

# Association between Goiter Prevalence and Urine Iodine Levels in 6-12-Year-Old Children in Central Iran

Ali Honarpisheh<sup>1</sup>, Abbas Taghavi<sup>1</sup>,  
Hossein Akbari<sup>2</sup>

## Abstract

**Background:** Goiter is thyroid enlargement, which is the most common visible symptom of iodine deficiency. Some studies have shown iodine deficiency in water, soil, and food in many places worldwide.

We aimed to determine the prevalence of goiter and the association between urine iodine levels in children with severity and prevalence of goiter in mountainous villages of Kashan city (center of Iran).

**Methods:** This descriptive-analytical study was performed on 263 children aged 6-12 years in villages of Kashan. In the present study, goiter and its grading was determined by WHO standard method. The patients' urine iodine levels were measured by Pino method (ammonium oxidation) and compared with standard scales.

**Results:** Of the children, 39.5% had goiter and the prevalence in girls was higher than boys (45.8% v 33.3%;  $P < 0.03$ ). All the patients with urine iodine level less than 25  $\mu\text{g}/\text{grcr}$  (gram creatinine), 87.5% of patients with urine iodine level less than 100  $\mu\text{g}/\text{grcr}$  and 24% of patients with urine iodine level more than 100  $\mu\text{g}/\text{grcr}$  had goiter.

**Conclusion:** The prevalence of goiter in mountainous places of Kashan is 39.5%. Although the people of these villages used iodized salt for years, these regions remain endemic parts of iodine deficiency. There was a significant association between urine iodine levels and the severity and prevalence of goiter ( $P < 0.001$ ).

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**Keywords** • Goiter • Iodine • endemic goiter

## Introduction

**G**oiter is the thyroid enlargement, which is the most common visible symptom of iodine deficiency.<sup>1,2,3</sup> Nowadays, it has been proven that iodine deficiency in nutritional diets and drinking water can cause damages to thyroid gland function. All of the disorders caused by iodine deficiency are called iodine deficiency disorders (IDD).<sup>4,5</sup>

It was until few years ago that the only complication of iodine deficiency was goiter; however, nowadays it is known that complications of iodine deficiency are even more, and it has untoward effects on health.

<sup>1</sup>Departments of Pediatrics, <sup>2</sup>Statistic, Kashan University of Medical Sciences, Kashan, Iran.

### Correspondence:

Ali Honarpisheh MD,  
Department of Pediatrics,  
Kashan University of Medical Sciences,  
Kashan, Iran.

**Tel:** +98 913 1613090

**Fax:** +95 +98 361 5558900

**Email:** [Honar\\_md@yahoo.com](mailto:Honar_md@yahoo.com)

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Detrimental effects of iodine deficiency on socioeconomic status push the iodine deficiency prevention programs.<sup>6</sup>

In the 39<sup>th</sup> WHO summit held in 1986, the importance of IDD prevention programs was emphasized. WHO also approved IDD eradication programs as the public health care for diminishing the rate of goiter to less than 10% among students that must have been fulfilled in 5-10 years.<sup>4,7</sup>

Many different replacement methods have been suggested to compensate iodine deficiency.

Since salt is used by all people, the Iranian Ministry of Health decided to add iodine to regular salt, in order to prevent the iodine deficiency.<sup>4</sup>

Assuming the iodized salt is standard then the sufficient iodine should be used by all individuals.

Although some studies have been carried out to determine the prevalence of goiter in Kashan city (center of Iran),<sup>8</sup> the present study was performed to measure iodine level in drinking water in mountainous regions of this city and to determine urine iodine levels in 6-12-year-old children, and to find out their association with goiter prevalence. We also aimed to determine whether there is still iodine deficiency and related complications, despite the use of iodized salt for years.

## Materials and Methods

This is a descriptive-analytical study which was done on 263 randomly selected students aged 6-12 years in mountainous regions of Kashan including Qamsar, Ghohrood, Varkan and Barzok.

The students were referred to health care

centers of the villages for physical examination by physicians and to receive instruction for urine collection. Thyroid examination according to WHO protocol was performed,<sup>4</sup> and based on the severity of disorder and goiter size, the selected students were scored between 0-2.

For measuring the 24-hour urine iodine levels, urine samples were collected in acid-washed containers. Urine iodine and creatinine levels were measured by Pino method,<sup>9</sup> and the results were recorded on data sheets. For statistical analysis, SPSS software version 14 was used. Chi-square test was employed as indicated.

## Results

The prevalence of goiter in 131 girls and 132 boys were 45.8% and 33.3%, respectively ( $P=0.03$ ).

The results showed that 94 cases (35.7%) were diagnosed as having goiter with grade 1 and 10 cases (3.8%) were diagnosed as having goiter with grade 2. There was an inverse association between the urine iodine excretion and the prevalence and severity of goiter.

The overall prevalence of goiter was 39.5%. The highest prevalence (50%) was seen in Varkan and the least prevalence (34.5%) was seen in Qamsar (table 1). Also 87.5% of the children had urine iodine levels of less than 100  $\mu\text{g}/\text{grcr}$  (gram creatinine) while 24% of them had urine iodine levels of more than 100  $\mu\text{g}/\text{grcr}$ . All of the children with urine iodine levels of less than 25  $\mu\text{g}/\text{grcr}$  had goiter ( $P<0.001$ ; minimum urine iodine level = 100  $\mu\text{g}/\text{grcr}$ ,<sup>1</sup> table 2).

**Table 1:** The distribution of goiter prevalence in studied villages

The village		Qamsar	Barzok	Ghohrood	Varkan	Total	P value
<b>Prevalence</b>							
Studied population		87	120	34	22	263	-
Number of patients	GI	28	47	12	7	94	-
	GII	2	2	2	4	10	-
Prevalence of goiter per 100 children	GI	32.2	39.2	35.3	31.8	35.7	0.397
	GII	2.3	1.7	5.9	18.2	3.8	0.005

G: Grade

**Table 2:** The distribution of goiter prevalence and severity according to the average level of urine iodine in studied villages.

Urine iodine $\mu\text{g}/\text{grcr}$		>100	50-100	25-50	< 25	total	P value
<b>Goiter Status</b>							
<b>Severity</b>		-	Mild	Moderate	Severe	-	
Negative (percent)		151 (75.9)	6 (22.2)	2 (9.1)	-	159 (60.5)	
Positive (percent)	GI	46 (23.1)	19 (70.4)	17 (77.3)	12 (80)	94 (35.7)	$p < 0.001$
	GII	2 (1)	2 (7.4)	3 (13.6)	3 (20)	10 (3.8)	
	Total	48 (24.1)	21 (77.8)	20 (90.9)	15 (100)	104 (39.5)	
Sum(percent)		199 (100)	27 (100)	22 (100)	15 (100)	263 (100)	

G: Grade

## Discussion

The present study showed that the prevalence of goiter in our region was 39.5%. Goiter was more common in girls (45.8%) than boys (33.3%) This difference was statistically significant ( $P < 0.03$ ). The prevalence of goiter was higher in boys in some studies,<sup>7,10</sup> while in other studies this prevalence was equal in both genders.<sup>11,12</sup> In most studies, the prevalence was higher in girls,<sup>4,13</sup> which is compatible with our findings. It is possible that hormonal factors have important roles in thyroid function.<sup>7</sup>

The goiter prevalence in our study was less than Isfahan province,<sup>2</sup> but considering that more than 20% of 6-12 years old children had simple goiter our region should be considered as hyperendemic goiter area. This may be caused by improper processing of iodized salt, or using goitrogenic foodstuffs in this region.

In our study the goiter prevalence in students with urine iodine levels less than 100 µg/grcr was 24.1% while it was 39.5% in patients with obvious clinical goiter. This finding suggests that other factors may contribute to goiter, which is compatible with other studies.<sup>4,6,14,15</sup>

Our results showed that 87.5% of patients with urine iodine levels less than 100 µg/grcr and all of the patients with urine iodine levels less than 25 µg/grcr had goiter (table 2).

There was a significant inverse association between urine iodine level and goiter prevalence ( $P = 0.001$ ); the less urine iodine levels, the more goiter prevalence and severity. On the other hand, some children with urine iodine levels more than 100 µg/grcr, which is in normal range, had goiter. This finding is compatible with other investigations.<sup>5</sup> Other goitrogenic factors such as genetic factors, toxic effects of some chemical substances, exposure to the ionized radiation, and nutritional habits may be important.<sup>11,16-18</sup>

Despite consumption of iodized salt for many years, goiter is still prevalent and remains as a health problem. This finding complies with other studies conducted in Iran and other parts of the world.<sup>6,9,11,19,20</sup>

## Conclusion

The present study showed that the prevalence of goiter in mountainous area of Kashan is 39.5% and despite consumption of iodized salt for many years, these regions are endemic parts of iodine deficiency. Our findings showed a significant inverse association between urine iodine levels and goiter severity and prevalence ( $P < 0.001$ ). We recommend an appropriate

strategy for storage and use of iodized salts in studied areas. Supervision on standard iodization of salts should be considered by responsible organizations. Further studies on other elements involving in appearance of goiter e.g selenium deficiency should be conducted.

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**Conflict of Interest:** None declared

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