

ENDEMIC GOITER IN THE LEMANAK AND AI RIVER VILLAGES OF SARAWAK

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Abstract. In a survey of 974 villagers (408 males, 566 females; ages = 11-82 years) of the Ai (n = 496; 212 males, 284 females) and Lemanak (n = 478; 196 males, 282 females) rivers in the district of Lubuk Antu in Sarawak's Sri Aman Division during July 1993, goiter was found in 31.8% of the subjects. The goiter prevalence was higher in the more interior Ai river area than in the Lemanak river area (36.9% vs 26.5%). In females aged 15 years and above, the goiter prevalence was 75.4% and 49.1%, respectively, in the Ai and Lemanak river areas. The difference in goiter prevalence between the two areas was related to the degree of iodine deficiency in the two areas. The median urinary iodine excretion in the Ai river villagers was 22.1 µg/l compared to 72.9 µg/l in the Lemanak river villagers (p < 0.0001). Goitrous subjects tended to have lower urinary iodine concentration than non-goitrous subjects. In the males, smoking of tobacco was associated with a two-fold increase in goiter frequency. Despite on-going distribution of iodized salt by the medical and health services in the State, only 23% of the 135 salt samples obtained from the households in the areas contained detectable iodine.

INTRODUCTION

Endemic goiter has been reported to be prevalent in many remote areas of Sarawak (Polunin, 1971; Ogihara *et al*, 1972; Maberly and Eastman, 1976; Chen and Yap, 1988). In a survey of an Iban community in the Ai river region of Lubok Antu district in 1976, Maberly *et al* reported a goiter prevalence of 99.5% among subjects aged 11 years and above. As part of efforts to control the problem, an informal program to distribute iodized salt to households living in goiter endemic areas was started by the Sarawak State Medical and Health Department in 1979. We recently carried out a goiter survey of the Iban community in the Ai river area, 14 years after the introduction of the above salt distribution activity and 17 years after Maberly *et al* (1976) conducted their study of the community. We report here the results of our survey which also included an examination of the endemic goiter situation in the neighboring Lemanak river area.

MATERIALS AND METHODS

The survey was conducted during July 1993 in 5 Iban villages or longhouses in the Ai river area and 6

Iban longhouses in the Lemanak river area. A total of 974 subjects aged 11 – 82 years were examined, 496 (212 males, 284 females) in the Ai river area and 478 (196 males, 282 females) in the Lemanak river area. The only means of transport to the villages was by boat which took between 1 to 4 hours, depending on the river water level and the location of the villages from the nearest link with road transport. The Ai river, which is located near the border with Indonesia, is more interior than the Lemanak river. To reach the Ai river requires crossing the Batang Ai dam which takes about an hour. The two rivers are located in the Lubok Antu district in the Sri Aman Division of Sarawak. To achieve full coverage, the investigators stayed overnight in the longhouses.

The thyroid glands were examined according to the procedure recommended by the WHO (Perez *et al*, 1960). Urine specimens were collected at random from a subsample of the subjects (approximately one-half of the total subjects examined) for iodine determination by the acid digestion method (Wawschinek *et al*, 1985). Water samples were collected from the longhouses for iodine determination by the same procedure. Salt samples were collected from the households for qualitative assessment of the presence of iodine by the field method of Rao and Ranganathan (1985). Each subject was also asked concerning his or her smoking habit.

The survey was conducted as a prelude to the selection of villages for a trial to evaluate the effectiveness of water iodization in the correction of iodine deficiency and in preventing the disorders that develop as a consequence.

The data were analysed using the Statistical Analytical System (SAS) software in a VAX 8350 computer.

RESULTS

The overall goiter frequency in the two areas was 31.8%. The goiter prevalence was higher in the Ai river area than in the Lemanak river area (Table 1); however, there was no significant difference in the frequency of visible goiter between the two areas. In both areas, the goiter frequency was higher in females than in males. The goiter frequency of females of child bearing age (15 years and above) was 75.4% in the Ai river area and 49.1% in the Lemanak river area. The distribution of goiter sizes in the two areas are shown in Table 1. All subjects were judged to be clinically euthyroid. Cretinism was diagnosed in 2 or 0.4% of the Ai river villagers; both were of the neurological type. Cretinism was not detected in the Lemanak villagers.

One hundred and twenty-five or 30.6% of males aged 16 years and above smoked tobacco (home-made and commercial brands) but only 28 or 4.9% of females of the same age group smoked. None of the younger subjects smoked. In the males, goiter frequency was significantly higher in smokers than non-

smokers (Table 2). Five (4%) of the smokers and none of the non-smokers had grade 3 or 4 goiters. Similar analyses were not done for females due to the small number of female smokers.

The median urinary iodine concentration of the Ai river villagers was significantly lower than that of the Lemanak river villagers (difference = 22.1 $\mu\text{g/l}$ - 72.9 $\mu\text{g/l}$ = -50.8 $\mu\text{g/l}$; $p < 0.0001$) (Table 3). Multiple regression results for the rank scores of urinary iodine values showed that, after adjustment for area differences in urinary iodine excretion, goitrous subjects had, on average, lower urinary iodine concentration than non-goitrous subjects ($p < 0.05$). Iodine was not detected in any of the water samples collected. One hundred and 35 salt samples were collected from the households of which only 31 or 23% contained iodine.

DISCUSSION

In 1976 Maberly *et al* reported that the prevalence of goiter in the Ai river area was 99.5%; 35% were grade 3 goiters, 55% grade 2 and 9.5% grade 1. Using their results as the base, the frequency and distribution of goiter sizes as revealed by the present study would suggest that there has been a reduction in the prevalence and severity of endemic goiter in the Ai river area. In the present study, the prevalence of goiter in the Ai river area was 36.9%, 29.2% being grade 1 goiters; 3.2% grade 2; and 4.4% grades 3 and 4. A number of factors could have contributed to this including the sporadic consumption of iodized salt

Table 1
Prevalence and distribution of goiter grades in the Ai and Lemanak River areas.

Location	Sex	Number examined	Prevalence No. (%)	Grade No. (%)				
				1a	1b	2	3	4
Ai River	M	212	34 (16)	14 (6.6)	14 (6.6)	2 (0.9)	2 (0.9)	2 (0.9)
	F	284	149 (52.5)	39 (13.7)	78 (27.5)	14 (4.9)	12 (4.2)	6 (2.1)
	M+F	496	183 (36.9)	53 (10.7)	92 (18.5)	16 (3.2)	14 (2.8)	8 (1.6)
Lemanak River	M	196	18 (9.2)	6 (3.1)	7 (3.6)	4 (2.)	1 (0.5)	0 (0)
	F	282	109 (38.7)	38 (13.5)	35 (12.4)	24 (8.5)	11 (3.9)	1 (0.4)
	M+F	478	127 (26.6)	44 (9.2)	42 (8.8)	28 (5.9)	12 (2.5)	1 (0.2)

Table 2
Prevalence of goiter in male smokers and non-smokers.

	Prevalence of goiter No. (%)
Ai River	
Smokers (n=48)	21 (43.8) ¹
Non-smokers (n=52)	8 (15.4) ¹
Lemanak River	
Smokers (n=77)	12 (15.6)
Non-smokers (n=38)	2 (5.3)
Ai+Lemanak Rivers	
Smokers (n=125)	33 (26.4) ²
Non-smokers (n=90)	10 (11.1) ²

Fisher's exact test: ¹p < 0.006; ²p < 0.002.

Table 3
Median urinary iodine concentration in the Ai and Lemanak River areas.

	Urinary iodine concentration (µg/l)	
	Ai River (n=212)	Lemanak River (n=206)
Median	22.1 ¹	72.9 ¹
Interquartile range	11.9-38.9	31.9-199.1
Range	0-284.1	0-512.9

¹Mann-Whitney test: p < 0.0001.

and the opening up of the area for tourism bringing with it a more cash orientated economy enabling the villagers to purchase food items such as dried anchovies, canned sardines, and biscuits brought in by traders from outside. However, the iodine status of the villagers remained poor as indicated by the low median urinary iodine concentration; this, coupled with the existence of goiter in more than 75% of the females of child bearing age, indicates that iodine deficiency remains a significant health problem in the area. In this context, the iodized salt distribution activity could be said to have failed. Only 23% of the salt samples obtained from the households in the two areas tested positive for iodine.

The prevalence of goiter in the Lemanak river area

was lower than that in the Ai river area. This appeared to be related to the degree of dietary iodine deficiency in the two areas. The median urinary iodine excretion, an indicator of iodine intake, of the Lemanak river villagers was significantly higher than that of the Ai river villagers. However, the level of the median urinary iodine concentration suggests that the iodine intake of the Lemanak population was still inadequate. This was mirrored in the existence of goiter in 49.1% of females aged 15 years and above in this area.

The drinking water of the Ai and Lemanak river areas is derived from mountain water which has been dammed and piped to the longhouses. The water contained no detectable iodine. This is not unexpected since the water is essentially rain water which is iodine free. Unless iodine is added or picked up from the soil by the running rain water, there will be no iodine in the water in the dam. In hilly terrains with a heavy rainfall such as that found in the Lemanak and Ai river areas, most if not all of the iodine in the soil would have been leached over the centuries by the rapid run off of rain water into streams and rivers that wind their way into the sea. Food crops grown on such soil will contain little or no iodine. Nearly all the foods consumed in the two areas are grown locally.

Smoking was associated with an increased occurrence of goiter in the males in the two areas. This may be related to the inhalation of cyanide which upon detoxification is converted to thiocyanate, a well-known goitrogen. Most of the subjects who smoked were heavy smokers (>20 cigarettes/day). Thiocyanate could also be derived from the consumption of cassava. Cassava leaves, lightly boiled or fried, form a common dish in the two areas; cassava roots, rarely eaten by the villagers, are used to feed the animals. The role of cassava leaf consumption in the etiology of endemic goiter in these areas is uncertain and will form the subject of our subsequent investigation.

In conclusion, despite the many efforts to control the problem, including the passing of legislation for the compulsory sale of iodized salt in goitrous areas in the State in 1982 and the distribution since 1979 of iodized salt through the State Medical and Health Services, endemic goiter continues to be an important public health problem in the Lubok Antu district in Sarawak. A major obstacle is the logistically difficult task of distributing iodized salt to widely scattered remote communities where endemic goiter and other iodine deficiency disorders prevail. In view of the negative impact that iodine deficiency - its effects include intellectual impairment - may have on social

and economic development, there is an urgent need to seek complementary or other approaches to the problem. Iodization of village water supplies represents one such approach and is presently on trial in Sarawak.

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