THE CURRENT SITUATION OF IODISED SALT USE AND THE EFFECTS OF IODINE DEFICIENCY ON HIGH RISK POPULATIONS IN VINH PHUC PROVINCE IN 2017

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ABSTRACT

\textbf{Background:} Vietnam's salt iodine supplementation program is a Government funded activity. Since 2005, the reduction of the funding source has had a direct impact on the effort to reduce iodine deficiency disorders nationwide, including Vinh Phuc. \textbf{Objectives:} Assessing the current situation of using salt and iodine-containing products of people in Vinh Phuc province. Determining the impact of iodine deficiency on the high risk subjects. \textbf{Methods:} The study applied the Descriptive Epidemiology method - Cross-sectional investigation to evaluate the current situation of iodized salt use and the effect of iodine deficiency on the at-risk subjects. The study was conducted in 2017 on 540 households, 108 women of reproductive age from 18-49 years old and 720 primary school students in 36 communes of Vinh Phuc province. \textbf{Results:} The results showed that 98.1% of the households use fish sauce, 11.9% use salt, 93.9% use used any type of seasoning powder, and 72.4% used iodized seasoning powder. 540 samples of salt and seasoning powder were taken for testing and all samples (100%) did not contain sufficient iodine content to meet disease prevention standards. The goitre rate in primary school students is 2.5%, mainly at level 1A (94.4%). There was no relationship between gender and goitre rate in students ($p = 0.6$). In women, there was no relationship between occupational status and iodine salt use ($p = 0.453$) and use of iodized seasoning powder ($p = 0.57$). There was no correlation between literacy and iodized salt and iodized powder use ($p = 0.3$ and $p = 0.7$). \textbf{Conclusion:} Iodine supplementation in salt, fish sauce and spices is one of the effective measures in iodine deficiency disorders prevention. The study proposes to strengthen inspection and implement strict sanction the production of iodine products that do not meet the quality standards to ensure the quality of products that reach consumers.

\textbf{Keywords:} iodine deficiency, iodized salt, high risk

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1. BACKGROUND

Iodine is an essential micronutrient for human health. According to statistics of the World Health Organization (WHO), there are more than one hundred countries with iodine deficiency problems around the world, about one and a half billion people live in iodine deficient areas and are at risk of developing disorders due to iodine deficiency, of which more than 11 million people suffer from mental slowing due to iodine deficiency [7].

Vietnam is a country in an iodine-deficient region with 94% of the population living in iodine-deficient areas. Since 1994, Vietnam has educated the entire population to use iodized salt for disease prevention and has achieved great successes in iodine deficiency disorders prevention activities. In 2005, Vietnam eliminated the iodine deficiency according to three criteria: coverage of iodized salt meeting disease prevention standards > 90%; the rate of goitre in children aged 8-12 years <5% and median urinary iodine level $\geq 10$ mcg / dl [1].

However, after 2005, the program of adding iodine to salt was no longer funded by the Government. Budget shortages and changes in management structure have resulted in a
significant decrease in iodized salt coverage and urinary iodine concentrations, to the point that the iodine deficiency disorders have once again become prevalent medical problems in the community. According to the report of the Central Endocrinology Hospital in 2011, the rate of iodized in Vietnam was 45.1%, the median urinary iodine level dropped to mild deficiency (only 8.3 mcg / dl in 2010) [2], by 2015, the iodized salt coverage in the Red River Delta was only 38.5% [3].

Similar to other provinces, the program on prevention of iodine deficiency disorders in Vinh Phuc has been significantly reduced since 2015, and prevention activities cannot be carried out regularly due to lack of funding. The proportion of households using iodized salt has been decreasing over the years. In 2005, the percentage of households using iodized salt in the province was 95.7%, in 2013 it dropped to 70%; in 2015 it was only 65.8%. The median urinary iodine level in women of reproductive age decreased significantly, in 2005 was 32.51 mcg / dl, in 2010: 8.5 mcg / dl, in 2016: 6.5 mcg / dl. The rate of goitre students from 2010 to present has not been evaluated. This has the risk of seriously affecting the results of eliminating iodine deficiency disorders, the danger of iodine deficiency is imminent.

So we conduct research on the topic: “Current situation of salt use, iodine-containing preparations and effects of iodine deficiency on at-risk subjects in Vinh Phuc province”, aiming at:

1. Assessing the current situation of using salt and iodine-containing products of people in Vinh Phuc province.
2. Determining the impact of iodine deficiency on the high risk subjects.

2. SUBJECTS AND METHODS OF THE STUDY

2.1. Research design, location and time
Design: Descriptive Epidemiology - Cross-sectional investigation.
Location: Vinh Phuc province
Time: from July to October 2017

2.2. Research subjects
- Women 18 - 49 years old.
- Children 8 - 12 years old.

2.3. Sample size
* Calculating the number of women 18 - 49 years old to be surveyed:
Apply the sample size formula:

\[ n = \frac{Z^2_{1-\alpha/2} \cdot p(1 - p)}{\Delta^2} \]

+ p is the estimated percentage of iodized salt using in the whole province which is 60%;
+ \( \Delta \) is he desired difference between the rate obtained from the sample (p) and the proportion of the population (P), taken is 0.042.
+ \( \alpha \) is statistical significance, which is 0.05 corresponding to 95% reliable. Correspondingly, we have \( Z_{1-\alpha/2} \) equalled to 1.96. We get \( n = 523 \).
After rounding up the number, we choose 540 subjects for investigation.

* Calculating the number of students aged 8-12 years old will survey:
Apply the sample size formula:

\[ n = \frac{Z^2_{1-\alpha/2} \cdot p(1 - p)}{\Delta^2} \]

+ Vớ p is the rate of goitre in the province, which is 3.9% according to the 2010 survey.;
+ \( \Delta \) The desired difference between the rate obtained from the sample (p) and the proportion of the population (P), taken is 0.015.
+ \( \alpha \): statistical significance, which is 0.05 corresponding to 95% confidence. Correspondingly, we have \( Z_{1-\alpha/2} \) equal to 1.96. We get \( n = 640 \), and rounding up the number we will choose 720 primary school students to participate in the survey.
Selecting samples:
- Deployed in the whole province. Each district was surveyed and evaluated in 4 communes and 4 primary schools.
- In each commune, we surveyed 3 administrative zones with 15 households and women aged 15 - 49 years old.
- At each primary school, we surveyed 20 students in grades 3 and 4.
- A total of 540 households surveyed, took 540 samples of salt / soup powder, 108 urine samples from women aged 15 to 49 years old.
and examined goitre ultrasound for 720 primary school students.

2.4. The method of data collection
- Method of interview, investigation combined with observation.
- Experimental method was used to investigate the content of iodine in salt /seasoning powder and urine; diagnostic imaging (ultrasound) was used to investigate goitre.

2.5. Data collection instrument
- Questionnaire for interview and observation.
- The ultrasound machine has a dedicated probe to survey the thyroid gland.
- Urine tubes, PE bags with splints for samples, pens.
- Cold thermos.

2.6. Data processing methods
- Design and enter, analyze data using SPSS 16.0 software
- Use appropriate statistical tests to compare: c2-test, T test.

2.7. Errors and measures to reduce errors
- Error:
  + There is no guarantee of randomness in selecting communes, households and students.
  + Subject does not understand the question, leading to a wrong answer.
  + Not getting enough test samples.
  + Sample test is not correct.
- How to fix errors:
  + Professional training, technical guidance for officers participating in the investigation.
  + Investigators must remember the questionnaire by heart, approach the object politely, openly and sincerely. When the investigating subject is confused, it is necessary to clarify the question.
  + Guiding investigators to take the necessary amount of salt and urine for testing: 30 grams of salt, equivalent to 4 teaspoons. Soup powder 40 grams, equivalent to 4 teaspoons. Urine 5 ml, equivalent to 4cm height of the tube.

3. RESULTS OF THE STUDY

3.1. General characteristics of research subjects

Table 1. Age of study subjects

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of women</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 – 30</td>
<td>192</td>
<td>35.6</td>
</tr>
<tr>
<td>31 – 40</td>
<td>204</td>
<td>37.8</td>
</tr>
<tr>
<td>41 – 49</td>
<td>144</td>
<td>26.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>540</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Comment: The average age of subjects is 34.4. In which the highest age is 49 years old, the lowest age is 18 years old.*

Table 2. Educational level

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Number of women</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not graduated from primary school</td>
<td>8</td>
<td>1.5</td>
</tr>
<tr>
<td>Graduated from primary school</td>
<td>17</td>
<td>3.1</td>
</tr>
<tr>
<td>Graduated from secondary school</td>
<td>217</td>
<td>40.2</td>
</tr>
<tr>
<td>High School Graduation</td>
<td>210</td>
<td>38.9</td>
</tr>
<tr>
<td>Graduated from college, university and higher</td>
<td>88</td>
<td>16.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>540</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Comment: Most of the surveyed women aged 18 - 49 have secondary education (40.2%) or high
school (38.9%). The rate of primary school and lower is very low (4.6%).

**Table 3. Occupation of research subjects**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Number of women</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trading</td>
<td>65</td>
<td>12.0</td>
</tr>
<tr>
<td>Administrative Officer</td>
<td>49</td>
<td>9.1</td>
</tr>
<tr>
<td>Worker</td>
<td>119</td>
<td>22.0</td>
</tr>
<tr>
<td>Farmer</td>
<td>295</td>
<td>54.6</td>
</tr>
<tr>
<td>Other jobs</td>
<td>12</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>540</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Comment:* The majority of women surveyed are farmer (54.6%), the second most numerous group of people are working as workers (22%).

**3.2. Current situation of using iodized salt and iodized products**

**Table 4. Use of salty spices**

<table>
<thead>
<tr>
<th>Spices</th>
<th>Number of households</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt</td>
<td>64</td>
<td>11.9</td>
</tr>
<tr>
<td>Seasoning powder</td>
<td>507</td>
<td>93.9</td>
</tr>
<tr>
<td>Fish sauce</td>
<td>530</td>
<td>98.1</td>
</tr>
</tbody>
</table>

*Comment:* Most of the surveyed households used fish sauce (98.1%). The proportion of households using salt in food processing is very small (11.9%), most of them use seasoning powder (93.9%).

**Table 5. The rate of using salt / iodized seasoning powder through interviews**

<table>
<thead>
<tr>
<th>Salt/Seasoning powder</th>
<th>Number of households</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use iodized salt / iodized powder</td>
<td>385</td>
<td>71.3</td>
</tr>
<tr>
<td>Use regular salt / powder</td>
<td>155</td>
<td>28.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>540</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Comment:* According to the interview, people are paying attention to buying and using salt / iodized seasoning powder, the number of people saying that their family is using salt / iodized soup powder is 71.3%.

**Table 6. Results of the quantitative iodine test in salt and broth**

<table>
<thead>
<tr>
<th>Results</th>
<th>Number of households</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 ppm</td>
<td>540</td>
<td>100</td>
</tr>
<tr>
<td>20 – 45 ppm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;45 ppm</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Comment:* All salt and seasoning powder samples tested did not contain sufficient iodine at preventive levels (between 20 and 45 ppm).
3.3. Evaluate the impact of iodine deficiency on the high risk subjects

**Figure 1.** Goitre prevalence among primary school students

*Comment:* The rate of goitre in primary school students accounts for 2.5%.

**Figure 2.** Goitre level

*Comment:* Goitre level is mainly at level 1A, accounting for 94.4%.

<table>
<thead>
<tr>
<th>Table 7: Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>P</strong></td>
</tr>
</tbody>
</table>

*Comment:* There is no relationship between gender and goiter in pupils.
Comment: The goitre rate is lowest in 2 delta districts: Vinh Tuong and Yen Lac, and highest in the mountainous midland districts: Tam Duong, Tam Dao, Binh Xuyen. In two mountainous districts of the province: Song Lo and Lap Thach, the goitre rate is only at an average level, while this was the main district suffering goitre 10 to 15 years ago.

The test result of the median urinary iodine level in urine tested by the Center for Disease Control of Thai Nguyen province is: 8.5 mg / dl, at a mild iodine deficiency.

4. DISCUSSION
4.1. General characteristics of research subjects
To ensure correct assessment of iodine use and iodine deficiency, the subjects must be representative of the community. The research results show that the average age of the study subjects is 34.4 years old, is at childbearing age and is usually the person responsible for housework and cooking in the family. The majority of women surveyed have secondary (40.2%) or high school education (38.9%), which is very convenient for the interview process and helps the survey results to be more accurate.

The majority of women surveyed are farmers (54.6%), the next significant group are working as workers (22%). The majority of subjects are employed women (97.8%). This characteristic is different from the 2016 study by Hong Huu Duc et al. in Binh Duong province in which 34.26% of women worked as housewife [4].

4.2. The situation of using iodized salt and iodized products
- Most of the surveyed households use fish sauce (98.1%). The proportion of households using salt in food processing is very small (11.9%), and most of them use seasoning powder (93.9%). Because the use of spices in Vinh Phuc has a special feature (often using fish sauce and seasoning powder), mixing iodine into seasoning powder and fish sauce should be encouraged. Scientific research has shown that the amount of iodine lost in fish sauce made from iodized salt is very small and iodine has no great influence on the color or taste of fish sauce [6].

- Current situation of using salt / iodized powder according to labels at the time of the survey: the proportion of households using salt or iodized powder was 71.3%. However,
according to the test results, all salt and seasoning powder samples did not contain enough iodine at preventive levels (from 20-45 ppm). It is important to add preventive iodine to table salt, and by that many countries have eliminated iodine deficiency disorders. These countries all emphasize the need to maintain to ensure lasting success [6]. In Vinh Phuc, the salt and powder samples do not contain enough iodine at preventive levels, perhaps due to the following reasons:

+ Because of low salt / iodized powder quality at the production stage (counterfeit goods, fake goods).
+ Because of reduced iodized salt / broth powder quality during circulation and use: circulation and distribution time is long, storage temperature is not suitable.

4.3. Iodine deficiency disorders assessment on high risk subjects

There was no relationship between gender and goitre. This is because the study age of the students is small (mainly 9-10 years old), so there is no gender development, the need for iodine is the same. The rate of goitre will be different between the sexes if the survey age is increased. The goitre rate in primary school students is 2.5%, of which 1A level is at 94.4%. The rate of goitre for students has decreased from 3.89% in 2010 to 2.5% in 2017. This is very good because although the rate of MI in the province is very low as above, it does not increase the goitre rate.

The prevalence of goitre is lowest in Vinh Tuong and Yen Lac (0%), in our opinion, this is a delta district with good economy compared to the rest of the province, fertile soil and adequate diet for the people. enough so there is no shortage of micronutrients, including iodine. The high rate of disease in Tam Duong (33.3%) and Tam Dao (27.8%) is because these are the two midland districts, the soil is washed away so the lack of iodine in the soil leads to the lack of iodine.

The results of the median urinary iodine test in the urine of women aged 18 - 49 are: 8.5 µg / dl, at a mild iodine deficiency. Data from 2015 up to now shows that this is the year with the highest level of urinary iodine (6.5 in 2015, 5.9 in 2016). The survey results also showed that the median urinary iodine level of Vinh Phuc has been in the range mild iodine deficiency since 2010, it will greatly affect the reproductive health of women of reproductive age, increases the risk of miscarriage, premature birth, stillbirth. There is a need for a follow-up study to evaluate the impact of iodine deficiency on this very vulnerable group because the iodine demand of women during pregnancy is 20-24.9 mcg / dl, which is one and a half times higher than normal level [5].

The study results show that there is no association between urinary iodine levels and the local goitre rate. We believe that the low rate of goitre in students in Vinh Phuc may be due to effective early detection and treatment. Goitre examination and detection are carried out by medical units from the commune health station regularly. The Provincial Preventive Medicine Center and the District Medical Center organize monthly examinations in remote communes with a schedule that is announced in advance.

5. CONCLUSION

5.1. General features

- Average age of study subjects is 34.4.
- Education level: mainly secondary school (40.2%) and high school (38.9%).
- Main occupations are farmers (54.6%) and workers (22%).

5.2. Current situation of using salt / iodized broth

- Most of the households use fish sauce and seasoning powder for food processing, the proportion of households using salt is very small (11.9%).
- Through interviews, the majority of households use iodized salt and seasoning powder (71.3%).
- Tests showed that 100% of salt / powder samples being used by Vinh Phuc people are not qualified for disease prevention.

5.3. Iodine deficiency disorders assessment on at-risk subjects

Assessment of iodine deficiency disorders on the at-risk subjects - The goitre rate in primary school students is 2.5%, of which 1A level is mainly at 94.4%. There was no relationship
between sex and goiter in these students. The rate of goitre is lowest in Vinh Tuong and Yen Lac (0%), highest in Tam Duong (33.3%) and Tam Dao (27.8%).

- The median urinary iodine level in the urine of women of reproductive age 18 - 49 years old is: 8.5 µg / dl, at a mild iodine deficiency.

6. RECOMMENDATION
- Raising awareness and guide people on how to choose food, how to find out information on packages and labels to buy food meeting quality standards.
- Adding iodine to fish sauce is a necessary requirement to enhance the effectiveness of iodine deficiency disorders prevention in the coming time.
- The quality of salt, iodized soup powder in households is very low, it is necessary to strengthen coordination among sectors: Health, Industry and Trade, and Police to manage well the iodized salt/powder circulating in the market. Strengthening inspection and strictly sanctioning cases of counterfeiting or goods not meeting quality standards to ensure high quality products can reach consumers.
- The iodine deficiency status of women of reproductive age in Vinh Phuc is only mild, but the situation has been going on for many years, which will cause chronic iodine deficiency, affecting reproductive health. Therefore, it is necessary to strengthen the management of childbirth in hospitals and medical stations, raise awareness and guide pregnant women and lactating mothers about appropriate micronutrient supplementation, including iodine supplementation.

REFERENCES

In Vietnamese

In English