

Iodine deficiency has recurred in Istanbul, Turkey

Abstract

Background: Iodine status of Turkish people improved after mandatory iodination of table salt; however there is a contrary results and difference between regions and age groups.

Aim: The aim of the present study was to assess iodine status in people living in Istanbul, Turkey.

Methods: This was a single center, retrospective study on subjects who attended to Acibadem Labmed Clinical Laboratories between January 2009 and December 2013 for the measurement of urinary iodine concentration (UIC). Subjects with UI and thyroid stimulating hormone (TSH) levels were included. Data on UIC was available for 1933 subjects (1629 women and 304 men).

Results: Mean UIC was 123, 2 µg/g creatinine (µg/gCr) and mean age of the subjects was 36, 58±0, 33years. Mean UIC of men were lower than women (101, 55±3, 95 vs 127, 24±2, 22 µg/gCr; p<0.001). Totally 917 (47, 4%) of the subjects were iodine deficient (UIC <100µg/gCr). Men were more iodine deficient than women (59, 5% vs 45, 2%; p<0.001). Younger subjects were more iodine deficient than the older ones (p<0.001). TSH levels of iodine deficient and sufficient subjects were not different (3, 34±0, 24 vs 3, 19±0, 22mIU/L; p>0,05). There was a positive correlation between iodine level and age (r=0, 149; p<0.03), but there was no correlation between iodine and TSH levels (p>0.05).

Conclusion: A considerable number of subjects in our study had UIC below the normal ranges for adults, demonstrating that iodine deficiency continues to be a major healthcare concern in Turkey. At least, mild iodine deficiency has recurred in people living in Istanbul. The results emphasize the need for continuous monitoring in all regions, even in a country with iodine sufficiency.

Keywords: iodine deficiency, urinary iodine concentration, turkey, istanbul, thyroid disease

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Abbreviations: UIC, urinary iodine concentration; TSH, thyroid stimulating hormone; IDD, iodine deficiency disorders; UI, urinary iodine.

Introduction

Iodine is an essential nutrient required by the thyroid gland to produce triiodothyronine and thyroxine. Thyroid hormones have pleiotropic effects, affecting multiple biological processes. Various international agencies are working with governments to reduce iodine deficiency globally since the 1990s. Turkey has been considered iodine sufficient since mandatory iodination of table salt in 1998. In 2007, national survey results demonstrated a gradual improvement (median urinary iodine concentration (UIC) 130µ/L) in the country.¹ However, today iodized table salt intake accounts for small amount of daily salt intake, cause of public health messages that have encouraged reductions in salt intake, and a general lack of awareness within the population about the importance of iodine in the diet and desire of natural food consumption have also led people to use Himalayan salt and rock salt etc. instead of iodized salt.

As approximately 90% of absorbed iodine is eventually excreted in the urine, the urinary iodine concentration (UIC) is a good indicator of changes in dietary iodine intake over preceding days or weeks.² WHO has set criteria for assessment of school-age children, adults, and pregnant and lactating women based on UIC. The WHO, UNICEF and ICCIDD have recommended the median UIC in school children as the main indicator for assessing and monitoring the iodine nutritional status of a population.³ The use of UIC to monitor

iodine deficiency disorders (IDD) has redefined the epidemiology and distribution of iodine deficiency, as iodine deficiency has now been found to prevalent in developed countries, major cities and coastal areas where goiter prevalence is low and iodine deficiency had been considered nonexistent or to have been eliminated.² Recent data suggest that using the median values of school-age children to represent the entire population are likely inappropriate and requires further consideration.⁴

Several studies have suggested that iodine status of Turkish people improved after mandatory iodination of table salt; however there is a contrary results and difference between regions and age groups. Therefore, the aim of the present study was to assess iodine status in people living in Istanbul, Turkey.

Material and methods

This was a single center, retrospective study on subjects who attended to Acibadem Labmed Clinical Laboratories between January 2009 and December 2013 for the measurement of UIC. The Acibadem University Ethics Committee for Human Studies approved the study protocol. Subjects with urinary iodine (UI) and thyroid stimulating hormone (TSH) levels were included. Data on UIC was available for 1933 subjects (1629 women and 304 men). Data on UIC and TSH were available for 212 of these subjects. UIC were determined according to previously described method.⁵ UI levels greater than 700µg/g creatinine were eliminated from analysis because it was unclear if these samples were a result of contamination or toxicity. TSH levels were measured in C8000 Modular Analytics by using

reagents from Roche Diagnostics. Repeatability CV and intermediate precision CV were determined to be $\leq 3,0\%$ and $\leq 7,2\%$ respectively by the manufacturer.

Descriptive statistics were presented as mean \pm standard error mean (SEM) for normally distributed data, and as counts and percentages for categorical data. The relationship between the categorical variables was examined using the Pearson Chi-square test; otherwise Fisher's exact test was used. The t-test or one-way Anova test was used to compare independent variables and Levene's test for homogeneity of variances. To determine the correlation between 2 variables, Pearson correlation analysis was performed. Results were evaluated with a confidence interval of 95%, and $p < 0.05$ was considered statistically significant.

Results

Mean UIC was 123, $2\mu\text{g/g}$ creatinine ($\mu\text{g/gCr}$) and mean age of the subjects was 36, $58\pm 0,33$ years. Mean UIC of men ($n:304$) were lower than women ($n:1629$); ($101,55\pm 3,95$ vs $127,24\pm 2,22\mu\text{g/gCr}$;

$p < 0.001$) and they were older than women ($38,84\pm 1,05$ vs $36,16\pm 0,34$ years; $p < 0.04$). UIC of 59 subjects (3,1%) was $< 20\mu\text{g/gCr}$ (severe iodine deficiency). Two hundred and fifty five (13,2%) were between $20-49\mu\text{g/gCr}$ (moderate iodine deficiency). Six hundred and three (31,2%) of the subjects demonstrated mild iodine deficiency. Iodine status was optimal in 738 (38,2%) of the subjects (UIC between $100-199\mu\text{g/gCr}$). One hundred and eighty three (9,5%) were between $200-299\mu\text{g/gCr}$ (more than adequate). The remaining 95 (4,9%) had excess iodine ($> 300\mu\text{g/gCr}$). Totally 917 (47,4%) of the subjects were iodine deficient (UIC $< 100\mu\text{g/gCr}$). Men were more iodine deficient than women (59,5% vs 45,2%; $p < 0.001$). There was a considerable variation among the subgroups. Younger subjects were more iodine deficient than the older ones ($p < 0.001$). UIC frequencies depending on age groups were given in Table 1 and median UIC of subjects between 2009 and 2013 years are given in Table 2.

TSH levels of iodine deficient and sufficient subjects were not different ($3,34\pm 0,24$ vs $3,19\pm 0,22\text{mIU/L}$; $p > 0.05$). There was a positive correlation between iodine level and age ($r = 0,149$; $p < 0,03$), but there was no correlation between iodine and TSH levels ($p > 0,05$).

Table 1 UIC frequencies depending on age groups

Age groups (years)	UIC ($\mu\text{g/gCr}$) number and percentage					
	<20	20-49	50-99	100-199	200-299	>300
15-24	22 37,3%	90 35,3%	149 24,7%	124 16,8%	26 4,2%	15 15,8%
25-34	14 23,7%	69 27,1%	199 33,0%	246 33,3%	59 32,2%	27 28,4%
35-44	12 20,3%	44 17,3%	120 19,9%	160 21,7%	35 19,1%	25 26,3%
45-54	5 8,5%	37 14,5%	81 13,4%	109 14,8%	30 16,4%	15 15,8%
>55	6 10,2%	15 5,9%	54 9,0%	99 13,4%	33 18,0%	13 13,7%
Total	59 100,0%	255 100,0%	603 100,0%	738 100,0%	183 100,0%	95 100,0%

$p < 0.001$

Table 2 Median UIC of subjects between 2009 and 2013 years

Years	Number	UIC ($\mu\text{g/gCr}$)	SEM
2009	171	124,38	6,72
2010	520	132,38	3,40
2011	406	109,69	3,84
2012	391	121,07	4,67
2013	445	126,21	4,72
Total	1933	123,20	1,99

$p < 0.004$

Discussion

The iodine intake of a population is usually evaluated by measuring urinary iodine excretion in a sample of the population. The most important value obtained is the median or mean urinary iodine concentration (micrograms per liter), in relation to creatinine excretion (micrograms iodine per gram creatinine), or 24 hour urinary iodine excretion (micrograms per day.² For populations, because it is impractical to collect 24 hour samples, UIC can be measured in spot urine specimens and expressed as the median, in micrograms per liter.⁶ Variations in hydration among individuals generally even out in a large number of samples, so that the median UIC in spot samples correlates well with that from 24 hour samples. However, the median UIC is often misinterpreted. Individual iodine intakes and, therefore, spot UICs are highly variable from day to day.⁷ To estimate iodine

intakes in individuals, because of day-to-day variability, several 24 hour collections are preferable but would be difficult to obtain. An alternative is to use the iodine/gram creatinine, which is more accurate and unbiased estimate of iodine excretion in adults than iodine concentration.⁸ In our laboratory, we use the iodine/gram creatinine for the measurement of UIC to decrease the percentage of mistakes.

The results of the present study show the low iodine excretions of people in Istanbul, Turkey, in comparison to earlier studies in Turkey.⁹ Erdogan et al. conducted serial national surveys to determine iodine status before and after mandatory iodization in Turkey.^{1,9–11} First study conducted between 1997 and 1999 just before the mandatory iodization, and published in 2002. In this national survey, Turkey was severe to moderate iodine deficient; national median UIC was 36 µg/L, and none of the provinces had sufficient iodine status.¹⁰ Therefore, a national IDD control program had been implemented and mandatory salt iodization was applied by July 1998 with 50–70 mg/kg KI or 25–40 mg/kg KIO₃ added to household salt.⁹ Second national survey was performed in 2002 and the result demonstrated an obvious improvement, yet it was not optimal for elimination of IDD; median UIC was 53 µg/L.¹¹ Third survey implemented in the same area in 2007 and the results demonstrated a gradual improvement in the country; median UIC was 130 µg/L.¹

In 2009, with the follow up monitoring purposes, another survey was performed; median UIC was 107 µg/L in Turkey, but during that time median UIC was 154 µg/L in Istanbul.⁹ In our study, we found median UIC as 123, 2 µg/gCr in Istanbul. This difference may be due to the measurement differences or ages of the subjects. In the surveys, Erdogan et al.¹¹ measured the UIC of school age children and expressed as the median UIC, in micrograms per liter, but we calculated UIC of adults and expressed as the median UIC, in µg/gCr. Choi J, et al.¹² found µg/gCr measurements lower than µg/l measurements in Korean subjects, the median levels of UI and UI/UCr ratio were 267.6 µg/L and 205.5 mcg/gCr.¹² In contrast, Eray E et al.¹³ found µg/gCr measurements higher than µg/l measurements in Turkish subjects, the median levels of UI and UI/UCr ratio were 160 µg/L and 215 mcg/gCr.¹³ UIC decreased in 2011, but then gradually increased in 2012 and 2013 in our present study. In the study of Erdogan et al.,⁹ 25.5% of subjects were iodine deficient, and none of them had severe iodine deficiency in Marmara region, in our study 47.4% of the subjects were iodine deficient and 3.1% of the them had severe iodine deficiency. In Global Iodine Nutrition Scorecard, 47.1% of Turkish children had iodine deficiency.¹⁴ Erdogan MF et al.¹⁵ found median UIC 89 µg/L in nonsurgical hospital staff in Ankara in a recent study. Kut A, et al.¹⁶ found iodine deficiency in 49.6% of Turkish first trimester pregnant women in Adana. Oguz Kutlu A, et al.¹⁷ found iodine deficiency in 72.8% of Turkish second trimester pregnant women in Ankara.

In our present study, younger subjects and men were more iodine deficient than the older ones and female subjects. In contrast, in previous studies, females were more iodine deficient than males.^{18,19} Nazeri P et al.²⁰ did not find any difference between male and female groups.²⁰ In the study of Haddow JE et al.¹⁹ the median UIC followed a U-shaped distribution with age, whereas there was a positive correlation between iodine level and age in our study as mentioned above.¹⁹ However, Choi J et al.¹² found significantly decreased UIC in the younger group compared to the older group.¹² The present study once again finds no association between low urine iodine and TSH measurements.^{2,19}

Conclusion

A considerable number of subjects in our study had UIC below the normal ranges for adults, demonstrating that iodine deficiency continues to be a major healthcare concern in Turkey. At least, mild iodine deficiency has recurred in people living in Istanbul. The results emphasize the need for continuous monitoring in all regions, even in a country with iodine sufficiency.

Acknowledgements

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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