KADAR YODIUM DALAM GARAM BERYODIUM YANG DIBUTUHKAN DI DAERAH ENDEMIK

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ABSTRAK

Garam beryodium telah dipergunakan di berbagai negara untuk penanggulangan jangka panjang Gangguan Akibat Kekurangan Yodium (GAKY). Beberapa hal penting yang dapat menurunkan kadar garam beryodium perlu diperhatikan untuk menjamin efektifitas program, seperti kehilangan yodium waktu memasak. Sebaliknya, kelebihan yodium dapat berakibat gangguan kesehatan seperti *iodine-induced hyperthyroidism* (IIH), *Autoimmune Thyroiditis*, dan beberapa kelainan lainnya. Penelitian ini bertujuan untuk mengetahui kadar garam beryodium yang dibutuhkan di daerah endemik, kehilangan yodium waktu memasak yang berhubungan dengan kadar garam beryodium. Penelitian ini merupakan suatu studi lapangan dengan rancangan sama subyek. Sepuluh kluster keluarga dipilih dengan cara acak sistematik dari anak SD 3 kelas 3-6. Seluruh anggota keluarga berjumlah 33 orang (2 keluarga dikeluarkan dalam analisis). Hasil pemeriksaan EYU (ekskresi yodium urin) diperoleh sebesar 84,4 (±32,11) μg/l dan 208,1 (±89,24) μg/l masing-masing untuk konsumsi garam nonyodium dan garam beryodium 43 ppm. Kehilangan yodium waktu memasak dijumpai sebesar 25%, dan asupam garam rata-rata adalah 6,64 g/orang/hari. Hasil perhitungan berdasarkan angka-angka ini diperoleh kadar garam beryodium yang dibutuhkan untuk daerah endemik adalah 22 ppm di tingkat konsumen atau 32 ppm di tingkat produksi untuk mencapai asupan yodium yang dianjurkan sebesar 150 μg. Untuk daerah endemik ringan (EYU 84,4 μg/l) hasil ini sedikit lebih tinggi dari rentang minimum (30 ppm) dan jauh di bawah rentang maksimum (80 ppm) dari rentang kadar garam beryodium yang ditentukan sebesar 30-80 ppm. Berdasarkan hasil tersebut perlu dilakukan peninjauan kembali penetapan rentang kadar yodium dalam garam beryodium dan kemasan disesuaikan dengan tingkat endemisitas (endemik ringan, endemik sedang, dan endemik berat).

Kata kunci: garam beryodium, kehilangan yodium, EYU, asupan garam.

IODINE LEVEL OF IODIZED SALT REQUIRED IN ENDEMIC AREA

ABSTRACT

Iodized salt had been used in many countries for long term iodine deficiency disorders (IDD) control program. Several things should be considered related to iodine loss in iodized salt, e.g. iodine loss during cooking that may effect the effectivity of the program. Too high iodine level on the other hand, will cause health problems such as iodine-induced hyperthyroidism (IIH) and autoimmune thyroiditis. The purpose of this study was to know the level of iodine in iodized salt required in endemic area to meet the iodine recommended daily allowance (RDA) of 150 μg/person/day. This study was a field trials using treatment by subyect design. Ten schoolchildren were selected systematically to get ten clusters of schoolchildren families. All members of the families were 33 persons (2 families were droped out). Urine examination showed the mean of urine iodine excretion (UIE) 84.8 ± 32.11 μg/L and 208.1 ± 89.24 μg/L of non-iodized salt and iodized salt consumption respectively. Salt intake was 6.64 g/person/day and iodine loss during cooking was 25%. Iodine level of iodized salt required in mild endemic area was 22 ppm at consumer level or 32 ppm at production level. This result was slightly higher than the minimum range (30 ppm) and much lower than the maximum range (80 ppm) was the level of iodine in iodized salt that was detemined by the government (30-80 ppm). Based on this finding, the range of iodine level in iodized salt production should be rivised according to the endemicity of area (mild, moderate, and severe).

Key words: *iodized salt, iodine loss, UIE, salt intake*

LATAR BELAKANG

Penggunaan garam beryodium merupakan tujuan jangka panjang dari penanggulangan GAKY dan terbukti telah berhasil di berbagai negara, seperti Swiss[1] dan di Afrika Selatan manfaatnya telah terlihat dalam 1 tahun.[2] Di Indonesia konsumsi garam beryodium sudah mencapai 60% dari seluruh keluarga dan angka ini diharapkan akan mencapai 90% sampai tahun 2000.[3] Kadar yodium dalam garam beryodium ditetapkan sebesar 30-80 ppm.[4] Kadar yodium yang dipergunakan di berbagai negara sangat bervariasi, mulai dari 25 ppm sampai 100 ppm. Kenya menggunakan kadar 100 ppm KIO_3.[5]

Hal-hal penting seperti pengemasan, pengangkutan, penyimpanan, kehilangan yodium sewaktu memasak yang berperan terhadap kehilangan yodium, kebiasaan makan berhubungan dengan asupan garam, dan cara memasak perlu diperhitungkan.[6] Kehilangan yodium dapat disebabkan oleh jenis makanan, jenis bahan, dan air pada waktu memasak,[7] dan beberapa jenis bumbu-bumbuan dan senyawa yang bersifat sebagai reduktor.[8]

Di sisi lain, sekelompok peneliti dalam *Prophylaxis of Endemic Goiter in Chelyabinskaya Oblast'* yang dikutip Levit et al[9] menyatakan bahwa asupan yodium yang berlebihan dapat menimbulkan kejadian kelainan autoimun tiroid, khususnya tiroiditis autoimun. Kelebihan yodium juga dapat meningkatkan kejadian *iodine-induced hyperthyroidism* (IIH), penyakit autoimun tiroid dan kanker tiroid.[10] Hipertiroidisme juga dilaporkan terjadi setelah program fortifikasi garam dengan yodium di Eropa dan Amerika Selatan, yodisasi roti di Negeri Belanda dan Tasmania.[11]

Berdasarkan hal-hal tersebut di atas perlu dilakukan perhitungan yang lebih teliti kadar yodium dalam garam beryodium untuk mencapai kebutuhan asupan yang dianjurkan dan untuk mencegah kemungkinan kelainan akibat kelebihan yodium. Untuk menghitung kadar yodisasi garam dalam produksi garam beryodium yang dibutuhkan di daerah endemik perlu diketahui beberapa hal, seperti: a) konsumsi yodium di suatu daerah, b) kehilangan yodium pada waktu memasak, c) kehilangan yodium dalam transportasi/distribusi/penyimpanan (dari tingkat produksi sampai tingkat konsumen), dan d) asupan garam. Berdasarkan hal-hal tersebut dibuat persamaan untuk menghitung kadar yodium dalam garam di tingkat produksi maupun di tingkat konsumen sebagai berikut[12]:

1. untuk menghitung kadar yodium di tingkat rumah tangga,

   $\mathbf{X_k}$ = $\{$**(0,976AKG–EYU)/0,976(1-S_1)**$\}$**/A_gx 1,685 ppm,** atau

   $$\mathbf{X_k = \left\{ \frac{0{,}976\,AKG - EYU}{0{,}976\left(1 - S_1\right)} \right\} / A_g \times 1{,}685}$$

2. untuk menghitung kadar yodium di tingkat produksi,

   $\mathbf{X_p = X_k/(1–S)}$

Keterangan:

EYU	=	eksresi yodium urin di derah endemik (μg), hasil pemeriksaan atau pustaka,
S_1	=	kehilangan yodium waktu memasak (%), perkiraan, atau dari pustaka,
S	=	kehilangan yodium dalam pengangkutan/distribusi/penyimpanan (%), perkiraan atau dari pustaka.
AKG	=	angka kecukupan gizi yodium yang dianjurkan (μg), dari pustaka,
A_g	=	konsumsi garam rata-rata per orang per hari (g/orang/hari), dari pustaka,
X_k	=	kadar garam yodium di tingkat konsumen (ppm),
X_p	=	kadar yodium dalam garam di tingkat produksi (ppm),
1,685	=	faktor konversi dari μg menjadi ppm.[13,14]

Sedangkan untuk menghitung kehilangan yodium waktu memasak dapat dibuat persamaa:

$\mathbf{S_1 = (EYU_{0ppm} – EYU_{Xppm})/0,579A_gX + 1}$

Keterangan:

S_1	=	kehilangan yodium waktu memasak (%),
EYU_{0ppm}	=	ekskresi yodium urin pada konsumsi garam nonyodium (μg),
EYU_{xppm}	=	ekskresi yodium urin pada konsumsi garam beryodium X ppm (μg).
A_g	=	konsumsi rata-rata garam (g/orang/hari).
X	=	kadar garam beryodium X ppm

SUBYEK DAN CARA PENELITIAN

Penelitian ini merupakan studi lapangan menggunakan rancangan sama subyek. Populasi 10 kluster keluarga anak SD 3 Rendang yang dipilih secara acak sistematik meliputi kelas 3 s/d 6 (umur 6-12 tahun). Jumlah sampel anggota keluarga seluruhnya adalah 43 orang, sudah melebihi jumlah yang dianjurkan WHO sebanyak 30 orang.

Perlakuan berupa pemberian garam beryodium 43 ppm diberikan kepada sampel keluarga setelah konsumsi garam nonyodium. Pemeriksaan sampel urin (EYU) menggunakan cara *acid digestion*, dilakukan di Laboratorium GAKY Universitas Diponegoro, Semarang.

HASIL DAN PEMBAHASAN

Sampel dalam penelitian ini berjumlah 33 orang (2 keluarga tidak diikutkan dalam analisis) terdiri dari 20 (60,6%) laki-laki dan 13 (39,4%) perempuan, terdistribusi di dua banjar, yaitu di Banjar Langsat 21 orang (63,6%) dan Banjar Tengah 12 orang (36,4%). Umur rata-rata adalah 23,4 tahun, umur terendah dan tertinggi masing-masing 10 dan 40 tahun.

Konsumsi Garam dan EYU. Untuk mengetahui kehilangan yodium pada waktu memasak, dalam penelitian ini dilakukan pemberian garam beryodium 43 ppm. Hasil pemeriksaan urin (EYU konsumsi garam nonyodium, garam beryodium 43 ppm) masing-masing adalah 84,4 (32,11) dan 208,2 (89,24) µg/L. Sedangkan asupan garam rata-rata adalah 6,64 (1,91) g/orang/hari (lihat tabel berikut).

Hasil Pemeriksaan EYU Konsumsi Garam Nonyodium dan Garam Beryodium 43 ppm dan Konsumsi Garam Rata-rata Per Orang Per Hari (n=33 Orang)

	EYU konsumsi garam nonyodium	EYU konsumsi garam beryodium 43 ppm	Asupan garam (g/orang/hari)
Rata-rata	84,4	208,1	6,64
Median	84,4	208,2	6,64
Std. Deviasi	32,11	89,24	1,91
Minimum	6,0	20,0	3,8
Maksimum	138,0	442,0	10,5

Kehilangan Yodium pada Waktu Memasak. Data yang perlu diketahui untuk menghitung kehilangan yodium pada waktu memasak adalah: EYU konsumsi garam nonyodium, EYU konsumsi garam beryodium, asupan garam rata-rata per orang per hari, dan faktor konversi kadar yodium dalam µg menjadi ppm sebesar 1,685.[13,14] Kehilangan yodium waktu memasak dihitung menggunakan persamaan berikut[12]:

$$\mathbf{S_1 = (EYU_{0ppm} - EYU_{Xppm})/0{,}579A_gX + 1}$$

Keterangan:

S_1 = kehilangan yodium waktu memasaki (%),

EYU_{0ppm} = ekskresi yodium urin pada konsumsi garam nonyodium (84,4 μg/l),

EYU_{43ppm} = ekskresi yodium urin pada konsumsi garam beryodium 43 ppm (208,2 μg/l),

A_g = konsumsi rata-rata garam (6,64 g/orang/hari),

X = 43 ppm.

Dari perhitungan menggunakan angka-angka tersebut di atas, diperoleh kehilangan yodium pada waktu memasak sebesar **25%**.

Dalam penelitian ini diperoleh kehilangan yodium pada waktu memasak sebesar 25%. WHO menganjurkan penggunaan kehilangan yodium pada waktu memasak sebesar 20%.[6] Penelitian lain menunjukkan kehilangan yodium pada waktu memasak tergantung dari bahan dan cara memasak yang berkisar antara 20-30%.[15] Hasil yang diperoleh dalam penelitian ini tidak begitu jauh berbeda dengan rentang hasil peneliti lainnya dan informasi terbaru tentang kehilangan yodium pada waktu memasak sebesar 20% sesuai anjuran WHO.

Kadar Garam Beryodium di Tingkat Konsumen. Untuk mencapai asupan yodium sebesar 150 μg (sesuai AKG) dan kehilangan yodium sebesar 25%, asupan garam sebesar 6,64 g/orang/hari, dan EYU sebesar 84,4 µg/L dapat dihitung kadar yodium yang diperlukan dalam garam beryodium untuk memenuhi kebutuhan asupan yodium yang dianjurkan di daerah endemik dengan menggunakan persamaan:

$$\mathbf{X_k = \left\{ \frac{0{,}976\,AKG - EYU}{0{,}976\left(1 - S_1\right)} \right\} / A_g \times 1{,}685}$$ [12]

Hasil perhitungan menggunakan angka-angka di atas diperoleh kadar yodium dalam garam beryodium yang dibutuhkan di daerah endemik di tingkat konsumen 22 ppm.

Kadar Garam Beryodium di Tingkat Produksi. Di tingkat produksi, kadar yodium dalam garam yang diproduksi dengan asumsi kehilangan yodium dalam pengangkutan sebesar 30% (dari tingkat produksi sampai konsumen), dihitung dengan menggunakan persamaan:

$$\mathbf{X_p = X_k/(1 - S)}$$ [12]

X_k = 22 ppm (hasil perhitungan)

S = 30% (perkiraan)

Berdasarkan anka-angka di atas diperoleh kadar yodium dalam garam beryodium yang dibutuhkan di daerah endemik tempat penelitian di tingkat produksi adalah 32 ppm. Di daerah endemik ringan dibutuhkan kadar garam beryodium sebesar 22 ppm di tingkat konsumen dan 32 ppm di tingkat produksi. Kadar garam beryoidum yang dibutuhkan di tingkat produksi sedikit di atas rentang minimum dan jauh di bawah rentang maksimum dari ditetapkan sebesar 30-80 ppm.[4]

Kadar yodium yang dipergunakan di berbagai negara sangat bervariasi, mulai dari 25 ppm sampai 100 ppm. Kenya menggunakan kadar 100 ppm KIO_3.[5] Berdasarkan *The Codex Alimentarius standard for food-grade salt* rentang yang diperbolehkan adalah 30-200 ppm.[16] CODEX dengan modifikasi menganjurkan kadar sebesar 40 ppm atau rentang 25-55 ppm dengan variasi ±15 ppm.[3] Hasil yang diperoleh dalam penelitian ini sebesar 32 ppm sesuai dengan anjuran CODEX, mengingat hasil ini adalah untuk daerah endemik ringan, akan tetapi sedikit lebih tinggi dari batas minimum (30 ppm) dan jauh lebih rendah dari batas maksimum (80 ppm) berdasarkan rentang yang ditetapkan di Indonesia sebesar 30-80 ppm.

SIMPULAN DAN SARAN

Simpulan. Kehilangan yodium pada waktu memasak diperoleh sebesar 25% masih dalam rentang hasil peneliti-peneliti lain dan tidak jauh berbeda dengan yang dianjurkan WHO sebesar 20%.[6]

Kadar yodium dalam garam beryodium sebesar 32 ppm di tingkat produksi yang dibutuhkan di daerah endemik (endemik ringan), sedikit di atas batas minimum dan jauh di bawah batas maksimum yang ditetapkan antara 30-80 ppm.

Saran. Untuk memperoleh kadar garam beryodium untuk daerah endemik sedang dan berat, perlu dilakukan pemeriksaan EYU di masing-masing daerah. Hal ini penting oleh karena indikator endemisitas biasanya dipergunakan TGR. Untuk tingkat nasional, perlu pemeriksaan EYU yang lebih menyeluruh sehingga dapat ditetapkan rentang kadar garam beryodium dalam produksi garam beryodium. Kemasan garam beryodium hendaknya dibagi tiga sesuai kebutuhan berdasarkan tingkat endemisitas, yaitu: endemik ringan, sedang, dan berat.

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IODINE LEVEL OF IODIZED SALT REQUIRED IN ENDEMIC AREA

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ABSTRACT

Iodized salt had been used in many countries for long term iodine deficiency disorders (IDD) control program. Several things should be considered related to iodized salt production, e.g. iodine loss during cooking that may effect the effectivity of the program. Too high iodine level on the other hand, can cause health problems such as iodine-induced hyperthyroidism (IIH) and autoimmune thyroiditis. The purpose of this study was to know the level of iodine in iodized salt required in endemic area to meet the iodine recommended daily allowance (RDA) of 150 μg/person/day. This study was a field trials using treatment by subyect design. Ten schoolchildren were selected systematically to get ten clusters of schoolchildren families. All members of the families were 33 persons (2 families were droped out). Urine examination showed the mean of urine iodine excretion (UIE) 84.8 ± 32.11 μg/L and 208.1 ± 89.24 μg/L of non-iodized salt and iodized salt consumption respectively. Salt intake was 6.64 g/person/day and iodine loss during cooking was 25%. Iodine level of iodized salt required in mild endemic area was 22 ppm at consumer level and 32 ppm at production level considering iodine loss during cooking. This result was slightly higher than the minimum range (30 ppm) and much lower than the maximum range (80 ppm) of the level of iodine in iodized salt that was detemined by the government (30-80 ppm). Based on this finding, the range of iodine level in iodized salt production should be revised according to the endemicity of area (mild, moderate, and severe).

Key words: *iodized salt, iodine loss, UIE, salt intake.*

BACKGROUND

Iodized salt has been used for long term iodine deficiency disorders (IDD) control program. The efectivity was showed in many countries such as: Swiss[1] and in South Africa that the result was visible in one year.[2] In Indonesia consumption of iodized salt has reached 60% families and is expected to raise up to 90% by 2000.[3] The level of iodine in iodized salt determined by the government was 30-80 ppm.[4] In many countries the level of iodine are varied from 25 ppm to 100 ppm. Kenya uses 100 ppm KIO_3.[5]

Several important things like: packages, transportation, storage, iodine loss during cooking, may result in iodine loss, un edditions, eating habits related with salt intake, and cooking methods also need to be considered.[6] Iodine loss might be caused by type of foods and water[7], during cooking several spicies and some substances as reductors.[8]

A study on Prophylaxis of Endemic Goiter in Chelyabinskaya Oblast' cited by Levit et al[9] found that excess of iodine intake might cause autoimmune thyroid diseases, mostly autoimmune thyroiditis. Excess of iodine intake can also raise incident of *iodine-induced hyperthyroidism* (IIH), autoimmune thyroid diseases and thyroid cancer.[10] Increased of hyperthyroidism was also reported after salt fortification program with iodine in Europe and Latin America, iodine fortification of bread in Deutch and Tasmania.[11]

Based on some matters mentioned above, it is necessary to make a more precise calculation by iodine level in iodized salt production in order to meet the recommended daily allowance (RDA) according to the endemicity of area and to prevent the possibile effect of excess iodine intake. Some points have to be know to make calculation of the iodine level in iodized salt production needed in endemic area, e.g.: a) iodine intake or UIY, b) iodine loss during cooking, c) iodine loss during transportation/distribution/storage (fron production level to household level), and d) salt intake. Based on those items, the equation to calculate iodine level of iodized salt at household level and iodine level of iodized salt at production level can be made as follows[12]:

1. to calculate iodine level of iodized salt at household level:

   $\mathbf{X_k = \{(0,976RDA–UIE)/0,976(1\text{-}S_1)\}/A_g x\ 1,685\ ppm}$, or

$$\mathbf{X_k = \left\{\frac{0,976\,RDA - UIE}{0,976\left(1 - S_1\right)}\right\} / A_g \times 1,685}$$

Note:

UIE	=	urine iodine excretion in endemic area (μg/L),
S_1	=	iodine loss during cooking (%),
RDA	=	recommended daily allowance (μg),
A_g	=	salt intake (g/person/day),
X_k	=	iodine level of iodized sal at household level (ppm),
1.685	=	conversion factor from μg to ppm.

2. to calculate iodine level of iodized salt at production level:

   $\mathbf{X_p = X_k/(1–S)}$

Note:

S	=	iodine loss from production level to household level,
X_k	=	iodine level of iodized sal at household level (ppm),
X_p	=	iodine level of iodized salt at production level (ppm),

Calculation of iodine loss during cooking used the following equation:

$$S_1 = (UIE_{0ppm} - UIE_{Xppm})/0,579A_gX + 1$$

Note:

S_1 = iodine loss during cooking (%),

UIE_{0ppm} = urine iodine excretion of non-iodised salt consumption (μg).

UIE_{xppm} = urine iodine excretion of X ppm iodised salt consumption (μg).

A_g = salt intake (g/person/day),

X = iodine level of X ppm iodized salt.

SUBYECTS AND METHOD

This study was a field research using treatment by subyect design. Ten clusters of schoolchildren families of No 3 Rendang Elementary School were selected. All members of the families were determined to be the sample. The number of sample required was 30 higher than 30 recommended by WHO. Ten schoolchildren were selected systematically among 72 schoolchildren of grade 3 to 6 (10-12 years of age).

Iodized salt (43 ppm, 2th treatment) was distributed after consumption of non-iodized salt (1th treatment). Acid digestion method was used for urine examination at IDD Laboratory of Diponegoro University, Semarang. Iodine loss was calculated based on UIE of non-iodized salt and 43 ppm iodized salt consumption, and the conversion factor was 1.685.[13,14] Iodine level in iodized salt needed produced was calculated using the previously equations mentioned above.

RESULTS AND DISCUSSION

Salt Intake and UIE of Non-iodized Salt and 43 ppm Iodized Salt Consumption

	Salt Intake (g/person/day)	UIE of Non-Iodized Salt Consumption (µg/L)	UIE of 43 ppm Iodized Salt Consumption (µg/L)
Mean	6.64	84.4	208.1
Median	6.64	84.4	208.2
Std. Deviation	1.91	32.11	89.24
Minimum	3.8	6.0	20.0
Maximum	10.5	138.0	442.0

Eight schoolchildren family as clusters were analyzed in this study (2 families were drop out). Total numbers of the families were 33, consists of 20 (60.6%) male and 13 (39.4%) female. They were living at two *banjars*, at *Banjar* Langsat 21 samples (63.6%) and *Banjar* Tengah

12 samples (36.4%). The mean of age was 23.4 years, minimum age was 10 years and maximum age was 40 years.

Urine examination showed the mean iodine exretion of non-iodized salt and 43 ppm iodized salt consumption of 84.4 ± 32.11 µg/L and 208.2 ± 89.24 µg/L respectively. The mean of salt intake was 6.64 ± 1.91 g/person/day (see the above table).

Iodine Loss During Cooking. The data to be known to calculate iodine loss during cooking are: UIE of non-iodized salt, 43 ppm iodized salt consumption, and salt intake. Fourty three ppm iodized salt was used in this study. Using the above finding, the following equation can be made. Convertion factor to be used was 1.685.[13,14]

$$\mathbf{S_1 = (UIE_{0ppm} - UIE_{Xppm})/0{,}579A_gX + 1}$$

Twenty five percent **(25%)** iodine loss during cooking was found from the calculation based on:

S_1 = iodine loss during cooking (%),
UIE_{0ppm} = 84.4 µg/L,
UIE_{43ppm} = 208.2 µg/L,
A_g = 6.64 g/person/day, and
X = 43 ppm.

WHO recommended to use iodine loss during cooking 20%.[6] Other studies found iodine loss ranged from 20 to 30% depend my on the type of foodstuffs and cooking methods.[15] Iodine loss during cooking found in this study was 25%, this result was between the range of other study results. This result was also not much different from 20%, the latest information about iodine loss during cooking that was recommended by WHO.[6]

Iodine Level of Iodized Salt at Household and Production Level. The level of iodine in iodized salt needed produced to meet iodine requirement at household level considering iodine loss during cooking, used the following equation:

$$\mathbf{X_k = \left\{\frac{0{,}976\,RDA - UIE}{0{,}976(1 - S_1)}\right\} / A_g \times 1{,}685}$$ [12]

Iodine level in iodized salt required in endemic area (mild endemicity, UIE 84.4µg/L), RDA 150 µg, S_1 25% was 22 ppm. At production level, iodine level in iodized salt to be produced to meet 150 µg iodine intake was calculated using the following equation:

$$\mathbf{X_p = X_k/(1 - S)}$$ [12]

X_k = 22 ppm (level of iodine in iodized salt at household level, from calculation)

S = 30% (iodine loss from production level to household level, assumption)

Iodine level in iodized salt required in endemic area (mild endemicity, UIE 84.4 µg/L) to meet iodine intake150 µg at production level from the calculation was 32 ppm. Iodine level of iodized salt at production level in mild endemic area was slightly higher than the minimal range (30 ppm) and much lower than the maximum range (80 ppm) of the range that was determined by the goverment (30-80 ppm).[4]

Many countries used a very wide range of iodine level of iodized salt. It ranges from 25 ppm to 100 ppm. Kenya uses iodine level in iodized salt of 100 ppm KIO_3.[5] According to The Codex Alimentarius standard for food-grade salt, the range which is allowed is 30-200 ppm.[16] CODEX with modification recommended the use of 40 ppm or range 25-55 ±15 ppm.[3] The 32 ppm iodized salt found in this study was between the range of CODEX recommendation, considering the result of was for mild endemic area.

CONCLUSION AND RECOMMENDATION

Conclusion. Iodine loss during cooking found in this study was 25%, it was between the range of the results of other studies.

Iodine level of iodized salt required in mild endemic area considering iodine loss during cooking was 32 ppm at production level. The level of iodine was slightly higher than the minimum range (30 ppm) and much lower than the maximum range (80 ppm) those were determined.

Recommendation. Urine examination is necessary to be carried out in other endemic area to determine the range of iodine level of iodezed salt to be produced based on endemicity of the area. Iodized salt should be packed in three categories based on the requirement in endemic area (mild, moderate, and severe).

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