The Prevalence of Endemic Goiter in Keban County in Elazığ City and Evalution of Iodine Levels

Hamis Çolak Yusuf Özkan Muzaffer Keçeci Halil Doğan Hüseyin Ataseven Sule Cengiz Ulusoy Necip İlhan

Fırat University School of Medicine, Elazığ, Turkey

Endemic goiter and iodine deficiency are serious health problems all over the world. Approximately 1 billion people are under risk of iodine deficiency with more than 300.000 of them have goiter. Iodine deficiency is still an important health problem in Europe as well as in Turkey.

A total of 253 people between 15 and 88 years old of which 103 were male and 150 were female from Keban County in Elazig city, which was considered to be a region of endemic goiter, were recruited to this study. Goiter was found by palpation in 54% of the males and 33% of the females (averagely 45.4% for both sexes). Among the subjects, 24.6% of the females and 24.6% of the males (22.9% of all subjects) were found to have goiter by ultrasonography (US) according to the criteria established by Gutekunts R.

Mean urinary iodine amount was 17.08 µg/dl. Urinary iodine level was found to be higher than 10 µg/dl in 79.4% of the subjects while it was found to be less than 2 µg/dl in 2.7%, 2 to 5 µg/dl in 4.7% and 5 to 10 µg/dl in 13.0% of the subjects. Urinary excretion of iodine was found to be higher in the group of subjects with goiter than group of the subjects without goiter but the difference was not significant ($p > 0.05$).

In conclusion, US revealed moderate goiter while urinary iodine investigations revealed mild iodine deficiency. It has been thought that it was likely for this situation to be attributed to iodine supplementation application in the salt preparations lasting over the last 3 years in ou r country as well as to other factors.

Key words: Goiter, Iodine Deficiency

Introduction

Endemic goiter is an important health problem all over the world. It has been described as enlargement of thyroid tissue due to several causes. Endemic goiter is term used to describe thyroid hyperplasia, which exists in more than 10% of people living in a particular region and resulting from deficiency of a special factor or a goitrogenic substance (1,2).

Correspondence address:

Hamis Çolak
Fırat University School of Medicine, Endocrinology,
Elazığ, Turkey
E-mail: rcolak99@yahoo.com

The leading and most common cause of endemic goiter is iodine deficiency. More than 15% of total population of the world is living in regions of iodine deficiency with 4% to 5% has been affected by disorders resulting from iodine deficiency. Approximately 1 billion people are under risk of iodine deficiency with more than 300.000 of them have goiter. More than 3 millions of people are cretin and several millions of people have mental and neurological disorders, which are results of iodine deficiency (3).

Endemic goiter is also an important health problem for our country. Black Sea Region is precedent in endemic goiter. Following this with decreasing order are East Anatolia Region, Aegean region, Marmara

Region, Middle Anatolia region, Mediterranean region and lastly, Southeast region (4).

This study aimed establishing the effects of thyroid functions and iodine deficiency on the prevalence of endemic goiter in adult population of older than 15 years old in order to establishing the prevalence of goiter and etiological cause of endemic goiter in Keban County in Elazig City.

Material and Methods

This study was conducted between 09-04-2002 and 09-10-2002 with collaboration between the Biochemistry Department and Endocrinology and Metabolic Diseases Department of Medical School of Firat University.

People who were 15 years old or older from Keban County in Elazig city which was considered to be a region of endemic goiter were included into this study. Before beginning to the study, approval was obtained from administrative authorities. Keban County is located on north-west of Elazig city and 45 kilometers far away from Elazig. Its number of inhabitants is 6580 with most of them dealing with agriculture and stock raising.

People of 15 years old or older who included into this study were selected randomly. A total of 253 people were included into the study and their ages were recorded. Thyroid examination was evaluated by the same specialist and staged according to WHO criteria.

The same specialist also performed Thyroid US. An US instrument trademarked Shimadzu SDU-450 with high resolution of 5 – 7.5 MHz and with linear probe of which maximal angle of vision was 6 x 6 centimeters and maximal focus was 6 centimeters. Thyroid volume, echogenity and nodular view of the thyroid were evaluated by US. Width and depth were measured for each lobe according to ellipsoid formula in calculating the thyroid volume. Product of these 3 dimensions was again multiplied by π / 6. In order to establish the total volume of the thyroid, estimated volumes of the right and left lobes were added (5,6). Volume of the isthmus was not included in this calculation.

Blood samples were taken from all subjects for fT3, fT4 and TSH determinations. Sera were separated following obtaining blood samples and these sera were inserted in serological tubes and stored -20°C. Thyroid functions were measured using electro-chemiluminescence immunoassay (ECLIA) method which was a luminescence immuno-assay (7).

In order to determine urinary iodine levels, spot urine samples were collected. Urine samples were put into de-ionized tubes and stored at -20°C. Urinary iodine measurement kits of which model was Bioclane UIA0192 (Australia) was used to measure the iodine level in the urine. Those who had urinary iodine level higher than 10 µg/dl were considered as normal while those who had urinary iodine level between 5 and 10 µg/dl were considered as mild iodine deficient, those who had urinary iodine level between 2-5 µg/dl as moderate iodine deficient and those who had urinary iodine level between 2 µg/dl were considered as severe iodine deficient.

Results

A total of 253 people from Keban County who were 15 years old or older (range: 15-88) were recruited into this study. Mean age of the people in the study was found to be 37.29 ± 17.35 (mean ± standard deviation). Of 253 subjects included in the study, 150 were female (59.3%) and 103 (40.7%) were male.

Goiter, as determined by palpation, was found in 81 of female subjects (54%) and 34 (33%) of male subjects. A total of 115 subjects from both groups were found to have goiter (45.45%). Table 1 shows staging of the goiter as determined by palpation according to sex.

37 of the women (24.67%) and 21 of the men (20.38%), i.e., a total of 58 subjects (22.92%) were found to have goiter according to the criteria established by Gutekunst, R. According to Gutekunst's criteria; thyroid volume above 18 ml in women and above 25 ml in men have been considered as goiter. Table 2 shows mean and standard errors of serum fT3, fT4 and TSH values and urinary iodine levels of groups with and without goiter on ultrasound.

The lowest urinary iodine excretion was found to be 0.3 µg/dl while the highest urinary iodine excretion was 33 µg/dl. Mean iodine level was found to be

17.07 ± 7.86 µg/dl. Mean iodine level was 17.69± 6.45 µg/dl and 16.89 ± 8.24 µg/dl, in the groups with and without goiter on ultrasound examination, respectively. Mean urinary iodine excretion rate was found to be higher in group with goiter than the group without goiter but this difference was not statistically significant (p>0.05). Table 3 shows urinary iodine excretion rates.

Table 1. Distribution of goiter stages by sex as determined using palpation.

Stage	Female		Male		Total	
	n	%	n	%	n	%
0	69	46.00	69	66.99	138	54.54
Ia	22	14.66	24	23.30	46	18.18
Ib	25	16.66	8	7.76	33	13.04
II	31	20.66	-	-	31	12.25
III	3	2.00	2	1.94	5	1.97
Total	150	100	103	100	253	100

Table 2. Average values and standard deviation for urinary iodine levels and serum fT3, fT4 and TSH levels in groups with and without goiter.

	Goiter on US	Mean	Standard deviation
fT3 (pg/ml)	Goiter (+): 58	2.90	0.64
	Goiter (-): 195	2.76	0.51
fT4 (ng/dl)	Goiter (+): 58	1.22	0.22
	Goiter (-): 195	1.21	0.59
TSH (µIU/ml)	Goiter (+): 58	1.81	3.53
	Goiter (-): 195	2.16	3.35
Urinary iodine	Goiter (+): 58	17.69	6.45
(µg/dl)	Goiter (-): 195	16.89	8.24

Table 3. Distribution of urinary iodine levels.

Urinary iodine levels	(n)	(%)
< 2 µg/dl.	7	2.76
2-5 µg/dl.	12	4.74
5-10 µg/dl.	33	13.04
> 10 µg/dl.	201	79.44
Total	253	100

Discussion

Endemic goiter is an important health problem all over the world. Approximately 1 billion people are under risk of iodine deficiency with more than 300.000 of them have goiter. More than 3 millions of people are cretin and several millions of people have mental and neurologica l disorders, which are results of iodine deficiency (3). Iodine deficiency is still an important health problem in Latin America, Africa and Asia and in a lot of European countries as well as in Turkey (3,8).

Endemic goiter first came into question in two studies, namely one by Kemal Atay published in 1935 and other by Rasim Onat published in 1948. These studies reported that goiter endemic was present in Kastamonu, Ilgaz, Duzce, Bolu, Bartin, Sinop vicinities as well as in other regions extending into Izmir, Aydin and Isparta cities (9). Consequently, studies conducted by Osman Saka, Sati Eser and Sitki Velicangil in 1956 revealed that the goiter was mostly present in Isparta, Burdur, Kastamonu, Zonguldak, Bolu, Rize and Giresun regions (10).

After 1960, Selahattin Kologlu and colleagues carried out numerous studies to highlight epidemiology and etiopathogenesis of goiter (11,12). These studies especially investigated iodine content of drinking water and food and found that most of the drinking water samples contained low level of iodine (0-0.25 µg/l) in Black Sea Region. Control water samples from Istanbul were found to contain an iodine content of 11.0 µg/l. It has suggested that the fact that the soil might have been lost its iodine content due to frequent and abundant rains in Black Sea region might be responsible for high prevalence of goiter in this region. (12,13). Kologlu also investigated the effects of goitrogens. He emphasized milk and collard (Brassica oleracea acephala), which is a planted Black Sea region in big amount. But he noted that required daily amount of thiocyanate to cause goiter is found in 8 to 9 kilograms of collard. L-5-vinylthiooxazolidone (VTO) has been studied in milk investigations. He concluded that milk and collard was not responsible for goiter endemic in this region (13-15). In 1981, Turkan Sungur demonstrated that iodine content of drinking water in some regions in Turkey was low (16). Irfan Urgancioglu and Husrev Hatemi also demonstrated that iodine content of drinking water in some regions in Turkey was low. Consequently, a total of 73.757 people from all over Turkey were examined by palpation and goiter prevalence in Turkey was found to be 30.5%.

Urgancioglu and colleagues found stage I goiter in 93.31% of goiter cases and stage II in 4.30% of the

cases, stage III 1.9% of the cases and stage IV goiter in 0.54% of goiter cases in their prevalence study. Prevalence of stage II goiter by regions was as follows: 5.32% in Black Sea Region, 4.98% in East Anatolia Region, 4.63% in Aegean Region, 4.41% in Marmara Region, 4.32% in Middle-Anatolia region, 3.78% in Mediterranean Region and 2.95% in South-East Anatolia Region. Goiter prevalence found to be 41.2% in a study by Egri and colleagues (17) while 62.9% of this was stage Ia goiter, 30.3% was stage Ib and 6.8% was stage II. Prevalence of goiter was found in this study to be 47.1% in women while it was 35.0% in men.

A total of 253 people, of which 150 were female and 103 were male, were included in our study. Goiter was found in 81 (54%) women and 34 (33%) men. Distribution of goiter in women by stage was as follows: stage 0, 46%; stage Ia, 14.6%; stage Ib, 16.6%; stage II, 20.6%; stage III, 2%. These figures were as follows in men: stage 0, 66.9%; stage Ia, 23.3%; stage Ib, 7.7%; stage II, 0%; stage III, 1.9%. As can be seen, no man was found with stage II goiter. Distribution of goiter by stage for both sex was as follows: Stage 0, 138 people (54.54%); stage Ia, 46 people (18.18%); stage Ib, 33 people (13.04%); stage II, 31 people (12.25%); stage III, 5 people (1.97%). Goiter was found in 115 people (45.45%) in the study.

Lazarus et al. (18) found that goiter frequency was 1.42 times higher in women than in men. Roti et al (19) reported a similar rate between men and women, which was 1.52 times higher in women. Zargar et al (20) found a goiter prevalence of 52.08% in a study on 1876 school children in Cashmere between 5 to 15 years old. They found goiter in 54.77% of boys and 49.23% of girls. Goiter prevalence was found to be 1.11 times higher in boys than in girls. Hintze et al (21) found a 2.4 times higher goiter prevalence in men compared with women in a study conducted in Germany. Goiter prevalence was found to be 1.34 times higher in girls compared with boys in a study by Egri et al (1.7).

In our study, goiter prevalence as determined by palpation was found to be higher in women. Goiter prevalence was found to be 1.64 times higher in women compared with men. Results of studies conducted in our country are consistent abroad studies in regard to distribution of goiter, as determined using palpation, by stage and sex.

In our study, a total of 58 people (22.92%) had goiter of whom 37 were female (24.66%) and 21 were male (20.38%). Goiter determined using ultrasound was found to be 1.21 times higher in women compared with men.

Vitti et al. (22) detected goiter by ultrasound in 12.7% of cases whose goiters couldn't be detected by palpation. Hintze et al (21) detected goiter in 31.8% of cases whose goiters couldn't be detected by palpation. They found goiter in 71 cases (25.6%) by palpation while their goiters couldn't be detected by ultrasound. Goiter was detected in 18 cases (13.04%) in our study whose goiters couldn't be detected by palpation. Goiter was detected in 75 cases (38.4%) in our study by palpation whose ultrasound examination didn't reveal goiter.

Daily amount of iodine excreted in the urine is equivalent of 85-90% of daily iodine consumption. Iodine deficiency in a particular region may be evaluated by amount of iodine in the urine. Urinary iodine excretion less than 20 µg/l indicates severe iodine deficiency, 20-50 µg/l indicates moderate iodine deficiency and 50 to 100 µg/l indicates mild iodine eficiency (3,23). Delange et al. (24) detected goiter by ultrasound in 7599 students in 12 countries in Europe. Goiter prevalence and daily urinary iodine excretion rates in various countries in Europe were as follows: In Slovachia, 14% and 13-14.3 µg/dl; in Germany, 25% and 10.3-12.6 µg/dl, in Austria, 29% and 9.8-12.0 µg/dl; in Belgium, 40% and 5.0-5.8 µg/dl; in Poland, 50%-80% and 2.0-3.2 µg/dl. It has been shown that there was an inverse relationship between urinary iodine excretion rate and goiter prevalence. It has been emphasized that goiter prevalence is below 5% while urinary iodine concentration is above 10 µg/dl.

Urinary iodine concentration was found to be higher in people with goiter determined by palpation than in people without goiter in our study. But the difference between these two groups was not statistically significant. Mean urinary iodine concentration of all of the subjects in our study was 17.07 ± 7.86 µg/dl. Mean urinary iodine level was 17.69 ± 6.45 µg/dl and 16.89 ± 8.24 µg/dl in

the subjects with and without goiter as determined by ultrasound, respectively.

Urinary iodine level in our study was 2 µg/dl or less in 7 subjects (2.76%), between 2-5 µg/dl in 12 subjects (4.74%) and between 5-10 µg/dl in 33 subjects (13.04%). A total of 201 subjects (79.44%) had an urinary iodine level above 10 µg/dl while a total of 52 subjects (20.6%) was found to have an urinary iodine level below 10 µg/dl. No relationship was found in our study between urinary iodine level and thyroid volume. Goiter prevalence, however, was found to higher than predicted from urinary iodine level. While a total of 58 subjects (22.92%) had goiter as determined by ultrasound, mean urinary iodine level should have been between 2-5 µg/dl with a goiter rate in this region where iodine is deficient (25). But we found mean urinary iodine level to be 17.07 ± 7.86 µg/dl in this region. Given this, although mean urinary iodine excretion rate is an indicator of iodine intake, goiter prevalence is an indicator reflecting the iodine intake partly and showing thyroid status. In addition to importance of iodine deficiency in high goiter prevalence, goitrogen factors and other environmental factor should also be kept in the mind (26). Although iodine deficiency is leading cause of goiter, the fact that urinary iodine level is similar in subjects with and without goiter suggest that other factor may play role in goiter.

Moderate prevalence of goiter was found by ultrasound in the study region while urinary iodine analyses revealed mild iodine deficiency. It has suggested that such an intervention as iodine supplementation into salt preparations, which has been effective in our country since 1999 and/or other factors than iodine deficiency may be responsible for development of goiter. It has been considered that an increase might have occurred in urinary iodine excretion as a result of iodine supplementation for the last three years. But no reduction should be anticipated in thyroid size with iodine supplementation if thyroid enlargement had been existing for a long time.

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