International Journal of Clinical Medicine Research
2016; 3(1): 38-42
http://www.aascit.org/journal/ijcmr
ISSN: 2375-3838

American Association for Science and Technology

Keywords
Pregnant Women,
Iodine Nutrition,
IDD

Received: February 5, 2016
Accepted: March 1, 2016
Published: March 14, 2016

Evaluation on Iodine Nutrition of Children and Pregnant Women in Akto County, Xinjiang in 2014

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Citation

Zhu Yun, Wen Juan, Sha La Mai Ti·Tu Er Xun Tai, Jiang Jian. Evaluation on Iodine Nutrition of Children and Pregnant Women in Akto County, Xinjiang in 2014. *International Journal of Clinical Medicine Research.* Vol. 3, No. 1, 2016, pp. 38-42.

Abstract

Objective: To know iodine nutrition level of children and pregnant women in severe epidemic areas of IDD. Method: According to the requirement of "The Eleventh Five Years' Plan" Project (Study on application of prevention technique of IDD in Xinjiang), random sampling was carried out. Results: Median of iodized salt of residents in Akto county was 32.4 mg/kg. There was statistical difference in coverage rate of iodized salt and intake rate of qualified iodized salt in residents in 2009 compared with those in 2014 (χ^2=4.59, P<0.05). In 2009, 60 samples of urinary iodine of the pregnant women were detected with median of 352 μg/L, and the samples less than 100 μg/L accounted for 6.67%, while there were 48 samples of the pregnant women in 2014, and 29.17% of the samples were less than 100 μg/L. Two hundred and forty-four children aged 8 to 10 years were examined by palpation. The coincidence rate was 73.6% between the palpation and B-ultrasound examination, and there was statistical difference (P<0.01) in goiter rate of children by palpation (χ^2=83.06) and B-ultrasound (χ^2=25.03) between 2009 and 2014. The difference in urinary iodine of children was also significant between the two years (t=5.65, P<0.005). Conclusions: Although the goiter rate of children basically has reached the standard of eliminating in akto county, but iodine deficiency of children and pregnant women is still exists. Therefore, universal iodized salt is a simple, safe and effective measures for control of Iodine Deficiency Disorders.

1. Introduction

Akto county is located in China's western border, the southwestern of Xinjiang Uygur Autonomous Region; the east of Pamirs. The north belongs to the east of pamirs, the east belongs to west margin of tarim basin; located in the east longitude 73°26′05″~76°43′31″, north latitude 37°41′28″~39°29′55″. The lower plain is only 1150 meters, the highest point of kongur peak is 7719 meters, elevation drop to 6569 meters. Besides criss-cross mountains and the undulating terrain result in complex and diverse climate. The district have not only cold alpine region and glacier precipitation, but also hot summer and drought area. Akto county is far away from oceans and surrounded by mountains, the special geographical environment results in an iodine-deficient area in Akto. IDD is epidemic severely in Akto county, Xinjiang, China. Iodized salt was freely delivered for people in poverty in Turpan region and southern Xinjiang in the second half year of 2007. So surveillance of iodine nutrition was important in the pregnant, especially, urinary iodine was one of the important indices for observing iodine nutrition of the pregnant women, and also a quantification

index for observing iodine nutrition level of people in area of iodine deficiency. Therefore, investigation on iodine nutrition level of the pregnant women in Akto county was carried out in 2009 and 2014.

2. Material and Method

2.1. Investigation Object and Method

2.1.1. Object

According to Study on application of prevention technique of IDD in Xinjiang, surveillance of IDD was developed in children in Akto county. Five townships were sampled randomly, and 200 children aged 8 to 10 years selected from each township. Palpation and B-ultrasound examination were performed to inspect goiter, and meanwhile, urinary samples were collected for analysis of urinary iodine (relevance existing between the selected children and the families).

2.1.2. Family Investigation

Two villages from each township, and 30 families from each village were selected for family investigation on source and type of iodized salt. Edible salt of the families were collected for quantitive analysis of iodine content.

2.2. Investigation Methods

(1) Thyroid examination: Standard for Endemic Goiter (WS276-2007).
(2) Detection for iodized salt: Iodine content in edible salt was detected with direct titration in GB/T 13025-1999.
(3) Determination of urinary iodine: Iodine were measured with As^{3+}–Ce^{4+} catalytic spectrophotometry (WS/T 107-2006).
(4) Statistical analysis: SPSS13 was taken to analyze the data.

3. Results

3.1. Iodized Salt

Edible salt of the residents in Akto county was investigated. Average median of the iodized salt was 32.4 mg/kg. The coverage rate of the iodized salt was improved year by year from 2009 to 2014, and it was 99.7% in 2009 and 100.0% in 2014. The rate of non-iodized salt was 0.4% (2009), while non-iodized salt wasn't found in 2014. There were statistical differences in coverage rate of iodized salt and intake rate of qualified iodized salt in the residents between 2009 and 2014 (χ^2=4.59, P<0.05, Table 1).

Table 1. *Investigation on edible salt of residents in Akto county in 2009 and 2014(%).*

year	Detected samples	Median (mg/kg)	Rate of non-iodized salt	Unqualified rate	Coverage rate	Rate of qualified iodized salt	Intake rate of qualified iodized salt
2009	288	36.0	0.4	12.5	99.7	87.5	87.2
2014	288	32.0	0.0	2.7	100.0	97.2	97.2
Total	1 152	32.4		5.9	98.4	94.0	92.5

3.2. Thyroid Examination

In 2009, 240 children aged 8 to 10 years took thyroid examination by palpation, with goiter rate of 55.0%, including 21 cases of enlargement grade Ⅱ. The result indicated that the epidemic situation of IDD in children in Akto was still serious. Otherwise, 242 children were measured by B-ultrasound, with goiter rate of 32.1%. The coincidence rate was 66.8% between the palpation and B-ultrasound. In 2014, the goiter rate of 240 children was 2.08% by palpation and 0.83% by B-ultrasound, with the coincidence rate of 73.6% between the two methods. The difference in goiter rate of the examined children by palpation and ultrasound in 2009 (χ^2=83.06) was significant compared with that in 2014 (χ^2=25.03, P<0.01, Table 2).

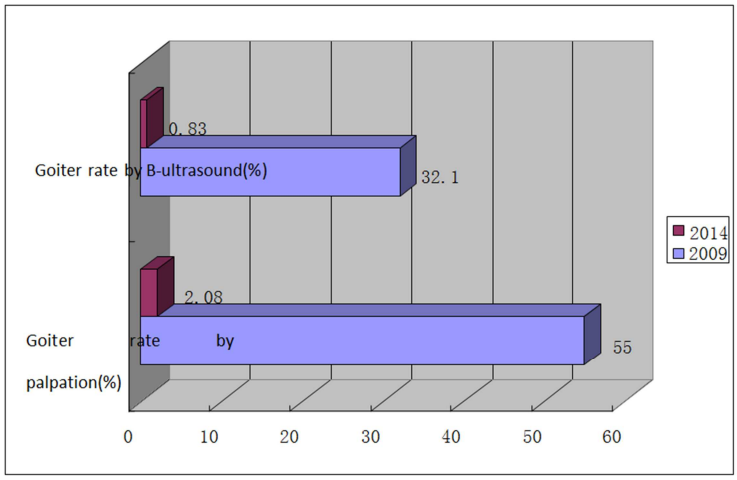

Figure 1. *Goiter rate of children aged 8-10 years in 2009 and 2014.*

Table 2. *Goiter rate of children aged 8-10 years in 2009 and 2014.*

year	Investigated No. of children	Goiter No.	Ⅰ°	Ⅱ°	Goiter rate (%)	No. of children by B-ultrasound	No. of children with goiter	Goiter rate (%)
2009	240	132	56	21	55.0	240	77	32.1
2014	240	5	5	0	2.08	240	2	0.83
Total	480	137	61	21	28.54	480	79	16.46

3.3. Urinary Iodine

There were 238 samples of urinary iodine collected in 2009, with median of 287.76 μg/L, and the median of the samples less than 100 μg/L accounted for 7.6%. In 2014, 238 samples were collected with the median of 108.4 μg/L, and 25.2% of the samples were less than 100 μg/L. The difference in urinary iodine content was obvious between the two years (t=5.65, P<0.01, Table 3).

Table 3. *Frequency distribution of urinary iodine of children aged 8 to 10 years in 2009 and 2014.*

year	Investigated No.	median (μg/L)	≤25 μg/L sample (%)	≤50 μg/L sample (%)	≤100 μg/L sample (%)	>100 μg/L sample (%)
2009	238	287.76	1(0.42)	2(0.84)	15(6.3)	220(92.4)
2014	238	108.4	5(2.1)	8(3.4)	50(21.0)	175(73.5)
Total	476		6(1.26C)	10(2.1)	65(13.7)	395(83.0)

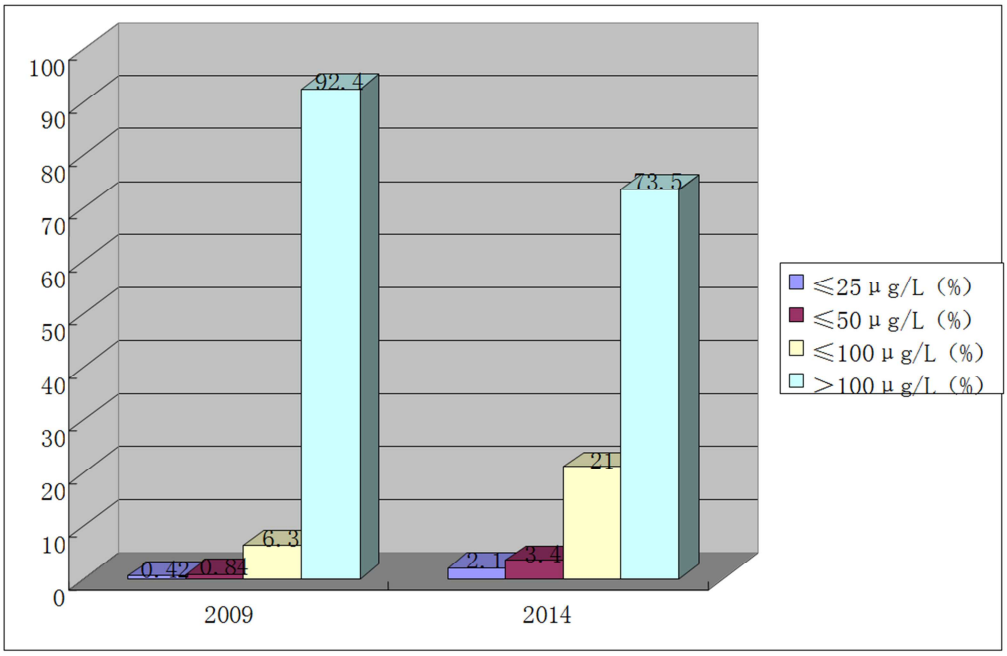

Figure 2. *Frequency distribution of urinary iodine of children aged 8 to 10 years in 2009 and 2014.*

In 2009, 60 samples of urinary iodine of pregnant women were detected with median of 352 μg/L, and the samples of median less than 100 μg/L accounted for 6.67%. In 2014, 48 samples were detected with median of 367 μg/L, and 29.17% lower than 100 μg/L (t=18.4, P<0.01, Table 4).

Table 4. *Frequency distribution of urinary iodine of pregnant women in 2009 and 2014.*

year	Investigated No.	the median (μg/L)	≤25 μg/L sample (%)	≤50 μg/L sample (%)	≤100 μg/L sample (%)	>100 μg/L sample (%)
2009	60	352	1(1.67)		3(5.0)	56(93.33)
2014	48	367	1(2.08)	5(10.4)	8(16.7)	34(70.8)
Total	168	352	2(1.19)	5(2.98)	13(7.73)	148(88.09)

4. Discussion

4.1. Intake Rate of Iodized Salt

The family investigation on edible salt indicated that, out of the 288 samples of edible salt detected in 2009, there was one sample of non-iodized salt, with the rate of unqualified iodized salt of 12.5%, the difference was significant compared with that in 2014. The intake rate of qualified iodized salt of the residents was higher 8 percentage points in 2014 than in 2009. It improved and reached the stage goal for IDD elimination in China in 2014 (national standard for elimination≥90%) [1]. The intake rate was 87% in 2009, and the samples of urinary iodine of the children less than 100 μg/L accounted for 7.6%. The results showed that, spread rate of iodized salt was over 90%, and the level of urinary iodine of some children was lower than the national elimination standard. There were individual differences in the same environment, and the intake rate and coverage rate of qualified iodized salt correlated with the level of urinary iodine of the children.

Iodine deficine continues to be an important global public hearth issue, with an estimated 2.2 million people (38% of the worlds population) living in iodine-deficine areas [6]. In 1990, the United Nations World Summit for children set forth the goal of eliminating iodine deficiency worldwide [7]，and considerable progress has since been achieved. This has largely been led by programmes of universal salt iodisation in various countries, in line with the recommendation of the world health organization [8].

4.2. Difference in Thyroid Examination on Children by Palpation and B-ultrasound

In 2009, the goiter rate was 21.9% by palpation and 9.9% by B-ultrasound, with the coincidence rate of 66.8%. There was statistical difference ($P<0.01$) in the goiter rate of the children between palpation ($\chi^2=85.06$) and B-ultrasound ($\chi^2=25.03$) compared with those in 2014. Isthmic portion volume of thyroid was not examined or calculated when measuring children's thyroid by B-ultrasound, and the enlargement of children's thyroid mainly appeared in the isthmic portion. Thyroid volume enlarges along with the growth of age for children in the development period, and subcutaneous tissue and fat increase also, and palpation difficulty multiplies, that will result in missed diagnosis. The examiner with experiences takes the thickness as sensitive index [2] by touching thyroid gland to find out whether the thyroid of children enlarges or not. And the obvious enlargement of thyroid observing by palpation of macroscopy will be normal volume by B-ultrasound examination. So, the normal value of children's thyroid measured by B-ultrasound should be studied further more.

4.3. Relationship Between Urinary Iodine and Goiter Rate of Children

Iodine is the key raw material of thyroid hormone synthesis. Iodine deficiency will cause decrease of thyroid hormone synthesis inevitably. Its feedback to thyroid-pituitary leads to the increase of thyroid-stimulating hormone excreted by pituitary, that will promote compensatory hyperplasia and hypertrophy of follicular epithelial cell, and induce intumesce of thyroid, that is simple goiter. People take in inorganic iodine 100-200 μg from food per day and the minimum daily adult requirement was about 100 μg. The intake iodine reduces to be iodides in gastrointestinal tract first, and then absorbs rapidly in intestinal tract. The iodides in the body mainly accumulate in thyroid gland, or the other tissues or their secretion temporarily, and come back to blood circulation finally for thyroid hormone synthesis, except for those in lactational breast tissue and placenta. The iodine in the body discharges mainly through kidney as iodides, and little by sweat and faeces.

4.4. Urinary Iodine of Pregnant Women

The results of urinary iodine of the pregnant women show that the urinary iodine of some of them is less than 100 μg/L, indicating that, improper cooking habit of adding iodized salt into the oil directly, results in sublimation of the iodine in the salt and loss of the iodine. The absorption and utilization of iodine in the body is affected by many factors. Reasonable and comprehensive measures of iodine supplement should be taken aiming at the special geographical and geological environment in southern Xinjiang and living habit of the minorities [3], and evaluated in combination with thyroid function. The normal value of urinary iodine of all people in the region and cut-off point inducing goiter and cretinism should be calculated for reasonable iodine supplement. Because of iodine metabolism affected by geology, food habit and heredity, ect. [4], rich source of local salt and easy to get in remote and poor areas in Xinjiang, the comprehensive measures of iodine supplement of iodized salt can't be implemented. The integrative measures of iodine supplement by spreading iodized salt and assisting with other iodine supplement should be developed [5], to speed up eliminating IDD and reach the national extinguishing standard as scheduled.

Foundation item: National science and technology support projects of "The Eleventh Five Years' Plan" (2007BAI07A14)

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