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Iodine Content in Urine Samples among Malays and Aborigines

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Abstract

A study was conducted to compare the urinary iodine concentrations in populations from Pahang, Central Malaysia, with those in the capital city Kuala Lumpur, and to compare those of Malays from villages at Batu Talam, Batu Malim, FELDA Sungai Koyan and Hulu Sungai with neighboring aboriginal settlements at Lanai and Buntu. Two hundred and forty urine samples were collected randomly among the population (male 1 1 1 and female 129). The urinary iodine concentrations, measured by the ashing method, among Malays were as follows: Batu Talam 1.1-7.6 micrograms/dl, Batu Malim 1.4-6.6 micrograms/dl, FELDA Sungai Koyan 0.5-6.9 micrograms/dl and Hulu Sungai 0.6-9.9 micrograms/dl. Among aborigines, the urinary iodine levels were 0.1-2.9 micrograms/dl in Lanai and 1.7-6.5 micrograms/dl in Buntu. There was a significant difference in the levels of urinary iodine with regard to gender, but not regarding age. The aborigines had significantly lower iodine levels than Malays ($P < 0.001$). This difference was also significant with regard to location. The urinary iodine content in Kuala Lumpur was the highest and that in the aboriginal Lanai village was the lowest. Thus, the study showed that the levels of iodine in the urine were influenced by ethnicity and geographic location.

KEYWORDS: urinary iodine, aborigines, Malays

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Iodine Content in Urine Samples among Malays and Aborigines

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A study was conducted to compare the urinary iodine concentrations in populations from Pahang, Central Malaysia, with those in the capital city Kuala Lumpur, and to compare those of Malays from villages at Batu Talam, Batu Malim, FELDA Sungai Koyan and Hulu Sungai with neighboring aboriginal settlements at Lanai and Buntu. Two hundred and forty urine samples were collected randomly among the population (male 111 and female 129). The urinary iodine concentrations, measured by the ashing method, among Malays were as follows: Batu Talam 1.1-7.6 μg/dl, Batu Malim 1.4-6.6 μg/dl, FELDA Sungai Koyan 0.5-6.9 μg/dl and Hulu Sungai 0.6-9.9 μg/dl. Among aborigines, the urinary iodine levels were 0.1-2.9 μg/dl in Lanai and 1.7-6.5 μg/dl in Buntu. There was a significant diffeence in the levels of urinary iodine with regard to gender, but not regarding age. The aborigines had significantly lower iodine levels than Malays ($P<0.001$). This difference was also significant with regard to location. The urinary iodine content in Kuala Lumpur was the highest and that in the aboriginal Lanai village was the lowest. Thus, the study showed that the levels of iodine in the urine were influenced by ethnicity and geographic location.

Key words: urinary iodine, aborigines, Malays

Iodine is an essential trace element that is widely distributed in nature. It is a constituent of thyroid hormones which play a vital role in growth and development (1). A healthy adult body contains a total of 15-20 mg iodine, of which 70 %-80 % is present in the thyroid gland. Vegetables, bread, cereals, maize, meat and dairy products such as milk and eggs contain iodine. However, foods of marine origin are richer in iodine than any other foodstuff.

Iodine that has been taken into the body is excreted in the urine. When renal clearance is normal, Koutras (1968) suggested that urinary iodine excretion below 10 μg/day is indicative of an iodine deficiency in humans (2). The best known disease associated with iodine deficiency is endemic goiter. Goiter, which is a swelling of the thyroid gland, is the oldest malady known to man. Goiter is a major health problem throughout the world, especially in remote areas such as the Alps, the Pyrenees, the Himalayas and the Andes. It is estimated to affect about 400,000 people in Asia (3). In Bangladesh, Bhutan, Burma, Indonesia, India, Nepal, Sri Lanka and Thailand, about 277 million people live in iodine deficient areas and about 102 million people actually suffer from goiter (4). In Malaysia, little attention has been given to the problem of endemic goiter because this disease is no longer a major health problem, especially in West Malaysia (5). However, in East Malaysia such as in Sri Aman Division, Lubok Antu and the upper Lemanak in Sarawak, the prevalence of goiter was reported to be high (6). Polunin (1971) found that in the same ethnic group, the prevalence of goiter among subjects living in rural areas was two times higher compared to subjects living in areas which were close to the sea (7). The purpose of this study was to determine the urinary iodine level among the aborigines and ethnic Malays in remote areas of Malaysia (Pahang) and to compare the same two ethnic groups living in Kuala Lumpur.

Subjects and Methods

Study population. A total of 244 subjects were studied from seven areas. There were two aboriginal settlements in Buntu and Lanai, four Malay villages from rural areas in Pahang (Felda Koyan, Hulu Sungai, Batu Talam and Batu Malim) and one Malay village in Kuala

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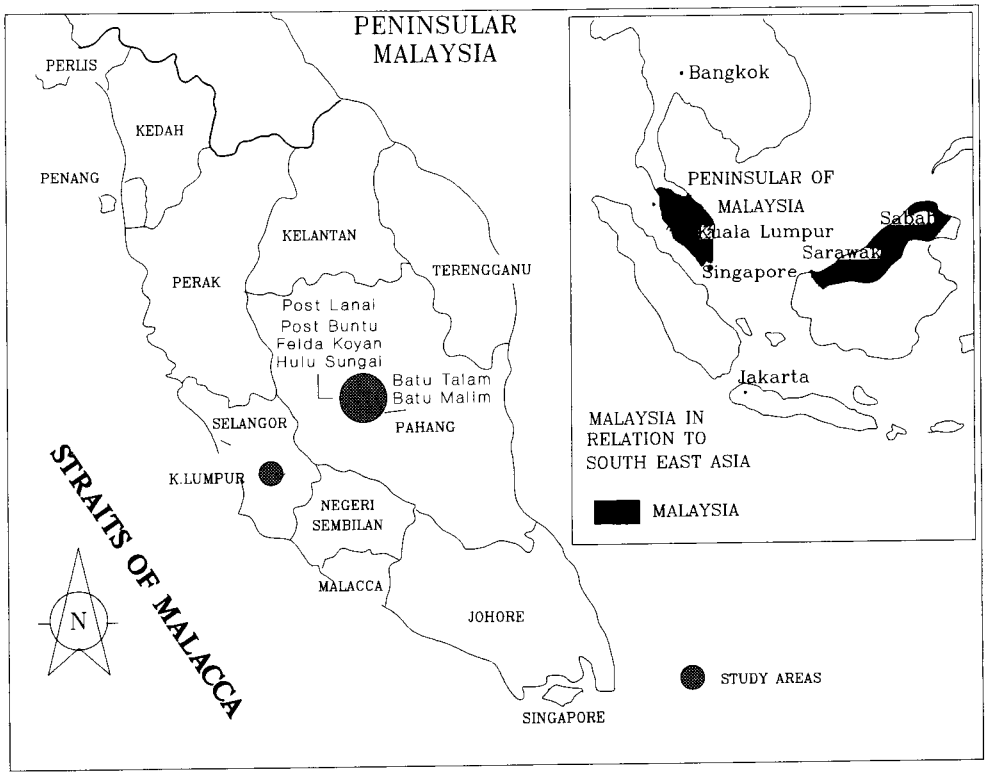

Fig. 1 Study areas.

Lumpur (Fig. 1). The cluster sampling method was used in this study. The aborigine village of Lanai is located on the banks of a river, deep in virgin jungle and is accessible only by boat. The main activities of the villagers were shifting cultivation, hunting and gathering jungle products such as bamboo, rattan and medicinal herbs. The Aborigine village of Buntu is located on the bank of a river and is accesible by road. The village is part of a government scheme to resettle the aborigines in a permanent place in order to provide them with basic amenities such as water supply, health care and schools. Their main activities were quite similar to the Orang Asli in Lanai except that they were not shifting cultivators. The traditional Malay villages of Hulu Sungai, Batu Talam and Batu Malim are located at the jungle fringes and are accessible by road. The main activities here are rubber tapping and farming. The Sungai Koyan (Malay) federal land scheme is a federal government land development scheme (FELDA) to restructure the community. Vast tracts of jungle were cleared for cultivation of oil palm. Settlers 30 to 40 years old were selected and given a plot of land to work on.

Urine samples. Urine samples were collected randomly from participants and placed in bottles without any preservative. The samples were kept in a cool room and sent to the laboratory for the determination of iodine level.

Measurement of iodine in the urine. The level of iodine in the urine was determined using the alkaline ashing method (8, 9). This method involves three steps: a) drying in oven for 15–18h at 110°C, b) ashing in a pre-heated muffle furnace at 500°C which was then raised to 600°C and c) acid extraction to eliminate any organic materials. The iodine level was then estimated using the Sandell-Koltholf method. In this reaction, iodine acts as a catalyst in the oxidation-reduction reaction between cesium (Ce) and arsenic (As). The iodine level was measured using a spectrophotometer at 420nm.

Results

Urinary iodine levels according to geographic location. Post Lanai, an aborigine settle-

ment located deep in the jungles of Pahang, had the lowest iodine level of all the locations (Table 1). Iodine levels in the villages in decreasing order were: Batu Talam $3.8 \pm 1.5 \mu g/dl$, Hulu Sungai $3.7 \pm 2.2 \mu g/dl$, Batu Malim $3.5 \pm 1.8 \mu g/dl$, Buntu $3.5 \pm 1.3 \mu g/dl$, FELDA Koyan resettlement scheme $2.9 \pm 1.9 \mu g/dl$, and Post Lanai $1.5 \pm 0.7 \mu g/dl$. It was found that the iodine levels in urine were significantly different among the various locations studied (ANOVA; $P < 0.001$, Table 1).

Urinary iodine level according to age, gender and ethnicity. The study found that women had significantly higher level of iodine in urine compared to men ($3.5 \pm 2.0 \mu g/dl$ and $2.9 \pm 1.6 \mu g/dl$, respectively) (Table 2). In terms of ethnicity, there was a significant difference in the level of iodine between Malays and aborigines although both lived in a similar condition. The aborigines had lower levels of iodine ($2.4 \pm 1.4 \mu g/dl$) compared to Malays ($4.3 \pm 2.7 \mu g/dl$) (Table 3). There was no significant difference among age groups (Table 4). The mean iodine levels according to age growps were: children less than 11 years old, $2.9 \pm 1.3 \mu g/dl$; adolescents, $3.9 \pm 2.9 \mu g/dl$; adults, $4.5 \pm 3.2 \mu g/dl$; and the elderly, $3.5 \pm 2.2 \mu g/dl$.

Table 1 Iodine levels in randomly collected urine samples in different geographic locations

Location	Ethnic type	Number of subjects examined	Iodine level ($\mu g/dl$)[a]
Post Lanai	Aborigine	30	1.5* ± 0.7
Post Buntu	Aborigine	28	3.5 ± 1.3
Batu Talam village	Malay	41	3.8 ± 1.5
Batu Malim village	Malay	23	3.5 ± 1.8
Hulu Sungai village	Malay	57	3.7 ± 2.2
FELDA Sungai Koyan resettlement scheme	Malay	30	2.9 ± 1.9

ANOVA; F = 8.42, *Significantly lower compared to other groups ($P < 0.001$). FELDA: Federal government land development scheme
a: Mean ± SD (standard deviation).

Table 2 Mean iodine level in urine according to gender

Gender	Number of subjects examined	Iodine levels ($\mu g/dl$)[a]
Males	92	2.9 ± 1.6
Females	117	3.5 ± 2.0

Student's *t*-test; $t = -2.35$, $P = 0.02$
a: Mean ± SD (standard deviation).

Table 3 Mean iodine level in urine according to ethnic group

Ethnic	Number of subjects examined	Iodine levels ($\mu g/dl$)[a]
Malays	149	4.3 ± 2.7
Aborigines	60	2.4 ± 1.4

Student's *t*-test; $t = 5.21$, $P < 0.001$
a: Mean ± SD (standard deviation).

Table 4 Mean iodine level in urine according to age groups

Age group	Number of subjects examined	Iodine levels ($\mu g/dl$)[a]
Children	16	2.9 ± 1.3
Adolescents	20	3.9 ± 2.9
Adults	55	4.5 ± 3.2
Elderly	118	3.5 ± 2.2

ANOVA; F = 2.64, $P > 0.05$
a: Mean ± SD (standard deviation).

Iodine levels among several areas of Pahang and Kuala Lumpur. The levels of iodine from differenct places in Pahang were compared to those in Kuala Lumpur. The mean iodine level in the urine among participants living in Kuala Lumpur was $7.7 \pm 3.4 \mu g/dl$. The levels of excretion were significantly different between Kuala Lumpur and Batu Talam, Batu Malim, FELDA Koyan resettlement scheme, and the two aboriginal settlements, Post Buntu and Post Lanai (*t*-test; $P < 0.001$). Comparison between Kuala Lumpur and Hulu Sungai village showed no significant difference in the amount of iodine excreted.

Discussion

Iodine deficiency not only causes goiter but has also associated with a high risk of abortions, stillbirths and congenital anomalies in the fetus (3). In adolescents, it may cause juvenile hypothyroidism, goiter, impaired mental function and cretinism, whereas in adults it may cause hypothyroidism and impaired mental funtion (1).

According to the National Academy of Sciences, United States, the recommended daily iodine intake is 40 μg for children aged 0-6 months, 50 μg for 6-12 months, 70-120 μg for 1-10 years and 120-150 μg for 11 years and older. In this study, there was a slight increase in the level of urinary iodine by age, indicating increased intake of iodine.

It is known that the prevalence of goiter is higher in women compared to men. About 60 % of adult Penan's women in Sarawak, Malaysia had goiter compared to 39.9 % of adult men (10). In this study, there was only a slight difference in urinary iodine levels excretion between men and women. However, we found that in remote areas the level of iodine in urine samples was significantly lower compared with less remote or urban areas. Post Lanai which is located far in the jungle had the lowest level of iodine of all the locations tested. There was a significant difference between Kuala Lumpur and rural villages in Pahang. This is probably because of the lower levels of iodine in soils and foods in remote areas and because those people living in remote areas get less iodine from foods especially seafoods. This could explain the high incidence of goiter among the aborigines in remote areas, and the decrease in the prevalence of goiter as the area closer to town, as reported earlier (5). Pearson's coefficient of correlation between the prevalence of goiter and urinary iodine of the subjects was -0.73 (5). In most areas with endemic goiter, the prevalence of goiter was associated with the remoteness and isolation of the locatioon (11). Determination of urinary iodine is the best method to determine the iodine status of the population and is a useful indicator for monitoring the effectiveness of future intervention program.

In conclusion, urinary excretion of iodine was low among the aborigines and those living in places located far from the sea.

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