

Urinary Iodine Excretion of Lactating Mothers Predicts the Iodine Content of Their Breast Milk

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Abstract

Background: Iodine is essential for normal growth, mental development and survival of infants. Bangladesh is an iodine deficient region. Breast milk is the only source of iodine for exclusively breast-fed infants. Routine measurement of breast milk iodine concentration is very difficult in our country due to some social and religious barriers. So, we designed this study in our population using urinary iodine as the indicator for assessing iodine status. **Objectives:** To assess the iodine status of lactating mothers and their breast-fed infants and to propose a method on how to predict the iodine concentration in breast milk. **Materials and Methods:** This observational analytical study was carried out in the department of Biochemistry, Bangabandhu Sheikh Mujib Medical University, Dhaka with active cooperation of Kumudini Women's Medical College Hospital, Mirzapur, Tangail involving fifty lactating mothers and their exclusively breast-fed infants. Early morning urine and breast milk samples were collected in dry and clean plastic container free from any chemical contamination. All statistical analyses were done by using SPSS (Statistical Programme for Social Science) 12 version software package for windows. **Results:** The median (range) urinary iodine concentration of lactating mothers and their breast-fed infants were 225.25 µg/L (61.50-530.00) and 225.75 µg/L (100.50-526.50). 9.6% (48) mothers had no biochemical iodine deficiency (UIE >100µg/L), only 4% (2) mothers had mild biochemical iodine deficiency (UIE 50-99µg/L). There was no biochemical deficiency of breast-fed infants. The median (range) breast-milk iodine concentration was 157 µg/L (54.50-431.50) which was more than three times of recommended minimum concentration (50 µg/L). Iodine in breast milk of lactating mothers positively correlated with their urinary iodine excretion ($P < 0.01$). Infant's urinary iodine positively correlated with iodine concentration in breast milk ($P < 0.01$) and also positively correlated with urinary iodine excretion of lactating mothers. **Conclusion:** Lactating mothers and their breast-fed infants in this study were found iodine sufficient. Urinary iodine concentration of lactating mothers predicts the iodine content of their breast milk.

Key words: Urinary iodine excretion (UIE), Breast milk iodine concentration.

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Introduction

Human infants are sensitive to maternal iodine nutrition during fetal development and later during breast feeding.¹ Iodine deficiency during post-partum period has the potential to affect neonatal neuropsychological development.² Breast milk

is the only source of iodine for the exclusively breast-fed neonates and infants. Bangladesh is an iodine deficient region³ and the government of Bangladesh, with assistance of UNICEF had initiated a universal salt iodination to provide iodized salt

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by the middle of 1994. Excessive iodine intake also causes hyperthyroidism, iodine induced hypothyroidism, autoimmune thyroid diseases.⁴⁻⁶ Despite the importance of iodine for infants health, there have been limited studies addressing iodine status of lactating mothers and their breast-fed infants, whether maternal iodine status reflects the iodine status of their breast-fed infants. Routine measurement of breast milk iodine concentration is very difficult in our country due to some social and religious barriers. So it is necessary to propose a method on how to predict the iodine content in breast milk. For these reasons, this study was designed and urinary iodine excretion (UIE) was used as the indicator for assessing iodine status.

Materials and Methods

This observational analytical study was carried out in the department of Biochemistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka with active cooperation of Kumudini Women's Medical College Hospital, Mirzapur, Tangail. Fifty lactating mothers and their exclusively breast-fed infants were included in this study. The age of the lactating mothers and their breast-fed infants were 20-40 years and 3-180 days and they had no known endocrine, renal, cardiovascular and liver diseases. All the subjects were informed in details about the nature and purpose of study and included in the study only when they had given their written consent. Early morning urine and breast milk samples were collected in dry and clean plastic container free from any chemical contamination. Temporarily these were kept in an ice box for preservation just after collection and during transportation and finally these were preserved in a -35°C freezer till the test was performed. Urinary iodine of lactating mothers and their breast-fed infants and breast-milk iodine were estimated by spectrophotometer based on the principle of Sandell-Clothoff reaction.⁷⁻⁹ All statistical analyses were done by using SPSS (Statistical Programme for Social Science) 12 version software package for windows. Urinary iodine and breast milk iodine level do not follow the normal distribution. So, Spearman's correlation coefficient test ('r' test) was done to see the correlation. The significance test was done at 95% confidence level.

Results

The mean age \pm SD (range) of lactating mothers was 24.92 ± 4.35 (20-36) years and their breast-fed infants were 78.22 ± 59.05 (5-180) days. The median (range) urinary iodine concentration of lactating mothers and their breast-fed infants were 225.25 $\mu\text{g/L}$ (61.50-530.00) and 225.75 $\mu\text{g/L}$ (100.50-526.500) respectively. The median (range) breast-milk iodine concentration was 157 $\mu\text{g/L}$ (54.50-431.50) (table I). Out of 50 lactating mothers, 48 (96%) mothers had no biochemical iodine deficiency (UIE $>100 \mu\text{g/L}$), only 2 (4%) had mild biochemical iodine deficiency (UIE 50-99 $\mu\text{g/L}$) (table II). There was no biochemical iodine deficiency of breast-fed infants (UIE $>100 \mu\text{g/L}$) (table III). Iodine in breast-milk of lactating mothers positively correlated with their urinary iodine excretion ($P < 0.01$) (Fig 1). Infant's urinary iodine positively correlated with iodine concentration in breast milk ($P < 0.01$) and also positively correlated with urinary iodine of lactating mothers ($P < 0.01$) (Fig 2, 3).

Table I: Median and ranges of breast milk iodine, urinary iodine of lactating mothers and urinary iodine of their breast-fed infants

Parameter	Median	Range
Breast milk iodine concentration ($\mu\text{g/L}$) (N=50)	157	54.50-431.50
Mothers urinary iodine concentration ($\mu\text{g/L}$) (N=50)	225.25	61.50-530.00
Infants urinary iodine concentration ($\mu\text{g/L}$) (N=50)	225.75	100.50-526.50

N= Number of subjects

Table II: Iodine status of lactating mothers using urinary iodine as the indicator

Iodine status	Number (N=50)	Percentage
Moderate to severe deficiency (Median Urinary iodine $<50 \mu\text{g/L}$)	0	0
Mild deficiency (Median Urinary iodine 50-99 $\mu\text{g/L}$)	2	4
Normal (Median Urinary iodine $\geq 100 \mu\text{g/L}$)	48	96

N= Number of subjects

Table III: Iodine status of breast-fed infants using urinary iodine as the indicator

Iodine status	Number (N=50)	Percentage
Deficiency (Median Urinary iodine <100 µg/L)	0	0
Normal (Median Urinary iodine ≥100 µg/L)	50	100

N= Number of subjects

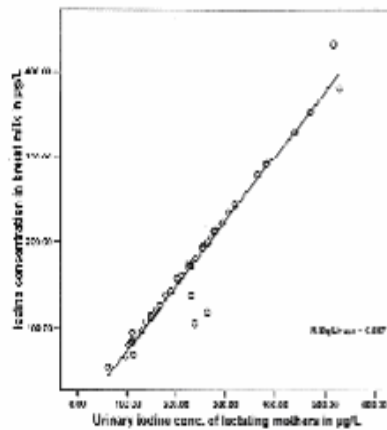


Fig 1. Correlation between urinary iodine and breast milk iodine of lactating mothers

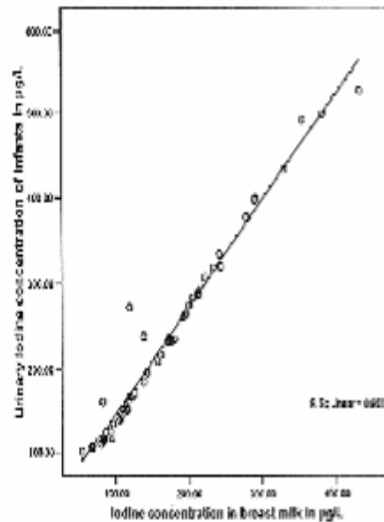


Fig 2. Correlation between infant's urinary iodine and breast milk iodine

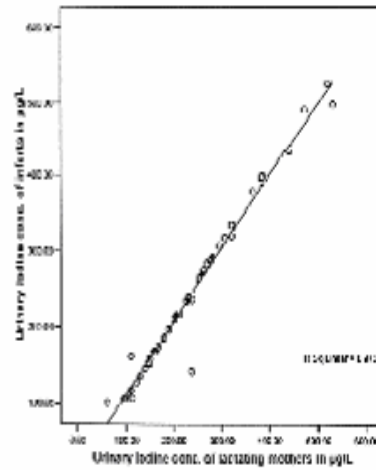


Fig 3. Correlation between urinary iodine of lactating mothers and their breast-fed infants

Discussion

This study was aimed to assess the iodine status of lactating mothers and their exclusively breast-fed infants, to evaluate whether maternal iodine status reflects the iodine status of their exclusively breast-fed infants and how to predict the iodine content of breast milk. Urinary iodine, breast milk iodine of fifty lactating mothers and urinary iodine of their breast-fed infants were measured. Median urinary iodine concentration of lactating mothers was 225.25 µg/L which was within normal range. Out of fifty lactating mothers, 48 (96%) mothers had no biochemical iodine deficiency. Only 2 (4%) mothers had mild biochemical iodine deficiency. According to the WHO, lactating mothers of this study were iodine sufficient.⁶ The median urinary iodine concentration of breast-fed infants was 225.75 µg/L which was normal. It indicates there was no biochemical iodine deficiency of breast-fed infants and they get sufficient iodine from their mother's milk. The median breast milk concentration was 157 µg/L which was within optimum range⁸, but more than three times of recommended minimum concentration.¹⁰ It was observed that two mothers had mild biochemical iodine deficiency but iodine concentration in breast milk of all lactating mothers was above the recommended minimum concentration. It may be due to ability of mammary glands to uptake iodine against electrochemical

gradient.¹¹ In this study, breast milk iodine concentration positively correlated with UIE of lactating mothers ($P<0.01$). It indicates UIE of lactating mothers predict the iodine content of their breast milk. This finding was consistent with the observation reported by Nelson et al.¹² and Pong paew et al.⁸ It was also observed that the lowest value of measured urinary iodine concentration of lactating mothers was 61.50 $\mu\text{g/L}$ and their corresponding breast milk iodine concentration was 54.50 $\mu\text{g/L}$ which was below the optimum concentration but just above the recommended minimum concentration. It indicates that lactating mothers of moderate to severe iodine deficiency is a risk for low iodine concentration in their breast milk. This observation was supported by the observation of Pong paew et al.⁸ In this study, infants' urinary iodine concentration positively correlated with iodine concentration in breast milk ($P<0.01$) and also positively correlated with maternal urinary iodine concentration. It indicates that maternal iodine status reflects the iodine status of their breast-fed infants. It may be concluded that lactating mothers and their breast-fed infants of this study were iodine sufficient. Urinary iodine excretion of lactating mothers predicts the iodine content of their breast-milk. Iodine status of exclusively breast-fed infants can be determined by the iodine status of their mothers.

References

1. Dorea JG. Iodine nutrition and breast feeding. *J Trace Elem Med Biol* 2002; 16(4): 207-220.
2. Chan SS, Hams G, Wiley V, Wilcken B, McElduff A. Postpartum maternal iodine status and the relationship to neonatal thyroid function. *Thyroid* 2003; 13(9): 873-876.
3. Yousuf HK, Quaz IS, Khan MR, Mohiduzzaman M, Nahar B, Rahman MM et al. Iodine deficiency disorders in Bangladesh. *Indian J Pediatr* 1997; 63(1): 105-110.
4. Nishiyama S, Mikeda T, Okada T, Nakamura K, Kotani T, Hishinuma A. Transient hypothyroidism or persistent hyperthyrotropinemia in neonates born to mothers with excessive iodine intake. *Thyroid* 2004; 14(12): 1077-1043.
5. Luberg P, Perderson B, Knudsen N, Ovesen L, Anderson S. Environmental iodine intake affects the type of nonmalignant thyroid diseases. *Thyroid* 2001; 11(5): 457.
6. WHO. Assessment of iodine deficiency disorders and monitoring their elimination. A guide for programme managers. 2nd edn. Geneva: WHO, 2001.
7. Dunn JT, Crutchfield HE, Gutekunst R, Dun D. Method for measuring iodine in urine. Netherlands: ICCIDD, 1993.
8. Pong paew P, Supawan V, Tungtrongchir R, Phonrat B, Vudhivai N, Chantarnnipepong Y et al. Urinary iodine excretion as a predictor of the iodine content of breast milk. *J Med Assoc Thai* 1999; 82(3): 284-289.
9. WHO. Progress toward the elimination of iodine deficiency disorders (IDDs). Geneva: WHO, 1999: 1-33.
10. Seibold-Weiger K, Wollmann H, Rendi J, Ranke M, Sper C. Iodine concentration in the breast milk of mothers of premature infants. *Geburtshilfe Neonatol* 2003; 203(2): 81-85.
11. Granner DK. Thyroid hormones. In: Murray RK, Granner DK, Mayes PA, Rodwell VW (eds). *Harper's Biochemistry*. 25th edn. London: Hall International (UK) Limited, 2000: 561-566.
12. Nelson M, Phillips DI, Morris JA, Wood T. Urinary iodine excretion correlates with milk iodine content in seven British town. *J Epidemiol Community health* 1998; 42(1): 72-75.