GOITER PREVALENCE, URINARY IODINE EXCRETION AND HOUSEHOLD SALT IODINE AFTER 10 YEARS OF SALT IODIZATION IN YAZD PROVINCE, IRAN

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ABSTRACT

Background: Iodine Deficiency Disorders(IDD) are the most important epidemic disorders in the world including Iran. For preventing IDD and its consequences, table salt has been iodized since 1989. At present, this programme has been 10 years old.

Objective: To determine the total goiter rate(TGR) and urinary iodine in 6-11 years old students in Yazd province and related cities after 10 years of salt iodized programme.

Subjects and Methods: A total 4755 primary school students(2948 boys and 1807 girls) aged 6-11 were selected by multistage cluster sampling method from the Yazd province. Thyroid examination and goiter classification were made according to World Health Organization(WHO) guidelines by two trained physicians. Urine sample and household salt was collected from 1/13th of total population. Urinary iodine was determined by a digestion method. Iodine of salt was determined by rapid test kit. Data was analyzed by SPSSWIN software.

Results: TGR of Yazd province was 40.9%(Girls 41.8% and boys 40.3% not significant). Prevalence of goiter grade 1 and grade 2 were 38.6% and 2.3%, respectively. These figurs for girls were 39.1% and 2.7% and for boys were 38.3% and 2% respectively. TGR of Taft, Abarkuh, Khatam, Yazd, Bafgh, Sadugh, Mehriz, Mybod and Ardakan were 43.3%, 41.5% 32.4%, 40.2%, 38.5%, 53.8%, 41.8%, 37.8% and 31.5% respectively. TGR was significantly different among these cities(pv<0.0001).

Overall mean of the urinary iodine was 264±123 µg/l and the corresponding mean in girls and boys were 236±118 µg/l and 281±123 µg/l, respectively which were significantly different(pv=0.001). Mean of urinary iodine in Taft, Abarkuh, Khatam, Yazd, Bafgh, Sadugh, Mehriz, Mybod and Ardakan were 224±146 µg/l, 229±130 µg/l, 332±114 µg/l, 266±122 µg/l, 264±84 µg/l, 291±116 µg/l, 208±125 µg/l, 235±103 µg/l and 279±118 µg/l, respectively (pv=0.02).

In general, 10.5% of study population had urinary iodine concentrations below 100 µg/l, 24.5% were in ideal range(100-200 µg/l) and 65% were higher than 200 µg/l. Approximately 94% of salt samples had iodine.

Conclusion: The study shows that after ten years iodized salt program has decreased the prevalence of goiter and increased urinary iodine. This means that Yazd province is "IDD free" from 2002.

KEY WORD: Iodine Deficiency, Endemic goiter, Urinary iodine, Iodized salt, IDD, Thyroid

Pak J Med Sci July-September 2005 Vol. 21 No. 3 298-302

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* Received for publication: June 15, 2004

Accepted: January 13, 2005

INTRODUCTION

Of the World's 191 countries, Iodine Deficiency Disorders(IDD) were a public health problem in 130 countries. Only 20 countries could be classified which no longer has IDD. This means that 740 million or 13% of the world's 5.857 billion population had goiter. Of the 5 billion people who live in the 130 countries affected by IDD, 38% or 2 billion, are at risk for IDD.[1]

Before the introduction of an IDD control

program, about 20 million people in Iran suffered from iodine deficiency.[2] Prevalence of these disorders in mountainous and desert rgions, as Yazd province has been very high.[3-5] In Iran, since 1989, special attention has been focused on the prevention of IDD. After the formation of the National IDD committee in 1989, production and distribution of iodized salt was selected as the main method of countering iodine deficiency disorders and iodized salt became available. In Yazd province, as other province of Iran, iodized salt has been distributed since 1994. The major aim of the present study was to determine the prevalence of goiter, urinary iodine excretion and iodine of household salt usage and to compare trend of these finding from 1990 and 1997.

SUBJECTS AND METHODS

Yazd province is located in the centeral part of Iran at 29.52 to 33.27 latitude and 52.55 to 56.37 longitude and most of Iranian deserts are located here. Different deserts cover an extensive area of the province. the population of the province is about 814000. This province consists of 9 cities (Taft, Abarkuh, Khatam, Bafgh, Mehriz, Mybod, Ardakan, Yazd, Tabas).

In this prevalence study 4755 Primary School Students (2948 boys and 1807 girls) aged 6-11 were selected by multistage "Probability proportionate to size" cluster (PPS) Sampling method. Thyroid examination and goiter classifications were made according to WHO guidelines by two trained physicians. Sumation of goiter grade-I and grade-II defined as total goiter rate(TGR).

From the one–Thirteenth of total population examined for thyroid, urine and household salt sample was collected by systematic random sampling. Urine samples were stored at - 20, until measures for iodine content.

The level of urinary iodine was measured by the digestion method and was expressed by µg/l.[6] Urinary iodine classification was made according to WHO recommendation in 6 groups.[7] under the 20 µg/l (severe deficiency), 20-49 µg/l (Moderate), 50–99 µg/l (Mild), 100-199 µg/l (Ideal), 200-299 µg/l (above ideal) and more than 300 µg/l (excess).

Salt iodine was determined by rapid test kit. ANOVA and T-tests were used to compare quantitative variables; For comparing qualitative variables, The chi-square test was employed. Spsswin software was used for data analysis.

RESULTS

Out of 4755 students who were examined, 1833 (38.6%) were goiter grade 1 and 109 (2.3%) goiter grade-II. Prevalence of the goiter grade 1 and grade-II in girls was 39.1% and 2.7%, respectively. Corresponding figures for boys were 38.3% and 2%, respectively. The goiter prevalence was not statisticaly significant(PV=0.2). TGR of boys and girls were 40.3% and 41.8%, respectively. As indicated in table-I, TGR in the age groups were not significant (PV=0.2).

The TGR of various cities of province were statistically significant (PV<0.0001, Table-II). Sadough city had the highest TGR and

Table-I: Prevalence of goiter in students by age groups and goiter grading

Age group (year)	*Goiter Grading*		*%TGR(n)*
	%Grade 1(n)	*%Grade 2(n)*	
6-6.9	39.9(414)	1.3(13)	41.1(427)
7-7.9	36.9(310)	2.5(21)	39.4(331)
8-8.9	38.4(365)	2.5(24)	40.9(389)
9-9.9	39.3(417)	2.3(24)	41.6(441)
10-11	37.8(327)	3.1(27)	40.9(354)
Total	38.6(1833)	2.3 (109)	40.9(1942)

Table-II: Prevalence of goiter in students by goiter grading and cities of Yazd province

City	*Goiter Grading*		*%TGR(n)*	*Total examined students*
	%Grade 1 (n)	*%Grade 2 (n)*		
Taft	34 (128)	10.3 (39)	44.3 (167)	377
Abarkuh	35.5 (88)	6 (15)	41.5 (103)	248
Khatam	30.2 (98)	2.2 (7)	32.4 (105)	324
Yazd	38.7 (770)	1.5 (30)	40.2 (800)	1989
Bafgh	37.5 (103)	1.1 (3)	38.5 (106)	275
Sadough	52.3 (283)	1.5 (8)	53.8 (291)	541
Mehriz	40.2 (132)	1.5 (5)	41.8 (137)	328
Mybod	37.2 (129)	0.6 (2)	37.8 (131)	347
Ardakan	31.5 (102)	0 (0)	31.5 (102)	326
Total	38.6(1833)	2.3(109)	40.9 (1942)	4755

Ardakan city had the lowest TGR (Table-II). Taft city had the highest prevalence goiter grade 2(10.3%).

The table-III illustrates mean of urinary iodine excretion by sex and age groups. Overal mean of urinary iodine in province was 264±123 µg/l and corresponding mean in girls and boys were 236±118 µg/l and 281±123 µg/l (PV=0.001), respectively. In Both sexes mean of urinary iodine in various age groups were not significantly different (In girls, PV=0.7 and in boys, PV=0.5).

Mean of urinary iodine in Yazd province cities Taft, Abarkuh, Khatam, Yazd, Bafgh, Sadough, Mehriz, Mybod and Ardakan were 224±146 µg/l, 229±130 µg/l, 332±114 µg/l, 266±122 µg/l, 264±84 µg/l, 291±116 µg/l, 208±125 µg/l, 235±103 µg/l and 279±118 µg/l, respectively that were significantly different (PV=0.02, Table-IV).

About 10.5% of study population had urinary iodine concentration under 100 µg/l , 24.5% were in ideal range (100–199 µg/l) and 65% were higher than 200 µg/l. Percent of population that had urinary iodine concentration above 300 µg/l in Taft, Abarkuh, Khatam, Yazd, Bafgh, Sadough, Mehriz, Mybod and Ardakan were 50%, 76.5%, 73.9%, 63.6%, 73.7%, 74.2%, 50%, 58.8% and 71.4%, respectively (Table-V).

Six percent of household salt samples did not contain iodine 1.1% was in 8 ppm level, 6% was in 15 ppm level and 86.8% of salt samples had above 30 ppm iodine contents (Table-VI). Therefore, approximately 4% of salt samples had iodine. In some cities, as Ardakan, Mybod and sadough, 100% of salt Samples had above 30 ppm iodine level (Table-VI).

Table-III: Mean of the urinary iodine (µg/l) by sex and age groups

Sex	*Boy*			*Girl*			
Age groups	*n*	*Mean±SD*	*Confidence interval 95%*	*n*	*Mean±SD*	*Confidence Interval 95%*	*PV**
6 - 6.9	41	296±122	285 – 335	27	212±121	164 – 260	0.007
7 – 7.9	37	288±115	250 – 327	19	260±130	197- 323	0.14
8 – 8.9	43	250±131	250 – 331	31	235±114	193 – 277	0.06
9 – 9.9	44	275±120	238 – 312	22	232±128	175 – 289	0.19
10 –11	36	254±125	212 – 296	23	246±102	202 – 290	0.79
Total	201	281±123	264 – 298	122	236±118	214 – 257	0.001
PV**		0.5			0.7		

* T-Test ** One way ANOVA

Table-IV: Mean of the urinary iodine (µg/l) by cities of Yazd province

City	*n*	*Mean±SD**	*Median*	*Confidence Interval 95%*
Taft	28	224±146	186	167 – 281
Abarkuh	17	229±130	319	231 – 366
Khatam	23	322±114	312	272 – 371
Yazd	140	258±122	245	238 – 279
Bafgh	19	284±84	287	243 – 324
Sadough	31	291±116	326	248 – 334
Mehriz	20	208±125	200	149 – 267
Mybod	17	235±103	230	182 – 288
Ardakan	28	279±118	288	233 – 325
Total	323	264±123	269	251 – 277

Table-V: Frequency distribution of study population by urinary iodine classification and cities of Yazd province

City	*Urinary iodine classification (µg/l)*									
	20 – 49		*50 – 99*		*100 – 199*		*200 – 299*		*300 ≤*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Taft	2	7.1	6	21.6	6	21.4	5	17.9	9	32.1
Abarkuh	0	0	2	1.18	2	11.8	2	11.8	11	64.7
Khatam	0	0	0	0	6	26.1	3	13	14	60.9
Yazd	6	4.3	8	5.7	37	26.4	32	22.9	57	40.7
Bafgh	0	0	2	6.5	6	19.4	5	16.1	18	58.1
Sadough	2	10	30	15	5	25	5	25	5	25
Mehriz	0	0	0	0	5	26.3	7	36.8	7	36.8
Mybod	0	0	1	5.6	6	35.3	6	35.6	4	23.5
Ardakan	0	0	2	7.1	6	21.4	8	28.6	12	42.9
Total	10	3.1	24	7.4	79	24.5	73	22.6	137	42.4

Table-VI: Frequency distribution of study population by household salt iodine and city

City	*Household salt iodine (ppm)*							
	0		*8*		*15*		*30≤*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Taft	2	8.3	0	0	2	8.3	20	83.4
Abarkuh	3	18.8	3	7.8	3	18.8	7	54.6
Khatam	1	4.5	0	0	2	9.1	19	87.4
Yazd	4	3.2	0	0	7	5.6	113	91.2
Bafgh	2	11.8	0	0	2	11.8	13	76.5
Sadogh	0	0	0	0	0	0	27	100
Mehriz	5	21.7	0	0	1	4.3	17	73.9
Mybod	0	0	0	0	0	0	127	100
Ardakan	0	0	0	0	0	0	15	100
Total	17	6	3	1.1	17	6	244	87.8

Table-VII: Criteria for monitoring progress towards sustainable elimination of IDD and present study finding

Indicator	*Cities*										
	Goal	*Province*	*Taft*	*Abarku*	*Khatam*	*Yazd*	*Bafgh*	*Sadough*	*Mehrize*	*Mybod*	*Ardakan*
1. Salt iodization proportion of household consuming effectively iodized salt	90<	94	91.7	81.7	95.5	96.8	88.2	100	78.3	100	100
2. Urinary iodine											
proportion below 100µg / l	<50	3.1	7.1	0	0	4.3	0	0	10	0	0
proportion below 50µg / l	<20	0	0	0	0	0	0	0	0	0	0
3. Grade 2 prevalence(%)	<5	2.3	10.3	6	2.2	1.5	1.1	1.5	1.5	0.6	0

DISCUSSION

The results of this study show a reduction in prevalence of goiter and a great elevation in urinary iodine levels in the population of the Yazd province area from 1993 to 2002.

The decrease in prevalence of goiter was observed in both genders and all ages (6 to11 years). In 1993, goiter prevalence was greater than 70%[2,5,8] and in 1997, it was 48%.[9] Prevalence in the present study was 40.9%. This shows that supplementation of iodized salt has resulted in significant decrease in the prevalence of goiter in the Yazd province. As per WHO standard,[10] the TGR of this province and related cities are higher than 30% (Severe state). Some countries are concerned about the persistence of goiter, although they found an improvement in urinary iodine level.[6] TGR is a very good indicator for initial assessment. This time the size of the goiter gets smaller and palpation becomes more difficult, and there can be a variation of about 40% between grade 0 and grade-I. Thus, in this situation grade-II (agreement in about 100%) is the better indicator. Except Taft and Abarkuh, prevalence of grade-II in total and other related cities were under the 5%. This means, IDD is under the controled (Table-VII). These findings are similar to national study in 1997 and other finding in various province.[9,11,12]

About 24.5% of student in this study had urinary iodine values of between 100 to 199 µg/l (ideal range), 10.5% of these were under the 100 µg/l (iodine deficient) and 65% of students had urinary iodine above 300 µg/l (Excessive iodine intake). WHO recommends that in countries that implement iodized salt program, urinary iodine should not been higher than 200 µg/l.[6]

This study also showed that approximately more than 90% of the population used iodized salt in the studied area. In some cities, as Mybod, Sadough and Ardakan, this figure was 100%. Table-VII shows summary of criteria for monitoring progress towardes sustainable elimination of IDD as a public health problem and findings of present study. Therefore, based on these findings, Yazd province and most of the related cities could be “IDD – free” states.

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