

Early neonatal hypoglycemia in exclusively breastfed babies in a developing country – India

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ABSTRACT

Background: Neonatal hypoglycemia has been a cause for concern due to increasingly frequent reports of long-term sequelae, leading to undue concern and inadvertent administration of formula feeds. Though hypoglycemia is usually encountered only in neonates with classical risk factors, hypoglycemia is also rarely seen even in babies with no known risk factors. These babies may present only with sequelae in later childhood. **Methods:** This is a hospital-based observational, prospective study. We included 299 exclusively breastfed neonates who were shifted to mother's side with no congenital malformation or need for neonatal intensive care unit (NICU) admission. The neonates were studied in two groups: "At Risk" and "No Risk." The "At Risk" group included babies with known risk factors like low birth weight, late preterm (34–36 weeks), small for gestational age (birth weight <10th centile), infant of a diabetic mother, or large for gestational age (birth weight >90th centile). Hypoglycemia was the primary outcome measured independent of feeding time for both groups. For the "At Risk" group, monitoring was done at 0, 1, 2, 3, 4, 12, 24 plus 48 h. For the "Not At Risk" group, it was done at 12 and 24 h of life. The factors associated with both groups were studied as the secondary outcome. **Results and Conclusion:** Out of 299 exclusively breastfed neonates, 13% were hypoglycemic. 27.06% were hypoglycemic in the "At Risk" group. In the "At Risk" group, low birth weight and primiparity were significant risk factors. The incidence of hypoglycemia in the "No Risk" group was 1.80%. Breast problems and breastfeeding problems, low education status of mother, young age, and primiparity were significant risk factors in the "No Risk" group.

Keywords: Breast problems, breastfeeding problems, exclusively breastfed, hypoglycemia, no risk factors

Introduction

Exclusive breastfeeding in the first 6 months has been recommended by the World Health Organization (WHO) since 2001, and the advantages to the infant like providing the best nutrition, immune protection, growth regulation, and development are well known.^[1] Various factors may lead to inadequate breastfeeding especially in the early neonatal period,

and those babies may have metabolic complications, the most important being hypoglycemia.^[2]

Neonatal hypoglycemia affects as many as 5–15% of otherwise healthy babies.^[3] Although a majority of these neonates have risk factors, a small percentage of them do not have risk factors but still end up with hypoglycemic brain injury, especially in developing countries.^[4,5] This has long-term implications on the development and neurological outcome of babies.^[6,7] Hypoglycemic brain injuries are seen in 35% of babies with symptomatic hypoglycemia and in up to 20% of those with asymptomatic hypoglycemia.^[4] Hypoglycemic brain injury typically affects the parieto-occipital and frontal regions of the brain, leading to sequelae like epilepsy, cognitive problems, cerebral palsy, cortical visual impairment, and strabismus.^[7,8]

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The WHO rightly recommends that universal hypoglycemia screening is not required in healthy-term neonates.^[9] But due to the emerging evidence for hypoglycemia leading to neuro-developmental sequelae, even in this group, risk factors for hypoglycemia need to be reassessed.

This study was conducted in the early neonatal period to find out the incidence and factors associated with the development of hypoglycemia in exclusively breastfed babies in a normal postnatal ward with the aim to ensure the full benefits of exclusive breastfeeding and identify those babies at risk of hypoglycemia.

Methodology

A prospective, observational study was done during the period of June 2018 to June 2019 in the Department of Pediatrics, Bangalore Baptist Hospital, Bangalore. This is a busy tertiary care referral Hospital in urban Bangalore where a mixed population in terms of socioeconomic strata are admitted and many high-risk deliveries are conducted. Exclusive breastfeeding is promoted for all babies. The study included 299 healthy exclusively breastfed newborns in the ward who were shifted to the mothers side. Those with congenital anomalies or requiring admission in the neonatal intensive care unit were excluded from the study. All mothers received help and instruction for breastfeeding either by a trained nurse or lactation consultant. All babies were seen at least three times a day by the doctors. Written informed consent from parents/guardians and approval by the institutional ethical and scientific committee was obtained.

Study definitions

- 1) Hypoglycemia was defined as a blood glucose level <45 mg/dl.^[2,6]
- 2) Exclusive breastfeeding was defined as giving a baby no other food, drink or water, in addition to breastfeeding.^[10]
- 3) “At Risk” group was defined as babies with any one or more of the following risk factors – low birth weight babies (LBW), late preterm babies (34 weeks-36 week gestation being admitted in the ward), small for gestational age (birth weight <10th percentile for gestational age), large for gestational age (birth weight >90th percentile for gestational age), and infants of diabetic mothers.^[11]
- 4) “No risk” group consists of those babies with no known risk factors as mentioned above.
- 4) Breastfeeding problems (BFPs) were defined as: undersatisfaction or lack of confidence or worry in the mother, engorged breast even after a feed, severe pain felt by mother while feeding, frequent assistance required for holding correctly, poor attachment and poor feeding as observed by a pediatrician or lactation consultant or nurse, i.e. baby too sleepy, very irritable, or reluctant to latch. This also includes breastfeeding technique (position, comfort, audible swallowing, latch)^[12]
- 5) Breast problems – flat or inverted nipple, cracked nipple, or mastitis

Clinical assessment

Maternal factors such as age of the mother, weight, education, parity, pregnancy complications, mode of delivery, duration of delivery, time of first feeding, and frequency of breastfeeding were assessed.^[12] Neonatal factors such as time after birth, birthweight, gestational age, and sex were assessed.

Laboratory analysis

Blood glucose levels were measured by glucometer (FreeStyleOptium Neo H) as part of the routine hypoglycemia screening protocol of the hospital.^[13]

Blood glucose levels were routinely monitored for “At Risk” group babies using reagent strips and glucometer at 0, 1, 2, 3, 4, 12, 24 and 48 h of life, independent of feeding time using heel prick samples as per the protocol.^[6]

GRBS was done for the “No Risk” group at 12 and 24 h of life independent of feeding time for this study.

Statistical analysis

Case records of both “At Risk” babies and “No Risk” were studied, proforma was filled, and data analysis was subsequently done, using Microsoft Excel and SPSS software version 18. Chi-square test was used for categorical variables and a *P* value < 0.05 was considered statistically significant.

Result

A total of 299 babies were recruited during the period of 12 months from July 2018 to June 2019 [Table 1].

The babies at “At Risk” constituted 44.48% and “No Risk” constituted 55.52% of our study population. The total incidence of hypoglycemia was 13.04%.

In total, 27% of babies in the AT risk group developed hypoglycemia and 1.77% of babies in the No Risk group developed hypoglycemia.

No risk group

BFPs, breast problems, education of mother, primarity, and maternal age were found to be significantly associated with hypoglycemia in this group. In all three babies with hypoglycemia, mothers had significant latching problems due to breast problems [Table 2]. All these mothers had lower educational status. The younger age of mothers with a mean age of 21.67 ± 2.08 was significantly associated with hypoglycemia in this group [Table 3].

At risk group

LBW babies who were small for gestational age (SGA) contributed to 46.2% of babies with hypoglycemia. It was followed by infant of diabetic mother (IDM) with 30.7%. LBW was the most common cause of hypoglycemia, out of whom 38.3% had hypoglycemia (*P* < 0.031).

Table 1: Demographics of our population

Variables	Total newborns (n=299) n (%)
Gender	
Male	144 (48.16)
Female	155 (51.84)
Mode of delivery	
NVD/Instrumental	177 (59.2)
LSCS	122 (40.8)
Parity	
Primiparous	134 (44.8)
Multiparous	165 (55.2)
Obstetrics complications	
Gestational diabetes	44 (14.7)
Hypertension	17 (5.68)
Anemia	17 (5.68)
No complications	221 (73.9)
Breast problems	
Flat nipple	12 (4.1)
Inverted nipple	3 (1)
Cracked nipple	1 (0.003)
No breast anomalies	283 (94.65)
Breastfeeding problems	
Perception of inadequate feed	45 (15)
Latching	23 (7.6)
Holding	12 (4.01)
No problem	219 (73.24)
Education of mother	
High school/diploma	152 (50.83)
Graduation/Postgraduation	114 (38.2)
Professionals/Honors	19 (6.35)
Illiterate/Primary	14 (4.7)

Primiparity was significantly associated with hypoglycemia in both “AT RISK” and “NO RISK” groups. In the “At Risk” group, the incidence of hypoglycemia in babies born to primiparous mothers was 34.3%, where 66.6% of them were term and 33.3% were late preterm, whereas in babies born to multiparous mothers, it was 19% ($P < 0.048$) and all were term babies. In the “No Risk” group, the incidence of hypoglycemia in babies born to primiparous mothers was 4.68%, and none of the babies born to multiparous mothers had hypoglycemia ($P < 0.027$).

BFPs were seen in 32.3% of mother-baby dyad in the “At Risk” group and 21.7% in the “No Risk” group. Perception of inadequate feeding was the most common BFP. Hypoglycemia was seen in 35.7% of babies with latching difficulty in the “At risk” group and 37.5% in the “no Risk” group. All three babies who were hypoglycemic in the “No Risk” group had a latching problem, and it was a significant risk factor ($P < 0.001$).

Breast problems were seen in 4.5% of “At Risk” population and 6% of “No Risk” population. Flat nipple was the most common breast problem. In the “No Risk” group, breast problems were significantly associated with hypoglycemia. Among the three babies with hypoglycemia in this group, two mothers had inverted nipples and one had flat nipples ($P < 0.001$) [Table 4].

Table 2: Association between variables and hypoglycemia “No risk”

VARIABLES	Hypoglycemia		P
	Yes (n=3)	No (n=163)	
GENDER			
MALE	2 (2.5)	79 (97.5)	0.532
FEMALE	1 (1.17)	84 (98.8)	
FIRST DBF			
<1/2 HR	3 (5.8)	49 (94.2)	0.082
½-1 HR	0 (0)	64 (100)	
>1 HR	0 (0)	46 (100)	
NOT KNOWN	0 (0)	4 (100)	
GESTATIONAL AGE			
TERM	3 (1.8)	163 (98.2)	0.892
LATE PRETERM	NA	NA	
PARITY			
PRIMI	3 (4.7)	61 (95.3)	0.027
MULTI	0 (0)	102 (100)	
EDUCATION			
ILLITERATE/PRIMARY	3 (33.3)	6 (66.7)	<0.001
SCHOOL			
HIGH SCHOOL/DIPLOMA	0 (0)	85 (100)	
GRADUATION	0 (0)	63 (100)	
PROFESSIONAL/HONORS	0 (0)	9 (100)	
BREAST PROBLEMS			
INVERTED NIPPLE	2 (100)	0 (0)	<0.001
FLAT	1 (14.3)	6 (85.7)	
CRACK	0 (0)	1 (100)	
NIL	0 (0)	156 (100)	
BREASTFEEDING PROBLEM			
LATCHING	3 (2.9)	5 (62.5)	<0.001
HOLDING	0 (0)	9 (100)	
INADEQUATE FEED	0 (0)	19 (100)	
NIL	0 (0)	130 (100)	
MODE OF DELIVERY			
NVD	3 (2.9)	100 (97.1)	0.393
LSCS	0 (0)	54 (100)	
INSTRUMENTAL	0 (0)	9 (100)	

Discussion

The incidence of hypoglycemia among our study population in our study was 13.04%, which was lower when compared to other studies,^[14,15] and this was perhaps due to frequent monitoring and lactation counselling by trained counselors and by doctors.

Our study confirms that babies with known risk factors like LBW, SGA, IDM, etc., are at higher risk for hypoglycemia. LBW babies have the highest risk of hypoglycemia in the “At Risk” group ($P < 0.031$).

The incidence of hypoglycemia in the NO RISK group was only 1.8%. Problems with latching due to flat nipples or inverted nipples was a significant risk factor causing hypoglycemia in this group. In all three babies who developed hypoglycemia, there were latching problems. However, the level of general random blood sugar (GRBS) was above 25 mg% in all these babies and none of these babies were symptomatic. After

Table 3: Comparison of mean maternal age in babies with hypoglycemia

MOTHER AGE	Mean±SD	P
HYPOGLYCEMIA "AT RISK"		
NO	26.16±3.93	0.191
YES	25.25±3.66	
HYPOGLYCEMIA "NOT AT RISK"		
NO	26.09±3.89	0.050+
YES	21.67±2.08	

Table 4: Association between variables and hypoglycemia in the "at risk" group

VARIABLES	Hypoglycemia		P
	Yes (n=36)	No (n=97)	
GENDER			
MALE	22 (34.9)	41 (65.1)	0.053
FEMALE	14 (20)	56 (80)	
FIRST DBF			
<1/2 HR	11 (44)	14 (56)	0.214
½-1 HR	15 (23.1)	50 (76.9)	
>1 HR	9 (23.1)	30 (76.9)	
NOT KNOWN	1 (25)	3 (75)	
GESTATIONAL AGE			
TERM	28 (25)	84 (75)	0.215
LATE PRETERM	8 (38.1)	13 (61.9)	
BIRTH WEIGHT			
<2.5 KG	18 (38.3)	29 (61.7)	0.031
>2.5 KG	18 (20.9)	68 (79.1)	
PARITY			
PRIMI	24 (34.3)	46 (65.7)	0.048
MULTI	12 (19)	51 (81)	
EDUCATION			
ILLITERATE/PRIMARY SCHOOL	1 (20)	4 (80)	0.106
HIGH SCHOOL/DIPLOMA	23 (34.3)	44 (65.7)	
GRADUATION	8 (15.7)	43 (84.3)	
PROFESSIONAL/HONORS	4 (40)	6 (60)	
OBS RISK FACTORS			
DIABETIC	16 (36.4)	28 (63.6)	0.298
HTN	2 (28.6)	5 (71.4)	
ANEMIA	3 (33.3)	6 (66.7)	
NIL	15 (20.5)	58 (79.5)	
BREAST PROBLEMS			
INVERTED NIPPLE	1 (100)	0 (0)	0.243
FLAT	1 (20)	4 (80)	
CRACK	0 (0)	0 (0)	
NIL	34 (26.8)	93 (73.2)	
BREASTFEEDING PROBLEMS			
LATCHING	5 (35.7)	9 (64.3)	0.292
HOLDING	2 (66.7)	1 (33.3)	
INADEQUATE FEED	8 (30.8)	18 (69.2)	
NIL	21 (23.3)	69 (76.7)	
MODE OF DELIVERY			
NVD	16 (28.6)	40 (71.4)	0.921
LSCS	18 (26.5)	50 (73.5)	
INSTRUMENTAL	2 (22.22)	7 (77.8)	

breastfeeding, the level returned to normal and further readings did not show any subsequent hypoglycemia. Therefore, undue

fear and supplemental feeds should be strongly discouraged in this category. All these mothers were primi parous and had flat nipples or an inverted nipples. Though antenatal screening is the best way to overcome these problems, it may be missed. Thus, all mothers and mother-baby dyads should be examined for breast problems and BFP in a routine postnatal ward. In a systematic review, 24.5% of women reported that they experienced BFPs.^[16] These problems negatively affect breastfeeding and can also cause hypoglycemia in newborns as shown in our study. Sorting out these problems needs the expertise of a lactation consultant and or extra attention from the doctors or nurses. These issues need to be sorted out with much patience and care. If these problems are not picked up, hypoglycemia may even cause brain injury leading to neurological sequelae in this group.

Perception of inadequate feeding was the most common BFP among mothers. However, it was reassuring that this was not a risk factor for developing hypoglycemia in both groups. This reiterates the fact that the visible secretion is not always relatable to the amount and inadequacy of feed.

Hypoglycemia was found in babies of younger age group mothers with a mean age of 21.67 ± 2.08 compared to nonhypoglycemic babies who were from higher age group mothers with a mean of 26.09 ± 3.89.

A significantly higher incidence of hypoglycemia is seen in babies born to primiparous mothers in both At Risk and No risk groups. This is not a previously known risk factor. The reasons that can be postulated for this could be undetected breast problems, unfamiliarity with feeding, higher levels of anxiety, and experiencing pain and loss of sleep for the first time. Therefore, looking for breast problems, good pain management, addressing the physical and emotional needs of the mother, and making sure she gets rest and sleep in between feeds may help in preventing this. Primiparity should be considered as an additional risk factor for hypoglycemia in the neonatal period in both At risk and No risk groups.

A higher incidence of hypoglycemia was found in babies born to mothers who were illiterate or primary school level rather than in mothers who were educated. The probable cause could be the inability to understand the importance of breastfeeding and the complications of inadequate breastfeeding. This group of mothers is also more likely to follow age-old family traditions about avoiding nutritious food and drinking inadequate water, which may hamper milk production. Adequate counseling of these mothers using simple terms and in their known language and ensuring frequent feeding and proper technique should be done for these mothers. More videos should be made in local languages and made available to the family.

Conclusions

Neonatal hypoglycemia is commonly seen only in babies with risk factors. Hypoglycemia in babies with no risk factors is extremely and rare and not severe. Mothers having breast problems,

latching problems, primiparity, and younger age may predispose to hypoglycemia in this group. Nonthreatening screening for hypoglycemia should be carried out in this group while actively promoting breastfeeding. A decimal finding in a small population could be “tip of the iceberg” for a larger population as the magnitude increases significantly.

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Conflicts of interest

There are no conflicts of interest.

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References

1. Dieterich CM, Felice JP, O'sullivan E, Rasmussen KM. Breastfeeding and health outcomes for the mother-infant dyad. *Pediatr Clin North Am* 2013;60:31-48.
2. Chang RJ, Chou HC, Chang YH, Chen MH, Chen CY, Hsieh WS, *et al.* Weight loss percentage prediction of subsequent neonatal hyperbilirubinemia in exclusively breastfed neonates. *Pediatr neonatol* 2012;53:41-4.
3. Bhand SA, Sheikh F, Siyal AR, Nizamani MA, Saeed M. Neonatal hypoglycemia; presenting pattern and risk factors of neonatal hypoglycemia. *Professional Med J* 2014;21:745-9.
4. Williams AF. Hypoglycaemia of the newborn: A review. *Bull World Health Organ* 1997;75:261-90.
5. Lubchenco LO, Bard H. Incidence of hypoglycemia in newborn infants classified by birth weight and gestational age. *Pediatrics* 1971;47:831-8.
6. Bhat SR, Lewis P, David A, Liza SM. Dehydration and hypernatremia in breast-fed term healthy neonates. *Indian J Pediatr* 2006;73:39-41.
7. Samayam P, Ranganathan PK, Kotari UD, Balasundaram R. Study of asymptomatic hypoglycemia in full term exclusively breastfed neonates in first 48 hours of life. *J Cliniagn Res* 2015;9:sc07-10.
8. Tam EW, Haeusslein LA, Bonifacio SL, Glass HC, Rogers EE, Jeremy RJ, *et al.* Hypoglycemia is associated with increased risk for brain injury and adverse neurodevelopmental outcome in neonates at risk for encephalopathy. *J Pediatr* 2012;161:88-93.
9. Haninger NC, Farley CL. Screening for hypoglycemia in healthy term neonates: Effects on breastfeeding. *J Midwifery Women's Health*. 2001;46:292-301.
10. Gartner LM, Morton J, Lawrence RA, Naylor AJ, O'hare D, Schanler RJ, *et al.* Breastfeeding and the use of human milk. *Pediatrics* 2005;115:496-506.
11. Cloherty JP. *Manual of Neonatal Care*. Philadelphia: Wolters Kluwer Health/Lippincott Williams and Wilkins; 2012. p. 284-93.
12. Jensen D, Wallace S, Kelsay P. LATCH: A breastfeeding charting system and documentation tool. *J Obstet Gynecol Neonatal Nurs* 1994;23:27-32.
13. Tentolouris A. Accuracy and usability of glucose meters. *J Clin Diagn Res* 2018;12:oc10oc14. doi: 10.7860/jcdr/2018/34055.11671.
14. Fanconi A, Bovet U, Tschumi A, Litschgi M. Blood glucose in the full term neonate in the first hours following birth. *Helv Paediatr Acta* 1982;37:449-56.
15. Harrisd L, Westonp J, Harding JE. Incidence of neonatal hypoglycemia in babies identified at risk. *J Pediatr* 2012;161:787-91.
16. Cornblath MD, Hawdon JM, Williams AF, Aynsley-Green A, Ward-Platt MP, Schwartz R, *et al.* Controversies regarding definition of neonatalhypoglycaemia: Suggested operational thresholds. *Pediatrics* 2000;105:1141-5.