IODINE DEFICIENCY IN PREGNANT WOMEN LIVING IN WESTERN TURKEY (EDIRNE)

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Abstract

Objective. Data about iodine status in pregnant women in Turkey is not sufficient. We aimed to determine the iodine status, goiter prevalence, iodized salt consumption among first trimester pregnant women living in Edirne.

Design and setting. Cross-sectional study was performed on pregnant women living in Edirne.

Subjects and methods. A total of 275 pregnant women in their first trimester were examined regarding iodized salt use, median urinary iodine concentration (UIC), presence or absence of goitre and thyroid function. Goitre status was determined by palpation. Participants filled out a questionnaire, which included questions regarding sociodemographic features, iodized salt consumption, knowledge, and behavior regarding iodine deficiency. UIC was measured using colorimetric method based on Sandell-Kolthoff reaction. Thyroid hormones and TSH were measured by chemiluminescence immunoassays.

Results. While the proportion of iodized salt use was 96.6%, UIC was below 150 µg/L in 88.4 % of the women. The median UIC was 77 µg/L, indicating insufficient iodine intake. Total goitre rate was 19.3%.

Conclusions. Our study shows that iodine deficiency is a serious problem among pregnant women in Edirne. We suggest that pregnant women living in Edirne should be supplemented by iodine-containing preparations in addition to iodized salt.

Key words: iodine deficiency, pregnant women, thyroid function tests, Turkey.

deficiency disorders can be prevented by adequate iodine intake (2). According to previous studies, Turkey was known as a moderately iodine deficient country before mandatory iodination (3, 4). Later studies among school-age children (SAC) showed that iodine status improved to mild iodine deficiency. In a recent study, Erdogan *et al.* showed first sign of eradication of endemic goiter and the effectiveness of iodination of table salt among SAC in Turkey, after a decade of mandatory iodination (5).

Because of increased thyroid hormone production, increased renal iodine losses, and fetal iodine requirements in pregnancy, dietary iodine requirements are higher in pregnant women than in nonpregnant women (6). Many studies demonstrated the benefits of iodine supplementation during pregnancy in areas of severe iodine deficiency (1, 7). Recent studies showed that iodine deficiency is still a serious health problem among pregnant women after mandatory iodination in Turkey (8, 9). Recently, Kutlu AO *et al.* found median urinary iodine concentration (UIC) in pregnant women 80.5 µg/L, indicating insufficient iodine intake in the iodine-sufficient capital city of Turkey, Ankara. They concluded that iodine nutritional status among SAC does not reflect the iodine supply for pregnant women (9).

In this study, we aimed to determine the iodine status, goiter prevalence, iodized salt consumption among first trimester pregnant women living in Edirne.

INTRODUCTION

Iodine deficiency remains a major health problem for populations throughout the world. Consequences of iodine deficiency include endemic goiter, cretinism, decreased intellectual performance and IQ scores, growth retardation, hypothyroidism, increased pregnancy loss and infant mortality (1). All of these health consequences which are termed iodine

SUBJECTS

The studied population comprised healthy 1st trimester pregnant women who presented at the Family Health Centers (19 centers) in the city center of Edirne between July 2013 and January 2014. The study protocol was approved by the local ethics committee. All the patients read and signed the informed consent

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forms before enrolling in the study. Two hundred and seventy-five healthy pregnant women who applied at the Family Health Centers were randomly selected in the study group. Subjects with known thyroid pathologies or any other acute or chronic diseases at the time of the presentation and those using medicines that might affect thyroid hormone metabolism or iodine bioavailability including iodine-containing prenatal vitamins were excluded. Participants filled out a questionnaire, which included questions regarding sociodemographic features, iodized salt consumption, knowledge, and behavior regarding iodine deficiency. All subjects underwent a physical examination followed by a thyroid palpation by the same investigator (H.Ç). Patients were classified according to the WHO goiter classification system (grade 0: no goitre; grade 1: thyroid palpable but not visible; grade 2: thyroid visible with neck in normal position) (10).

Early-morning spot urine samples were collected in deiodized test tubes and immediately transported to the laboratory and stored in a lightproof box at -84°C until just before analysis. To identify the iodine content, spectrophotometric determination of urinary iodine by the Sandell-Kolthoff reaction was performed (11). A recent WHO/ICDIDD expert

group defined epidemiological criteria for assessing iodine nutrition based on the median or range in UIC of pregnant women. Based on these ranges, iodine intake was accepted as follows: insufficient, if UIC $<150\text{ }\mu\text{g/L}$; adequate, if between 150 and $249\text{ }\mu\text{g/L}$; more than adequate, if between 250 and $499\text{ }\mu\text{g/L}$; and excessive, if $500\text{ }\mu\text{g/L}$ (12).

Blood samples were obtained during their routine antenatal visit to determine total triiodothyronine (T3), total thyroxine (T4), free T3 (FT3), free T4 (FT4) and TSH. They were measured by chemiluminescence immunoassays using Architect i2000SR analyzer (Abbott).

The data was statistically analyzed with SPSS 15.0 package program. Statistical analysis was performed using parametric (Chi-square test and Student's t-tests) tests. To determine the correlation between variables, Pearson correlation analysis was performed. Values for $p < 0.05$ were accepted as statistically significant.

RESULTS

A total of 275 first trimester pregnant women aged between 17 and 41 years were enrolled for this study. Demographic features of subjects were shown in Table 1. The mean of residence duration was 173 ± 140.9 months and mean gestational age of the pregnant women was found as 9.83 ± 2.17 weeks.

None of our patients was diagnosed as having clinical overt hyperthyroidism, subclinical thyrotoxicosis was diagnosed in 7 (2.54%) patients. Overt hypothyroidism was not detected, while subclinical hypothyroidism was diagnosed in 20 (7.27%) patients. Laboratory results of the subjects were shown in Table 2.

Goitre was detected in 53 (19.3%) of 275 women by palpation according to the WHO classification. Of the women with goitre, 41 (14.9%) were defined as grade 1 and 12 (4.4%) as grade 2.

The median UIC was $77\text{ }\mu\text{g/L}$ (min-max 10-605 $\mu\text{g/L}$). UIC was below $150\text{ }\mu\text{g/L}$ in 243 (88.4%) pregnant women indicating insufficient iodine intake. Distribution of UIC in the study group was shown in Table 3.

When queried, 99.6% of the women said that they used iodized salt. When asked how they stored the iodized salt, 74 (26.9%) of the patients stored it in the packages the salt was bought in, 198 (72%) used closed bowls, 3 (1.1%) used open bowls. Of the subjects, 192 (69.8%) added iodized salt to dishes while they were

Table 1. Demographic features of pregnant women in the study group

Variables	n	%
Education level		
Non-literate	14	5.1
Primary school	55	20
Secondary school	58	21.1
High school	73	26.5
University	75	27.3
Occupation		
Housewife	188	68.4
Others	87	31.6
Income level(\$/month)		
<500	61	22.2
500-1000	123	44.7
1000-1500	57	20.7
>1500	34	12.4
Smoking history		
Present	36	13.1
Absent	239	86.9
Number of pregnancy		
1	108	39.3
2-4	156	56.7
>5	11	4
Number of abortions		
0	224	81.5
1-2	47	17
>3	4	1.5

Table 2. Laboratory results of pregnant women in the study group

Variables	Mean±SD	Min-max	Reference range
Age (Years)	27.29±5.17	17-41	
BMI(kg/m ²)	24.74±4.36	14.8-37.5	
Total T3(ng/mL)	1.26±0.22	0.65-2.01	0.58-1.59
Total T4(µg/mL)	8.23±1.8	5.05-12.84	4.87-11.72
Free T3(pg/mL)	2.94±0.28	2.32-4.07	1.71-3.71
Free T4(ng/dL)	1.0±0.11	0.7-1.46	0.7-1.48
TSH(mU/L)	1.22±0.88	0.008-9.86	0.35-4.94
In pregnant women with subclinical hypothyroidism			
Total T3(ng/mL)	1.23±0.14	1.03-1.51	
Total T4(µg/mL)	7.49±1.25	5.37-10.17	
Free T3(pg/mL)	2.89±0.22	2.37-3.13	
Free T4(ng/dL)	0.93±0.07	0.72-1.06	
TSH(mU/L)	3.18±1.59	2.53-9.86	
In pregnant women with subclinical hyperthyroidism			
Total T3(ng/mL)	1.32±0.26	0.98-1.73	
Total T4(µg/mL)	10.05±1.83	6.85-12.48	
Free T3(pg/mL)	3.18±0.49	2.71-4.07	
Free T4(ng/dL)	1.22±0.14	1.01-1.46	
TSH(mU/L)	0.06±0.02	0.008-0.09	

Table 3. Distribution of urinary iodine concentration (UIC) in the study group

Referance range for the median UIC	Iodine intake based on the median UIC	Number of pregnant women	%
<150 µg/L	Insufficient	243	88.4
150-249 µg/L	Adequate	27	9.8
>250 µg/L	More than adequate	5	1.8

cooking, 13 (4.7%) added it before they begin cooking, 55 (20%) added iodized salt after cooking into the stewpot, 15 (5.5%) added it onto their plates while they are eating. Only forty-six (16.7%) of women reported that they had heard about iodine deficiency and its consequences.

In the correlation analysis, there was no correlation found between UIC and age, BMI, thyroid function tests, abortion rate, using iodized salt and goitre status.

DISCUSSION

According to the results of previous monitoring studies on the basis of UIC in SAC, Edirne has become an iodine sufficient area after mandatory iodization of salt. Median UIC increased from 78 µg/L to 120 µg/L among SAC (13). Recent studies showed that iodine deficiency is still a serious health problem among pregnant women after mandatory iodination in Turkey (8, 9). In our study, we found median UIC of first trimester pregnant women 77 µg/L. Our result demonstrated that 88.4 % of these pregnant women were iodine deficient and 19.3% had goitre.

Dietary iodine intake is required for thyroid

hormone production. Changes in metabolism and physiology during pregnancy increase the maternal iodine requirement. Both maternal and fetal hypothyroidism can result from severe iodine deficiency in pregnancy (12). Severe iodine deficiency is related with poor obstetric outcomes including spontaneous abortion, prematurity and stillbirth. It is associated with adverse effects on the fetus including congenital anomalies, decreased intelligence, neurologic cretinism (14). Haddow *et al.* (15) assessed 7 to 9-year old children of women with mild second-trimester TSH elevations and found that IQ scores averaged 7 points lower than children of matched euthyroid women. Several studies have shown deficient iodine status in pregnant women in many other countries including Australia, China, Pakistan, USA and many European countries (16). According to the previous studies, iodine deficiency in pregnant women is a significant problem in Turkey. Kurtoglu S. *et al.* reported that median UIC in mothers in the first week after delivery was 30.2 µg/L indicating severe iodine deficiency in Kayseri (17). In a 2008 report performed in Malatya, Eğri *et al.* (8) found that median UIC was 77.4 µg/L and 72.3% of the pregnant women were found to have UIC<100 µg/L. Iodized salt consumption rate was only 42.6% among pregnant

women. Kut A *et al.* (18) investigated iodine status, iodized consumption rate, and goiter prevalence in first trimester pregnant women 8 year after the mandatory iodination. Even though the rate for iodized salt use among the pregnant women was 95%, the median UIC of pregnant women was found 149.7 µg/L and total goiter prevalence was found 24.8%. Çetinkaya K *et al.* (19) reported that iodine deficiency rate higher in the first trimester when fetal neurodevelopment is most affected. The median UIC values of first trimester pregnant women was 126 µg/L. Kutlu AO *et al.* (9) found that median UIC was 80.5 µg/L in second trimester pregnant women in the iodine sufficient capital city of Turkey. While the proportion of iodized salt use was 80.2%, UIC was below 150 µg/L in 72.8% of the women. Total goitre rate was found as 15.4%. These studies confirm that iodine deficiency continues to be a major problem after mandatory iodination in Turkey.

From 1994 to 2002, the iodized salt consumption rate increased from 57% to 80% in Edirne (13). According to WHO recommendations, the iodized salt consumption rate of a population should be at least 90% (12). In the present study, 99.6% of the pregnant women said that they used iodized salt. In spite of the high rate of iodized salt consumption, the median UIC was low according to WHO/UNICEF/ICCIDD recommendation. Most likely, this is closely related to our patients' knowledge, attitudes, and behavior toward the production, storage and usage. Rana R *et al.* reported that loss of iodine from iodized salt depends upon type of cooking method and time of addition of salt during cooking (20). Wang *et al.* (21) showed that loss of iodine was greater when salt was stored in plastic bag than in glass bottle. The loss was greater in fortified salt stored at 37°C and under 76% humidity than in that at 20-25°C and under lower humidity. They claimed that iodized salt loses 2% to 63% of its iodine content when salt is used before or during cooking. In our study, 25.5% of pregnant women added iodized salt properly after cooking into the stew pot or their plate. Furthermore, only forty-six (16.7%) of women reported that they had heard about iodine deficiency and its consequences. Therefore, we consider that pregnant women in Edirne should receive iodine supplementation in addition to the use of iodized salt and they should be informed about iodized salt consumption, storage and usage.

In prospective studies, the prevalence of undiagnosed subclinical hypothyroidism in pregnant women ranges from 3% to 15%. Subclinical hypothyroidism is associated with multiple adverse

outcomes in the mother and fetus, including spontaneous abortion, pre-eclampsia, gestational hypertension, gestational diabetes, preterm delivery, and decreased IQ in the offspring (23). Subclinical hyperthyroidism during pregnancy has few clinical consequences and usually no treatment is required. In our study, subclinical thyrotoxicosis was diagnosed in 7 (2.54%) patients and subclinical hypothyroidism was diagnosed in 20 (7.27%) patients. The increased prevalence of thyroid dysfunction in pregnancy and the need for proper management to reduce obstetrical and neonatal adverse events led the American Thyroid Association (ATA) and the Endocrine Society (ES) to release specific guidelines (24, 25).

Currently the American Thyroid Association recommends a supplement of 150 mcg iodine/day during pregnancy and lactation in addition to the use of iodized salt (22). Most multivitamin/mineral products that are marketed as prenatal supplements do not contain iodine. Now iodine tablets are available in Turkey but it is not reimbursed from Ministry of Health. We suggest that The Ministry of Health should provide iodine supplementation to pregnant women as a part of the IDD control programme especially in iodine insufficient areas.

We did not analyse iodine content of salt samples used at home. It is first potential limitation factor of this study. The second limitation factor is lack of ultrasonography data of the pregnant women.

In conclusion, our study shows that iodine deficiency is a serious health problem among pregnant women after mandatory iodination in Edirne. These data also confirm that iodine nutritional status among SAC does not reflect the iodine supply of pregnant women in the same region. Pregnant women in Edirne should be supplemented by iodine-containing preparations in addition to iodized salt.

Conflict of interest

The authors declare no conflicts of interest that could be perceived as prejudicing the impartiality of the research reported.

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