

## Maternal Iodine Status Reflects the Iodine Status of their Breast-Fed Infants

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### Abstract

**Background:** Bangladesh is an iodine deficient region and the government of Bangladesh, with assistance of UNICEF had initiated a universal salt iodination program to provide iodized salt by the middle of 1994. Breast milk is the only source of iodine for exclusively breast-fed infants. Iodine deficiency and iodine excess both have bad impact on infant's health. **Objectives:** To assess the iodine status of lactating mothers and their breast-fed infants and to evaluate whether maternal iodine status reflects the iodine status of their breast-fed infants. **Material 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 containers free from any chemical contamination. Urinary iodine was used as an indicator for assessing iodine status. All statistical analysis was done by using SPSS (Statistical Program 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 225.75µg/L (100.50-526.00). 96% (48) mothers had no biochemical iodine deficiency (UIE  $\geq$ 100µg/L), only 4% (2) mothers had mild biochemical iodine deficiency (UIE, 50-99µg/L). There was no biochemical iodine deficiency of breast-fed infants. The median breast-milk iodine concentration was 157µg/L which was more than three times of recommended minimum concentration (50µg/L). Iodine in breast milk of lactating mothers was positively correlated with their urinary iodine excretion ( $P < 0.01$ ). Infant's urinary iodine was positively correlated with iodine concentration in breast milk ( $P < 0.01$ ) and also positively correlated with urinary iodine of lactating mothers ( $P < 0.01$ ). **Conclusion:** Lactating mothers and their breast-fed infants in this study were iodine sufficient. Iodine status of exclusively breast-fed infants can be determined by the iodine status of their mothers.

### Key words

Urinary iodine excretion (UIE), Breast milk iodine concentration, Iodine status of lactating mothers, exclusively breast- fed infants.

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## Introduction

Human Infants are sensitive to maternal iodine nutrition during fetal development and later during breast feeding.<sup>1</sup> Iodine deficiency during post-partum period has the potential to affect neonatal neuro psycho intellectual development.<sup>2</sup> Breast milk is the only source of iodine for the exclusively breast-fed neonates and infants.

Bangladesh is an iodine deficient region<sup>3</sup> and the government of Bangladesh, with assistance of UNICEF had initiated a universal salt iodination program to provide iodized salt by the middle of 1994. Excessive iodine intake also causes hyperthyroidism, iodine induced hypothyroidism, autoimmune thyroid diseases.<sup>4-6</sup> Despite the importance of iodine for infants' health, there have been limited studies addressing iodine status of lactating mothers and their breast-fed infants, as to 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 barrier. 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 containers 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.<sup>7-9</sup> All statistical analyses was done by using SPSS (Statistical Program for Social Science) 12 version software package for windows. Urinary iodine and breast milk iodine level do not follow the normal distribution. Thus 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  $\pm$ 4.35 (20-36) years and their breast-fed infants were 78.22 $\pm$ 59.05 (5-180) days. The median (range) urinary iodine concentration of lactating mothers and their breast-fed infants were 225.25 $\mu$ g/L (61.50-530.00) and 225.75  $\mu$ g/L (100.50-526.500) respectively. The median (range) breast-milk iodine concentration was 157  $\mu$ g/L (54.50-431.50) (Table 1). Out of 50 lactating mothers, 48 (96%) mothers had no biochemical iodine deficiency (UIE $\geq$ 100  $\mu$ g/L), only 2 (4%) had mild biochemical iodine deficiency (UIE, 50-99  $\mu$ g/L) (Table 2).

There was no biochemical deficiency of breast-fed infants (UIE $\geq$ 100  $\mu$ g/L) (Table 3). Iodine in breast-milk of lactating mothers was positively correlated with their urinary iodine excretion (P<0.01) (Fig 1). Infant's urinary iodine was 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). Out of 50 breast-fed infants, 37 (74%) infants were taken breast-fed 10-12 times, 11 (22%) infants were taken more than 12 times and 2 (4%) were taken less than 10 times in 24 hours.

**Table 1: 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 ( $\mu$ g/L) (N=50)	157	54.00-431.50
Mother's urinary iodine concentration ( $\mu$ g/L) (N=50)	225.25	61.50-530.00
Infant's urinary iodine concentration ( $\mu$ g/L) (N=50)	225.75	100.50-526.50

N = Number of Subjects

**Table 2: 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 $\mu$ g/L)	0	0
Mild deficiency (Median urinary iodine 50-99 $\mu$ g/L)	2	4
Normal (Median urinary iodine > 100 $\mu$ g/L)	48	96

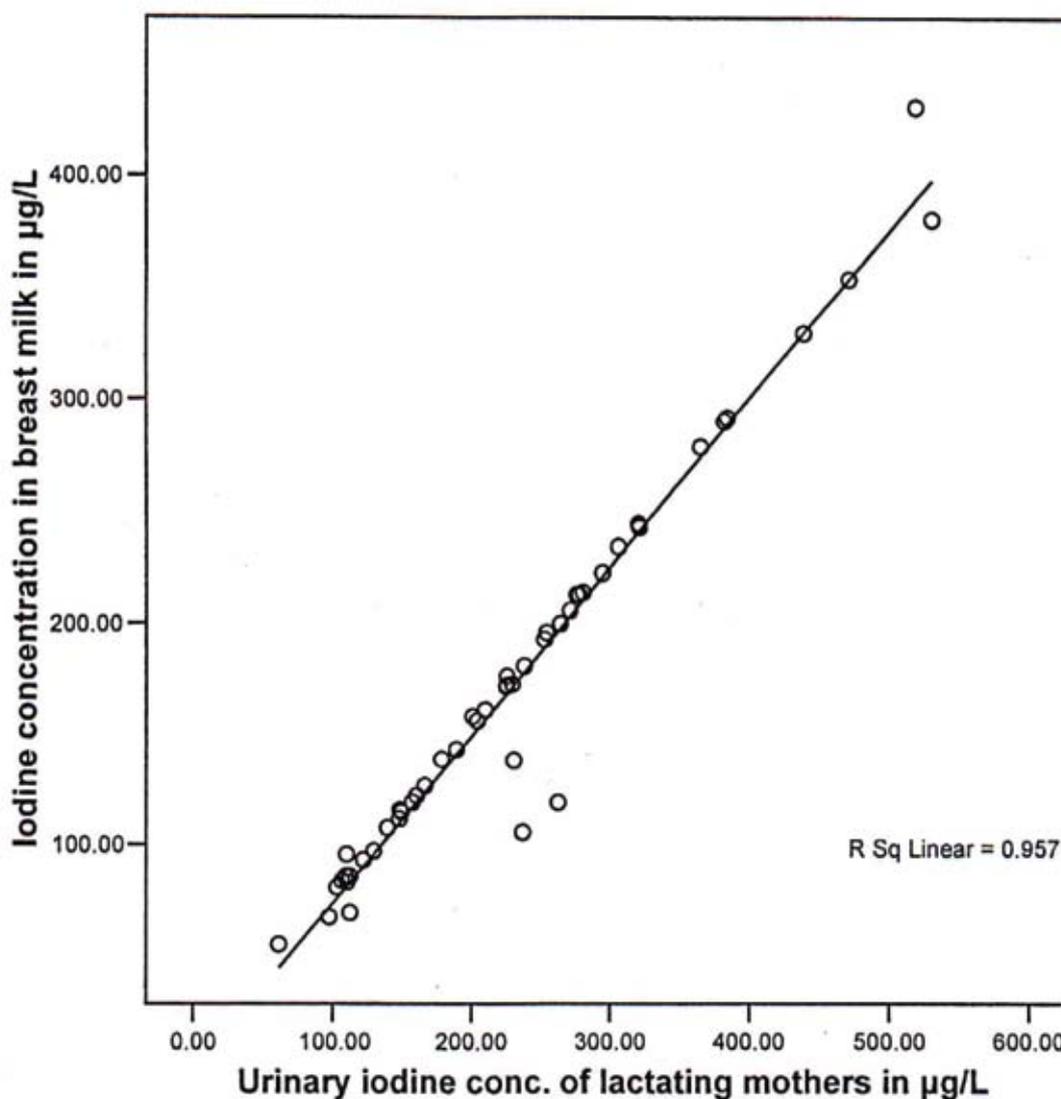
N = Number of Subjects

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**Table 3: 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.**

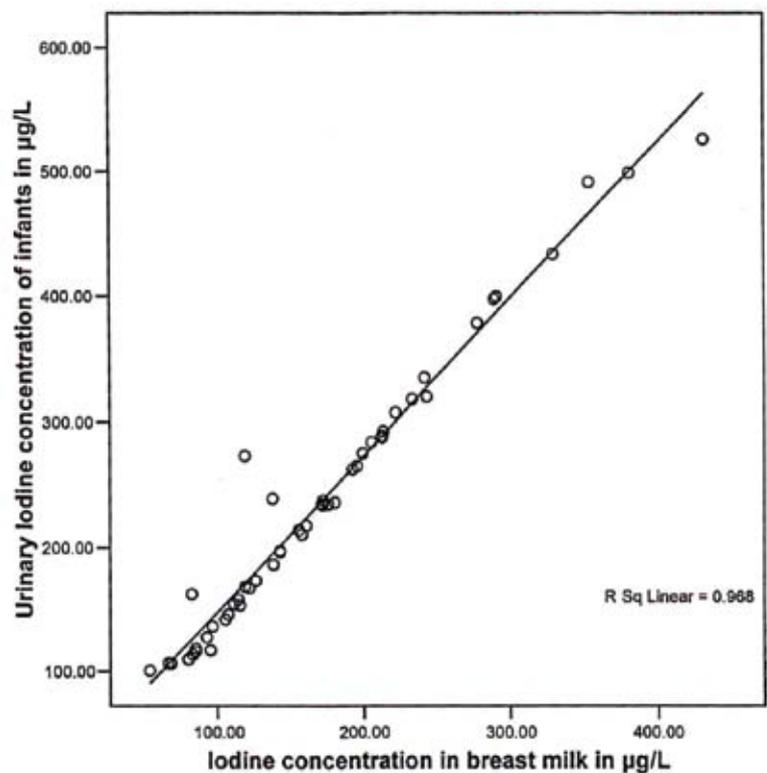


Fig 2: Correlation between infants urinary iodine and breast milk iodine

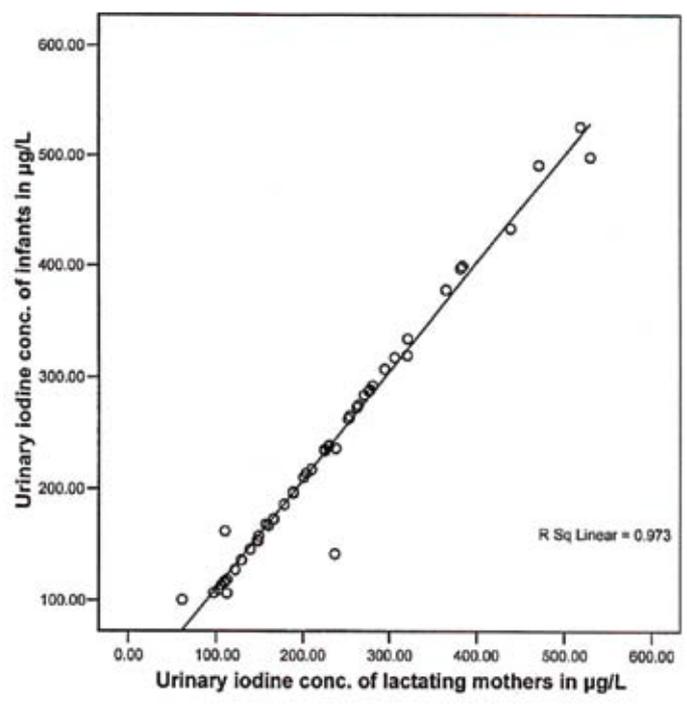


Fig 3: Correlation between urinary iodine of lactating mothers and their breast-fed infants.

## 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 225.25µg/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.<sup>6</sup> The median urinary iodine concentration of breast-fed infants was 225.75µg/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 157µg/L which was within optimum range<sup>8</sup>, but more than three times of recommended minimum concentration.<sup>10</sup> 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 mammary glands having the ability to uptake iodine against electrochemical gradient.<sup>11</sup> In this study, breast milk iodine concentration was 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.<sup>12</sup> and Pong paew et al.<sup>8</sup> It was also

observed that, the lowest value of measured urinary iodine concentration of lactating mothers was 61.50µg/L and their corresponding breast milk iodine concentration was 54.50µg/L which was below the optimum concentration but just above the recommended minimum concentration. It indicates lactating mothers of moderate to severe iodine deficiency are at risk for their breast milk to contain low iodine concentration. This observation was supported by the observation of Pong paew et al.<sup>8</sup> In this study, infants urinary iodine concentration was 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. Out of fifty breast-fed infants, 37 (74%) infants were taken breast-fed 10-12 times, 11 (22%) infants were taken more than 12 times, and only 2 (4%) infants were taken less than 10 times in 24 hours. So, apparently it is said that if breast milk iodine concentration is within normal range, 10-12 numbers of feeding in 24 hours for infants is enough to get sufficient iodine from their mother's milk.

## Conclusion

Lactating mothers and their breast-fed infants of this study were iodine sufficient. Iodine status of exclusively breast-fed infants can be determined by the iodine status of their mothers. Urinary iodine excretion of lactating mothers predicts the iodine content of their breast-milk. If iodine content of breast-milk is within normal range, 10-12 numbers of feeding in 24 hours for infants is enough to get sufficient iodine from their mother's milk.