Breast Milk Iodine Concentrations in Lactating Mothers at Queen Sirikit National Institute of Child Health

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Background: *In Thailand, Iodine Deficiency Disorder (IDD) has been one of the most serious nutritional problems for over 50 years, especially for infants and young children. Iodine is an essential component of thyroid hormones, which are necessary for brain and body development especially during the first 2 years of life. During the first 6 months of life, infants receive iodine exclusively from breast or formula milk. Several national programs have been implemented to eliminate IDD.*
Objective: *To evaluate breast milk iodine concentrations in lactating mothers.*
Material and Method: *100 lactating mothers from Lactation Clinic, Queen Sirikit National Institute of Child Health were included in this study from September 2011 to April 2012. Mothers completed questionnaires for analyzing demographic data and iodine intake. Samples of breast milk were collected to measure iodine content.*
Results: *The median value of breast milk iodine concentration was 129.7 mcg/L (IQR = 81.0, 205.7). Forty-two percent of the samples contained more than 150 mcg/L of iodine, which was in the range of sufficient iodine levels for infants. Factors relating to the iodine content in breast milk are baby's age, mother's age and mother's consumption of iodine fortified egg (p-value = 0.004, 0.035, 0.030, respectively).*
Conclusion: *Iodine is essential for pregnant and lactating women, as well as infants. For mothers, consumption of iodized salt, iodized fish sauce, and iodine fortified food can improve iodine status of mothers. For infants, initiating breastfeeding soon after birth and maintaining exclusive breastfeeding can help infants achieve optimal nutritional status.*

Keywords: *Breast milk, Iodine*

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Iodine deficiency disorders (IDD) is the world's leading cause of avoidable mental retardation and delayed growth in children[1]. Iodine is an essential component of thyroid hormones, which are necessary for brain and body development especially during the first 2 years of life[1]. Iodine deficiency during pregnancy and early childhood can impede brain development of the fetus and lower children's intelligence quotient (IQ) level. WHO, UNICEF, and ICCIDD (International Council for the Control of Iodine Deficiency Disorders) recommends daily iodine intake of 200 mcg for pregnant and lactating women[2].

During the first 6 months of life, infants receive iodine exclusively from breast or formula milk. In order to receive sufficient iodine among breastfed infants, the iodine content of breast milk should be 150-180 mcg/L[3,4]. Previous studies showed that the concentration of iodine in human milk is 20-50 times higher than that of plasma[4]. There are two major factors affecting iodine content of breast milk: 1) maternal factors, including stage of lactation and iodine supplements, and 2) environmental factors such as salt iodization.

In Thailand, IDD has been one of the most serious nutritional problems for over 50 years. Several national programs have been implemented to eliminate IDD, such as goiter control among schoolchildren and neonatal Thyroid Stimulating Hormones (TSH) screening program for congenital hypothyroidism. However, the "2009 External Review of the IDD Elimination Program in Thailand" report showed that about 60-70 percent of pregnant women had insufficient iodine and the use of iodized salt at the household level was below 60 percent[5]. As a result, the government implemented a new 5-year master plan

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(2006-2010) for IDD control. The 5-year master plan included 6 main strategies, which are: 1) quality iodized salt production and distribution, 2) monitoring and surveillance of iodine status, 3) empowerment of local administrative organizations, 4) communication and social marketing, 5) research, and 6) supporting strategies[6].

In line with the new 5-year master plan, the present study aims to evaluate breast milk iodine concentrations in lactating mothers after the implementation of universal salt iodization and iodine supplement during pregnancy strategies.

Material and Method

The present study was approved by the Ethics Committee of Queen Sirikit National Institute of Child Health (QSNICH). The study population included lactating mothers from the lactation clinic, QSNICH, from September 2011 to April 2012. The consent form was signed by participants before collecting breast milk and completing the questionnaires.

Participants were asked to complete the questionnaire to assess demographic data, perinatal history, and iodine intake using Food Frequency Questionnaire (FFQ). Approximately 10 ml of breast milk was collected in a plastic container and refrigerated. The breast milk iodine concentration was measured by using the spectrophotometer kinetic assay method[7]. Statistical analysis of the data was performed using SPSS version 20.0. Descriptive analysis and Independent Samples t-test were used. All tests were two-tailed and defined significance as p-value <0.05.

Results

One hundred lactating mothers aged from 16 to 44 years participated in the study. Demographic results showed that the mean age of all mothers was 30 years. About 60% of the mothers finished college or higher level education. 80% of the children were born full-term and 66% was the first child in the family. The children's age at the collecting date varied, with the median value being 31 days (IQR = 14.0, 71.0). The majority of the children received breast milk exclusively since birth (85%). Regarding iodine fortification, 90% of the mothers use iodized salt while 76% use iodized fish sauce. About 60% of the mothers consumed at least two iodized eggs per week and 23% consumed fish/seafood more than 2 times per week. However, only 18% and 7% of the mothers reported iodine supplements during pregnancy and lactation, respectively.

Breast milk evaluation showed that the median value of breast milk iodine concentration was 129.7 mcg/L (IQR = 81.0, 205.7). Table 1 shows the reference intervals for breast milk iodine concentration. 58% of the samples contained less than 150 mcg/L of iodine, which falls within the range of iodine insufficiency for infants.

Table 2 presents differences in the demographic data between groups of mothers with and without adequate breast milk iodine concentrations. Results showed that the child's age was associated with breast milk iodine concentration (p = 0.004). Normal breast milk iodine concentrations was seen in 56% of mothers with children less than 1 month old and 28% of mothers with children more than 1 month. Mothers who were less than 35 years old were more likely to have sufficient levels of breast milk iodine concentrations (p = 0.035). Normal breast milk concentration was seen in 48% of young mothers and 24% of older mothers. Furthermore, about half of the mothers who gave birth, both full-term and pre-term, had adequate amount of iodine in her breast milk. No statistically significant difference was found between breast milk iodine concentration and the mother's education, family's income, and the onset of breastfeeding.

Table 3 presents differences in the mother's iodine intake between groups of mothers with and without adequate breast milk iodine concentrations. Only the amount of iodine fortified eggs consumed per week was associated with a reduced risk of iodine insufficiency in breast milk (p = 0.011). Mothers who consumed more than one egg per week were 2.5 times more likely to have normal breast milk, iodine concentration. No statistical difference was found between breast milk, iodine concentrations and consumption of iodized salt, iodized fish sauce, fish/seafood, or iodine supplements during pregnancy and lactation.

Discussion

The values of breast milk iodine

Table 1. The reference intervals for breast milk iodine concentration (n = 100)

Breast milk iodine concentration (mcg/L)	Number	Percent
<150	58	58
150-200	17	17
>200	25	25

Table 2. Differences in demographic data between groups of mothers with or without adequate breast milk iodine concentration (n = 100)

Characteristics	Breast milk iodine concentration (mcg/L)		OR (95% CI)	*p*-value
	<150 (n = 58)	≥150 (n = 42)		
Mother's age (years)				
<35	39 (52%)	36 (48%)	0.34 (0.12- 0.95)	0.035
≥35	19 (76%)	6 (24%)		
Mother's education				
Below college level	19 (47.5%)	21 (52.5%)	0.49 (0.22-1.10)	0.063
Above college level	39 (65%)	21 (35%)		
Family's income (baht per month)				
≤30,000	29 (55.8%)	23 (44.2%)	0.83 (0.37-1.83)	0.395
>30,000	29 (60.4%)	19 (39.6%)		
First child				
Yes	37 (56.1%)	29 (43.9%)	0.79 (0.34-1.84)	0.371
No	21 (61.8%)	13 (38.2%)		
Child's age (month)				
<1	22 (44%)	28 (56%)	0.31 (0.13-0.70)	0.004
≥1	36 (72%)	14 (28%)		
Child				
Fullterm	47 (58.8%)	33 (41.2%)	1.17 (0.43-3.13)	0.477
Preterm	11 (55%)	9 (45%)		
Exclusive breastfeeding since birth				
Yes	47 (55.3%)	38 (44.7%)	0.45 (0.13-1.53)	0.154
No	11 (73.3%)	4 (26.7%)		

concentrations among mothers were inconsistent in this study. Even though the median value was slightly lower than the acceptable value of 150 mcg/L, approximately 42% of mothers had normal breast milk iodine concentration. Moreover, the results were significantly higher than the mean level of 51 mcg/L from a previous study in Khon Kaen province by Pongpaew et al[8]. The improvement of iodine status among lactating mothers between these two studies may be due to the implementation of the universal salt iodization and iodine supplementation for pregnant mothers in 2008.

In the present study, the majority of mothers used iodized salt and fish sauce as sources for iodine. Most hospitals provided iodine supplement at antenatal clinics during pregnancy and lactation, but mothers may not know about the supplement. Therefore, few mothers reported that they received iodine supplement during pregnancy.

Azizi and Smyth reviewed the iodine content of breast milk from various studies worldwide and found that only mothers in countries with salt iodization program had adequate amount of iodine in breast milk[4]. The findings of iodine insufficiency among some lactating mothers in this study was consistent with data from Nutrition Division of the Ministry of Public Health. The national survey in 2007 showed that 46.9% of pregnant women had urine iodine concentration less than 100 mcg/L or iodine insufficiency[5]. Moreover, a study in 2003 by Rajatanavin at Ramathibodi Hospital, Bangkok, found that 31% of neonates had cord blood TSH levels higher than 11.2 mIU/L, which was in the range of a moderate iodine deficiency[7].

Results from the present study showed that factors associated with a reduced risk of iodine insufficiency in breast milk included baby's age, mother's age and mother's consumption of iodine-fortified egg. It is clearly shown that colostrums and transitional milk had more iodine content than mature milk. The finding was consistent with previous studies that showed a significant decrease of iodine content in breast milk at day 60 and day 90[10,11]. Therefore, all infants should receive breastfeeding soon after birth in order to acquire colostrums and transitional milk.

Further studies should explore why young mothers are more likely to have normal breast milk iodine concentrations than older mothers do. Results from this study showed that only the amount of iodine-

Table 3. Differences in mother's iodine intake between groups of mothers with or without adequate breast milk iodine concentration (n = 100)

Characteristics	Breast milk iodine concentration (mcg/L)		OR (95% CI)	*p*-value
	<150 (n = 58)	≥150 (n = 42)		
Use of iodized salt				
Yes	52 (57.8%)	38 (42.2%)	0.91 (0.24-3.46)	0.585
No	6 (60%)	4 (40%)		
Use of iodized fish sauce				
Yes	43 (56.6%)	33 (43.4%)	0.78 (0.31-2.01)	0.394
No	15 (62.5%)	9 (37.5%)		
Fish/seafood consumption (times per week)				
<3	42 (54.5%)	35 (45.5%)	0.53 (0.19-1.42)	0.149
≥3	16 (69.6%)	7 (30.4%)		
Iodized egg consumption (eggs per week)				
<2	27 (71.1%)	11 (28.9%)	2.46 (1.04-5.80)	0.030
≥2	31 (50%)	31 (50%)		
Iodine supplement during pregnancy				
Yes	8 (44.4%)	10 (55.6%)	0.51 (0.18-1.43)	0.153
No	50 (61.0%)	32 (39.0%)		
Iodine supplement during lactation				
Yes	3 (42.9%)	4 (57.1%)	0.52 (0.11-2.45)	0.324
No	55 (59.1%)	38 (40.9%)		

fortified eggs consumed per week by mothers was positively associated with iodine content in breast milk. The finding suggests that pregnant and lactating women should consume iodine-fortified food other than iodized salt and fish sauce in order to receive sufficient amounts of iodine. Due to salt restriction among pregnant women, health personnel should advise the consumption of food containing iodine and continue iodine supplement for lactating mothers.

Conclusion

Iodine is essential for pregnant and lactating women, as well as infants. The implementation of universal salt iodization and iodine supplement for pregnant mothers improved iodine status of mothers. Health personnel should encourage pregnant and lactating mothers to consume iodized salt, iodized fish sauce, and iodine fortified food in addition to iodine supplement. For infants, initiating breastfeeding soon after birth and maintaining exclusive breastfeeding can help infants achieve optimal nutritional status.

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Potential conflicts of interest

None.

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ปริมาณสารไอโอดีนในน้ำนมแม่ที่มารับบริการที่คลินิกนมแม่ สถาบันสุขภาพเด็กแห่งชาติมหาราชินี

ธันยพร เมฆรุ่งจรัส, รัชดา เกษมทรัพย์

ภูมิหลัง: *โรคขาดสารไอโอดีนเป็นปัญหาทางโภชนาการที่สำคัญของประเทศไทยโดยเฉพาะในกลุ่มทารกและเด็กเล็ก สารไอโอดีนเป็นส่วนประกอบที่สำคัญของฮอร์โมนธัยรอยด์ซึ่งจำเป็นต่อการเจริญเติบโตของร่างกายและพัฒนาการของสมอง ทารกได้รับไอโอดีนส่วนใหญ่จากน้ำนม*

วัตถุประสงค์: *เพื่อศึกษาปริมาณสารไอโอดีนในน้ำนมของมารดาที่มารับบริการที่คลินิกนมแม่*

วัสดุและวิธีการ: *มารดาจำนวน 100 รายเข้าร่วมในการศึกษาโดยเก็บน้ำนมเพื่อตรวจหาสารไอโอดีนและตอบแบบสอบถามซึ่งประเมินการบริโภคสารไอโอดีนและข้อมูลส่วนตัว*

ผลการศึกษา: *ค่ามัธยฐานของสารไอโอดีนในน้ำนมแม่เท่ากับ 129.7 mcg/L (IQR = 81.0, 205.7) ร้อยละ 42 ของตัวอย่างน้ำนมมีสารไอโอดีนมากกว่า 150 mcg/L ซึ่งเพียงพอสำหรับทารก ปัจจัยที่พบว่ามีผลต่อปริมาณ สารไอโอดีนในน้ำนมแม่ คือ อายุของลูก อายุของแม่ และปริมาณไข่เสริมไอโอดีนที่แม่บริโภคต่อสัปดาห์ (p-value = 0.004, 0.035, 0.030 ตามลำดับ)*

สรุป: *สารไอโอดีนมีความสำคัญสำหรับหญิงตั้งครรภ์ หญิงให้นมบุตร และทารก นอกเหนือจากการได้รับยาเสริมไอโอดีน การบริโภคเกลือและน้ำปลาเสริมไอโอดีน และอาหารเสริมไอโอดีนในกลุ่มหญิงตั้งครรภ์และหญิงให้นมบุตร ช่วยป้องกันภาวะพร่องไอโอดีนสำหรับทารก การได้รับนมแม่ตั้งแต่แรกเกิดและได้รับอย่างต่อเนื่อง ช่วยให้ทารกได้รับสารอาหารอย่างครบถ้วน*