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Iodine deficiency in pregnant women in eastern Turkey (Malatya Province): 7 years after the introduction of mandatory table salt iodization

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Abstract

Objective: The aim of the present study was to evaluate the urinary I excretion of pregnant women in Malatya Province, eastern Turkey.
Design and setting: A cross-sectional study was performed on pregnant women in urban and rural settlements of Malatya Province.
Subjects: Urinary I excretion was measured for 824 pregnant women who were randomly selected using a probability-proportional-to-size sampling methodology.
Results: Median urinary I concentration (UIC) of pregnant women was 77·4 μg/l. The percentage of pregnant women with UIC below 100 μg/l was 83·3.
Conclusion: These results indicate that I deficiency disorders (IDD) is still a problem in Malatya Province and most certainly in other parts of the country. Proper monitoring of I content of the salt sold or used in the area, in order to strengthen the IDD intervention programme, is suggested.

Keywords
Urinary iodine
Iodine deficiency
Pregnant women
Turkey

I deficiency and related disorders are still important public health concerns affecting more than 130 countries and 2·2 billion people[1]. Children born in I-deficient areas are at risk of neurological disorders and mental retardation because of the combined effects of maternal, fetal and neonatal hypothyroxinaemia[2]. Thyroid hormones act by regulating the metabolic pattern of most cells of the organism and I is required for their synthesis. They also play a determining part in the process of early growth and development of most organs, especially of the brain, which occurs in man during fetal and early postnatal life. Thus, I deficiency, if severe enough to affect thyroid hormone synthesis during this critical period, will result in brain damage during fetal development as a result of maternal hypothyroidism[3,4]. I-deficient communities have been found to score 10–15 points lower in intelligence quotient tests than people in I-replete areas[1].

I deficiency disorders (IDD) can be prevented by ensuring adequate I intake, and this is the primary objective of the current worldwide drive to eliminate IDD[5]. According to the dietary allowances for I, as endorsed by the International Council for Control of Iodine Deficiency Disorders (ICCIDD) and WHO, the ideal I intake should be 150 μg/d for normal adults and 200 μg/d for pregnant and lactating women[6,7].

Turkey is known as an area with mild to moderate I deficiency according to previous epidemiological studies[8,9]. Total goitre prevalence found in Turkey was as high as 30·5%, and that of visible goitre 6·7%, in a survey completed in 1987[10]. In a survey conducted in 1997 in twenty cities of Turkey by measuring sonographic thyroid volumes and urinary iodine concentrations (UIC), goitre prevalence was found to be 31·8% (between 5% and 56%) and UIC was found to be less than 100 μg/l in all cities. In a more recent survey among schoolchildren in Malatya Province, median UIC was 78 μg/l, indicating mild I deficiency[11].

Iodization of table salt is the most effective way to correct I deficiency[12]. In Turkey, iodization of table salt was initiated in 1968 on a voluntary basis and then legal regulation was made targeting mandatory table salt iodization in 1998. Since 1998, all table salt has to be iodized legally; however, iodization of salt for the food industry is not enforced[13]. Evaluation of the effects of mandatory table salt iodization has not been performed in Malatya Province since 1998. Assessing UIC is one of the recommended methods to evaluate the status of I nutrition of the population. In the present study, by measuring UIC, we aimed to evaluate I nutrition status in pregnant women living in Malatya, which was defined as a mildly endemic goitrous area before the beginning of the mandatory salt iodization programme.

Material and methods

Subjects

The studied population comprised pregnant women who were residents of Malatya Province. Malatya is a province

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located in eastern Turkey with a population of 853 658. A stratified probability-proportional-to-size sampling methodology was used to select the study sample. Malatya Province was divided into two strata: urban and rural. Settlements without a municipality and all villages were recruited as rural area. A cumulative list of the settlements' (separately in urban and rural areas) populations was created and thirty clusters were selected by systematic sampling from a random start in each stratum. The target sample size of 900 pregnant women was allocated to urban and rural areas as 70 % and 30 %, respectively. Completion of the first trimester of pregnancy was determined as selection criterion. A total of 824 pregnant women were involved the study, reaching a coverage rate of 91·6 %.

Questionnaire

Selected pregnant women were either visited at their home by a researcher accompanied by a midwife in rural areas or invited to a health centre in urban areas. After verbal informed consent was obtained, all pregnant women were administered a face-to-face questionnaire. The first section of the questionnaire inquired about demographic data, in which respondents provided descriptive background information, while the second section of the questionnaire was related to pre-existing thyroid diseases, consumption of iodized *v.* non-iodized salt at home, special diets, intake of medicines (in particular, multivitamins or minerals) and exposure to contrast media or other I-containing pharmaceuticals.

Clinical assessment

A clinical neck examination was performed by the same investigator (C.E.) and goitre was ascertained and classified according to the criteria recommended by WHO/UNICEF/ICCIDD (grade 0 = no goitre; grade 1 = thyroid palpable but not visible; grade 2 = thyroid visible with neck in normal position). When in doubt, the immediate lower grade was recorded. The results were recorded in a pre-designed questionnaire. The sum of grades 1 and 2 provided the overall goitre frequency (or prevalence) in the study population[14].

Urinary iodine concentration

Casual urine samples were obtained from pregnant women in the morning into a 40 ml plastic urine sample container labelled with their identification code. Samples were placed immediately into polyethylene tubes with tight lids. The samples were immediately transported to the laboratory where they were stored in a deep freezer until just before analysis. The Sandell–Kolthoff manual acid digestion method was used to determine I concentrations[15].

WHO/ICCIDD recommends that the median UIC for a population should be >100 μg/l. Mild I deficiency is defined as UIC = 50–99 μg/l; moderate I deficiency as UIC = 20–49 μg/l; and severe I deficiency as UIC < 20 μg/l. Not more than 20 % of samples from a population should have median UIC below 50 μg/l[14–16].

Statistical analyses

Urinary I data were analysed using the Statistical Package for the Social Sciences statistical software package version 9·0 (SPSS Inc., Chicago, IL, USA). UIC was not normally distributed, and therefore the median was used as the measure of central tendency. Data are presented as median with interquartile range in the table.

Kruskal–Wallis and Mann–Whitney *U* tests were performed to detect significant differences in UIC according to residence, age, trimester, goitre status and fertility characteristics of the pregnant women.

Results

The sample population comprised 824 pregnant women aged between 15 and 44 years (mean: 26·5 (SD 5·6) years), of whom 580 resided in urban (70·4 %) and 244 resided in rural areas (29·6 %).

Goitre was detected in 201 (24·4 %) of 824 pregnant women by palpation, according to the WHO classification. Of the goitrous women, 146 (17·7 %) were defined as grade 1 and fifty-five (6·7 %) as grade 2.

During the inquiry, only 351 (42·6 %) pregnant women declared that they had been using iodized salt at home. Overall, 72·3 % of the pregnant women were found to have UIC < 100 μg/l. The median UIC level was 77·4 μg/l. Of the subjects, 137 (16·7 %) had UIC above 100 μg/l, 596 (72·3 %) had UIC between 50 and 100 μg/l and ninety-one (11·0 %) had UIC below 50 μg/l.

The distribution of UIC in the pregnant women by personal characteristics is shown in Table 1. No significant differences in UIC were found according to residence, age, gravidity, parity, pregnancy interval, trimester of pregnancy or goitre status.

Discussion

I deficiency is a significant public health problem which still keeps its importance both in Turkey and in many developing countries. Despite the fact that I deficiency affects all people at all ages, especially pregnant women and children are at high risk.

It is known that I deficiency has a negative impact on reproductive function, the fetus and the infant, and that mental development particularly in the fetal period is profoundly susceptible to hypothyroidism during pregnancy[17]. Even mild or subclinical hypothyroidism during pregnancy may affect the mental development of the infant[2,18]. For this reason, an adequate dietary intake of I throughout the pregnancy period is highly important. The WHO/UNICEF/ICCIDD recommendation for daily I intake during pregnancy is 200 μg[14].

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Table 1 The distribution of urinary iodine concentration (UIC) in pregnant women by personal characteristics: Malatya Province, Turkey

	UIC (μg/l)						
	Median	Range	<20 (%)	20–49 (%)	50–99 (%)	100–150 (%)	>150 (%)
Overall (*n* 824)	77·4	63·2–93·2	1·1	9·9	72·3	15·8	0·9
Residence*							
Urban (*n* 580)	77·4	64·4–93·0	0·9	8·1	74·9	15·6	0·5
Rural (*n* 244)	77·4	56·7–93·0	1·7	14·3	65·8	16·5	1·7
Age group (years)*							
15–24 (*n* 349)	80·0	61·8–94·0	1·2	12·2	69·1	17·2	0·3
25–29 (*n* 234)	77·4	64·5–91·7	0·9	9·5	72·7	16·0	0·9
>30 (*n* 241)	76·1	61·9–91·7	1·2	7·1	76·3	13·7	1·7
Number of pregnancy*							
1 (*n* 278)	78·7	61·9–94·3	1·5	11·6	68·4	18·5	0·0
2–4 (*n* 430)	76·1	64·5–93·0	1·2	8·5	74·8	14·4	1·2
>5 (*n* 116)	76·1	59·2–91·7	0·0	11·3	72·2	14·8	1·7
Number of live births*							
None (*n* 318)	78·7	61·9–95·6	1·3	12·1	67·3	19·4	0·0
1–4 (*n* 473)	76·1	63·2–91·7	1·1	8·5	76·1	13·2	1·1
>5 (*n* 33)	85·9	64·5–105·9	0·0	9·4	65·6	18·8	6·3
Previous pregnancy interval (months)*							
1–24 (*n* 319)	76·1	63·2–94·0	1·3	9·8	69·2	18·3	1·3
≥25 (*n* 505)	76·8	64·5–91·4	0·6	8·3	77·9	11·9	1·3
Trimester*							
Second trimester (*n* 524)	77·4	61·9–93·0	1·0	11·4	72·3	14·5	0·8
Third trimester (*n* 300)	78·7	64·4–93·0	1·3	7·4	72·1	18·1	1·0
Goitre status*							
Goitrous (*n* 613)	77·4	63·2–93·0	0·8	10·2	72·9	15·3	0·7
Not goitrous (*n* 211)	78·0	63·5–91·7	2·1	8·3	71·5	16·7	1·4

*$P > 0·05$ (NS).

As more than 90 % of the I obtained through the diet is excreted by the kidneys, the best indicator of I intake obtained through recent diet is UIC[14]. WHO/UNICEF/ICCIDD reported that if the median UIC is less than 100 μg/l in the adult group for whom the optimal I intake is recommended as 150 μg/d, this shows that I intake is insufficient. However, WHO/UNICEF/ICCIDD have not determined a limit regarding which level of median UIC indicates insufficiency although they recommend daily I intake for pregnant women as 200 μg. When the various studies carried out on pregnant women are analysed, it is observed in these studies generally that the limit values recommended for adult groups have been utilized. Delange asserts that daily I intake for a pregnant woman should be 250–300 μg by taking into account the rise in the need for thyroxine during pregnancy and the amount of I and thyroxine passed to the fetus. In this case, he says that if the median UIC level is less than 150 μg/l, it reflects insufficient I intake[19].

In the present study, the median UIC of pregnant women was found as 77·4 μg/l equally in both urban and rural regions. Furthermore, UIC levels were similar in relation to residence, age, gravidity, parity, pregnancy interval, trimester of pregnancy and goitre status. It is known that salt iodization is a key factor in the prevention of I deficiency. Although a mandatory salt iodization programme was launched in Turkey in 1998, only 46·2 % of the pregnant women involved in the present study expressed that they used iodized salt at home. The use of iodized salt in rural regions is less than in urban regions (28·3 % *v.* 53·6 %, respectively). It is still highly common to use the salt produced for the food industry (without I) at home due to reasons such as habit and cheapness. It is expected that UIC should be high among both pregnant women living in urban areas and non-goitrous pregnant women. However, we could not detect a significant difference in UIC among groups. This circumstance could have two explanations. The first is that since three-quarters of the pregnant women had UIC less than 100 μg/l, we can comment that mild I deficiency is common in Malatya Province. The second explanation relates to a limitation of our study: iodized salt usage was based on data obtained by questionnaire, we did not analyse a sample of the salt used in the pregnant women's homes using I test kits.

According to the criteria set by WHO/UNICEF/ICCIDD, our results show that the problem of I deficiency still exists among pregnant women living in Malatya Province. On the other hand, when the recommendation of Delange is taken into consideration, it can be put forward that the situation of I deficiency is even more considerable. In another study carried out on pregnant women in Kayseri, median UIC was found as 30·2 μg/l. Considering to these data, it can be said that I deficiency in pregnant women remains an important problem in Turkey. Moreover, when research asserting that the excretion of I from the kidneys rises during pregnancy is taken into account, it can be considered that I deficiency in pregnant women is even more severe than it seems[19].

In conclusion, according to the results of the present study, I deficiency still exists in Malatya region in spite of

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the mandatory salt iodization programme. In order to increase the number of houses in which iodized salt is used, necessary intervention should be planned and implemented, and a salt monitoring system controlling I content of the salt used should be set effectively. In Turkey, the regions considered problematic for raising the consumption of iodized salt rapidly in the short to medium term should be detected, and programmes such as the short-term distribution of capsules of iodized oil in these regions should be handled by the Ministry of Health.

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Conflict of interest: None.

Author contributions: M.E. designed the study, obtained the data, analysed the data and drafted the manuscript. C.E. designed the study and obtained the data. L.K. obtained and analysed the data.

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