ORIGINAL ARTICLE

The Prevalence of Endemic Goiter and Its Relationship to Urine Iodine in Primary School Age Children in Khoramabad

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Abstract

Backgrounds: Iodine deficiency disorder is a major public health problem in areas where there is a lack of iodine in drinking water, soil, and food. This study was carried out to assess the prevalence of goiter among school children in the age group of 6-10 years in Khorramabad city. Also, the level of urine iodine was evaluated.

Methods: The study was conducted from January 2012 to January 2013 in 1125 school children of 6-10 years of age, attending all the schools of Khorramabad city. The subjects were selected through stratified, random, and cluster sampling methods. Their Goiter degrees were evaluated according to WHO classification. Excretory urine iodine was measured based on micrograms per deciliter. Furthermore, the digestion method was used for experimentation.

Results: Out of the 1125 subjects, 866 (77%) had Goiter. 24.2% were diagnosed with Goiter 1a, 45.3% with goiter 1b, and 7.2% with type 2 Goiter. Regarding Goiter, there was no difference between the two sexes. The prevalence of goiter increased with age, but it decreased with the increase of parental educational level. Also, goiter prevalence was lower in families with a higher socioeconomic status. The median urinary iodine was 17.1 micrograms per deciliter, which is desirable in terms of the WHO criterion.

Conclusion: The results of the study indicated that using iodizing edible salt to fight with iodine deficiency was effective and helped Khorramabad reach the International indexes of iodine control. Despite this, Khorramabad is one of the hyper- endemic regions in the world.

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Introduction

Today, it has been confirmed that the lack of iodine in food and drinking water can affect the function of the thyroid gland.[1,2] Iodine deficiency can cause problems called Iodine Deficiency Disorders (IDD). The most serious problems are endemic Goiter, Hypothyroidism, Stillbirth, Congenital Malformations,[3] minor brain damage, irreversible nerve-brain-psychotic regeneration problems, and infertility.[4] Goiter is an enlarged thyroid gland, the most common symptom of Iodine deficiency.[5,6] Endemic Goiter is common in mountainous regions and areas with deficiency of iodine in drinking water, soil, and food.[7,8] Based on global researches, around 2 billion people in the world have IDD, especially in Southern Asia and the African Desert.[9]

WHO highlighted the importance of IDD prevalence in 1986. It also confirmed programs to

eradicate IDD, such as public health programs to decrease the level of goiter to 10% among the students carried out by 2000.[10,11] In studies, until 1990, around 40 million infants per year were prone to congenital malformations of the brain due to their mothers' lack of dietary iodine. This rate reached 28 million children by 1997, a clear reduction, but it is still regarded as high.[12]

According to previously carried out studies, iodine deficiency and endemic Goiter used to be epidemic in all of the provinces of the Islamic Republic of Iran.[13,14] In reaction to the high prevalence of endemic Goiter in some regions of Iran (up to 89.5% in Semirum), a national program was started in 1989 to control IDD.[14] The mandatory use of iodizing salt was legislated in 1994.[15]

The legislation of the prevention of IDD was followed by a high level of success in Iran[13,16] but, despite sufficient iodine intake, there was goiter prevalence in some enriched regions with endemic iodine. And there also was a mild to moderate degree of Goiter. Thus, the prevalence of goiter cannot be justified only by the lack of iodine. Among the suggested factors, there were also unexpected factors, such as unknown *Goitrogens*, no use of iodized salt, no standard of Iodized salt, thyroid self-defending diseases, or the lack of some micronutrients such as Iron and selenium.[17]

Due to different reports on Goiter in our country, the lack of current information on Goiter prevalence in KhorramAbad city, the importance of children groups, and occasional controlling programs held only every five year in the country, and omission of disorders caused by lack of iodine, this study (2012-2013) was carried out to determine the prevalence of endemic goiter, to measure the level of urine iodine and test the diet iodine level among school children aged between 6 and 10 in Khorramabad.

Materials and Methods

This study was carried out in 2012-2013 as a cross-sectional study. 1125 Khorramabad city school children, aged between 6 and 10, participated in the study. They were chosen by cluster sampling method among girls and boys at elementary schools. Biographic and background information of each student was registered through documentation, the parents were interviewed, and the results were registered in each student's questionnaire. Then each student was visited by a trained medical doctor for clinical examination of the thyroid gland and the Goiter rates determined by the WHO protocol were resolved. Based on World Health Organization standards,[18] when the thyroid gland cannot be seen and is untouchable, it is in zero level; when it is not visible but it is touchable, it is leveled in 1A. When the thyroid gland is seen by head extension, it is 1b; also, if it is observable in the normal form of the head, it is type 2, and if it is observable from 6 meters it is Goiter type 3.

Analysis of urine iodine is a basic tool for recognizing iodine levels; more than 90% of the received iodine is visible in urine. Urine samples of the student were collected to determine their iodine level. Iodine testing was done by acidic digestion method, in which urine details are digested by Chloride *acid* in high temperatures resulting in the release of iodine. According to Global Health Organization's recommendations, the level of urine excretion of iodine lower than 2µg/dl means severe lack of iodine, between 2 and 4.9 µg/dl means medium lack of iodine, between 5 and 9.9 µg per dl indicates a low level of lack of iodine, between10 and 19.9 shows a situation without lack of iodine, between 20 and 29.9µg/ dl means the reception of more than necessary iodine, and more than 30 means much more reception of iodine than necessary. In this study, data analysis was done using SPSS software; χ^2 independence method, Spearman correlation coefficient, and statistical descriptive methods were used to analyze the data of the experiments.

Results

1125 students aged between 6-10 years participated in this study; they were visited by doctors and urine samples were taken. 77% of the students had Goiter, 24.4% had type 1a, 45.3 % 1b, and 7.2 % Goiter type 2. No case of Goiter type 3 was seen (Table1).

The median urinary iodine concentration was 17.1 µ/dl, the mean urinary iodine was determined to be 18.98 and the standard deviation of urinary iodine was 10.3. According to urinary iodine concentration, 6.8% of the students had moderate to severe iodine deficiency, which is considered to be within the range allowed (up to 20%) and 11.3% had mild iodine deficiency. 40.4% had normal urinary iodine, 25.9% had more than needed iodine, and 15.6% had very high urinary iodine levels. Of the 1125 students surveyed, 50.8% were male and 49.2% female.

According to the results of Chi-square test of independence, there was no significant relationship between gender and Goiter prevalence (P=0.81). Goiter prevalence in boys was 76.7% and in girls 77.2; the difference was not statistically significant (Table1).

Of the 1125 students surveyed, 18.7% were 6-years-old, 19.8% were 7-years-old, 18.8% were 8 -years-old, 20.8% were 9-years-old, and 22% were 10-years-old.

The prevalence of goiter in 6 year old students was 73.3% and it was 80.6% in 10 year old ones. Based on Spearman correlation coefficient, there was no significant relationship between urine iodine level and

Table 1: Adaptive table of students categorized according to sex and goiter prevalence

Grade Goiter		Sex		Total
		Boy	Girl	
0	Frequency	133	126	259
	percent	23.3	22.8	23
a[1]	Frequency	140	135	275
	percent	24.5	24.4	24.5
b[1]	Frequency	254	256	510
	percent	44.4	46.3	45.3
2	Frequency	45	36	81
	percent	7.9	6.5	7.2
Total	Frequency	572	553	1125
	percent	100	100	100

family dimension. Medium poverty to high poverty levels of students' families with >6 and < 3 members were 12% and 21.4% respectively, and in students with 3-4 and 5-6 members these percentages were 6.3% and 6.5% respectively; the difference was not significant.

Discussions

Lack of iodine and its related disorders still exist worldwide; in most parts of Iran, such as Khoarrmabad, it seems to be endemic. Many studies have been done in different provinces to determine goiter prevalence and the present study is the most recent one.

As prevalence of Goiter was more than 50% in this region, Khorramabad is considered one of the hyper-epidemic regions of the world. The present prevalence of goiter compared to a 1989 study which was 100%[19] shows reduction and it has increased compared to 66% high prevalence in 1994.[20] Furthermore, the results indicated that the median urine iodine is 17.1 µg per dl which is within the range of the Global Health standard.[18] Researchers around the world are still trying to find the reason for high existence of Goiter regardless of the sufficient intake of iodine.

Kapil and colleagues[21] reported that the total Goiter rate is 16.8% and median Urinary Iodine concentration level was 115 µg/L amongst school age children in district Pauri, Uttarakhand of India. In the Girma and colleagues'[22] study, the total goiter prevalence of 750 school children aged between 6 and 18 years in Metekel Zone, northwest Ethiopia was 39.5% and their median urinary iodine concentration range was 39.9 µg/L. Uzun and colleagues have shown that the prevalence of hypothyroidism in children aged 6-12 and 13-19 years of the West Black Sea region of Turkey was 10.4% and 18.9%, respectively, and the median urinary iodine concentration levels in children aged 6-12 and 13-19 years were 83 µg/l and 78 µg/l, respectively.[23] Although Kocak and colleagues have reported that the overall goiter prevalence was 26.5% in an adult population in a formerly iodine-deficient area of Turkey,[24] Kapil and colleagues have found that the total goiter prevalence was 15.8% in the children aged of 6-12 years in district Kangra, Himachal Pradesh after 60 years of salt iodization.[25]

The thyroid gland changes slowly; thus, the intake of iodine salt is not capable of controlling goiter prevalence. This may be one of the reasons for the high level of goiter regardless of iodine intake. Zimmerman's study on Iodine deficiency,[26] a study in Turkey on Zinc deficiency,[27] and a study in Sudan on the lack of vitamin A and malnutrition[28] were introduced as reasons of the slow decreasing rate of goiter endemic. The effect of anti-thyroid antibodies is one of the reasons of goiter prevalence regardless of the sufficient iodine consumption. Boukis' study, carried out in 1983 in a region diagnosed with iodine deficiency in Greece, showed that anti-thyroid antibodies of goiter patients could not be measured before treatment by oily iodine but 3 -6 months after treatment with oily iodine these antibodies were positive in 42.8% of the patients.[29] In a Ashrafi and colleagues' study in Isfahan, due to the prevalence of anti-thyroid antibodies in patients with goiter in comparison to healthy people, self defense was determined as a reason for simple goiter after public use of iodized salt.[30] The same was the result for a study in Semirum, carried out in 2007, which indicated that anti-thyroid antibodies were recognized as a reason for the remaining of goiter regardless of the consumption of iodized salt.[17]

Havach's study in 1985 showed that adding iodine to food to treat goiter due to the lack of iodine resulted in the prevalence of self defended thyroiditis and an increase in anti-thyroid antibodies.[31] Furthermore, Zhang and colleagues[32] concluded that the excessive intake of iodine might serve as a risk factor for toxic nodular goiter, thyroid papillary carcinoma and Hashimoto's thyroiditis.

In this study, there was no significant relationship between goiter and sex; this confirms the results of studies in 2001 in Tehran,[33] Semirum in 2007[17] Kocak in 2014,[23] Marwaha in 2012[34] and Markazi in 2001[35] and many other studies.[36-38] But, in studies such as those carried out in Tehran in 2007[39] and in Kashan in 2008[40] and some other studies, the prevalence of

goiter was determined higher among girls.

In a 1997 study carried out in Kashan, the prevalence of goiter was determined higher among boys compared to girls.[41] In this study, there was a significant and linear relationship between age and prevalence of goiter; aging increases the prevalence of goiter. This shows the increase in public knowledge and the effect of the consumption of iodized salt.

In similar studies in Bandar Abaas in 2000[42] and in Tehran in 2007, aging showed a higher prevalence of goiter.[39] In a study in 2002 in Yazd, there was no relationship between age and goiter.[43]

In this study, there was no significant relationship between goiter prevalence and family dimensions, although goiter among single parent families and families with more than 6 members was higher compared to families with 3 to 6 members.

Conclusion

This study demonstrated that iodine deficiency is still a severe public health problem in Khorramabad city**,** about 25 years after the introduction of salt iodine supplementation program**.** This study suggests that autoimmunity may be one of the mechanisms responsible for goiter persistence, after iodine replenishment, in this iodine deficient region, but the role of other factors should also be considered. We suggest the further confirmation of the existing monitoring system for the quality of iodized salt. Also, there is a need for further studies in all Iranian providences to achieve proper elimination of IDDs in the community.

Conflict of Interest: None declared.

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