Evaluation and monitoring of iodine deficiency disorders in school children in north-east Thailand

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The possibility of improving iodine deficiency disorder (IDD) in school children in Khon Kaen province was investigated during the period of 1 year, using an operational research approach. Four schools in Pupaman and Srichompu districts, namely Ban Khoa Wong, Na Fai Witaya, Ban Pa Num Tieng and Ban Non Khom, were selected for this study. Ban Non Khom served as the control school. Different methods were used for iodine fortification. Iodized salt was used for the children of the Ban Khoa Wong school, iodized water was used for Na Fai Witaya school and iodized fish sauce was used for Ban Pa Num Tieng school. The iodized salt, water and fish sauce were provided with the help of the school teachers under the supervision and advice of the team of investigators. Urine iodine excretion as well as palpation of the thyroid gland and the thyroid hormones T4, T3 and TSH were selected for monitoring and evaluation. The proportion of children with low urine iodine excretion, indicated by a cut-off point suggested by the WHO/ICCIDD/UNICEF working group, decreased during the course of the project in all schools receiving iodine supplementation as well as in the control school. However, the decrease was less in the control school in comparison with the implementation schools. Furthermore, the goitre rate decreased in all schools under investigation. The decrease of the goitre rate for the children of the control school might have been due to the activities of a village health volunteer from a nearby village who was using iodized salt for IDD control according to the ongoing national programme initiated by the Ministry of Public Health. No significant difference in the level of thyroid hormones was detected before or at the end of the supplementation for either the experimental schools or the control school. The results from the determination of thyroid hormone serum levels could not be used for assessing the outcome of the project. The measuring of urinary iodine excretion might be helpful in monitoring the iodine intake during the intervention phase. Long-term effects of iodine fortification could be seen best by the declining proportion of children with goitre. However, an observation of 1 year might not have been enough to clearly see the outcome of the project. The other possible contributing error to this study is intra-observer variation of the palpation technique when the sample size was not big enough. Goitrogens in this area might be another risk factor for the high prevalence rate of goitre. Further study in this field should be encouraged. The results of the study indicate that iodine fortification of salt and fish sauce is more effective than iodine fortification of drinking water. Due to the local preference of adding fish sauce (*nam pla*) instead of salt to almost all dishes, fish sauce proved to be the best vehicle for iodine fortification. The success of the project depended heavily on the understanding and cooperation of the school teachers and the school children. Major constraints in conducting this project were the insufficient distribution of iodized salt and potassium iodide solution for the fortification of drinking water, and the inconsistency of iodide concentration in the salt after fortification.

Key words: iodine supplementation, salt, fish sauce, drinking water, iodine deficiency disorder, north-east Thailand, Khon Kaen, evaluation, monitoring, urine iodine.

Introduction

Iodine is an essential micronutrient. The human requirement of iodine is 150 μg/day.[1] About 90% of this comes from food and 10% from water.[2] A deficiency in iodine causes goitre, mental retardation, loss of hearing and other neurological

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impairments. Also, thyroid insufficiency during foetal development and childhood results in short stature.[1–4]

In Thailand, endemic goitre is found in the north and north-eastern regions of the country.[5,6] A Thai–German cooperation project entitled 'Promotion of health and nutritional status of rural women in North-east Thailand' recently aimed to improve the nutritional status of women in north-east Thailand. A baseline survey in connection with this project was conducted in 12 villages spread over three districts in the Khon Kaen province. The project estimated the prevalence rate of goitre among women of childbearing age to be 35.1, 58.4 and 71.6%.[7] In the study area, an investigation was conducted to find the best way to control and monitor iodine deficiency. The vehicles used for iodine fortification were salt, fish sauce and drinking water. Results showed that fortified fish sauce and iodized salt were well accepted by the villagers.[8] Although the study was focused on women of childbearing age, other vulnerable groups such as school children should also benefit from iodine fortification.

The prevalence of goitre among school children in Khon Kaen province is also high, as seen in a survey conducted by the Division of Nutrition, Ministry of Public Health.[9–10] Iodine supplementation in this population group should be initiated. The aim of this study was to provide iodine supplementation to school children using the same vehicles provided previously to women of childbearing age.[8]

A system of evaluation and monitoring was established whereby urinary iodine concentrations were determined before iodine supplementation was provided to the school children and then at three month intervals during the one year study period. Serum thyroid hormone and goitre palpations were also carried out before the intervention period and again at its conclusion.

Materials and methods

School children from four primary schools, namely Ban Khao Wong, Na Fai Witaya, Ban Pa Num Tieng and Ban Non Khom, located in two districts in Khon Kaen province were randomly selected for this study.[11] General observations such as age, sex, prevalence of goitre as well as urinary iodine concentration and serum thyroid hormone were determined before iodine supplementation was provided. After the results had been reviewed, implementation was planned as follows:

1. In Ban Khao Wong school, iodized salt was used in a concentration of 50 g KIO_3 in 1000 kg NaCl resettling in a concentration of 50 p.p.m. KIO_3 in NaCl. This iodized salt was given regularly to all school children throughout the study period. The normal intake of salt was 5–10 g/day, meaning that the children might receive approximately 100–150 µg/1000 mL of iodine per day.
2. In Na Fai Witaya school, drinking water was iodized by adding concentrated iodine solution to the existing drinking water container in the school. The final iodine concentration was 200 µg/1000 mL of drinking water. It was estimated that the school children would receive at least 200 µg of iodine per day.
3. In Ban Pa Num Tieng school, fish sauce fortified with iodine was used. The final concentration of iodine in fish sauce was 80 µg/10 mL. The fish sauce was given to all school children as well as to their families for cooking in the household. The estimated amount of fish sauce intake per day was 15–20 mL, meaning that iodine intake might have been 120–160 µg/day. However, it was estimated that the children would receive iodine from other sources as well.
4. Ban Non Khom school served as the control. Being under the regular service of a national programme, the school was occasionally provided with information, iodized salt or other forms of iodine supplements.

With the exception of the control school, the three implementation schools received all of the iodine-fortified items throughout the study period. Monitoring and evaluation were carried out every third month by research teams in co-operation with teachers from the schools.

The children in all four schools were examined for urinary iodine concentration. This was done before the operational period and every third month after supplementation for 1 year. Serum T4 (thyroxine), T3 (tri-iodothyronine), thyroid stimulating hormone (TSH) and thyroid palpation were carried out in the periods before and after implementation.

Laboratory analysis

Casual urine samples were collected in the morning from all subjects. Twenty-millilitre aliquots of urine samples were chilled upon collection, frozen within 18 h and subsequently stored at – 20°C. Urinary iodine concentrations were measured using acid digestion, a method recommended by WHO/ICCIDD/UNICEF.[12] Thyroid palpation was carried out by the same physician throughout the study period.[13] Serum T4, T3 and TSH were determined using the method of radio-immunoassay supplied by a commercial kit from Diagnostic Products Cooperation, Los Angeles, CA, USA.[14]

Data analysis

Data analysis was done by using the standard statistical methods provided by the Minitab computer program (Minitab Inc, PA, USA).[15] Medians and 95% confidence intervals (CI) were calculated. The Mann–Whitney *U* test and the Wilcoxon rank sum test was used to compare the differences between implementation and control groups.

Results

Number, age range and method of iodine implementation are shown in Table 1. Median and 95% CI of urinary iodine concentration in all school children before and every 3 months after implementation are also shown in Table 1. Urine iodine concentration increased significantly in all schools. Table 2 shows the medians and 95% CI of serum T3, T4 and TSH of the school children in all of the implementation schools as well as in the control school, both before and after implementation. No significant differences were found when thyroid hormones before and after supplementation were compared. However, serum T3 and T4 in the school children from Na Fai Witaya (intervention with iodized drinking water) and Ban Pa Num Tieng (intervention with fortified fish sauce) increased significantly after implementation as compared with those from Ban Khao Wong (intervention with iodized salt) and Ban Non Khom (control school). Serum TSH in the children from Na Fai Witaya also increased significantly after implementation (Table 2).

The prevalence of severe iodine deficiency disorder (IDD) in school children, with urinary iodine concentration being used as an indicator as recommended by WHO/ICCIDD/UNICEF,[12] before and after implementation is shown in Table 3. Severe levels of IDD among the school children from all three of the implementation schools decreased, particularly at Na Fai Witaya (iodized drinking water) where especially severe IDD (urinary iodine < 2.0 µg/dL) was found. The results after implementation show that the prevalence of normal children in the implementation schools increased. Table 4 shows the prevalence of goitre in the school children before and after implementation, according to goitre grading. An increasing number of normal goitre grade (grade 0) was shown in all implementation groups, while a decrease was observed in the control group. Prevalence of goitre (grades 1A, 1B and 2) decreased in the school children from all implementation schools but in the control group an increase in the prevalence of grade 1A goitre was found (Table 4).

Table 1. Medians and 95% confidence interval of urinary iodine concentration in school children before and after implementation

Parameters	Ban Khao Wong	Na Fai Witaya	Ban Pa Num Tieng	Ban Non Khom
Number	68	75	57	63
Age (years)	8.9 (8–10)	9.6 (9–10)	9.4 (9–10)	9.4 (9–10)
Method of iodine implementation	iodized salt	iodized water	iodization in fish sauce	control
Urine iodine (µg/dL)				
Before	$9.6^{a,b}$ (6.8–12.8)	12.3^{ac} (9.5–13.6)	10.8^{ac} (9.3–12.9)	12.9^{c} (11.8–14.7)
After 3 months	27.2^{a} (22.1–34.8)	12.9^{b} (10.8–14.6)	12.7^{b} (10.4–14.6)	20.0^{a} (16.3–29.7)
After 6 months	17.6 (13.4–19.5)	14.2 (10.4–17.8)	15.8 (12.6–17.6)	13.0 (10.7–17.2)
After 9 months	9.5^{a} (8.0–12.0)	16.7^{b} (10.4–19.1)	10.9^{a} (7.6–15.1)	17.4^{b} (14.9–22.0)
After 12 months	19.5^{a} (16.1–23.9)	30.5^{bc} (18.3–40.0)	18.8^{ad} (16.6–24.9)	30.0^{acd} (16.8–40.0)

[abcd] Any difference in index letters along the same horizontal line indicates difference between the values $P < 0.05$ using Kruskal-Wallis analysis of variance and multiple comparison.

Discussion

School children belong to one of the vulnerable groups for IDD, according to WHO/ICCIDD/UNICEF recommendations.[12] These groups include (i) infants; (ii) pre-school children in MCH clinics; (iii) preschool children in households; (iv) children in schools; (v) pregnant women in MCH clinics; and (vi) adult women in households. In the past, the iodine status of vulnerable groups was mostly assessed by using clinical symptoms such as an increase in the size of the thyroid gland. Problems arose when thyroid size was used to monitor the result after supplementation because the size was inconsistently reduced. Therefore, the use of urine iodine determination and thyroid hormone was recommended by WHO/ICCIDD/UNICEF as a useful method for evaluation and monitoring. Although problems still exist because of the complicated and difficult nature of these methods, many countries and regions still use the urine iodine determination

Table 2. Medians and 95% confidence interval of serum T4, T3 and TSH in school children before and after implementation

Parameters	Ban Khao Wong	Na Fai Witaya	Ban Pa Num Tieng	Ban Non Khom
Number	68	75	57	63
Age	8.9 (8–10)	9.6 (9–10)	9.4 (9–10)	9.4 (9–10)
Method of iodine implementation	Iodized salt	Iodized water	Iodization in fish sauce	Control
Serum T4 (µg/dL)				
Before implementation	8.9^{ab} (8.6–10.0)	8.7^{c} (8.4–9.0)	7.6^{bd} (7.2–8.1)	7.2^{d} (6.9–7.5)
After implementation	7.8^{a} (6.6–8.6)	7.4^{a} (6.8–7.8)	8.5^{b} (7.5–9.3)	7.5^{a} (7.0–8.0)
Serum T3 (ng/dL)				
Before implementation	125.9^{a} (124.0–132.0)	127.5^{ab} (122.0–133.0)	140.5^{b} (134.0–146.3)	144.0^{ac} (136.8–152.3)
After implementation	121.0^{a} (115.0–126.4)	130.3^{b} (125.2–133.8)	136.0^{b} (132.0–145.0)	119.0^{a} (114.3–127.2)
Serum TSH (µIU/mL)				
Before implementation	1.3^{a} (1.0–1.5)	1.1^{b} (1.0–1.2)	1.1^{a} (1.0–1.3)	1.4^{c} (1.2–1.9)
After implementation	1.4^{a} (1.2–1.5)	2.0^{b} (1.7–2.4)	1.4^{a} (1.1–1.9)	1.7^{c} (1.5–1.8)

[abcd] Any difference in index letters along the same horizontal line indicates difference between the values $P < 0.05$ using Kruskal-Wallis analysis of variance and multiple comparison.

Table 3. Prevalence of severity of IDD in school children using urinary iodine concentration as an indicator by WHO/ICCIDD/UNICEF recommendation before and after implementation

Urine iodine	Ban Khao Wong (n = 68)		Na Fai Witaya (n = 75)		Ban Pa Nam Tieng (n = 57)		Ban Non Khom (n = 63)	
	Before (%)	After (%)	Before (%)	After (%)	Before (%)	After (%)	Before (%)	After (%)
Severe IDD (<2.0 µg/dL)	—	—	2 (2.7)	—	—	—	—	
Moderate IDD (2.0–4.9 µg/dL)	8 (11.8)	—	3 (4)	2 (2.7)	3 (5.3)	—	3 (4.8)	1 (1.6)
Mild IDD (5.0–9.9 µg/dL)	24 (25.3)	8 (11.8)	24 (32)	8 (10.7)	21 (36.8)	7 (12.3)	19 (30.2)	9 (14.3)
No deficiency (≥ 10 µg/dL)	36 (52.9)	60 (88.2)	46 (61.3)	65 (86.7)	33 (57.9)	50 (87.7)	41 (65.1)	53 (84.1)

Table 4. Prevalence of goitre in school children before and after implementation

Goitre grading	Ban Khao Wong (*n* = 68)		Na Fai Witaya (*n* = 75)		Ban Pa Num Tieng (*n* = 57)		Ban Non Khom (*n* = 63)	
	Before (%)	After (%)	Before (%)	After (%)	Before (%)	After (%)	Before (%)	After (%)
Grade 0	53.0	68.2	55.1	49.3	7.0	76.8	72.6	66.7
Grade 1A	37.9	27.3	34.8	35.6	21.1	16.0	16.1	31.7
Grade 1B	9.1	4.5	10.1	13.7	49.1	5.4	11.3	1.6
Grade 2	—	—	—	1.4	22.8	1.8	—	—

method to monitor iodine supplementation. These include Algeria,[16] central Ethiopia,[17] French-speaking Africa,[18] Thailand,[19] Japan,[20] and Bohemia.[21] There might be some variations in the urinary iodine concentration due to time of specimen collection.[22–23] In a study carried out on 824 males and females, Brug *et al.* reported that it was better to use urinary iodine concentrations reported in proportion of microgram iodine/g creatinine than iodine concentrations alone.[24] However, in some areas the excretion of creatinine from children might vary depending on protein intake. The proportion of iodine concentration and gram creatinine will therefore not be correct.[25–26] Because of this, only urine iodine concentration (µg/dL) was used in this study to compare the results after supplementation.

Serum T4, T3 and TSH before and after supplementation were also determined by using radio-immunoassay as the standard method.[27] In this study, the median of these thyroid hormones from the children both before and after supplementation were not found to be significantly different (Table 4). Serum TSH has been used to screen congenital hypothyroidism[28] and non-thyroidal illnesses (NTI)[29] as well as to monitor oral iodized oil supplementation.[16] Benmiloud *et al.* concluded that thyroid hormones could not be used to evaluate and monitor supplementation.[16] High TSH levels were observed in only a few of the subjects suffering from mild iodine deficiency but in most of the subjects with severe iodine deficiency.[30] It has been suggested that TSH be used only for epidemiological surveillance.[19]

Considering the prevalence of severity of IDD in school children, using urinary iodine concentration as an indicator as recommended by WHO/ICCIDD/UNICEF before and after implementation as shown in Table 3, the level of severity in school children decreased in all implementation schools and severe IDD (urinary iodine > µg/dL), as found in Na Fai Witaya (iodized drinking water), disappeared. In all of the implementation schools, the number of normal children (urinary iodine ≥ 10 µg/dL) increased and was higher than in the control school (Table 3). However, the proportion of children without goitre in the control group also increased during the study period. This may have been due to activities such as the regular organization and distribution of iodized salts at the village level, carried out by health volunteers around the control school.

The increase of urine iodine concentration in both the implementation and control schools did not correlate with time (Tables 1, 2). There appeared to be seasonal variations in food intake. This observation is supported by Schelp *et al.*, who reported that food supplementation is dependent on season.[31] Therefore, although iodine supplementation was provided, food intake varied in each season, which brought about unexpected results.

Using urinary iodine concentration as a criterion, the results showed an increasing percentage of non-deficiency in all of the implementation schools in comparison with the control school (Table 3). Using palpation of the thyroid gland, an increase was observed in the percentage of grade 0 of children from the intervention schools, while a decrease was observed in the control school (Table 3). It was shown that prevalence of goitre was not related to urinary iodine concentration.[7] Therefore, it is appropriate to use urinary iodine concentration as a tool to monitor an iodine supplementation programme.

Regarding grades 1A, 1B and 2 prevalence, grade 1A showed an increase of 16.1–31.7% in Ban Non Khom (control school), while a decrease in grades 1A, 1B and 2 was observed in all of the implementation schools, most noticeably at Ban Khao Wong and Ban Pa Num Tieng (Table 4). These two schools were supplemented with iodized salt and iodized fish sauce. These two methods probably need continuous supplementation, as shown in a previous study.[8]

The decrease of goitre prevalence was not consistent with time (Table 4). A possible explanation for this might be found in other factors which cannot be controlled, such as intra-observer variation of palpation by physician, goitrogen interference and small sample size. Further study into this is required.

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泰國東北部學齡兒童碘缺乏病（ IDD ）的監控與評估

摘　要

作者用一年時間研究了泰國 Khon Kaen 省學齡兒童碘缺乏病（ IDD ）改善的可能性，他們在 Pupaman 和 Srichompu 地區選擇了 Ban Khoa Wong 、 NaFai Witaya 、 Ban Pa Num Tiang 和 Ban Non Khom 四間學校爲對象，攝取不同形式的強化碘鹽。 Ban Khoa Wong 學校給予碘鹽， NaFai Witaya 學校給予碘化水，和 Ban Pa Num Tiang 學校給予碘化魚醬， Ban Non Khom 學校作爲對照。在研究人員的指導下，通過學校老師的幫助給予碘鹽、碘化水和碘化魚醬。尿碘排量、甲狀腺觸診和甲狀腺激素 T4 、 T3 和 TSH 的結果均用作研究的監控和評估。

界定低尿碘排量是根據 WHO / ICCIDD / UNICEF 提出的標準，在試驗期間補充碘鹽和對照學校兒童尿碘排量均下降，但與補充碘鹽的學校比較，對照學校下降較少。在研究過程中發現，所有學校甲狀腺腫發病率均低。對照學校兒童甲狀腺腫發病率低的原因可能早些時候曾用碘鹽控制所致。

三間補充碘鹽和一間對照學校的兒童，在試驗前後沒有發現血清甲狀腺素水平有明顯差異。

從血清甲狀腺素測定的結果不能用作研究的評估，尿碘排量也許對試驗期間監控碘的攝取有所幫助，長期給予強化碘鹽可使兒童甲狀腺腫比率下降，觀察一年時間也許不能清楚地看出結果。其它可能的誤差是，當甲狀腺腫不明顯時觸診不易鑒別，在這個地區中致甲狀腺腫物質也許是甲狀腺腫發病的另一危險因素，在這個領域內進一步研究應該是鼓勵的。

研究結果提出強化碘鹽和碘化魚醬較碘化水更有效果。由于當地人喜用碘化魚醬（ nam pla ）代替食鹽，因此碘化魚醬被認爲是最好的供碘物質。試驗的成功主要依靠學校老師和學齡兒童的合作與理解。

進行該研究的主要障礙是強化碘鹽分配不足和碘化鉀溶液配製碘化水不夠供應及強化碘鹽的濃度不衡定。

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บทคัดย่อ

คณะผู้วิจัยได้ทำการศึกษาวิจัยติดตามและประเมินผลการควบคุมโรคขาดสารไอโอดีนในเด็กนักเรียน 4 โรงเรียนคือ โรงเรียนบ้านเขาวง โรงเรียนนาฝายวิทยา โรงเรียนบ้านผาน้ำเที่ยง และโรงเรียนบ้านโนนคอม ซึ่งโรงเรียนเหล่านี้ตั้งอยู่ในอำเภอภูผาม่าน และอำเภอสีชมพู จังหวัดขอนแก่น โดยกำหนดให้โรงเรียนเขาวง โรงเรียนนาฝายวิทยา และโรงเรียนบ้านผาน้ำเที่ยงเป็นโรงเรียนกลุ่มทดลองโดยได้รับการเสริมไอโอดีนในรูปแบบต่าง ๆคือ โรงเรียนบ้านเขาวงได้รับเกลือเสริมไอโอดีน โรงเรียนนาฝายวิทยาได้รับน้ำดื่มเสริมไอโอดีน โรงเรียนบ้านผาน้ำเที่ยงได้รับน้ำปลาเสริมไอโอดีน โดยมีโรงเรียนบ้านโนนคอมเป็นโรงเรียนควบคุม ดัชนีชี้วัดที่ใช้เพื่อติดตามและประเมินผลของการเสริมไอโอดีนในรูปแบบต่าง ๆคือ ปริมาณไอโอดีนในปัสสาวะ ขนาดของต่อมธัยรอยด์ และปริมาณธัยรอยด์ฮอร์โมนในเลือดซึ่งได้แก่ T3 T4 และ TSH การเสริมไอโอดีนในรูปแบบต่าง ๆได้ปฏิบัติอย่างต่อเนื่อง ตลอดระยะเวลา 1 ปี ส่วนดัชนีชี้วัดต่าง ๆที่ใช้ในการติดตามและประเมินผล ได้ทำการทดสอบในระยะเวลาต่าง ๆกัน คือปริมาณไอโอดีนในปัสสาวะตรวจสอบทุก ๆ 3 เดือน ปริมาณธัยรอยด์ฮอร์โมนในเลือดและขนาดของต่อมธัยรอยด์ วัดผลเมื่อเริ่มต้นโครงการและสิ้นสุดโครงการ หลังจากสิ้นสุดโครงการแล้ว ได้ทำการประเมินผลปริมาณไอโอดีนในปัสสาวะในกลุ่มต่าง ๆโดยแบ่งแยกประเภทตามความรุนแรงของโรคขาดสารไอโอดีน ซึ่งแนะนำโดย WHO/ICCIDD/UNICEF พบว่าอัตราความรุนแรงของโรคขาดสารไอโอดีนในเด็กนักเรียนมีค่าลดลงในโรงเรียนกลุ่มทดลอง รวมทั้งในกลุ่มควบคุมด้วย ซึ่งการลดลงในกลุ่มควบคุมเชื่อว่าเกิดจากการแจกจ่ายเกลือไอโอดีนในโครงการของกระทรวงสาธารณสุข อันเนื่องมาจากนโยบายแก้ปัญหาโรคขาดสารไอโอดีนแห่งชาติ โดยอาสาสมัครสาธารณสุขที่รับผิดชอบในพื้นที่มีความกระตือรือร้นต่อการแก้ปัญหาการขาดสารไอโอดีน อย่างไรก็ตามเมื่อเปรียบเทียบจำนวนร้อยละที่เพิ่มขึ้นของกลุ่มปรกติพบว่า โรงเรียนทดลองทั้ง 3 โรงเรียน มีอัตราการเพิ่มขึ้นถึงร้อยละ 25.3, 25.4 และ 29.8 ตามลำดับ ในขณะที่โรงเรียนควบคุมเพิ่มขึ้นเพียงร้อยละ 19 ซึ่งมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ เมื่อใช้อัตราการเป็นโรคคอพอกหรือขนาดของต่อมธัยรอยด์เป็นดัชนีชี้วัดพบว่าอัตราการเป็นโรคคอพอกลดลงในโรงเรียนบ้านเขาวงซึ่งเสริมด้วยเกลือเสริมไอโอดีน และโรงเรียนบ้านผาน้ำเที่ยงซึ่งเสริมไอโอดีนในน้ำปลา ในขณะที่อัตราการเป็นโรคคอพอกได้เพิ่มขึ้นในโรงเรียนนาฝายวิทยาซึ่งเสริมไอโอดีนในน้ำดื่มและโรงเรียนบ้านโนนคอมซึ่งเป็นโรงเรียนควบคุม ส่วนปริมาณธัยรอยด์ฮอร์โมนชนิดต่าง ๆในเลือดเช่น T4 T3 และ TSH พบว่าไม่มีความแตกต่างกันเมื่อเริ่มโครงการและเมื่อสิ้นสุดโครงการ คณะผู้วิจัยเชื่อว่าการใช้ดัชนีชี้วัดในการติดตามและประเมินผลการเสริมไอโอดีนในเด็กนักเรียนด้วยการวัดปริมาณไอโอดีนในปัสสาวะน่าจะเป็นดัชนีชี้วัดที่ดีและมีความไวกว่าดัชนีอื่น ๆ อย่างไรก็ตามควรจะใช้ร่วมกับดัชนีชี้วัดอื่น ๆเช่นขนาดของต่อมธัยรอยด์ด้วย ส่วนการเสริมไอโอดีนในรูปแบบต่าง ๆนั้น ปรากฏว่าการเสริมไอโอดีนด้วยเกลือเสริมไอโอดีนและน้ำปลาเสริมไอโอดีนจะทำได้ค่อนข้างสม่ำเสมอกว่าการใช้น้ำดื่มเสริมไอโอดีนโดยเฉพาะอย่างยิ่งในพื้นที่ทางภาคตะวันออกเฉียงเหนือ ปัจจัยที่จะต้องคำนึงถึงอีกประการหนึ่งคือจำนวนของนักเรียนในแต่ละกลุ่มทดลองอาจจะมีจำนวนน้อยเกินไป (57-75 คน) ความผิดพลาดจากการคลำขนาดของต่อมธัยรอยด์ของแพทย์ผู้ตรวจ ซึ่งเป็น intra observer variation ของแต่ละบุคคลอาจเกิดขึ้นได้ ประกอบกับภาวะการขาดสารไอโอดีนในบริเวณนี้อาจมีสาเหตุมาจากสารก่อคอพอก (goitrogen) อื่น ๆที่อาจมีในสิ่งแวดล้อมในบริเวณพื้นที่ที่ทำการศึกษา ซึ่งสมควรจะได้ค้นคว้าวิจัยต่อไป ปัญหาและอุปสรรคที่พบคือการบริหารจัดการเพื่อให้ได้มาซึ่งเกลือเสริมไอโอดีนและสารละลายไอโอดีนเข้มข้นซึ่งมักทำให้การเสริมไอโอดีนเป็นไปอย่างไม่สม่ำเสมอ รวมทั้งการควบคุมคุณภาพของปริมาณไอโอดีนที่มีอยู่ในเกลือเสริมไอโอดีนยังไม่สม่ำเสมอ อย่างไรก็ดีคณะผู้ศึกษาวิจัยครั้งนี้เชื่อว่ามาตรการต่าง ๆจะได้รับการปรับปรุงแก้ไขเพื่อให้การดำเนินการเสริมไอโอดีนเป็นไปได้โดยทั่วถึงในพื้นที่ที่มีความเสี่ยงต่อการขาดสารไอโอดีนเพื่อขจัดโรคขาดสารไอโอดีนให้หมดไปในอนาคต

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