Original Article

Relation between third trimester urinary iodine concentrations and newborn thyrotrophic hormone

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Abstract

Background: The aim of the study was to evaluate the third trimester urinary iodine excretion and to assess its relation with newborns thyroid function. **Materials and Methods**: A total of 208 healthy third trimester pregnant women without previous history of thyroid disease were included in the study. Urinary iodine levels of mothers were measured and neonatal TSH levels were screened on the 3- 5th day following birth. **Results**: The median urinary iodine level in the mothers was 50µg/L. According to WHO criteria for iodine status:14.9%, 34.1% and 49.6% had severe, moderate and mild iodine deficiency, respectively, and only 1.4%, had the adequate iodine intake . In 6 neonate (2.8%) who their TSH level were between 5- 10 IU/ml, nobody had criteria for congenital hypothyroidism at recall visit (15th day). Our results showed the reverse relation between mean Neonatal TSH levels and mother's third trimester iodine level (r= -0.19, p=0.006). **Conclusion:** Although all of mothers included in this study stated that they were using iodized salt, iodine deficiency was frequent . There was also a significant relation between mean neonatal TSH levels and mother's third trimester iodine urinary level.

Keywords: Pregnancy, Iodine status, Newborn, Thyroid function

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Introduction

Adequate dietary iodine intake during pregnancy is essential to prevent adverse maternal and neonatal outcomes. Even, mild and moderate degrees of iodine deficiency (ID) during pregnancy and early childhood have been linked to reduced intellectual function (1- 3). During normal pregnancy, glumerular filtration rate (GFR) increases within the first month after conception with a peak in the end of the first trimester at approximately 40–50% above pre-pregnant levels (4). So, pregnancy-related increases in GFR could deplete total body iodine reserves in circumstances of borderline or overt iodine deficiency if dietary intake remains low. Recent publications on the consensus statement from the American Thyroid Association highlight the importance of higher dietary iodine intake in

pregnancy, and higher pregnancy-specific urinary iodine concentrations (UIC) reference ranges, to allow for these physiological changes .The recommendation is that a median UIC of 150–249 μg/liter might be expected in an iodine-sufficient pregnancy (5, 6). In recent years, there have been increasing concerns about pregnant and lactating women who do not receive enough iodine in the countries that have been iodine sufficiently for several decades (7-9). Mild ID is still common in western Europe (10), and the results of UIC in healthy newborns and their nursing mothers from an iodine-sufficient region of Iran showed that UIC < 150 was found in 79.1% of mothers (11).We report here the possible impact of maternal third trimester iodine status on offspring' thyroid function in healthy Iranian women.

Methods

Between July 2011 and July 2012, a total of 208 healthy third trimester pregnant women without previous history of thyroid disease were consecutively recruited when they attended a routine antenatal fallow up at urban healthy centers in Arak City, Central Province, Iran. The study was approved by the local ethics committee, and written informed consent was obtained from each of the participants. Gestational dates were confirmed by ultrasound in the first trimester. For this study, we specifically recruited women who were not taking iodine supplementation. A spot urine sample was collected to allow UIC measurement in cases of participation to the study. Casual urine samples were collected and kept frozen at −30º C until they were analyzed.

As part of the National Neonatal Screening Program, a heel-prick blood sample was taken between 72 and 120 h after birth from all infants. TSH level was measured by immune-radiometric assay (IRMA) (XitImmunotech, Belgium) in filter papering and UIC was measured by digestion method based on a modification of Sandell-Kolthoff reaction with intra-assay coefficients of variation (CV) of 1.2% and inter-assay CV of 2.2%).

Results

Although all of the mothers included in the study stated that they were using iodized salt, 14.9% were found to be sever iodine deficient. Median ioduria was 50μg/L. The repartition of the population according to WHO criteria during pregnancy for iodine status [12] has been shown in table 1.As shown in this table, 14.9% (n=31) with severe ID, had UIE<20 μg/L; in 34.1% (n=71) with moderate iodine deficiency, UIE was between 20 and 50μg/L; in 49.6% (n=103) with mild ID, UIE was between 50 and 99 μg/L; and 1.4% (n=3) with adequate iodine intake had UIE ≥100 μg/L. With a threshold of UIE at 150 μg/L,100% of pregnant women were considered as the iodine deficient.

The mean TSH levels of the neonates at screening visit have been shown in table 2. In 6 neonate (2.8%) who their TSH level were between 5-10 IU/ml, nobody had criteria for congenital hypothyroidism at recall visit (15th day). Our results showed that correlation between mean Neonatal TSH and mother's third trimester iodine level was significant (r= -0.19, p=0.006).

Analysis

Statistical Package for the Social Sciences (SPSS; Version 16.0) was used for statistical analyses. Kolmogorov-Smirnov test was used to determine normal distribution. Descriptive statistics were presented as mean±standard deviation (SD) for normally distributed data, and as counts and percentages for categorical data. The relationship between the categorical variables was examined using the Chi-square test. Student's t-test was used for the comparison of two groups with normally distributed variables, and the Mann-Whitney U-test was used for non- normally distributed data. Results were evaluated with a confidence interval of 95%, and $p<0.05$ was considered statistically significant.

Discussion

In the present study, the overall median of third trimester UIC values in pregnant women in Arak was 50 μg/L. These results indicate that the use of iodized

Table 1: Urinary iodine status of the mothers in relation to different neonatal TSH levels.

Mother's	Neonatal			
Iodine level	**TSH ≤ 1 IU/ml (%)**	**TSH=1.1- 2 IU/ml (%)**	**TSH> 2 IU/ml (%)**	**Sum (%)**
< 20 µg/L	12 (38.7)	6(19.4)	13(41.9)	31(100)
20-49.99 µg/L	25 (35.2)	22(31)	24(33.8)	71(100)
50-99.99 µg/L	55(53.4)	26(25.2)	22(21.4s)	103(100)
100-149 µg/L	2(66.7)	1(33.3)	0(0)	3 (100)
Sum	94(45.2)	55(26.4)	59(28.4)	208(100)

Table 2: Relation between mean Neonatal TSH and Mother's third trimester iodine level.

Mother's	Neonatal TSH			P value
Iodine level	**Minimum**	**Maximum**	**mean±SD**	
< 20 µg/L	0.1	5.9	1.76±1.36	0.006
20-49.99 µg/L	0.1	9.7	1.93±1.67	
50-99.99 µg/L	0.1	5.7	1.36±1.07	
100-149 µg/L	0.3	1.5	0.73±0.66	

salt during pregnancy did not meet their full iodine requirements. The iodine requirement increases in pregnant and nursing mothers and cannot be satisfied by using standard iodized salts. Despite the mandatory use of iodized salt in Iran from 1994, studies have shown that the rate of iodine deficiency continued to be significantly high in sensitive populations, such as pregnant and nursing mothers (11, 13). Several studies on the changes in UI excretion throughout gestation have been reported in the iodine-sufficient areas from Sweden (14), Switzerland (15) and Spain (16).

WHO -recommended criteria have been used to classify a population's severity of IDD based on the school-aged children, and the median UIC of 100–199 µg/liter indicates adequate iodine nutrition (17). For pregnant and lactating women, median UIC of 150–249 µg/liter indicates adequate iodine intake.

Iodine deficiency in the mother during the pregnancy causes severe iodine deficiency in the fetus (18,19). In present study, although, there were no cases of congenital hypothyroidism but significant inverse relationship between the level of neonatal TSH and mother's urinary iodine may indicate this effect. Unfortunately, In our study urinary iodine concentration was not measured in the newborns. This situation made it difficult to interpret the relation. Since the only source of iodine in newborns is from mother, we do not expect a high level of urinary iodine, furthermore; immature neonatal renal iodine excretion (20) and iodized antiseptics applied to mothers for cleansing the skin prior to delivery (21) could interfere with the measurement of real iodine status in newborns.

Another limitation of our study design was that mother's UIC was measured in once time. Because the UIC is affected by daily iodine intake (22-25), once time measuring do not necessarily represent of body iodine status.

Conclusion

In conclusion, iodine deficiency in pregnant mothers in Iran remains an important health problem.

Since, even mild and moderate degrees of iodine deficiency during pregnancy and early childhood have been linked to reduced intellectual function (1-3), it is reasonable that these deficiencies be monitored and corrected. The use of iodized salt during pregnancy appears to be insufficient in satisfying the iodine requirement. Recommending multivitamin tablets with iodine to pregnant women may provide a solution.

Conflicts of Interest

The authors declare that there is no conflict of interest in this study.

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