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Do mothers with high sodium levels in their breast milk have high depression and anxiety scores?

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Abstract

Objective: This study aimed to assess the possible association of high breast milk sodium levels with postpartum depression and anxiety.

Methods: A total of 150 mothers and their healthy, exclusively breastfed newborns aged 8 to 15 days were recruited. Mothers were asked to complete scales for evaluation of postnatal depression and anxiety following an interview for consent and sociodemographic data collection. Breast milk samples were obtained to measure sodium and potassium (K) levels.

Results: Forty-nine mothers had higher than expected breast milk Na concentrations and a high Na/K ratio. These mothers scored significantly higher on the scales of postnatal depression and state anxiety ($P = 0.018$ and $P = 0.048$, respectively).

Conclusions: This study shows that compared to normal breast milk Na levels and Na/K ratio, high breast milk Na and high Na/K ratio, with possible serious consequences in infants, are associated with maternal depressive and anxious symptoms in the postpartum period.

Keywords

Postpartum anxiety, postpartum depression, breast milk, Na, Na/K ratio, hypernatremic dehydration, newborn, mammary gland permeability

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Introduction

Postnatal maternal psychiatric morbidities, such as postpartum depression, have major consequences for the woman, her child, and the family. Important caregiving activities, such as breastfeeding, sleep, adherence to well-child visit, and vaccine schedules, can be compromised in depressed mothers. Maternal depression also influences attachment and bonding of the newborn, and can affect the child's development, leading to cognitive, social, emotional, and behavioural problems that last into adolescence.[1]

Breastfeeding is one of the first relationships between the mother and newborn. Therefore, effects of postnatal depression on breastfeeding practices have received increasing interest in the last decade. Most of the research regarding this topic has focussed on the association of initiation and duration of breastfeeding with postpartum depression, providing evidence for adverse effects of postpartum depression on breastfeeding practices.[2,3] Besides continuity of breastfeeding, few studies have investigated any association between maternal depressive and anxious feelings and breast milk content in the postnatal period.[4,5] Following recognition of breastfeeding being associated with hypernatremia, a potential life-threatening condition for infants, the association of maternal adverse psychosocial characteristics and high breast milk Na concentrations has started to be examined.[6] Previous maternal psychiatric morbidity, postnatal state anxiety, the perception of having a poor relationship with their mother, and the belief of being unsuitable to be a mother have been suggested to be more common in women who had higher than expected Na concentrations in their breast milk compared with controls.[4] Additionally, Flores-Quijano et al. showed that high breast milk Na concentrations of exclusively breastfed mothers were associated with maternal feelings that their milk was insufficient for their newborns.[5] They indicated a marginally significant relationship between maternal depression and mammary gland permeability as shown by the Na/K ratio in breast milk. This ratio is expected to rapidly decrease, starting from postpartum day 3, and keep decreasing until the 6th month if breast feeding is continued. The Na/K ratio is an indicator of successful breastfeeding in the first postpartum week.[5,7]

Early detection of failure of breastfeeding in depressed and anxious mothers in the postpartum period may have clinical implications for the newborn's growth. Therefore, the present study aimed to investigate the association of breast milk Na levels and the Na/K ratio with postnatal depression and anxiety in a sample of mothers who exclusively breastfed their newborns.

Materials and methods

This study was approved by the Dokuz Eylul University Medical Sciences Research Ethics Committee. Informed written consents were obtained from all of the participants.

Patients

The sample consisted of mothers of 150 exclusively breastfed healthy newborns, who weighed 2500–4000 g at birth and were born at 38–42 weeks' gestation. The mothers were consecutively admitted to the well-baby unit of the Pediatrics Department of Dokuz Eylul University Faculty of Medicine and Tepecik State Hospital for routine monitoring at 8–15 days postpartum.

Mothers who were recruited had no breast problems, such as an engorged or wounded breast or mastitis, which account for failure of lactation. Exclusive breastfeeding was defined as mothers not offering anything, including water, other than breast milk.

Measures

Sociodemographic data regarding mothers and their newborns were collected by a semi-structured interview. Postnatal maternal anxiety and depression were assessed using the self-report State and Trait Anxiety Inventories (STAI-I and STAI-II) and the Edinburgh Postnatal Depression Scale (EPDS), respectively.[8,9] Higher scores indicated higher anxiety and depression levels depending on the instrument used. All three instruments have been shown to be valid and reliable for the Turkish population.[10,11] Additionally, mothers were also asked whether they had received any psychiatric treatment.

Breast milk sampling

A volume of 10 ml of milk was obtained by manual milking of either breast. Sodium levels are not affected by the mother's diet, the method that milk is obtained (manually or by electric pump), being collected from either breast, or being obtained prior or following breastfeeding.[12]

The milk sample was centrifuged at 3000 rpm for 10 minutes to separate the serum in which Na and K are present. Samples were stored at −20°C until analysis. Biochemical analysis of the breast milk samples was performed using a Cobas 6000 analyzer (Roche Diagnostics) via an indirect method with an ion selective electrode. Breast milk Na concentrations greater than 18 mmol/L and Na/K ratios greater than 1.0 were considered as high in accordance with relevant literature.[12,13,14]

Data analysis

Data were analysed using SPSS version 15 (SPSS Inc. 2006).[15] Descriptive statistics, including means, standard deviations, and percentages, were calculated for sociodemographic variables. Bivariate analyses were performed to assess the association between variables using Spearman's correlation. Chi-square and t-tests were used to evaluate the potential group differences for categorical and continuous variables, respectively. A P value < 0.05 was considered as significant.

Results

Mothers who participated in the study were aged between 17 and 41 years (mean age, 28.6 years; SD, 5.2). None of the mothers were taking any psychotropic medication or receiving any psychiatric treatment. Newborns were aged 8–15 days (mean, 10.4 days; SD, 2.5) with a birth weight of 2500–4000 g (mean, 3304.6 g; SD, 363.7). Additional sociodemographic data regarding mothers and newborns are shown in Table 1.

High Na levels (> 18 mmol/L) and a high Na/K ratio (> 1.0) were present in 49 (32.7%) of 150 milk samples. Newborns of mothers who had high breast milk Na levels and a high Na/K ratio were significantly more likely to be the first child of the family ($P = 0.021$ for Na, $P = 0.013$ for Na/K) (Table 1).

Mothers with high breast milk Na levels had significantly higher mean STAI-I scores than did mothers without high breast milk Na levels ($P = 0.048$). Mothers with high Na/K ratio also had higher STAI-I scores but this was not significant compared to mothers with normal Na/K ratio ($P = 0.063$). No significant difference in the STAI-II score was observed (Table 2).

Mean EPDS scores of mothers with high breast milk Na levels and a high Na/K ratio were significantly higher than those without high breast milk Na levels and without a high Na/K ratio ($P = 0.018$ for Na; $P = 0.047$ for Na/K) (Table 2). Correlation analysis showed a significant correlation between mean Na levels and the mean EPDS score ($r = 0.217$, $P = 0.008$).

Table 1. Group comparisons regarding maternal and newborn sociodemographic characteristics.

	Na levels > 18 mmol/L (N = 49)	Na levels < 18 mmol/L (N = 101)	p
Newborn characteristics			
Sex (N, %)			
Female	24 (31.6)	52 (68.4)	
Male	25 (33.8)	49 (66.2)	0.862 *
Birth order (N, %)			
First child of the family	36 (40.0)	54 (60.0)	
Second child or more	13 (21.7)	47 (78.3)	**0.021** *
Age, days (M, SD)	10.4 (2.5)	10.4 (2.6)	0.901 **
Gestational age, weeks (M, SD)	39.1 (0.9)	39.0 (0.9)	0.841 **
Birth weight, g (M, SD)	3274.5 (415.2)	3319.2 (337.2)	0.483 **
Maternal characteristics			
Maternal education (N, %)			
High school or less	35 (32.4)	73 (67.6)	
University/postgraduate	14 (33.3)	28 (66.7)	1.000*
Delivery status (N, %)			
Normal vaginal delivery	21 (30.9)	47 (69.1)	
Caesarean delivery	28 (34.1)	54 (65.9)	0.728 *
Age, y (M, SD)	28.4 (4.9)	28.4 (5.4)	0.786 **

Na: sodium. Bold values indicate statistical significance.
*Chi-square test. **t-test.

Table 2. Comparison of mothers' scores of the State and Trait Anxiety Inventories (STAI-I and II) and the Edinburgh Postpartum Depression Scale (EPDS).

	STAI-I	t	p	STAI-II	t	p	EPDS	t	p
Na levels < 18 mmol/L	31.6 ± 9.1	−1.993	**0.048**	40.5 ± 9.0	−1.462	0.146	7.2 ± 4.6	−2.397	**0.018**
Na levels > 18 mmol/L	34.8 ± 9.2			42.9 ± 10.1			9.3 ± 5.7		
Na/K < 1.0	31.7 ± 9.1	−1.876	0.063	40.6 ± 9.1	−1.368	0.173	7.3 ± 4.8	−2.005	**0.047**
Na/K > 1.0	34.7 ± 9.2			42.8 ± 9.9			9.1 ± 5.5		

Na: sodium, Na/K: sodium/potassium ratio, EPDS: Edinburgh Postpartum Depression Scale, STAI-I: State Anxiety Inventory, STAI-II: Trait Anxiety Inventory. Bold values indicate statistical significance.

Discussion

In this study, we aimed to investigate the associations of breast milk Na levels and the Na/K ratio with postnatal depression and anxiety. Although a direct causal relationship is controversial, we showed that high breast milk Na levels and the Na/K ratio were associated with high postnatal depression and anxiety scores.

There have been few studies regarding the association of postnatal maternal psychiatric morbidity and breast milk content. Flores-Quijano et al. compared breastfeeding practices in postnatally depressed and non-depressed mothers.[5] They suggested

that depressed women had a marginally high breast milk Na/K ratio in their breast milk. Additionally, they found that high EPDS scores were compatible with mothers not feeling confident about breastfeeding.[5] In our study, we compared mothers with high and expected levels of Na in their breast milk and found that mothers had significantly higher scores of postnatal depression when they had high breast milk Na levels. Furthermore, these mothers also had significantly higher state anxiety scores than those without high breast milk Na levels. Our results appear to support those by Flores-Quijano et al.'s indicating that postpartum depression has adverse effects on breast milk content and that state anxiety may be another psychiatric morbidity related to high Na levels in breast milk.

In our sample, nearly one third of the mothers had high Na levels in their breast milk, which is a similar finding to that by Flores-Quijano et al.[5] This finding also indicates that approximately one third of newborns may be feeding on breast milk with high Na levels. Blood Na concentrations > 150 mmol/L are a potentially lethal condition for neonates.[6]

A potential explanation for the physiopathology of this condition is as follows. Mothers who cannot hold their newborn on their breast long enough to allow proper ductal evacuation might have increased mammary gland permeability. This condition is thought to be related to incomplete closure of the close connections between mammary gland epithelial cells that have not been sufficiently evacuated, causing an increased passage of Na from plasma to milk.[4,5,13,14] This hypothesis still needs to be tested by further studies measuring the time spent at the breast.

Our study also showed that birth order (i.e., being the first child) may be another risk factor associated with high breast milk Na concentrations. This finding might be related to the breastfeeding experience, which has been suggested to affect successful lactation.[6,16]

There are several limitations to our study. These limitations include reporting bias because a lot of the data were based on maternal reports and questionnaires. Although several studies have suggested using the STAI and EPDS to determine anxiety and postpartum depression,[8,9,17,18] clinical assessment is necessary for diagnosis of postnatal depression and anxiety. Additionally, the data were obtained from a limited population. An extended epidemiological study that assesses the association between breast milk Na levels and maternal emotional factors is necessary.

Despite its limitations, to the best of our knowledge, our study is the first to assess the association of high levels of breastmilk Na, which is an indicator of lactation failure, with postnatal maternal anxiety and depressive scores of mothers of babies without hypernatremic dehydration. Further research is required to determine whether breast milk Na levels improve with psychiatric treatment of postnatal depression and anxiety. This could lead to other studies for implementation of breast milk Na measurements in clinical practice as a screening tool to detect adverse effects of postnatal depression and anxiety on feeding of newborns.

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Declaration of conflicting interest

The Authors declare that there is no conflict of interest.

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