Iodine Survey Report

Non-Communicable Disease Branch
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Executive Summary

The Department of Health (DH) of the Hong Kong Special Administrative Region Government (HKSAR) has commissioned The Chinese University of Hong Kong (CUHK) to conduct the Iodine Survey, aimed to assess the iodine status among school-aged children, pregnant women and lactating mothers in Hong Kong.

Iodine is an essential micronutrient required for the production of thyroid hormone to support growth and development. Persistently low iodine intake will result in iodine deficiency. The thyroid gland will be depleted of iodine to synthesise adequate thyroid hormone. The resulting low level of thyroid hormones in the blood is the principal factor responsible for damage to the developing brain and other harmful effects known collectively as iodine deficiency disorders (IDD). Children, pregnant and lactating women, are particularly vulnerable to IDD and should ensure adequate dietary iodine intake for them to meet the requirement.

The World Health Organization (WHO) considers iodine deficiency as the single most important preventable cause of brain damage worldwide and recommended a daily intake of 150μg for adolescents and adults, and 250μg for pregnant and lactating women.

The Study

Between February and December 2019, a total of 1,023 school-aged children, 1,513 pregnant women, and 482 lactating mothers were recruited from different regions of Hong Kong. Information on socio-demographic, consumption of iodised salt, specified iodine-rich food and nutritional supplement were collected via face-to-face questionnaire interview, and spot urine iodine tests were conducted for all participants. Median urinary iodine concentration (UIC), which is the most commonly used indicator and reflects recent iodine intake of target group, was assessed. In addition, for school-aged children, size of the thyroid glands were measured by ultrasonography (USG) to assess the total goitre rate. Median UIC and total goitre rate results were classified according to the epidemiological criteria for assessing iodine nutrition based on median UIC and the prevalence of goitre provided by the WHO respectively.

Key findings

Among the 1,023 school-aged children, 122 (11.9%) reported consumption of iodised salt at home, while 995 (97.3%) reported consumption of specified iodine-rich food including 226 (47.9%) taking more than once per month. The median UIC of 1,023 school-aged children with valid urine sample was 115 μg/L, which is classified as "adequate" iodine intake according to the cut-off points (i.e. 100-199 μg/L) as recommended in the WHO's Guide. The total goitre rate assessed with body surface area (BSA)-specific reference values and age-specific reference values are 1.7% and 2.2% respectively. Both the BSA-specific and age-specific total goitre rates for school-aged children in this survey fall within the category of “none” degree for IDD based on the prevalence of goitre provided by WHO.

Among the 1,513 pregnant women, 71 (4.7%) reported regularly consumed iodised salt, while 1,262 (83.4%) reported consumption of specified iodine-rich food during pregnancy including 828 (54.7%) taking more than once per month during pregnancy. Moreover, 1,128 (74.6%) took iodine-containing nutritional supplements during pregnancy; of them 894 (59.1%) took iodine-containing supplements at average daily iodine intake of equal to or above 150 μg/day. The main reason for those never took iodine-containing supplements during pregnancy was “did not know iodine supplement is necessary during pregnancy”. The median UIC of 1,509 pregnant women with valid urine sample was 134 μg/L, which was classified as “insufficient” iodine intake (i.e. <150 μg/L). The median UIC of 892 women who took iodine-containing supplements at average daily iodine intake of at least 150 μg/day was 156 μg/L, and is classified as “adequate” iodine intake (i.e. 150 - 249 μg/L) according to the WHO classification. The median UIC for pregnant women with iodine-containing supplementation at average daily intake less than 150 μg/day, and those did not consume any supplement or consumed supplement without iodine were 132 μg/L and 97 μg/L respectively, which were <150 μg/L. Meanwhile, pregnant women with iodine-supplementation at average daily intake less than 150 μg/day, their median UIC is not significantly above or equal to 150 μg/L [p=0.47]; the median UIC for pregnant women who did not take any supplement or took supplement without iodine is significantly below 150 μg/L [p<0.001].

Among the 482 lactating mothers, 24 (5.0%) reported regularly consumed iodised salt, while 260 (53.9%) reported consumption of specified iodine rich food including 137 (28.4%) taking more than once per month during lactating period. Moreover, 209 (43.4%) took iodine-containing nutritional supplements during lactation; of them 137 (28.4%) took iodine-containing supplements at average daily iodine intake of at least 150 μg/day. The main reason for those never took iodine-containing supplements during lactation was “did not know iodine supplement is necessary during lactation”. The median UIC of all 479 lactating mothers with valid urine sample was 65 μg/L, which was classified as “insufficient” iodine intake (i.e. <100 μg/L). Nevertheless, the median UIC of 136 lactating mothers who took iodine-containing supplements at average daily iodine intake of at least 150 μg/day was 84 μg/L, which was also classified as “insufficient” iodine intake according to the WHO classification. The median UIC for lactating mothers with iodine supplementation at average daily intake less than 150 μg/day, and those did not consume any supplement or consumed supplement without iodine were 71 μg/L and 58 μg/L respectively, which were <100 μg/L. The median UICs for all lactating mothers and their subgroups are significantly below 100 μg/L [p<0.001].

Conclusion

For school-aged children, based on the epidemiological criteria for assessing iodine nutrition by median UIC and the epidemiological criteria for assessing the severity of IDD by the prevalence of goitre, the iodine status of school-aged children is classified as “adequate”, and the degree of IDD falls into the category of “none”.

For pregnant women, based on the WHO epidemiological criteria for assessing iodine nutrition by median UIC, the iodine status of pregnant women with iodine-containing supplements at average daily iodine intake of equal to or above 150 μg/day is classified as “adequate”, while the iodine status of pregnant women with iodine-containing supplements at average daily iodine intake of less than 150 μg/day and those without iodine supplement is classified as “insufficient”.

For lactating mothers, based on the WHO epidemiological criteria for assessing iodine nutrition by median UIC of lactating women, the iodine status of lactating mothers, those with or without iodine-containing supplement are classified as “insufficient”. Although lactating mothers with iodine-containing supplements at average daily iodine intake of at least 150 μg/day have higher median UIC than those with iodine-containing supplements at average daily iodine intake of less than 150 μg/day and those without iodine-containing supplements, their iodine status is still classified as “insufficient”. Nevertheless, maternal median UIC may not be a good indicator of iodine content in breast milk, due to preferential excretion of iodine into breast milk.

Recommendation

The Working Group on Prevention of Iodine Deficiency Disorders (Working Group) which has been set up by DH and Centre for Food Safety (CFS), Food and Environmental Hygiene Department, with representatives from the the Hospital Authority, Hong Kong College of Community Medicine, the Hong Kong College of Family Physicians, the Hong Kong College of Obstetricians and Gynaecologists, the Hong Kong College of Paediatricians, and the Hong Kong College of Physicians, has reviewed the latest scientific evidences, including the key findings of the survey, in July 2021. The following recommendations were made by the Working Group:

- Health education on iodine intake among pregnant and lactating women should be strengthened;
- Joint recommendation for iodine intake for pregnant and lactating women should be made in collaboration with relevant parties. Key messages includes (1) taking iodine-containing supplement at least 150ug iodine per day, (2) consuming food with more iodine as part of a healthy balanced diet, and (3) using iodised salt; and
- Based on findings of adequate iodine intake among school aged children, mandatory salt iodisation programme is not warranted in local situation.

1. Background and Survey Method

1.1 Background

1. Iodine is an essential micronutrient required for the production of thyroid hormone to support growth and development. [1] Persistently low iodine intake will result in iodine deficiency. The thyroid gland will be depleted of iodine to synthesise adequate thyroid hormone. The resulting low level of thyroid hormones in the blood is the principal factor responsible for damage to the developing brain and other harmful effects known collectively as iodine deficiency disorders (IDD). [2]

2. Globally, about 30% of the world's population live in areas with iodine deficiency. Iodine deficiency affects all populations at all stages of life, but would result in irreversible derangement of the brain and central nervous system during critical period from the second trimester of pregnancy to the third year of life. Children, pregnant and lactating women, are particularly vulnerable to IDD and should ensure adequate dietary iodine intake for them to meet the requirement [1, 2, 3, 4]. The World Health Organization (WHO) considers iodine deficiency as the single most important preventable cause of brain damage worldwide and recommended a daily intake of 150μg for adolescents and adults, and 250μg for pregnant and lactating women. [2]

3. There are some studies suggesting that iodine deficiency is prevalent in Hong Kong. After completion of the first Hong Kong Population-based Food Consumption Survey, the Centre for Food Safety (CFS) conducted a preliminary study to understand more about the local dietary intake of iodine in 2011. Findings suggested that median daily intake might be probably below the recommendation made by the WHO. However, the study acknowledged its inherit limitations which underestimated the iodine intake levels and recommended more studies to be conducted on vulnerable groups by using biochemical tests and clinical examinations to provide more comprehensive view of the local iodine status.[3]

4. To fill the information gap on local iodine nutritional status, a Preparatory Meeting for IDD with representatives from Department of Health (DH), CFS and relevant Colleges including Hong Kong College of Community Medicine, Hong Kong College of Obstetricians and Gynaecologists, Hong Kong of Physicians and Hong Kong College of Paediatricians) was convened in 2014 to review the local situation and international experience on IDD. Subsequently, the DH commissioned the Chinese University of Hong Kong (CUHK) to conduct the Iodine Survey to assess iodine status of the three vulnerable groups, namely school-aged children, pregnant women and lactating mothers.

1.2 Objectives

5. The Survey aimed to assess the iodine status among school-aged children, pregnant women and lactating mothers in Hong Kong.

1.3 Sample frame and selection

Subjects

6. This is a territory-wide cross-sectional observational study. The sampled subjects for all target groups were geographically weighted over four regions in Hong Kong (i.e. Hong Kong Island, Kowloon, New Territories East and New Territories West). The recruitment (fieldwork) period was between 13 February 2019 and 19 December 2019.

7. School-aged children, were recruited at Student Health Service Centres (SHSCs) while pregnant women and lactating mothers were recruited at the Maternal and Child Health Centres (MCHCs) and HA birthing hospitals. The sites of recruitment are shown in Appendix 1.

Inclusion and exclusion criteria

8. Children aged 6-12 years were eligible for the school-aged children subgroup. However, children who had known medical conditions requiring diet restriction, thyroid disorders, or was taking long term medication were not eligible.

9. Women aged 18 or above, who were carrying a singleton pregnancy were eligible for the pregnancy subgroup, whereas mothers aged 18 or above, who delivered a singleton pregnancy and were predominantly breastfeeding (i.e. more than 50% of her baby's feed were from breast milk) were eligible for the lactating subgroup. Women who had a prior history of thyroid disease, autoimmune disease, any medical condition requiring long term medications or diet restriction were not eligible for the pregnant subgroup. Lactating mothers whose baby was born preterm, with low birth weight, older than 6-months old at the time of recruitment, had been breastfed for less than one week or had been introduced on solid food, were not eligible for the lactating subgroup.

1.4 Method

Questionnaires

10. Demographic data, dietary iodine intake from iodised salt and iodine-rich food, and use

of nutritional supplementation were obtained through face-to-face interviews using questionnaires.

Assessment of the dietary iodine intake

11. For the school-aged children subgroup, use of iodised salt and consumption frequency of iodine-rich food including kelp, laver, etc. were recorded.

12. For the pregnant women and lactating mothers, dietary iodine intake was assessed by recording the consumption pattern of specified iodine-rich food only, including cooked kelp / algae, cooked seaweed, and seaweed snack after pilot survey. Consumption habit of iodised salt and use of iodine-containing nutritional supplement were recorded. Moreover, pregnant women and lactating mothers were asked to make a detailed record of all the iodine-containing nutritional supplementations, such as the timing of commencement and cessation of each nutritional supplement. Milk and milk products fortified with iodine were not classified as iodine-containing supplements.

Measurement of urinary iodine concentration

13. Median urine iodine concentration (UIC) is used as the biochemical indicator to assess the current iodine status of the three target groups.

Urine sample collection

14. The participants were asked to collect at least 10 mL of spot urine sample directly into a clean acid-washed trace element urine bottle provided to them at the recruitment site. They were provided with a pair of disposable gloves, and special precautions were taken to avoid sample contamination. They were reminded to screw the bottle cap properly to the urine bottle after urine collection to prevent leaking. The urine bottles were placed into double bags and transported in a leak-proof container back to the laboratory at the Department of Chemical Pathology, Prince of Wales Hospital on the same day. Samples were stored at 4℃ until the day of analysis.

Assays of urinary iodine concentrations (UIC)

15. Urinary iodine was assayed by an inductively coupled plasma mass spectrometer concentration (ICPMS) by Agilent ICPMS 7700 with octopole reaction system (Agilent Technologies, US). UIC was assayed in micromole of iodine content per litre of urine (μmol/L) and was converted in microgram in per litre of urine (μg/L). Both the laboratory in the Department of Pathology and the urine iodine measurement test are accredited against ISO15189:2012 standard by the National Association of Testing Authorities, Australia (NATA).

The urine iodine assay was also externally monitored by two independent external quality assessment programmes, namely, the Ensuring the Quality of Urinary Iodine Procedures (EQUIP) by the Centers for Disease Control and Prevention (CDC), US and the Quebec Multi-element External Quality Assessment Scheme (QMEQAS) by the Centre de toxicologie du Quebec, Canada.

Measurement of thyroid size by ultrasound

16. The prevalence of goitre or the total goitre rate (TGR) was also used to assess the severity of IDD. Size of the thyroid glands are measured in all recruited children by ultrasonography (USG) according to the WHO scanning protocol [2] using the portable ultrasound system (GE LOGIQ e R7 Ultrasound Machine), performed by trained sonographer.

17. Children were scanned in supine position with a pillow or rolled towel under the shoulders to maintain neck extension. Ultrasound gel (Sky gel, ISD Meditech) was used, and the transducer was held at a 90-degree angle to the skin, using only minimal pressure.

18. During transverse ultrasound scanning, the lateral aspect of each thyroid lobe was delineated by the echo-free lumina of the carotid arteries (pulsation) and jugular veins (distension on Valsalva). The maximal depth (anteroposterior) of the transverse section of each lobe was measured at a 90-degree angle to the skin surface, and the maximal width (mediolateral) was measured at 90-degrees to the depth measurement. The measurement did not include the thyroid capsule or the thyroid isthmus.

19. During longitudinal ultrasound scanning, the measurement of the thyroid lobe length referred to the maximal cranio-caudal extent of the gland itself without any other specific external landmarks.

20. Thyroid volume was calculated by the sum of the volumes of both lobes with the exclusion of the volume of the isthmus.

21. Volume (V) of each lobe was calculated from the measurements of the depth (d), width (w) and length (l) of each lobe by the formula: V (ml) = 0.479 x D (cm) x W (cm) x L (cm) [2].

22. Measurements for body weight [W] and body height [H] were performed by SHSC staff according to conventional standard method. Body surface area was calculated from body weight (W) and body height (H) with the following formula from Dubois et al [5]: BSA (m^2) = W (kg) $^{0.425}$ x H (cm) $^{0.725}$ x 71.84 x 10 $^{-4.}$

Follow up and referral

23. Ultrasound reports were provided to all participants; those with abnormal findings were referred to specialist clinic for further assessment and treatment.

Sample size calculation

24. For school-aged children, assuming the prevalence of goitre in children is 3.8% [6], the sample size was calculated by the OpenEpi program as follows:

Sample Size for Percentage Frequency in a Population (Random Samples) [7]		
		Reference/remarks
Population size (6-12 years old), N	400000	Census and Statistics Department, HKSAR
Anticipated % frequency, p	3.8	Ref. [6]
Confidence limits as +/- % of 100, d	1.2	
Desired confidence level, Z	1.96	For 95 % confidence
Design effect, DEFF	1.0	1.0 for random sample

Sample size,

$n = [DEFF*N*p*(1-p)] / [(d/Z)^2*(N-1)+p*(1-p)]$

$n = [1*400000*0.038*0.962]/[(0.012/1.96)^2*(400000-1)+(0.038*0.962)]$

$n = 973$

25. To overcome unexpected circumstances, such as unable to save urine or insufficient urine for laboratory assay, it was designed to recruit extra subjects for the calculated sample size. A total of 1000 children with a gender ratio at 1:1 was expected to be recruited, in which half would be from age 6 to 9 and the remaining half would be from age 10 to 12. As the number of participants enrolled from each region was based on the proportion of school-aged children attending SHSCs at the four regions of Hong Kong, the recruitment ratio at the HKI, KLN, NTE and NTW regions was around 10:24:12:17 respectively (Appendix 2).

26. The mean and standard deviation of pregnant women's UIC were 100 μg/L and 108 μg/L in a previous study [8]. We assumed the pregnant women at each trimester, and lactating mothers had the same standard deviation. At least 448 subjects are required to estimate a mean with 95% confidence at a precision (or margin of error) of ± 10 μg/L in each subgroup. [9] We also assumed a 10% of unsuccessful quantification of UIC from the urine sample, hence at least 498 subjects are required for each subgroup. Therefore, the study was designed to recruit 500 pregnant women at each trimester and 500 lactating mothers. As the number of participants recruited from each region was based on the proportion of patient load of MCHC among

individual clusters, the recruitment ratio at the HKI:KLN:NTE:NTW regions was around 3:6:5:6. (Appendix 2).

Sample size,

$n = (Z\ \sigma / E)^2 = (1.96 * 108 / 10)^2 = 448$
Desired sample size = 448/0.9 = 498

$Z_{\alpha/2}$	1.96	The critical value for 95 % confidence
σ	108 μg/L	The standard deviation estimated from a previous study
E	10 μg/L	Margin of error

Statistical analysis

27. Data are expressed as mean +/- standard deviation (SD), median [interquartile range (IQR)] or number (proportion). Between-group comparisons of UIC were performed by using Mann–Whitney U Test, Median Test, Kruskal-Wallis H Test, and Wilcoxon Signed Rank Test as appropriate. A P value <0.05 for two-tailed statistical tests was used to indicate statistical significance. Statistical analysis was performed by using SPSS, version 26.0 (SPSS Inc., Chicago, IL).

1.5 Pilot survey

28. For the school-aged children subgroup, pilot survey was conducted at the Western Student Health Services Centre on 3 Jan 2019 and a total of 22 school-aged children aged 6-12 were recruited. Logistic issues were identified and were resolved after discussion with SHSC staff. The questionnaire and other assessment tools remained unchanged.

29. For the pregnant women and lactating mothers subgroups, pilot survey was conducted for 3 days (8, 11 and 15 Jan 2019) in Lek Yuen MCHC, where 23 pregnant women and 11 lactating mothers were recruited. Problems on study logistics were identified and resolved after further discussion with MCHC staff. Besides, the 18-items food frequency questionnaire (FFQ) was considered too time-consuming and not practicable to be used on-site for this survey so the FFQ was modified to questions focusing on the amount and frequency of three specified iodine-rich food (namely cooked kelp/algae, cooked seaweed, and seaweed snack) and whether the participants had regular consumption of iodised salt.

1.6 Quality control

30. A series of quality control measures were adopted to ensure that all data collected from the fieldwork were of satisfactory quality. The workflow and instruction sheets for the Survey fieldwork were provided to SHSC, MCHC, and hospital staff. Research team conducted site visits to relevant centres and clinics prior to commencement of the fieldwork. Quality control (QC) checks were performed at regular intervals during and upon completion of fieldwork.

Questionnaire

31. When conducting interviews for all subgroups, the research staff noticed that a lot of mothers had misunderstood sea salt as iodised salt. In this regard, research staff clarified and confirmed with the participants the type of salt they were referring to, i.e. ordinary salt, sea salt, iodised salt, before recording their response. The research team also cross-checked and verified with the participants on their responses in the questionnaire when the responses were unexpected and unusual.

Anthropometric measurements, specimen collection and imaging

32. Physical measurements of school-aged children were done by conventional standard method. Specimen collection and imaging followed the procedures stated in the study protocol which adopted procedures stated in the relevant manuals from WHO. All ultrasound findings were reviewed and endorsed by a radiology specialist.

33. The gloves and urine bottles provided to the participants were tested by the laboratory staff to confirm that they were free of any iodine content before the commencement of the study. For the laboratory assay, UIC measurement was repeated when the level was at or above 3.94 μmol/L (i.e 498.73 μg/L) according to the laboratory standard.

Data handling

34. Quality control measures on coding, data input (double data entry), data validation (duplication, skipping, range and consistency checks) were implemented. In addition, at least 15% of respondents have been selected and called for quality checking. 100% of them had answered the QC question correctly with 10ML of urine sample saved.

1.7 Ethical approval

35. The study was approved by The Department of Health Ethics Committee (Ref no: LM 399/2018), Joint Chinese University of Hong Kong-New Territories East Cluster Clinical Research Ethics Committee (Ref no: 2018.439 and 2018.426), New Territories West Cluster Research Ethics Committee (Ref no: NTWC/REC/19053), Research Ethics Committee (Kowloon Central/Kowloon East) (Ref no: KC/KE-19-0091-ER-1) and Hong Kong East Cluster Research Ethics Committee (Ref no: HKECREC-2019-036). Written informed consent was obtained from all parents/guardians of school-aged children, and pregnant women and lactating mothers by research staff.

2. Results and Interpretation

2.1 Recruitment results

36. A total of 1,023 school-aged children, 1,513 pregnant women, and 482 lactating mothers were recruited from different regions of Hong Kong (Appendix 3).

2.2 Survey Findings (For School-aged children)

Demographic data

37. School-aged children for the subgroups aged 6-9 and aged 10-12 were recruited at a median (IQR) age of 7.98 (6.99-8.89) and 11.02 (10.48-11.75) respectively. The recruitment ratio of male to female was 1.16 to 1, and 0.4% of the participants reported themselves as non-Chinese. Details of the participants including anthropometric measurements, demographic data on gender, ethnicity, cross-border status (for attending school), whether born in Hong Kong and parents' education level was shown in Appendix 4, Table 4.1.

Anthropometric measurements

38. The mean (SD) weight of the Age 6-9 group and Age 10-12 group is 26.1 Kg (6.1) and 39.7 Kg (10.5) respectively, while the mean (SD) height of the Age 6-9 group and Age 10-12 group is 127.2 cm (7.9) and 146.0 cm (8.3) respectively (Appendix 4, Table 4.1).

Consumption of iodised salt

39. Among the 1,023 school-aged children, 11.9% reported consumption of iodised salt at home and 81.5% did not (Table 1). Detailed breakdown by age subgroups are shown in Appendix 4, Table 4.2.

Table 1: Consumption of iodised salt in school-aged children at home

Consumption of iodised salt at home	No. of subjects	%
Yes	122	11.9
No	834	81.5
Don't know	67	6.5
Total	1,023	100.0

Note: Figures may not add up to their corresponding totals owing to rounding.

Consumption pattern of specified iodine-rich food#

40. Among the 1,023 school-aged children, 97.3% reported consumption of kelp / laver while 2.7% did not (Table 2). Detailed breakdown by age and gender subgroups are shown in Appendix 4, Table 4.3.

Table 2: Consumption pattern of specified iodine rich food# in school-aged children

Consumption of kelp / laver	No. of subjects	%
Yes	995	97.3
More than once per week	*132*	*12.9*
More than once per month to once per week	*358*	*35.0*
Once per month or less	*505*	*49.4*
No	28	2.7
Total	1,023	100.0

#Specified iodine rich food included kelp/ laver or snacks that contain kelp/ laver

Urine Iodine Content (UIC)

41. Among the 1,023 school-aged children, the median UIC was 115 μg/L which is classified as **"adequate"** iodine intake (i.e. 100-199 μg/L) according to the cut-off points (Table 3) for classifying iodine nutrition status into different degrees of public health significance as recommended in the WHO's Guide. Detailed breakdown by age and gender subgroups are shown in Appendix 4, Table 4.4.

Table 3: Epidemiological criteria for assessing iodine nutrition based on median UIC of school-aged children (≥ 6 years)

Median UIC (μg/L)	**Iodine intake**	**Iodine Status**
< 20	Insufficient	Severe iodine deficiency
20-49	Insufficient	Moderate iodine deficiency
50-99	Insufficient	Mild iodine deficiency
100-199	Adequate	Adequate iodine nutrition
200-299	Above requirements	Likely to provide adequate intake for pregnant/lactating women but may pose a slight risk of more than adequate intake in overall population
≥ 300	Excessive	Risk of adverse health consequence

42. No significant statistical difference was found in the median UIC between the aged 6-9 and aged 10-12 subgroups (Appendix 4, Table 4.4).

43. The median UIC for participants with consumption of iodised salt at home was higher than those who did not. The difference was statistically significant despite the small sample size of those who had regular consumption of iodised salt at home (Appendix 4, Table 4.5).

Total goitre rate

44. Size of thyroid glands of school-aged children was measured by ultrasound. Values of thyroid size from school-aged children were compared with reference values for thyroid volume by USG as stated in the WHO's Guide. Total goiter rate was defined as number or percentage of participants who have thyroid volume greater than 97th percentile. The total goitre rate assessed with body surface area (BSA)-specific reference value and age-specific reference value are 1.7% and 2.2% respectively (Table 4). Detailed breakdown by age and gender subgroups are shown in Appendix 4, Table 4.6.

Table 4: Number and percentage of school-aged children with thyroid volume (ml) greater than 97th percentile against body surface area (BSA)-specific and age-specific reference values

	Number (%) of participants with thyroid volume greater than 97th percentile (Total goitre rate)
Compare against BSA-specific reference value in the WHO's Guide	17 (1.7%)
Compare against age-specific reference value in the WHO's Guide	22 (2.2%)

45. The epidemiological criteria for assessing the severity of IDD based on prevalence of goitre in school-aged children were provided in WHO's Guide (Table 5). Both the BSA-specific and age-specific total goitre rates for school-aged children in this Survey fall within the category of "none" for iodine deficiency disorder.

Table 5: Epidemiological criteria for assessing the severity of IDD based on the prevalence of goitre in school-aged children

	Degrees of IDD, expressed as percentage of the total of the number of children surveyed			
Total goitre rate (TGR)	None	Mild	Moderate	Severe
	0.0-4.9%	5.0-19.9%	20.0-29.9%	≥30%

2.3 Survey findings (Pregnant Women)

Demographic data

46. Pregnant women were recruited at a median (IQR) age of 32.7 (29.7-35.6) years; 820 (54.2%) were nulliparous; 32 (2.1%) pregnant women reported themselves as non-Chinese. Details of the participants, including demographic data on ethnicity, education level, and occupation was shown in Appendix 4, Table 4.7.

Consumption of iodised salt

47. Among the 1,513 participants, only 71 (4.7%) women reported that they regularly consumed iodised salt during pregnancy (Table 6). A detailed breakdown by trimesters are shown in Appendix 4, Table 4.8.

Table 6: Consumption of iodised salt in Pregnant Women

	No. of subjects	%
Yes	71	4.7
No	1,442	95.3
Total	1,513	100.0

Consumption pattern of specified iodine-rich food^

48. The frequency of consumption of specified iodine-rich food is shown in Table 7. Among the 1,513 participants, 1,262 (83.4%) women reported that they consumed during pregnancy, 339 (22.4%) and 489 (32.3%) women were taking more than once per week and more than once per month to once per week, respectively. A detailed breakdown by trimesters are shown in Appendix 4, Table 4.9.

Table 7: Consumption of specified iodine-rich food^ in Pregnant Women

	No. of subjects	%
Yes	1,262	83.4
More than once per week	339	22.4
More than once per month to once per week	489	32.3
Once per month or less	434	28.7
No	251	16.6
Total	1,513	100.0

^Specified iodine-rich food includes cooked kelp/ algae, e.g. kelp soup, seaweed salad, cooked seaweed and seaweed snacks/ seaweed (for sushi, hand roll, ramen)

Use of nutritional supplements

49. Among the 1,513 pregnant women, 74.6% reported consumption of iodine-containing nutritional supplements during pregnancy, 18.3% consumed nutritional supplements without iodine regularly, and 7.1% did not consume any supplements at all (Table 8).

Table 8: Consumption of nutritional supplements in Pregnant Women

	No. of subjects	%
Consumed iodine-containing supplement	1,128	74.6
Consumed nutritional supplements without iodine	277	18.3
Did not consume nutritional supplement	107	7.1
Unknown*	1	0.1
Total	1,513	100.0

*One pregnant woman who reported to have consumed nutritional supplements did not report the brand of supplement taken and is classified as unknown, because the iodine content of the supplement cannot be ascertained.

50. Reasons for not taking iodine-containing supplements were provided by those who reported they never took an iodine-containing nutritional supplement, including those never took a nutritional supplement, had only been taking a non-iodine-containing nutritional supplement, or the nutritional supplement they reported to have consumed during pregnancy was later checked to contain no iodine. Among the 371 pregnant women who provided reasons for consuming nutritional supplements without iodine or did not consume nutritional supplements, the two main reasons reported were "Did not know iodine supplement is necessary during pregnancy" (52.8%) and "Thought her daily diet provides enough iodine" (26.1%); and followed by "Thought her nutritional supplement contains iodine already (at the

time of interview)" (9.7%). Table 9 showed the reasons reported by the pregnant women who never took iodine-containing supplements during pregnancy. Further details of the reasons reported by the pregnant women who never took iodine-containing supplements during pregnancy are shown in Appendix 4, Table 4.11.

Table 9. Main reasons for never took iodine-containing nutritional supplements during pregnancy[1]

	No. of subjects[2] (%)
Did not know iodine supplement is necessary during pregnancy	196 (52.8%)
Thought her daily diet provides enough iodine	97 (26.1%)
Thought her nutritional supplement contains iodine already (at the time of interview)	36 (9.7%)
Others	42 (11.3%)

Note:
1. Multiple reasons are allowed here; and
2. The base includes 371 pregnant women who provided reasons for taking nutritional supplements not containing iodine and those who never took any nutritional supplement during pregnancy.

51. Majority (60.7%) of pregnant women reported that they purchased the supplements themselves, while near one third (31.5%) of them obtained the supplements from the public sector (MCHCs and/or public hospitals). Appendix 4, Table 4.13 showed the sources where pregnant women obtained the iodine-containing supplements.

52. Among the 1,513 pregnant women, 59.1% consumed iodine-containing supplements with an average daily iodine intake of at least 150 μg/day over the two weeks before interview, 12.9% consumed such supplements but with an average daily iodine intake of less than 150 μg/day. On the other hand, a quarter (28.0%) either consumed nutritional supplements without iodine or did not consume iodine-containing supplements. Table 10 and Table 4.14 (Appendix 4) showed the number and proportion of participants by the average daily iodine intake from iodine-containing supplements over the two weeks before the interview.

Table 10: Average daily iodine intake (μg/day) from iodine-containing supplements over the two weeks before interview for Pregnant Women

	No. of subjects	%
Consumed iodine-containing supplement with an iodine intake of at least 150 μg/day	894	59.1
150 – 249 μg/day	*866*	*57.2*
250 – 499 μg/day	*28*	*1.9*
Consumed iodine-containing supplement but less than 150 μg/day	195	12.9
Did not take any supplement or took supplement without iodine	423	28.0
Unknown*	1	0.1
Total	1,513	100.0

*One pregnant woman who reported to have taken nutritional supplements did not report the brand of supplement taken and is classified as unknown because her average daily iodine intake could not be estimated.
Note: Figures may not add up to their corresponding totals owing to rounding.

Urine Iodine Content (UIC)

53. Among the 1,513 pregnant women enrolled, three did not provide a sufficient volume of urine sample, and one did not collect a urine sample after the interview. For 1,509 pregnant women who had valid urine samples, their median UIC was 134 μg/L, which is classified as "insufficient" according to the classification in the WHO's Guide (Table 11) [2].

Table 11: Epidemiological criteria for assessing iodine nutrition based on the median UIC of pregnant women

Median UIC (μg/L)	Iodine Intake
< 150	Insufficient
150-249	Adequate
250-499	Above requirements
≥ 500	Excessive*

*"Excessive" means in excess of the amount required to prevent and control iodine deficiency.

54. The median UIC for pregnant women at first, second and third trimesters were 138, 123 and 137 μg/L respectively (Appendix 4, Table 4.15), and all fell within the category of "insufficient" according to criteria for pregnant women in WHO's Guide (Table 11).

55. Among the 1,508 pregnant women with available data on average daily iodine intake and valid urine samples, the median UIC of women who had and those who had not regularly

consumed iodised salt was 167 µg/L and 132 µg/L, respectively. The sample size was small for those who had regular consumption of iodised salt; there is no statistically significant difference between these two subgroups (Appendix 4, Table 4.16).

56. The median UIC for pregnant women with iodine-containing supplementation at average daily iodine intake at least 150 µg/day, with iodine-containing supplementation at average daily iodine intake less than 150 µg/day over the two weeks before interview, and those did not consume any supplement or consumed supplement without iodine were 156 µg/L, 132 µg/L and 97 µg/L respectively (Appendix 4, Table 4.17). The median UICs for pregnant women taking iodine-containing supplementation at average daily iodine intake at least 150 µg/day is significantly above 150 µg/L [$p<0.001$], while that for those who did not take any supplement is significantly below 150 µg/L [$p<0.001$]. However, due to the small sample size, for the median UIC of pregnant women taking iodine-supplementation at average daily iodine intake less than 150 µg/day cannot be shown to be significantly below 150 µg/L [$p=0.47$] (Appendix 4, Table 4.17). There is a statistically significant difference in median UIC among the aforesaid three subgroups of pregnant women [$p<0.001$] (Table 12).

Table 12: Median UIC (µg/L) for pregnant women with iodine supplement at an average daily intake of ≥ 150 µg/day of iodine, those with iodine supplement less than 150 µg/day of iodine and those without iodine supplementation (n=1,508)

Iodine intake from iodine supplements (excluding formula milk) over the two weeks before the interview	No. of subjects	Median UIC (µg/L)	
With iodine supplementation at an average daily intake of ≥ 150 µg/day of iodine	892	156	$p<0.001$
With iodine supplementation at an average daily intake of < 150 µg/day of iodine	195	132	
Did not consume any supplement or consumed supplement without iodine	421	97	
Overall	1,508	134	

Notes:

1. One pregnant woman who reported to have consumed iodine-containing nutritional supplement did not report the brand of supplement taken and is classified as unknown. As a result, her average daily iodine intake could not be estimated.

2.4 Survey Findings (Lactating Mothers)

Demographic data

57. Lactating mothers were recruited at a median (IQR) age of 33.0 (29.9-35.9) years; 236 (49.0%) had their first delivery. 12 (2.5%) mothers reported themselves as non-Chinese. Mothers were enrolled at a median (IQR) of 52 (34-68) days after their delivery; their infants were born at a median (IQR) gestational age of 39.0 (38.3-40.0) weeks, and the median (IQR) of birth weights were 3133 (2907-3440) grams. Appendix 4, Table 4.18, showed the demographic data on the participants' ethnicity, education level, and occupation. Appendix 4, Table 4.19 showed the mode of delivery of lactating mothers.

Consumption pattern of iodised salt

58. Among the 482 participants, 24 (5.0%) mothers reported that they regularly consumed iodised salt during lactation (Table 13).

Table 13: Consumption pattern of iodised salt for Lactating Mothers

	No. of subjects	%
Yes	24	5.0
No	458	95.0
Total	482	100.0

Consumption pattern of specified iodine-rich food^

59. The frequency of consumption of specified iodine-rich food is shown in Table 14. Among the 482 participants, 260 (53.9%) women reported that they ever took the specified iodine-rich food during lactation, 55 (11.4%) and 82 (17.0%) women were taking the specified iodine-rich food more than once per week and more than once per month to once per week, respectively.

Table 14: Consumption of specified iodine rich food^ in Lactating Mothers

	No. of subjects	%
Yes	260	53.9
More than once per week	55	11.4
More than once per month to once per week	82	17.0
Once per month or less	123	25.5
No	222	46.1
Total	482	100.0

^Specified iodine rich food included cooked kelp/ algae, e.g. kelp soup, seaweed salad, cooked seaweed and seaweed snacks/ seaweed (for sushi, hand roll, ramen)

Use of nutritional supplements

60. Among the 482 lactating mothers, 43.4% reported consumption of iodine-containing nutritional supplements during lactation, 16.6% consumed nutritional supplements without iodine and 40.0% did not consume any nutritional supplements at all (Table 15).

Table 15: Use of nutritional supplements in Lactating Mothers

	No. of subjects	%
Consumed iodine-containing supplement	209	43.4
Consumed supplement without iodine	80	16.6
Did not consume nutritional supplement	193	40.0
Total	482	100.0

61. Reasons for not taking iodine-containing supplements were provided by those who reported they never took any nutritional supplementation, had only been taking non-iodine containing nutritional supplementation, or the nutritional supplement they reported to have consumed during lactation was later checked to contain no iodine. The main reasons for never took iodine-containing nutritional supplements were "Did not know iodine supplement is necessary during lactation" (66.4%) and "Thought her daily diet provides enough iodine" (29.1%). Table 16 and Appendix 4, Table 4.20 showed the reasons reported by the lactating mothers who never took iodine-containing supplements during lactation.

Table 16: Main reasons for never took iodine-containing nutritional supplements during lactation[1]

	No. of subjects[2] (%)
Did not know iodine supplement is necessary during lactation	178 (66.4%)
Thought her daily diet provides enough iodine	78 (29.1%)
Thought her nutritional supplement contains iodine already (at the moment of interview)	2 (0.7%)
Others	10 (3.7%)

Note:

1. Multiple reasons are allowed here; and
2. The base includes 268 lactating mothers who provided reasons for consuming nutritional supplements not containing iodine and those who never consumed any nutritional supplement during lactation.

62. Majority (69.2%) of the lactating mothers reported that they purchased the supplements themselves, while 23.8% of them obtained the supplements from the public sector (MCHCs and/or public hospitals). Appendix 4, Table 4.22 showed the sources where the lactating mothers obtained the iodine-containing supplements.

63. Among the 482 lactating mothers, 28.4% consumed iodine-containing supplements regularly with an average daily iodine intake of at least 150 µg/day over the two weeks before the interview, 12.2% consumed such supplements but with an average daily iodine intake of less than 150 µg/day and over half (59.3%) did not consume any supplement or consumed supplement without iodine (Table 17). Appendix 4, Table 4.23 showed the participants' detailed average daily iodine intake from iodine-containing supplements over the two weeks prior to the interview.

Table 17: Average daily iodine intake (µg/day) from iodine-containing supplements over the two weeks prior to interview for Lactating Mothers

	No. of subjects	%
Consumed iodine-containing supplement with iodine intake of at least 150µg/day	137	28.4
150 – 249 µg/day	*130*	*27.0*
250 – 499 µg/day	*7*	*1.5*
Consumed iodine-containing supplement but less than 150 µg/day of iodine	59	12.2
Did not consume any supplement or consumed supplement without iodine	286	59.3
Total	482	100.0

Note: Figures may not add up to their corresponding totals owing to rounding.

Urine Iodine Content (UIC)

64. Among the 482 lactating mothers enrolled, one did not provide sufficient volume of urine sample, and two did not provide urine sample after the interview.

65. For 479 lactating mothers with valid urine samples, the median UIC was 65μg/L (Appendix 4, Table 4.24), which is classified as "insufficient" according to the classification in the WHO's Guide (Table 18) [10]. Though lactating mothers have the same requirement for iodine intake as pregnant women, the reference value of median UIC is lower than that of pregnant women because iodine is excreted in breast milk. [2]

Table 18: Epidemiological criteria for assessing iodine nutrition based on the median UIC of lactating women

Median UIC (μg/L)	Iodine Intake
< 100	Insufficient
≥ 100	Adequate

66. Among the 479 lactating mothers with available data on average daily iodine intake and valid urine samples, the median UIC of those who had and had not regularly consumed iodised salt were 75μg/L, 64 μg/L respectively. The sample size was small for those who had regular consumption of iodised salt, there is no statistically significant difference in median UIC between these two subgroups (Appendix 4, Table 4.25). The median UIC for lactating mothers with iodine supplementation at average daily iodine intake at least 150 μg/day, with iodine supplementation at average daily iodine intake less than 150 μg/day over the two weeks prior to interview, and those did not consume any supplement or consumed supplement without iodine were 84 μg/L, 71 μg/L and 58 μg/L respectively; all median UICs are significantly below 100 μg/L [$p<0.001$] (Appendix 4, Table 4.26). However, we observe a statistically significant trend of higher median UIC in women taking iodine supplementation at a higher dose of at least 150 μg/day among the aforesaid three subgroups of lactating mothers [$p=0.001$] (Table 19).

Table 19: Median UIC (μg/L) for lactating mothers with iodine supplement at average daily intake of ≥ 150 μg/day of iodine, those with such iodine supplement less than 150 μg/day of iodine and those without iodine supplementation (n=479)

Iodine intake from iodine-containing supplements (excluding formula milk) over the two weeks prior to interview	No. of subjects	Median UIC (μg/L)	
With iodine supplementation at average daily intake of ≥ 150 μg/day of iodine	136	84	p=0.001
With iodine supplementation at average daily intake of < 150 μg/day of iodine	59	71	
Did not consume any supplement or consumed supplement without iodine	284	58	
Overall	479	65	

3. Discussion and Conclusion

3.1 Discussion and Limitation

Discussion

67. Adequate iodine intake is particularly important among young children, pregnant and lactating women. [2] To achieve adequate iodine intake, the primary source is from diet such as the consumption of iodine-rich foods (e.g. kelp, algae, and seaweed) and iodised salt, and by taking nutritional supplement when indicated [11]. Advice on adequate iodine intake had been published by the Family Health Service of the Department of Health (FHS, DH). Being the first territory-wide survey to assess the iodine status of the three vulnerable groups, the findings of the Iodine Survey filled the information gap on the local iodine status and provided valuable information for subsequent formulation of recommendation for the target population groups.

<u>Iodine status</u>

68. In this study, the median UIC of 1,023 school-aged children is 115 μg/L. Moreover, the BSA-specific and age-specific total goitre rates for school-aged children were 1.7% and 2.2% respectively, which fall within the category of “none” for iodine deficiency disorder by WHO’s epidemiological criteria. Findings of total goitre rate among school-aged children are compatible with their results of median urinary iodine concentration at the status “**adequate iodine nutrition**”.

69. Among 1,513 pregnant women and 479 lactating mothers, their median UIC were 134 and 65 μg/L, respectively. Further analysis suggests that iodine intake of pregnant women with iodine supplement at an average daily intake of equal to or above 150 μg/day of iodine is classified as “adequate”, while iodine intake of pregnant women with iodine supplement less than 150 μg/day of iodine or without iodine supplement is classified as “insufficient”. Due to the small sample size, the median UIC of pregnant women taking iodine-containing supplementation at average daily iodine intake less than 150 μg/day could not be shown to be significantly below 150 μg/L. However, they are still most likely to be “insufficient”. As for lactating mothers, the iodine intake for those with or without iodine supplement regardless of their average daily iodine intake, which is classified as “insufficient” according to the WHO classification.

70. Although previous studies on the iodine status of these target population groups are limited, it may be worthwhile to note that findings from the Survey are comparable to the reported results from the other surveys. For school-aged children, a study on a fasting urine sample of 104 children showed a mUIC of 121 μg/L [12], and another study showed a mUIC of 190 μg/L from 476 random urine samples of adolescents (mean age ± S.D., 15.3 ± 1.8 years old) [6]. Similar goitre rates as this survey was noted in previous local epidemiological survey of childhood goitre in 1996, where presence of goitre was assessed according to the WHO classification of goitre by palpation; and goitre rate of 3.5% was reported which also fall within the category of "none" for IDD. [6] It may be worthwhile to note that despite dietary habits have change over time in relation to the change in community beliefs, dietary iodine intake for children is still considered to be adequate. For pregnant women, the Chinese University of Hong Kong (CUHK) recently reported that the median UIC of 600 women at the first trimester of pregnancy assessed at the Prince of Wales Hospital (PWH) was 100 μg/L.[8]

Use of iodine-containing nutritional supplement

71. For pregnant women and lactating mothers, only 43.4% of lactating mothers reported to have taken iodine-containing supplements during lactation, as compared to 74.6% in pregnant women. Moreover, an increase in the proportion of pregnant women taking iodine-containing supplements was observed as the pregnancy progressed, from 52.9% in the first trimester , 80.9% in the second trimester, to 90.1% in the third trimester. A possible explanation for this observation is that pregnant women before their first antenatal visit and lactating mothers were unaware of the importance of adequate iodine intake during pregnancy and lactation, as evidenced by the main reasons of not taking iodine-containing supplements reported by the participants. Under the current practice of antenatal care in the public sector, pregnant women attending and followed up by MCHCs and some obstetric clinics of public hospitals would be prescribed iodine-containing supplements from their first antenatal visit until delivery. At the same time, lactating mothers were required to purchase the supplements themselves.

72. In view of the preliminary results of the Iodine Survey, health education on the need of taking an iodine-containing supplement during pregnancy and breastfeeding has been enhanced at antenatal talks, antenatal and postnatal interviews by the Family Health Service (FHS). Moreover, iodine-containing supplements were also provided to pregnant women at 37-38 weeks to cover their needs for the first month of lactation after delivery. With regard to the iodine content in iodine supplements, only 59.1% and 28.4% of pregnant women and lactating mothers took supplements that contained at least 150 μg of iodine per day, despite it is recommended by WHO and overseas countries that pregnant women and lactating mothers should take supplements with an iodine content of 150-250μg per day. In light of the findings, pregnant women and lactating mothers should be encouraged to check the iodine content when purchasing iodine-containing supplements to meet the extra requirement during the period.

73. Among the pregnant women who were taking iodine supplementation and in average at or above 150 μg/d during the past two weeks before the interview, the median UIC (156μg/L) fell within the WHO's epidemiological criteria of "adequate iodine intake". This finding is compatible with the recommendation by most overseas countries that pregnant women should take supplements that contain 150-250μg of iodine per day. However, lactating mothers who were taking iodine supplementation and in average at or above 150 μg/d during the past two weeks before the interview, the median UIC (84 μg/L) was still below 100 μg/L and is classified as "insufficient' according to WHO's criteria. This result is consistent with overseas studies in which median UIC in lactating mothers, in general, were found to be below 100μg/L even with iodine supplementation and in countries with mandatory iodine fortification as such New Zealand, Denmark [13][14]. In addition, a study evaluated UIC and breast milk iodine concentration (BMIC) as biomarkers for iodine status in lactating women with a wide range of iodine intakes. Results showed that the median UIC of lactating women in iodine sufficient population might be lower than 100 μg/L but their BMIC may remain adequate. Hence, maternal median UIC may not be a good indicator of iodine content in breast milk, due to preferential excretion of iodine into breast milk. [15]

Limitation

Sample frame and recruitment method

74. The study subjects were a convenient sample recruited from Student Health Service, MCHC and antenatal clinics of the selected public hospitals, some subgroups who did not visit these services may not be covered, especially those receiving services from private health sectors. However, Student Health Service covers all primary schools in Hong Kong with an average annual attendance rate of around 83% for primary students; 64.6% of known live births occurred in public hospitals, in which these pregnant women attended antenatal care in either MCHC or public hospitals, the sample was considered to have reasonably covered a majority of the population for each of the target subgroups in Hong Kong.

Study design

75. Due to the complexity of assessing iodine intake by food analysis, only the consumption pattern of specified iodine-rich food was assessed. Moreover, the iodine content of food varies with preparation and cooking methods that further complicated the assessment of iodine intake. [16] In addition to food consumption, consumption of iodised salt and iodine-containing nutritional supplement were self-reported information and were also subject to recall bias. As such, the consumption habits of specified iodine-rich food, iodised salt and use of iodine-containing supplements cannot provide a comprehensive estimation of the participants' total daily iodine intake.

Use of spot urine iodine to reflect iodine status

76. Spot urine iodine was recommended for assessing a population's iodine status through population-based median urinary iodine levels by WHO [2]. Day-to-day and within-day variation of urinary iodine excretion tends to even out among populations. Nevertheless, spot UIC only reflects iodine intake over a short time, and the intra-individual variation can be considerable. As such, median UIC would only be used to reflect the iodine status of the population and spot UIC would not be able to reflect the individual iodine status .

Thyroid size

77. For the school-aged children subgroup, thyroid size was measured to assess the severity of IDD based on the prevalence of goitre. While urinary iodine concentration assess iodine nutrition only at the time of measurement, thyroid size reflects iodine nutrition over months or years. For populations that may have attained iodine sufficiency based on median urinary iodine concentration, goitre may persist.

3.2 Conclusion

78. According to WHO, there are many indicators to assess the magnitude of IDD as a public health problem and to monitor the effects of an intervention on the iodine status of a population. The use of urinary iodine concentration is recommended to monitor impact, and it is reflective of the current intake of iodine, while goitre assessment by ultrasound was considered useful in assessing thyroid function by WHO. [2] Based on median UIC (for pregnant women, lactating mothers and school-aged children) and total goitre rate (for school-aged children only), key findings of the survey are summarised below-

- Iodine status of school-aged children is classified as adequate;
- Iodine status of pregnant women with iodine supplement at average daily iodine intake of equal to or above 150 μg/day is adequate;
- Iodine status of pregnant women with iodine supplement less than 150 μg/day of iodine intake and those without iodine supplement is insufficient;
- Iodine status of lactating mothers is insufficient.

3.3 Way forward

79. To review the local and overseas situation and scientific evidences on prevention of iodine deficiency disorders, and to make recommendations for local situation for prevention of iodine deficiency disorders, a Working Group on Prevention of Iodine Deficiency Disorders (Working Group) was set up by the Department of Health (DH) and Centre for Food Safety (CFS), Food and Environmental Hygiene Department, with representatives from the Hospital Authority, the Hong Kong College of Community Medicine, the Hong Kong College of Family Physicians, the Hong Kong College of Obstetricians and Gynaecologists, the Hong Kong College of Paediatricians, and the Hong Kong College of Physicians. The Working Group Meeting was held on 6th July 2021 to review the latest scientific evidences including the key findings of the survey. The following recommendations were made by the Working Group-

- Health education on iodine intake among pregnant and lactating women should be strengthened;
- Joint recommendation for iodine intake for pregnant and lactating women should be made in collaboration with relevant parties. Key messages includes (1) taking iodine-containing supplement at least 150ug iodine per day, (2) using iodised salt, and (3) consuming food with more iodine as part of a healthy balanced diet; and
- Based on findings of adequate iodine intake among school aged children, mandatory salt iodisation programme is not warranted in local situation.

80. Moreover, to raise awareness about insufficient iodine intake in the vulnerable groups (pregnant women and lactating mothers) and prevention of iodine deficiency disorders, the joint recommendations for pregnant and lactating women on iodine intake (Appendix 5) will be publicized and disseminated to healthcare professionals via relevant organisations including HA, relevant colleges and societies.

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Appendix 1

Recruitment of subjects

Site of recruitment for the Survey

<table>
<tr><th>Population group</th><th>Type of health care centre / clinic / institution</th><th>Hong Kong Island (HKI)</th><th>Kowloon (KLN)</th><th>New Territories East (NTE)</th><th>New Territories West (NTW)</th></tr>
<tr><td>School-aged children</td><td>Student Health Service Centre (SHSC)</td><td>Western SHSC</td><td>Lam Tin SHSC</td><td>Shek Wu Hui SHSC</td><td>Tuen Mun SHSC</td></tr>
<tr><td rowspan="4">Pregnant women and lactating mothers</td><td>Public Hospital</td><td>Pamela Youde Nethersole Eastern Hospital</td><td>Queen Elizabeth Hospital</td><td>Prince of Wales Hospital</td><td>Tuen Mun Hospital</td></tr>
<tr><td rowspan="3">Maternal and Child Health Centre (MCHC)</td><td rowspan="3">Chai Wan MCHC</td><td>Lam Tin MCHC</td><td rowspan="3">Lek Yuen MCHC</td><td>Tsing Yi MCHC</td></tr>
<tr><td>Kwun Tong MCHC</td><td>Tin Shui Wai MCHC</td></tr>
<tr><td>East Kowloon MCHC</td><td>Yan Oi MCHC</td></tr>
</table>

Appendix 2

Targeted recruitment of school-aged children, pregnant women at each trimester, and lactating mothers from each of the four regions of Hong Kong

	HKI (15%)	**KLN** (30%)	**NTE** (25%)	**NTW** (30%)	**Total**
School-aged children	161	382	188	269	1,000
Aged 6-9	81	187	97	135	500
Aged 10-12	80	195	91	134	500
Pregnant women	225	450	375	450	1,500
1^{st} trimester	75	150	125	150	500
2^{nd} trimester	75	150	125	150	500
3^{rd} trimester	75	150	125	150	500
Lactating mothers	75	150	125	150	500

Appendix 3

Actual recruitment results (number of respective respondents)

	HKI	**KLN**	**NTE**	**NTW**	**Total**
School-aged children	195	399	181	248	1,023
Aged 6-9	124	213	65	119	521
Aged 10-12	71	186	116	129	502
All pregnant women	228	453	378	454	1,513
1st trimester	77	151	126	153	507
2nd trimester	76	151	126	150	503
3rd trimester	75	151	126	151	503
Lactating mothers	73	143	122	144	482

Appendix 4 Survey Findings

School-aged children

Table 4.1:Demographic characteristics for all recruited school-aged children

Demographic characteristics	Aged 6-9		Aged 10-12		Overall	
	No. of subjects (n)	%	n	%	n	%
Sex						
Male	273	52.4%	271	54.0%	544	53.2%
Female	248	47.6%	231	46.0%	479	46.8%
Ethnicity						
Chinese	517	99.2%	502	100.0%	1019	99.6%
non-Chinese	4	0.8%	0	0.0%	4	0.4%
Cross-border school children attending school in HK	26	5.0%	41	8.2%	67	6.5%
Whether born in HK	492	94.4%	469	93.4%	961	93.9%
Mother's education level						
Primary or none	13	2.5%	36	7.2%	49	4.8%
Secondary	247	47.4%	314	62.5%	561	54.8%
College/university	171	32.8%	92	18.3%	263	25.7%
Post-Secondary/other professional training	89	17.1%	60	12.0%	149	14.6%
Unknown	1	0.2%	0	0.0%	1	0.1%
Father's education level						
Primary or none	15	2.9%	33	6.6%	48	4.7%
Secondary	236	45.3%	279	55.6%	515	50.3%
College/university	190	36.5%	113	22.5%	303	29.6%
Post-Secondary/other professional training	77	14.8%	76	15.1%	153	15.0%
Unknown	3	0.6%	1	0.2%	4	0.4%
Total	521	100.0%	502	100.0%	1023	100.0%
	Aged 6-9		Aged 10-12		Overall	
Age (years), median (IQR)	7.98 (6.99-8.89)		11.02 (10.48-11.75)		9.94 (7.94-11.01)	
	Mean	SD	Mean	SD	Mean	SD
Weight (kg)	26.1	6.1	39.7	10.5	32.8	10.9
Height (cm)	127.2	7.9	146.0	8.3	136.4	12.5
Body surface area(m^2)	0.961	0.130	1.268	0.180	1.112	0.219

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.2: The number and proportion of participants who reported consumption of iodised salt

	Aged 6-9		Aged 10-12		Overall	
	n	%	n	%	n	%
Consumed iodised salt	60	11.5	62	12.4	122	11.9
Did not consume iodised salt	421	80.8	413	82.3	834	81.5
Uncertain about consumption of iodised salt	40	7.7	27	5.4	67	6.5
Total	521	100	502	100	1,023	100

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.3:Frequency of consumption for specified iodine rich food# in school-aged children

Consumption of kelp / laver	Aged 6-9						Aged 10-12					
	M		F		subtotal		M		F		subtotal	
	n	%	n	%	n	%	n	%	n	%	n	%
Yes	265	97.1	245	98.8	510	97.9	258	95.2	227	98.3	485	96.6
More than once per week	*36*	*13.2*	*36*	*14.5*	*72*	*13.8*	*22*	*8.1*	*38*	*16.5*	*60*	*12.0*
More than once per month to once per week	*101*	*37.0*	*102*	*41.1*	*203*	*39.0*	*80*	*29.5*	*75*	*32.5*	*155*	*30.9*
Once per month or less	*128*	*46.9*	*107*	*43.1*	*235*	*45.1*	*156*	*57.6*	*114*	*49.4*	*270*	*53.8*
No	8	2.9	3	1.2	11	2.1	13	4.8	4	1.7	17	3.4
Total	273	100	248	100	521	100	271	100	231	100	502	100

Specified iodine-rich food includes kelp / laver or snacks that contain kelp/ laver

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.4:Median UIC of school-aged children by age and gender

School-aged children		No. of subjects	Median UIC (µg/L)
Aged 6-9*	Male	273	116
	Female	248	106
	Subtotal	521	110
Aged 10-12*	Male	271	128
	Female	231	112
	Subtotal	502	120
All school-aged children		1,023	115

***** No significant statistical difference was found in the median UIC between the aged 6-9 and aged 10-12 subgroups. (p=0.238)

Table 4.5:Median UIC of school-aged children with or without regular consumption of iodised salt

	No. of subjects	Median UIC (µg/L)
Consumed iodised salt exclusively*****	25	173
Did not consume iodised salt*****	834	114

***** There is significant statistical difference in the median UIC between participants who had and had not regularly consumed iodised salt. (p=0.011)

Table 4.6:Number of school-aged children with thyroid volume (ml) greater than 97th percentile against body surface area (BSA)-specific and age-specific reference values, by gender and age

	Age 6-9			Age 10-12			Overall		
	Number greater than 97th percentile								
	M	F	Subtotal	M	F	Subtotal	M	F	Total (% out of all participants)
By BSA reference value in the WHO's Guide	2	4	6	4	7	11	6	11	17 (1.7%)
By Age reference value in the WHO's Guide	6	6	12	3	7	10	9	13	22 (2.2%)

Figure 1: Thyroid volumes of all male school-aged children when compared against the WHO's BSA-specific values for male

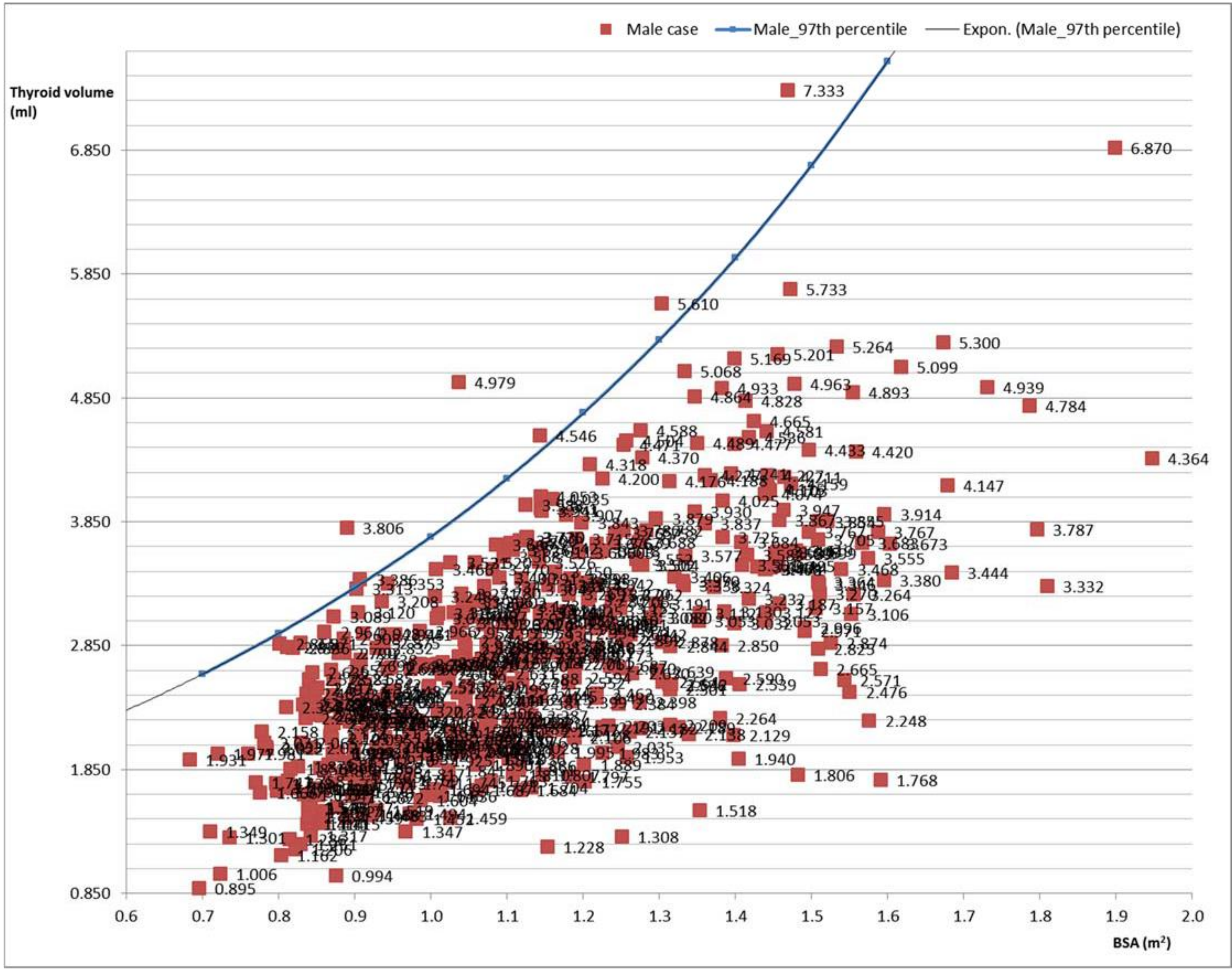

Figure 1 showed the distribution of thyroid volumes (■) of all male school-aged children. There were a total of 6 male school-aged children with thyroid volume greater than 97th percentile when compared against BSA-specific reference value in the WHO's guide.

Figure 2: Thyroid volumes of all female school-aged children when compared against the WHO's BSA-specific values for female

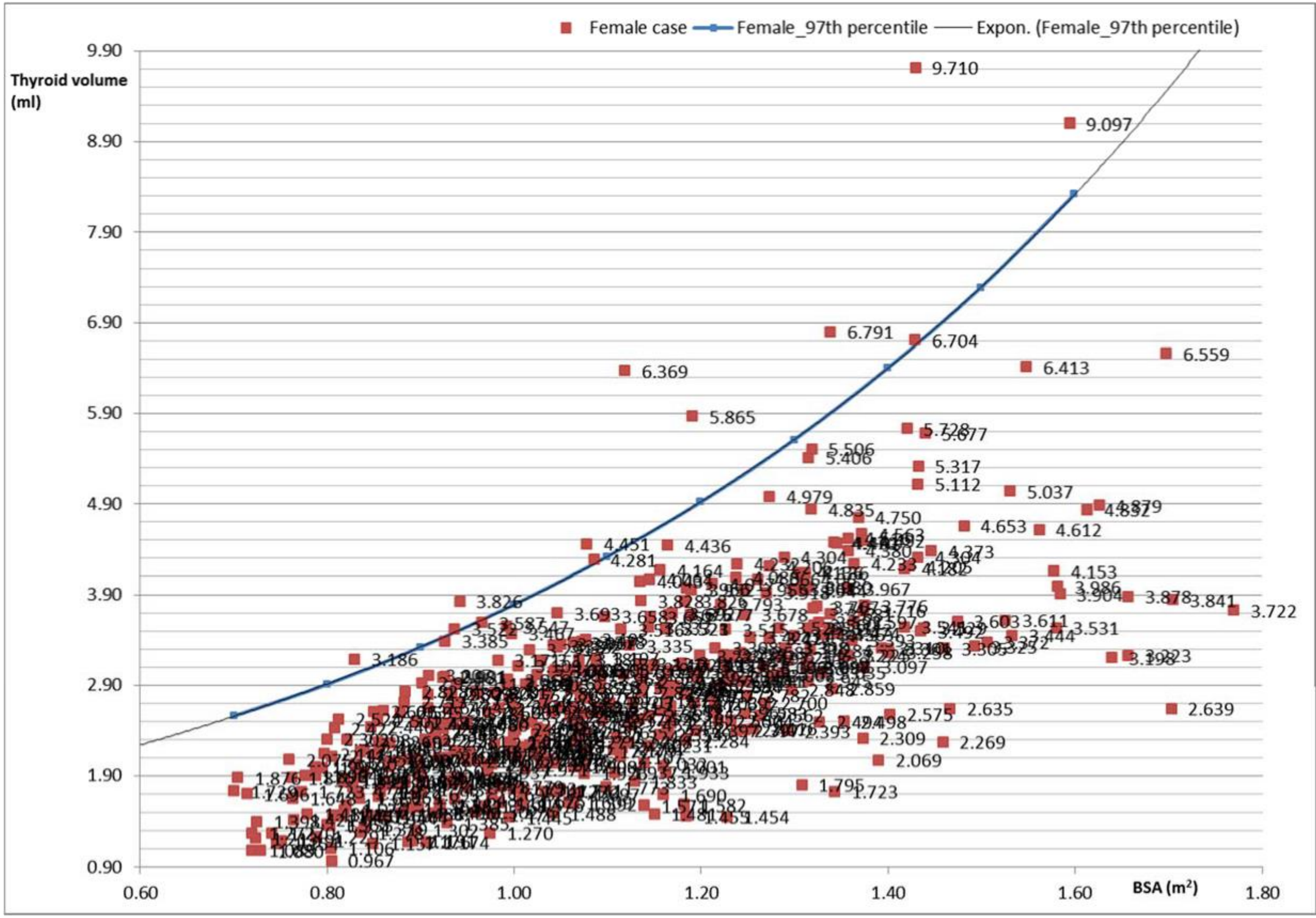

Figure 2 showed the distribution of thyroid volumes (■) of all female school-aged children. There were a total 11 female school-aged children with thyroid volume greater than 97th percentile when compared against BSA-specific reference value in the WHO's guide.

Figure 3: Thyroid volumes of all male school-aged children when compared against the WHO's age-specific values for male

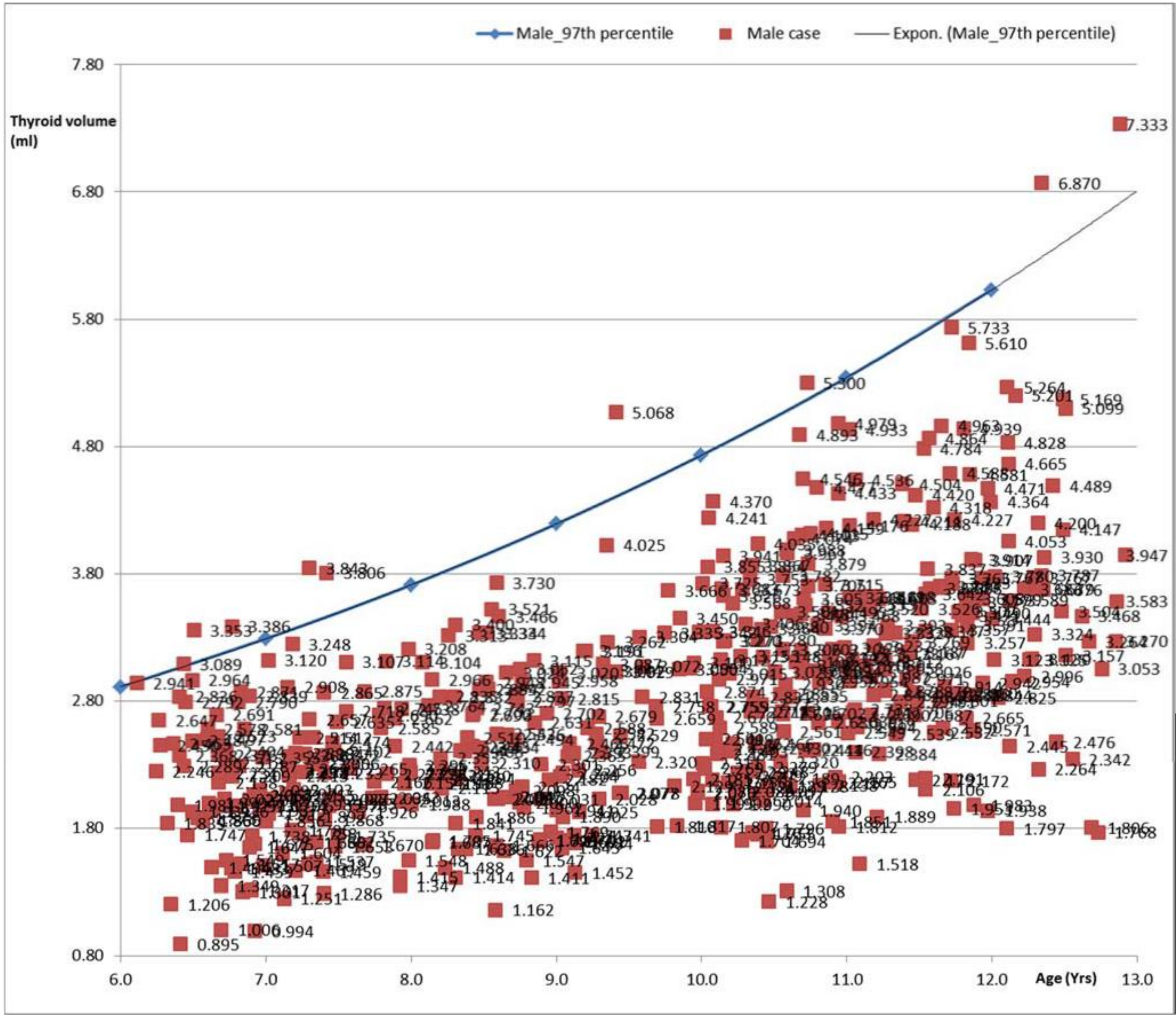

Figure 3 showed the distribution of thyroid volumes (■) of all male school-aged children. There were a total 9 male school-aged children with thyroid volume greater than 97^{th} percentile when compared against age-specific reference value in the WHO's guide.

Figure 4: Thyroid volumes of all female school-aged children when compared against the WHO's age-specific values for female

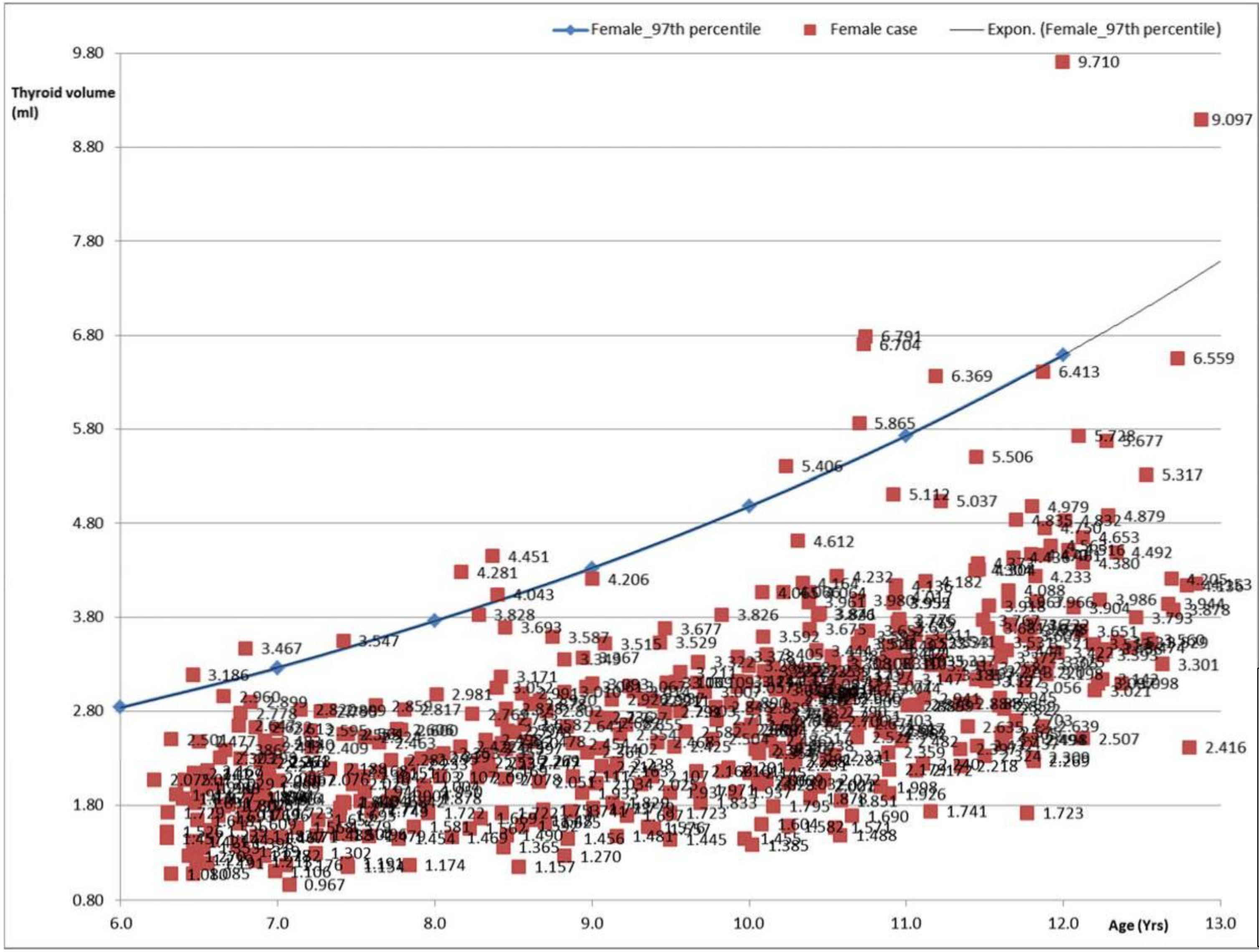

Figure 4 showed the distribution of thyroid volumes (■) of all female school-aged children participants. There were a total of 13 female school-aged children with thyroid volume greater than 97th percentile when compared against age-specific reference value in the WHO's guide.

Pregnant women

Table 4.7: Demographic characteristics for all recruited pregnant women

<table>
<tr><th colspan="2" rowspan="2">Demographic characteristics</th><th colspan="2">1st Trimester</th><th colspan="2">2nd Trimester</th><th colspan="2">3rd Trimester</th><th colspan="2">Overall</th></tr>
<tr><th>n</th><th>%</th><th>n</th><th>%</th><th>n</th><th>%</th><th>n</th><th>%</th></tr>
<tr><td colspan="2">Ethnicity</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Chinese</td><td>494</td><td>97.4</td><td>493</td><td>98.0</td><td>494</td><td>98.2</td><td>1,481</td><td>97.9</td></tr>
<tr><td colspan="2">Non- Chinese</td><td>13</td><td>2.6</td><td>10</td><td>2.0</td><td>9</td><td>1.8</td><td>32</td><td>2.1</td></tr>
<tr><td colspan="2">Education level</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Primary or below</td><td>3</td><td>0.6</td><td>5</td><td>1.0</td><td>5</td><td>1.0</td><td>13</td><td>0.9</td></tr>
<tr><td rowspan="2">Secondary</td><td>Junior secondary level</td><td>47</td><td>9.3</td><td>53</td><td>10.5</td><td>41</td><td>8.2</td><td>141</td><td>9.3</td></tr>
<tr><td>Senior secondary level</td><td>143</td><td>28.2</td><td>149</td><td>29.6</td><td>168</td><td>33.4</td><td>460</td><td>30.4</td></tr>
<tr><td rowspan="2">Tertiary</td><td>Diploma/certificate/ associate degree</td><td>80</td><td>15.8</td><td>92</td><td>18.3</td><td>103</td><td>20.5</td><td>275</td><td>18.2</td></tr>
<tr><td>Degree</td><td>234</td><td>46.2</td><td>204</td><td>40.6</td><td>186</td><td>37.0</td><td>624</td><td>41.2</td></tr>
<tr><td colspan="2">Occupation</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Manager and administrators</td><td>56</td><td>11.0</td><td>45</td><td>8.9</td><td>47</td><td>9.3</td><td>148</td><td>9.8</td></tr>
<tr><td colspan="2">Professionals</td><td>80</td><td>15.8</td><td>87</td><td>17.3</td><td>66</td><td>13.1</td><td>233</td><td>15.4</td></tr>
<tr><td colspan="2">Associate professionals</td><td>21</td><td>4.1</td><td>22</td><td>4.4</td><td>34</td><td>6.8</td><td>77</td><td>5.1</td></tr>
<tr><td colspan="2">Clerical support workers</td><td>100</td><td>19.7</td><td>83</td><td>16.5</td><td>99</td><td>19.7</td><td>282</td><td>18.6</td></tr>
<tr><td colspan="2">Service and sales workers</td><td>68</td><td>13.4</td><td>89</td><td>17.7</td><td>70</td><td>13.9</td><td>227</td><td>15.0</td></tr>
<tr><td colspan="2">Housewives</td><td>152</td><td>30.0</td><td>147</td><td>29.2</td><td>159</td><td>31.6</td><td>458</td><td>30.3</td></tr>
<tr><td colspan="2">Unemployed</td><td>14</td><td>2.8</td><td>17</td><td>3.4</td><td>13</td><td>2.6</td><td>44</td><td>2.9</td></tr>
<tr><td colspan="2">Others</td><td>16</td><td>3.2</td><td>13</td><td>2.6</td><td>15</td><td>3.0</td><td>44</td><td>2.9</td></tr>
<tr><td colspan="2">Total</td><td>507</td><td>100</td><td>503</td><td>100</td><td>503</td><td>100</td><td>1,513</td><td>100</td></tr>
</table>

Table 4.8: The number and proportion of participants who consumed iodized salt regularly during pregnancy

	1st Trimester		2nd Trimester		3rd Trimester		Overall	
Consumption of iodized salt	n	%	n	%	n	%	n	%
Consumed regularly	17	3.4	23	4.6	31	6.2	71	4.7
Did not consume regularly	490	96.6	480	95.4	472	93.8	1,442	95.3
Total	507	100	503	100	503	100	1,513	100

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.9: Frequency of consumption of specified iodine-rich food^ during pregnancy

	1st Trimester		2nd Trimester		3rd Trimester		All pregnant participants	
	n	%	n	%	n	%	n	%
Yes	371	73.2	441	87.7	450	89.5	1262	83.4
More than once per week	90	17.8	120	23.9	129	25.6	339	22.4
More than once per month to once per week	159	31.4	175	34.8	155	30.8	489	32.3
Once per month or less	122	24.1	146	29.0	166	33.0	434	28.7
No	136	26.8	62	12.3	53	10.5	251	16.6
Total	507	100	503	100	503	100	1,513	100

"Yes" refers to those reported they had consumed the specified iodine rich food^ during pregnancy

^Specified iodine rich food includes cooked kelp/ algae, e.g. kelp soup, seaweed salad, cooked seaweed and seaweed snacks/ seaweed (for sushi, hand roll, ramen)

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.10: The number and the proportion of pregnant women reported taking iodine-containing nutritional supplement during pregnancy at the time of interview

	1st trimester		2nd trimester		3rd trimester		Overall	
	n	%	n	%	n	%	n	%
Ever taken	268	52.9	407	80.9	453	90.1	1128	74.6
Never took	238	46.9	96	19.1	50	9.9	384	25.4
Unknown*	1	0.2	0	0	0	0	1	0.1
Total	507	100	503	100	503	100	1,513	100

* One pregnant woman could not provide the name of the nutritional supplement that she was taking and hence she was classified as unknown.

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.11: Reasons reported by the pregnant women who never took iodine-containing supplement in the present pregnancy

Main reasons *	1st trimester (n=233)	2nd trimester (n=90)	3rd trimester (n=48)	Overall (n=371)
Did not know iodine supplement is necessary during pregnancy	135 (57.9%)	47 (52.2%)	14 (29.2%)	196 (52.8%)
Thought her daily diet provides enough iodine	53 (22.7%)	26 (28.9%)	18 (37.5%)	97 (26.1%)
Thought her nutritional supplement contains iodine already (at the time of interview)	19 (8.2%)	6 (6.7%)	11 (22.9%)	36 (9.7%)
Plan to take at later gestation	21 (9.0%)	2 (2.2%)	0 (0.0%)	23 (6.2%)
Other reasons	5 (2.1%)	9 (10.0%)	5 (10.4%)	19 (5.1%)
Discomfort after taking supplement	*0 (0.0%)*	*4 (4.4%)*	*2 (4.2%)*	*6 (1.6%)*
Did not know which supplement to take	*2 (0.9%)*	*3 (3.3%)*	*0 (0.0%)*	*5 (1.3%)*
Personal choice not to take	*1 (0.4%)*	*0 (0.0%)*	*3 (6.3%)*	*4 (1.1%)*
Still having nausea and vomiting associated with pregnancy	*1 (0.4%)*	*1 (1.1%)*	*0 (0.0%)*	*2 (0.5%)*
Just known pregnant recently	*1 (0.4%)*	*1 (1.1%)*	*0 (0.0%)*	*2 (0.5%)*

* Participants can provide more than one reason.

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.12: Total number of iodine-containing supplements ever taken by the participants during pregnancy up to the time of the interview

Total number supplements ever taken	1st trimester		2nd trimester		3rd trimester		Overall	
	n	%	n	%	n	%	n	%
1	253	94.4	361	88.7	386	85.2	1,000	88.7
2	15	5.6	43	10.6	62	13.7	120	10.6
3	0	0.0	3	0.7	5	1.1	8	0.7
4	0	0.0	0	0.0	0	0.0	0	0.0
Total	268	100	407	100	453	100	1,128	100

Table 4.13: Sources from which participants obtained their iodine-containing supplements during pregnancy

Sources *	1st trimester		2nd trimester		3rd trimester		Overall	
	n	%	n	%	n	%	n	%
MCHCs / Public hospitals	10	3.5	186	39.2	216	39.1	412	31.5
Private hospitals / clinics	29	10.2	33	7.0	30	5.4	92	7.0
Self-purchase	239	84.5	252	53.2	303	54.9	794	60.7
Sample presented by nutritional companies	4	1.4	3	0.6	2	0.4	9	0.7
Unknown	1	0.4	0	0	1	0.2	2	0.2

*Participants can provide more than one answer. Unknown refers to missing data in the questionnaire.

Table 4.14: Average daily iodine intake from iodine-containing supplements over the two weeks prior to the interview

	1st Trimester		2nd Trimester		3rd Trimester		Overall	
	n	%	n	%	n	%	n	%
Average amount of daily iodine from the supplement								
< 50 µg/day	21	4.1	9	1.8	7	1.4	37	2.4
50 – 99 µg/day	19	3.7	20	4.0	23	4.6	62	4.1
100 – 149 µg/day	18	3.6	33	6.6	45	8.9	96	6.3
150 – 249 µg/day	200	39.4	*325*	*64.6*	*341*	*67.8*	*866*	*57.2*
250 – 499 µg/day	*5*	*1.0*	*12*	*2.4*	*11*	*2.2*	*28*	*1.9*
Not taking any iodine-containing supplement	243	47.9	104	20.7	76	15.1	423	28.0
Unknown*	1	0.2	0	0	0	0	1	0.1
Total	507	100	503	100	503	100	1,513	100

* One woman could not provide the name of the nutritional supplement that she was taking and hence she was classified as unknown

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.15: The median UIC of Pregnant women by trimester (n=1,509)

	No. of subjects	**Median UIC (µg/L)**
All pregnant women	1,509^	134
1st trimester	504	138
2nd trimester	502	123
3rd trimester	503	137

^ Valid urine samples were available for 1,509 pregnant women only

Table 4.16: Comparison of urinary iodine concentration (UIC) in pregnant women regularly consumed iodized salt during pregnancy vs those did not.

	No. of subjects	**Median UIC (µg/L)**
Consumed iodized salt regularly*	71	167
Did not consumed iodized salt regularly*	1,438	132

***** No significant statistical difference was found in the median UIC between participants with regular consumption of iodised salt and those did not (p=0.22)

Table 4.17: Median UIC (μg/L) for pregnant women who had ever taken iodine-containing supplement, those with iodine supplement at average daily intake of ≥ 150 μg/day of iodine, those with such iodine supplement less than 150 μg/day of iodine, and those without iodine supplementation (n=1,508)

	No. of participants	Median UIC (μg/L)
All pregnant women	1,508	134
Ever taken iodine-containing supplements over the **two weeks** prior to the interview	1,087	153
Taken average daily iodine intake of ≥150μg/day from iodine-containing supplements over the **two weeks** prior to the interview	892	156*[a]
Taken average daily iodine intake of <150μg/day from iodine-containing supplements over the **two weeks** prior to the interview	195	132[§b]
Did not take any supplement or took supplement without iodine	421	97[+ab]

*The median UIC for pregnant women taking iodine-containing supplementation at average daily iodine intake at least 150 μg/day over the two weeks prior to interview is significantly above 150 μg/L by one sample median test (i.e. Wilcoxon Signed Rank Test) (p<0.001), and is classified as "adequate" according to the classification in the WHO's Guide.

[§]The median UIC for pregnant women taking iodine-containing supplementation at average daily iodine intake less than 150 μg/day over the two weeks before interview 132 μg/L, but cannot be shown to be significantly below 150 μg/L by one sample median test (i.e. Wilcoxon Signed Rank Test) (p=0.47) due to the small sample size of this subgroup. The iodine status for this subgroup is concluded as " insufficient".

[+]The median UIC for pregnant women who did not take any supplement or took supplement without iodine over the two weeks prior to interview is significantly below 150 μg/L by one sample median test (i.e. Wilcoxon Signed Rank Test) (p<0.001), and is classified as "insufficient" according to the classification in the WHO's Guide.

[a]Post-hoc analysis showed there is significant statistical difference in the median UIC between participants taking supplements in average of ≥150μg/day of iodine and participants who did not take any iodine containing supplement over the two weeks prior to the interview (p<0.001).

[b]Post-hoc analysis showed there is significant statistical difference in the median UIC between

participants taking supplements in average of <150µg/day of iodine and participants who did not take any iodine containing supplement over the two weeks prior to the interview (p=0.02).

Lactating mothers

Table 4.18: Demographic characteristics for all recruited lactating mothers

Demographic characteristics		n	%
Ethnicity			
Chinese		470	97.5
Non-Chinese		12	2.5
Education level			
Primary or below		3	0.6
Secondary	Junior secondary level	48	10.0
	Senior secondary level	144	29.9
Tertiary	Diploma/certificate/ associate degree	97	20.1
	Degree	190	39.4
Occupation			
Manager and administrators		40	8.3
Professionals		74	15.4
Associate professionals		21	4.4
Clerical support workers		70	14.5
Service and sales workers		58	12.0
Housewives		204	42.3
Unemployed		7	1.5
Others		8	1.7
Total		482	100

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.19: Mode of delivery of lactating mothers

	n	%
Vaginal delivery	352	73.0
Caesarean section	130	27.0
Total	482	100

Table 4.20: Reasons reported by the lactating mothers who never took iodine-containing supplement during lactation

Main reasons*	N=268
Did not know iodine supplement is necessary during lactation	178 (66.4%)
Thought her daily diet provides enough iodine	78 (29.1%)
Thought her nutritional supplement contains iodine already (at the moment of interview)	2 (0.7%)
Too busy for baby care	3 (1.1%)
Avoid because of co-existing medical problem	3 (1.1%)
Others	4 (1.4%)
Personal choice not to take	2 (0.7%)
Plan for later period	2 (0.7%)

* Participants can provide more than one reason.

Table 4.21: Number of iodine-containing supplements ever taken by the participants during lactation

Number of iodine-containing supplements ever taken by each participant	n	%
1	192	91.9
2	17	8.1
3	0	0.0
4	0	0
Total	209	100

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.22: Sources from which participants obtained their iodine-containing supplements after delivery

Sources*	n	%
MCHCs / Public hospitals	57	23.8
Private hospitals / clinics	14	5.8
Self-purchase	166	69.2
Sample presented by nutritional companies	3	1.3

*Participants can provide more than one answer.

Table 4.23: Average daily iodine intake from iodine-containing supplements over the two weeks prior to the interview

	n	%
Average amount of daily iodine from the supplement		
< 50 µg/day	14	2.9
50 – 99 µg/day	24	5.0
100 – 149 µg/day	21	4.4
150 – 249 µg/day	130	27.0
250 – 499 µg/day	7	1.5
Not taking any iodine-containing supplement	286	59.3
Total	482	100

Note: Figures may not add up to their corresponding totals owing to rounding.

Table 4.24: Median UIC of Lactating mothers (n=479)

	No. of subjects	**Median UIC (µg/L)**
Lactating mothers	479^	65

^ Valid urine samples were available for 479 lactating women only

Table 4.25: Comparison of urinary iodine concentration (UIC) in lactating mothers who regularly consumed of iodized salt during lactation vs those did not

	No. of subjects	**Median UIC (µg/L)**
Consumed iodized salt regularly*	24	75
Did not consumed iodized salt regularly*	455	64

***** No significant statistical difference was found in the median UIC between participants with regular consumption of iodised salt and those who did not (p=0.29)

Table 4.26: Median UIC (μg/L) for lactating mothers who had ever taken iodine-containing supplement, those with iodine supplement at average daily intake of ≥ 150 μg/day of iodine, those with such iodine supplement less than 150 μg/day of iodine, and those without iodine supplementation (n=479)

	No. of participants	Median UIC (μg/L)
All lactating mothers	479	65[+]
Ever taken iodine-containing supplements over the **two weeks** prior to the interview	195	80
Taken ≥150μg/day of iodine from iodine-containing supplements over the **two weeks** prior to the interview	136	84[+a]
Taken <150μg/day of iodine from iodine-containing supplements over the **two weeks** prior to the interview	59	71[+]
Did not take any supplement or took supplement without iodine	284	58[+a]

[+]The median UICs for all lactating mothers and their subgroups are significantly below 100 μg/L by one sample median test (i.e. Wilcoxon Signed Rank Test) ($p<0.001$), and is classified as "insufficient" according to the WHO's Guide.

[a]Post-hoc analysis showed there is significant statistical difference in the median UIC between participants taking supplements in average of ≥150μg/day of iodine and participants who did not take any iodine containing supplement over the two weeks prior to the interview ($p=0.001$).

Appendix 5 Joint Recommendation on Iodine Intake for pregnant and lactating women

Iodine is an essential micronutrient required for normal thyroid function, growth and development. If iodine deficiency exists during the critical period from the second trimester of pregnancy to the third year after birth, the brain and central nervous system of the baby will have irreversible derangement. Pregnant and lactating women are particularly vulnerable to iodine deficiency disorders (IDD) due to the increased daily requirement. From children's nutrition and health perspective, the following recommendations on iodine intake for pregnant and lactating women are made so as to meet their daily requirement of 250 μg iodine:

Take an iodine-containing supplement daily

- Pregnant and lactating women are recommended to take iodine-containing supplements regularly and they should check the iodine content of the supplement to make sure that they have at least 150 μg iodine each day. They should seek advice from healthcare professionals if they have doubt.
- Women with existing medical conditions or thyroid problems should consult healthcare professionals and take supplements as advised by them.

Consume a variety of iodine-rich foods

- Consume food with more iodine as part of a healthy balanced diet. Seaweed, kelp, seafood, marine fish, eggs, milk and dairy products are food with more iodine.
- In the event that iodine supplements cannot be taken, pregnant and lactating women may increase iodine intake from diet in order to the meet the daily requirement of 250 μg of iodine per day.

Use iodised salt

- Use iodised salt instead of ordinary table salt.
- Pay attention to keep the overall salt intake to less than 5 g (less than 1 teaspoon) per day.
- As iodine content in iodised salt may be affected by humidity, heat and sunlight, iodised salt should be stored in a tight and coloured container and kept in a cool and dry place. It should be added to food just before serving.

For more information, please visit the Department of Health website:
Iodine Survey: https://www.chp.gov.hk/files/pdf/iodine_survey_report_en.pdf
Do you have adequate iodine?: https://www.fhs.gov.hk/english/health_info/woman/30146.html

衞生署 Department of Health
衞生防護中心 Centre for Health Protection
食物環境衞生署 Food and Environmental Hygiene Department
食物安全中心 Centre for Food Safety
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