIBF is low, especially following CS deliveries. Therefore, optimal breastfeeding support to all mothers remain crucial for a better outcome.

ORCID

https://orcid.org/0000-0003-2237-2326 (Chukwuma Chidiebere Adaku)
https://orcid.org/0000-0002-7724-288X (Petronilla Tabansi)
https://orcid.org/0000-0002-1332-8756 (Peace Opara)

Conflicts of Interest

The authors declare no conflicts of interest.

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