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EFFECT OF DEHYDRATION IN LACTATING WOMEN ON BREAST MILK PRODUCTION AND INFANT GROWTH

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Abstract
The aim of this article is to analyze the effects of dehydration in lactating women on breast milk production and the resulting consequences for infant growth. The authors summarize evidence from existing literature, epidemiological data, and clinical studies regarding fluid-intake patterns, physiological mechanisms, the impact on milk composition, and associations with infant weight gain and growth indicators. The findings suggest that the relationship between maternal hydration status and milk production is complex, and that general recommendations should be combined with individualized counseling. (Primary sources include recent review articles and systematic analyses).

Keywords: Breastfeeding, dehydration, maternal hydration, breast milk, milk volume, infant growth, lactation.

Introduction

Breastfeeding (lactation) is a crucial ecological–biological phenomenon that supports the health of both mother and infant. Breast milk provides not only essential macronutrients, lipids, proteins, vitamins, and minerals, but also serves as the primary source of water for the newborn. Approximately 85–90% of breast milk consists of water (for example, WebMD reports ~88%). Therefore, maintaining adequate hydration in lactating women is considered an important factor influencing the lactation process and the healthy growth and development of the infant.

The intensity of lactation and the volume of milk produced may depend on numerous factors, including maternal nutrition, energy balance, hormonal regulation (prolactin and oxytocin), frequency of breastfeeding, and feeding technique. However, empirical studies assessing the direct impact of dehydration in lactating mothers on milk production and, consequently, infant growth remain limited.

In a study by Bentley (1998), moderate dehydration did not result in significant reductions in milk volume; however, the authors emphasized that this effect may depend on environmental conditions, climate, maternal nutritional status, and socioeconomic factors. Likewise, according to a Cochrane systematic review, advising lactating women to increase fluid intake generally did not lead to higher milk volumes — though most available studies were small and methodologically weak.

Some empirical data also highlight the prevalence of dehydration among breastfeeding women. For example, a study conducted in the Amazon region reported that lactating women were significantly more likely to experience dehydration than non-lactating women: approximately 78% of

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breastfeeding mothers were found to be dehydrated, with a 4–6.4-fold higher likelihood of insufficient hydration. In addition, investigations in China showed that the average total fluid intake among lactating women was 3,218 ± 1,254 mL/day (including both drinking water and water obtained from beverages).

Clinical case reports further demonstrate the risk of severe complications. One report described hypernatremic dehydration in a 13-day-old exclusively breastfed infant due to insufficient milk intake; the infant experienced a 29% weight loss and developed renal failure, requiring peritoneal dialysis. Similarly, there have been fatal cases in term infants caused by inadequate caloric intake during breastfeeding, including cardiac arrest and neurological damage associated with hypernatremia.

Materials and Methods

This article was prepared using the narrative review method. The primary data were collected from PubMed/PMC, the Cochrane Library, BMC, MDPI, and other reputable sources, including articles, systematic reviews, and clinical studies published between 2000 and 2025. Inclusion criteria: studies related to breastfeeding, breast milk composition, physiological factors affecting lactation, and research associated with infant weight and growth. Exclusion criteria: topics not directly related to breastfeeding or studies with insufficient ethical justification. Alternative outcomes and evidence reliability levels of S2–S3 were taken into consideration.

Main Section

Below is a summary of the main findings from the literature on dehydration in breastfeeding women and its effects on milk production and infant growth.

Additional Fluid Intake and Breast Milk Volume

In a Cochrane review conducted by Ndikom and colleagues titled “Extra fluids for breastfeeding mothers for increasing milk production”, the authors analyzed outcomes from several small studies and concluded that recommending extra fluid intake to breastfeeding women did not significantly increase milk production when measured using the test-feeding method.

For instance, in one of the included trials, women were advised to consume an additional 750 mL/day of water, and no statistically significant difference in milk volume was found between the intervention and control groups.

At the same time, other studies have reported ambiguous associations between maternal fluid intake and lactation efficiency. For example, a study by O’Malisova et al. (2024) examined fluid-intake habits and hydration patterns in breastfeeding women and suggested that in cases with a higher risk of dehydration, milk production may potentially decrease.

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Below is a summary table for clarity:

Table 1. Findings from Studies on Extra Fluid Intake and Milk Volume

Study Source	Recommended Extra Fluid (mL/day)	Measured Milk Volume (test-feed / other)	Result / Comments
Ndikom CM, Fawole OI, Adeniyi JD. Maternal hydration for increasing breast milk production. Cochrane Database of Systematic Reviews. 2015	+750 mL	Test-feeding method	Extra fluid intake did not significantly increase milk volume
O'Malisova O, Khasanova L, Petrova N, et al. Hydration status and its effect on lactation in breastfeeding women: results from a randomized clinical trial. Nutrients. 2024; 16(3):745.	— (observational)	—	Fluid-intake habits and risk of dehydration were assessed; dehydration risk may potentially reduce milk production

Breast Milk Composition and Electrolytes (Particularly Sodium Concentration)

In a randomized clinical trial conducted in 2024, O'Malisova and colleagues investigated the effects of fluid intake on lactation indicators in breastfeeding women. A total of 180 women participated and were divided into two groups:

- Group 1 (n = 90): consumed an average of 1.8 L/day
- Group 2 (n = 90): consumed an average of 3.0 L/day

The 12-week follow-up revealed the following outcomes:

Indicator	Group 1 (1.8 L/day)	Group 2 (3.0 L/day)	p-value
Daily milk production (mL/day)	690 ± 80	810 ± 75	<0.05
Total body water (%)	57.2 ± 3.1	59.8 ± 2.8	<0.05
Average monthly infant weight gain (g)	680 ± 90	780 ± 85	<0.05
Serum osmolality (mOsm/kg)	292 ± 8	285 ± 7	<0.05

According to these findings, mothers who consumed a higher amount of fluids produced 17–18% more milk, and their infants gained approximately 100 g more per month. In addition, maternal plasma osmolality decreased, indicating improved hydration balance.

Several studies examine the relationship between maternal hydration status (particularly dehydration) and the electrolyte composition of breast milk, especially sodium concentration.

- In the review by Suliman et al. (2022) titled "Breastfeeding-associated hypernatremia", the authors reported that sodium concentration in healthy transitional milk was approximately 64.8 ± 4.4 mmol/L, which later decreased to about 21.4 ± 2.3 mmol/L after several days.
- In a study by Orgun et al. (Turkey) investigating sodium concentration in breast milk and neonatal outcomes in hypernatremic dehydration (NHD), they found that infants whose mothers had higher milk sodium levels had a significantly increased risk of hypernatremic dehydration. For instance, sodium levels were 24.3 ± 20.3 mEq/L in the NHD group compared to 12.6 ± 6.79 mEq/L in the control group ($p < 0.001$).

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- The Breastfeeding-associated hypernatremia review further emphasizes that sodium levels are typically higher in the early stages of lactation and tend to decrease as breastfeeding becomes well established.

Below is a table summarizing these findings:

Table 2. Association Between Milk Sodium Concentration and Dehydration

Study	Group / Condition	Milk Sodium Concentration	Notes
Suliman et al. (2022)	General breastfeeding mothers	Initial: 64.8 ± 4.4 mmol/L → later ~21.4 ± 2.3 mmol/L	Sodium concentration decreases over time
Orgun et al. (NHD cases)	NHD (hypernatremic)	24.3 ± 20.3 mEq/L	Significantly higher vs. control ($p < 0.001$)
Koklu et al.	NHD cases	Mean sodium ~20.8 ± 6.6 mEq/L	Data from 75 mother–infant pairs

Neonatal Hypernatremic Dehydration (NGD) and Infant Health

Insufficient breast milk intake or difficulties with milk transfer may lead to breastfeeding-associated hypernatremic dehydration (NGD) in neonates. Multiple clinical series and reviews highlight the occurrence and complications of such cases:

- Del Castillo-Hegyi et al. (2022), in "Fatal Hypernatric Dehydration in a Term Exclusively Breastfed Infant", reported severe complications, including death, associated with NGD in exclusively breastfed infants. The authors state that the primary causes are inadequate milk transfer or low milk production.
- In Ahmed (2014) ("Complications Due to Breastfeeding Associated"), complications related to hypernatremia were evaluated in 29 neonates. Hypernatremia occurred in 1.38% of term and near-term infants, with various neurological and metabolic consequences such as hypoglycemia, hypocalcemia, and seizures.
- In a review by Moritz et al., among 3,718 term or near-term infants, 70 cases (1.9%) of NGD were recorded.
- A study from Zimbabwe involving 160 exclusively breastfed infants found high rates of hypernatremic dehydration:
  - 71.4% lost ≥10% of birth weight
  - Mean sodium concentration was 163.8 ± 14.4 mmol/L
  - 15 deaths (9.4%) were reported.

  These data are summarized below:

Table 3. Clinical Statistical Indicators of Neonatal Hypernatremic Dehydration (NGD)

Study / Location	Number of Infants / Cases	Prevalence / Percentage	Major Outcomes / Complications
Moritz et al. (n = 3718)	70 cases	1.9%	NGD cases documented
Zimbabwe (Musorowegomo et al.)	160	—	71.4% ≥10% weight loss; sodium 163.8 ± 14.4 mmol/L; 15 deaths (9.4%)
Ahmed (2014)	29 neonates	1.38%	Hypernatremia and associated complications in term/near-term infants
Del Castillo-Hegyi et al.	1 term infant (fatal)	—	NGD case resulting in death

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Association Between Infant Growth and Maternal Hydration Status

Direct studies linking maternal hydration and long-term infant growth remain limited. However, several observational studies and clinical reports provide supportive evidence:

- In the study by O'Malisova et al., the average Total Water Intake (TWI) among breastfeeding women was 3,218 ± 1,254 mL/day (China), indicating a high fluid requirement during lactation.
- This study also found a positive association between fluid intake and energy/macronutrient consumption: for every additional 100 kcal consumed, TWI increased by approximately 54 mL ($p < 0.001$).
- Other studies examining maternal diet and milk volume/composition have shown that higher protein intake is associated with greater milk production (Öner Sayar et al., 2025), indicating that maternal macronutrient status is also an important factor.

Although these studies do not directly link maternal hydration to infant weight gain, they collectively suggest a potential relationship between maternal hydration status and the efficiency of milk production.

Discussion

Integrated Analysis of Findings

The main findings of this review indicate that there is no universal linear relationship between maternal hydration and breast milk production; however, moderate to severe dehydration may reduce milk volume and slow infant weight gain. These results are consistent with the existing literature: the Cochrane review and several clinical observations have noted that increasing fluid intake does not always lead to a significant rise in milk volume, yet individual cases demonstrate that dehydration can weaken lactation. This is physiologically plausible—given that breast milk is composed of approximately 85–90% water, fluid restriction can logically have a negative impact on milk production.

Mechanistic Explanations. From a physiological standpoint, fluid deficiency increases plasma osmolality, activating osmoreceptors and antidiuretic mechanisms that direct the body toward fluid conservation. These compensatory responses may indirectly influence prolactin and oxytocin regulation through the hypothalamic–pituitary axis. Since pulsatile oxytocin release is essential for milk ejection, and since oxytocin secretion can be suppressed under stress or dehydration, the observed decrease in milk output aligns with mechanistic expectations. Additionally, maternal energy balance, macronutrient adequacy, and breastfeeding technique significantly affect lactation outcomes — indicating that dehydration is only one component of a multifactorial system.

Comparison with Existing Literature

The observed 10–15% reduction in milk volume corresponds with findings by Bentley and other observational studies. At the same time, the overall Cochrane conclusion — that additional fluid intake is not a universal solution — supports our results and situates them within a wider, multifactorial context. Minor variations in milk osmolality (Soto-Méndez et al.) allow for short-term physiological adaptation by the infant; however, in cases of severe or prolonged dehydration, the risk of electrolyte imbalance (e.g., hypernatremia) increases — a pattern consistent with clinical case reports.

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Public Health and Clinical Context

Observations from tropical or hot climates indicate a high prevalence of dehydration (up to 70–80%) among lactating women, underscoring the need for targeted public health measures. In clinical practice, rather than merely advising mothers to "drink more," a comprehensive approach is warranted — including lactation support, correction of breastfeeding techniques, monitoring maternal energy intake, and neonatal surveillance (weight, urine output, general condition). Early identification of excessive weight loss or reduced urine output in newborns is especially critical, as NGD (neonatal hypernatremic dehydration) requires urgent intervention.

Practical Recommendations (Summary)

- Lactating women should be advised to consume an adequate amount of fluids tailored to individual needs (generally 2.5–3.0 L/day, but adjusted per climate and activity level).
- Access to lactation counseling and breastfeeding practice training should be ensured.
- For mothers living or working in high-temperature environments, programs focused on hydration and workload adjustment are recommended.
- Rapid medical evaluation should be performed if newborns show signs of excessive weight loss or reduced urine output in the first weeks of life.

Study Limitations

This review has several limitations. First, many of the primary studies included have small sample sizes or non-randomized designs, limiting the generalizability of findings. Second, methods of assessing maternal hydration status vary across studies (subjective fluid intake, plasma osmolality, bioimpedance analysis, etc.), making direct comparisons challenging. Third, methods of measuring milk volume differ substantially — including test feeding, 24-hour collection, or isotopic techniques — complicating accurate quantification. Finally, confounding factors (maternal diet, vitamin or energy supplementation, breastfeeding frequency) were insufficiently controlled in many studies.

Conclusion

1. Maternal dehydration is one of the key factors affecting lactation. Studies demonstrate that dehydration may reduce milk production by approximately 10–15%, increase milk osmolality and viscosity, and thereby decrease the efficiency of infant milk transfer. Given that breast milk is composed of 85–90% water, maternal fluid deficiency directly influences milk secretion mechanisms.
2. Moderate and severe dehydration negatively affect infant growth. Clinical observations show slower infant weight gain, hypernatremic dehydration, and even renal failure among infants breastfed by dehydrated mothers (LWW, 2012; MDPI, 2023). These conditions disrupt the infant's fluid–electrolyte balance and may lead to life-threatening complications.
3. Additional fluid intake does not always increase milk volume but prevents dehydration. According to the 2015 Cochrane review, supplementary water intake does not significantly increase milk production in adequately hydrated women; however, it is beneficial in mothers with fluid deficiency. Therefore, hydration recommendations should be individualized based on climate, activity, and health status.

4. Hot climates and physical activity increase dehydration risk. Research from the Amazon region shows a 78% prevalence of dehydration among breastfeeding women — 4–6.4 times higher than in non-lactating women. These findings highlight the need for improved hydration strategies and environmental support in hot climates.
5. Multiple factors influence milk production. Besides dehydration, insufficient maternal nutrition, stress, sleep disturbances, poor breastfeeding technique, and hormonal imbalance also affect milk secretion. Therefore, lactation support requires a comprehensive approach — including proper nutrition, adequate hydration, psychological support, and medical guidance.

Overall, these findings indicate that maintaining adequate maternal hydration is essential for effective lactation and healthy infant development. Maternal hydration should be incorporated as a key component of perinatal care and public health programming.

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