

Correlation between Mothers Breast Milk Sodium and Baby's Serum Sodium and Renal Functions across Seasons

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Abstract: Background: Breastmilk undoubtedly provides complete nutrition which is required for the healthy life of infant as well as mother. Breast - feeding with high sodium content milk may cause hypernatremic dehydration in neonates. The number of cases with hypernatremic dehydration tends to increase particularly in the summer. Objectives of the Study: a) To correlate sodium content of mother's breast milk with serum sodium urea and creatinine of exclusively breastfed neonates. b) To determine whether high breast milk sodium levels during summer months can cause hypernatremic dehydration in exclusively breastfed neonates. c) To compare the breastmilk sodium levels during summer and winter. Study Design: Prospective observational study. Study Participants: The data was collected from 128 Exclusively breastfed neonates and their mothers admitted to postnatal wards of teaching hospitals attached to MR medical college, kalaburagi. Results: We tried to correlate Breastmilk sodium with serum sodium, urea and creatinine of the baby during summer and winter months. Mean breastmilk sodium levels were higher ($P=0.001$) in summer 36.06 ± 8.66 than winter months 29.18 ± 9.5 . Mean serum sodium, urea and creatinine levels were higher ($P=0.001$) in summer which resulted in dehydration in 62% of neonates. Breast milk sodium levels were higher in primiparous mother compared to multiparous mothers ($P=0.001$). Conclusion: Within the constraints of the present study, it can be concluded that high sodium content in mother's breast milk during summer resulted in high serum sodium, urea and creatinine in the baby and also resulted in dehydration compared to winter months.

Keywords: Dehydration, Hypernatremia, lactation failure, primiparity.

1. Introduction

Breast milk provides all the essential nutrients, minerals and trace elements. The quantity of breast milk obtained by the neonate on the first day of life is <100ml which rapidly increases to 500ml/day [1]

Hypernatremia was previously thought to be unusual in breast - fed babies.

But since 1979 to 1989, there were reports of hypernatremic dehydration occurring in exclusively breastfed neonates [2, 3]. Since 1990's there has been an increase in the number of breastfed infants reported to have hypernatremia and hypernatremic dehydration. The condition carries an acute morbidity and mortality. Hypernatremia in all ages may occur in association with reduced fluid intake, excess fluid loss or excessive sodium intake.

Adequate breast milk intake depends on several interrelated stages:

Mammogenesis

Lactogenesis

Galactopoiesis

Effective milk removal, Effective maternal and infant breastfeeding techniques and Intact milk ejection reflex [4].

It is normal over the 1st week of life for the neonate to lose 7% of its birth weight through normal diuresis. Regain birth weight by the 10th day of life. Rapid weight loss or weight loss > 7% of birth weight [5].

High breast milk sodium was associated with primi parity, prematurity, cesarean section, nipple problems, lactation failure, lower level of maternal breastfeeding education, Summer months [6, 7]

Evans et al found that the volume of breastmilk transferred to infants born by C - sec was less compared to NVD by day 6, only 20% of infants in C - sec group had regained birth weight compared to 40% NVD born [8]

The electrolyte composition of breast milk was evaluated from 1st to 28 days of postpartum in a study by Koo and Gupta. The mean sodium concentration of breastmilk immediately after delivery was 64.8 ± 4.4 mEq/L. By postpartum day 3 it was 21.4 ± 2.3 mEq/L. By the end of 2 weeks it was 7 ± 2 mEq/L [9]. A gradual decrease in breastmilk sodium level is considered as an indicator of successful breastfeeding. Opposite is accepted to be true for unsuccessful breastfeeding [10].

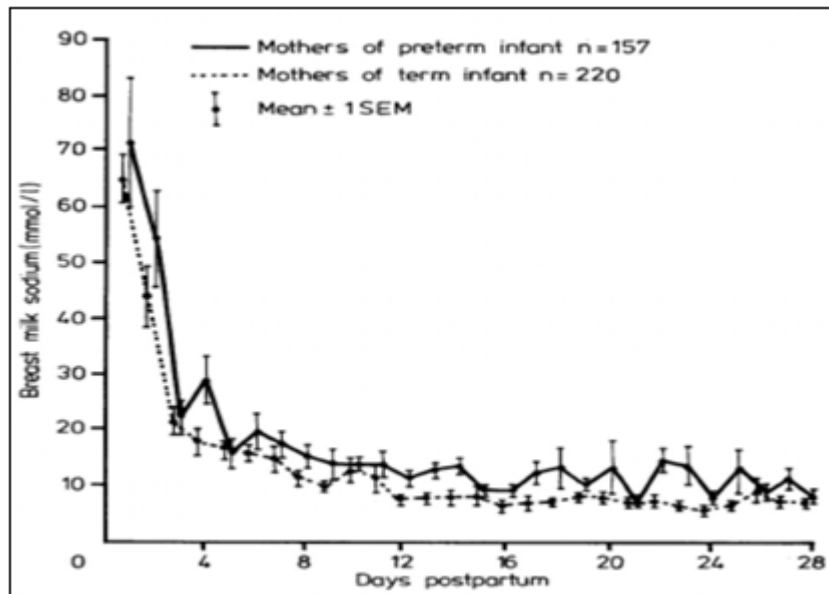


Figure 1: Postpartum changes in breast milk sodium⁴

This study was conducted to correlate the incidence of hypernatremic dehydration in term neonates which is classically associated with inadequate breast milk intake, particularly due to insufficient lactation and its association with summer and winter months of the year. The number of cases of hypernatremic dehydration tends to increase particularly during summer months because of high temperature, which can cause dehydration in both mother as well as infant [4, 11]

A prospective case control study done by **Orgun T L et al (2019) [12]** at Dr. BehcetUz Children disease and surgery training and research hospital, Turkey concluded that high breast milk sodium level was closely related to hypernatremic dehydration in neonates and being primiparous mother appeared as a significant risk factor for high breast milk sodium content.

A cross-sectional study done by **K. Babalala, Sarvi B J (2019) [13]** at tertiary care centre Aligarh, concluded that prevalence of hypernatremia in exclusively breastfed term asymptomatic neonates was 4.8% and was 7 times more common in early neonatal period in summer months and 6 times more common in babies born to primi mothers. There was a significant positive correlation of serum sodium with blood urea and creatinine levels.

2. Methods

This prospective observational study was conducted in neonatology unit of department of paediatrics at basaveshwara and sangameshwara tertiary care teaching hospitals attached to MR medical college from march 2021 to august 2022 after obtaining ethical clearance from Institutional ethical committee for human research. Written informed consent was taken from parents for participation in the study.

Term babies who were appropriate for gestational age and exclusively breastfed were included in the study. Babies

with IUGR, NICU admission and those who received IV fluids were excluded from the study.

128 newborns and their mothers were included in the study. Breastmilk sample was collected from postnatal mothers at 48hrs (day 3) and 72hrs (day 4) after delivery during summer months i. e, from March to may and winter months from October to December.

10 - 15 ml of breast milk was expressed manually and collected in a container and sent to laboratory.

Blood samples were collected from newborns at 48hrs (day 3) and 72hrs (day 4) after delivery during summer months i. e, from March to may and winter months from October to December. 2ml of blood sample was collected in plain vacutainer and sent to laboratory for estimation of Serum urea, creatinine and sodium were analysed.

3. Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. Results on continuous measurement are presented as Mean & SD and categorical as Frequency & percentage. Inferential statistics, like the Independent t test is applied to compare the values over a period of time within a group. $P < 0.05$ was considered statistically significant.

4. Results

Out of 128 newborns and mothers enrolled in the study 57% were from summer and 43% from winter. 33 (44.6%) babies were born by LSCS and 41 (55.4%) were via NVD in summer. 26 (48.1%), 28 (51.9%) babies were born via LSCS and NVD respectively in winter. The mean breast milk sodium during summer on day 3 and day 4 was 39.31 (9.46) and 32.82 (7.87) and during winter 33.18 (10.16) and 27.61 (9.16) on day 3 and day 4 respectively. Breastmilk sodium level was statistically higher in summer on day 3 ($P=0.001$) and 4 ($P=0.001$) compared to winter. Serum sodium levels

during summer on day3 and 4 were 147.36 (4.50) and 143.71 (4.98) and during winter 144.50 (5.58) and 140 (5.43) respectively. Sodium levels were statistically higher in summer on day 3 (0.002) day 4 (0.003) compared to winter.

Serum urea levels were statistically higher during summer on day 3 (P=0.002) and day 4 (P=0.003). Serum creatinine levels were statistically higher in summer on day 3 (0.038).

Statistically significant difference was observed for primigravida and multigravida mothers, breast milk sodium levels were higher In primigravida mothers compared to multigravida mothers on day 3 (P=0.001) and day 4 (P=0.001).

Statistically significant positive correlation was observed between breast milk sodium and serum sodium levels of baby. Summer (correlation coefficient 0.747 and P=0.001) and winter (correlation coefficient 0.527 and P= 0.001). i. e, as the breast milk sodium levels increased there was increase in serum sodium levels of the baby.

Statistically significant positive correlation was observed between breast milk sodium and serum urea levels of baby. Summer (correlation coefficient 0.704 and P=0.001) and winter (correlation coefficient 0.531 and P= 0.001). i. e, as the breast milk sodium levels increased there was increase in serum urea levels of the baby.

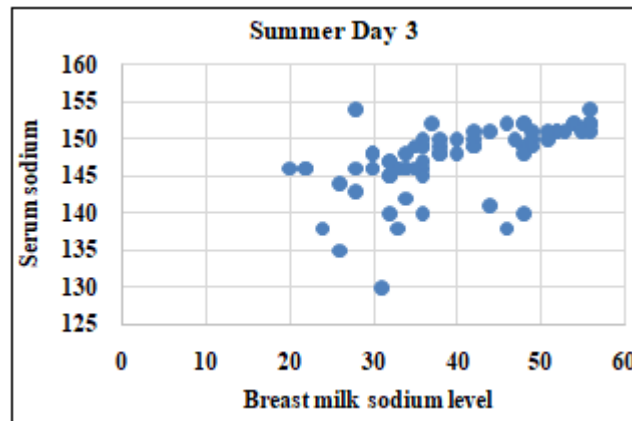
Statistically significant positive correlation was observed between breast milk sodium and serum creatinine levels of baby. Summer (correlation coefficient 0.769 and P=0.001) and winter (correlation coefficient 0.425 and P= 0.001). i. e, as the breast milk sodium levels increased there was increase in serum creatinine levels of the baby.

It was also found that breast milk sodium was significantly high in dehydrated group (P=0.001).

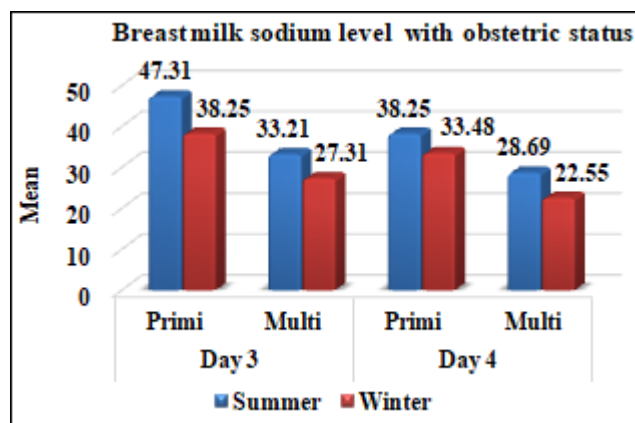
Table 1: Comparison of breast milk sodium and serum sodium levels in summer and winter

	Summer (Mean±SD)	Winter (Mean±SD)	P value
Day 3			
Breast milk sodium	39.31 (9.46)	33.18 (10.16)	0.001*
Serum sodium	147.36 (4.50)	144.50 (5.58)	0.002*
P value	0.001*	0.001*	
Day 4			
Breast milk sodium	32.82 (7.87)	27.61 (9.16)	0.001*
Serum sodium	143.71 (4.98)	140.87 (5.43)	0.003*
P value	0.001*	0.001*	

*statistically significant (p<0.05)



Graph 1: Breast milk sodium with serum sodium of baby Day 3



Graph 2: Breast milk sodium with Obstetric status

5. Discussion

Out of 128 newborns in the present study it was observed that 54.1% were male and 45.9% were female out of 74 neonates during summer and 50% male and 50% female out of 54 neonates in winter. In a study by Sandeep s [16] it was observed that 61.29% were male and 38.7% were female babies.

In the present study there was no significant difference observed with mode of delivery and breast milk sodium levels in both summer and winter months. Orgun T et al [12], Kadegaon B et al [13], Mathew V et al [14] also reported no statistically significant correlation between breast milk sodium and mode of delivery.

Statistically significant difference was observed with a p value of 0.001 with breast milk sodium level being higher in primigravida compared to multigravida during both during summer and winter months. Orgun T et al reported a statistically significant correlation between breast milk sodium and primiparity with a P<0.05. Kadegaon B et al also reported the prevalence of hypernatremia 6 times more common in primi mothers with a (p= 0.010)

Statistically significant difference was observed with a p value of 0.001 with breast milk sodium level being higher in summer compared to winter months of the year. Orgun T et al reported a mean breast milk concentration of 24.48 (20.54) mEq/L from post - partum day 2 - 14. Mujawar S et al [15] reported a mean breast milk sodium of 38.3 (mEq/L).

Mathew v et al reported a mean breast milk sodium levels of 38.5 and 22.2 (mEq/L) on day 3 and day 4.

Statistically significant difference was observed with a p value of 0.002 with serum sodium level being higher in summer compared to winter months of the year. Orgun T et al reported the mean serum sodium level of the all patients was found 153.19 (4.08) mEq/L. Kadegaon B et al reported a mean sodium levels of 156.6 (5.5) mEq/L. Sandeep S reported a mean sodium levels in summer to be 160mEq/L and 139.5mEq/L in winter months.

There was a significant correlation of urea and creatinine with breast milk sodium (P= 0.001). Kadegaon B et al reported that there was a significant correlation of serum sodium with urea and creatinine.

Statistically significant positive correlation was observed between breast milk sodium and serum sodium (P=0.001), urea (P= 0.001) and creatinine (P=0.001) levels of the baby. In summer it was severely correlated and in winter it was moderately correlated.

The present study there was a significant increase in breast milk sodium on day 3 and day 4 during summer months (March - may) and 62% of hypernatremic cases were during summer. Kadegaon B et al reported that majority (76.9%) of hypernatremic cases were seen during summer (May - Aug) that is 7 times more common during summer (P=0.017). Sandeep s reported that majority (61.7%) of the hypernatremic cases were seen during summer months. And also profound effect of temperature on sodium concentration and dehydration.

6. Conclusion

The study concludes that high sodium content in mothers breast milk during summer can lead to increased serum sodium, urea, and creatinine levels in the baby, resulting in dehydration. The study also found that breast milk sodium levels were significantly higher in primiparous mothers and in dehydrated groups.

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