Thiamin Status of Inhabitants on North-East Thailand

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SUMMARY

To clarify the thiamin status of inhabitants of rural Northeast Thailand, a survey study was carried out at Don Deang village in Khon Kaen province in 1983 and 1984. Foods for this villagers were mainly glutinous rice and immature papayas, and some fishes, chicken, chilli and leaf vegetables. Thiamin intake was 0.56 ± 0.21 mg/day and 0.23 ± 0.07 mg/1000kcal. Blood thiamin levels were 22.3 ± 7.2 ng/ml in adults and 17.3 ± 8.0 ng/ml in school children, in this villagers and 29.0 ± 10.1 ng/ml in the employees. Subjects with enlarged heart were found in 48.1% in the villagers. From these results, it is postulated that marginal thiamin deficiency are prevalent in this area.

INTRODUCTION

It is well known that in a resettlement area of Northeast Thailand, there are many marginal nutritional deficiencies[1-9]. Major factor for these deficiencies is insufficient supply of nutrients from the daily diet[10,11]. Schreurs *et al.* had reported the vitamin B_1, B_2, and B_6 status of school children in two resettlment areas in Northeast Thailand by measurements of erythrocyte transketolase activity, for vitamin B_1 status, of erythrocyte glutathione reductase activity for vitamin B_2 status and of erythrocyte glutamate-oxaloacetate transaminase activity for vitamin B_6 status. They demonstrated that the vitamin B_1 status was sufficient, but about 20% to 35% of the children showed evidence of vitamin B_2 and B_6 deficiencies. Also Migasena *et al.* said that 24% of the mother were found to be thiamin deficient as judged from thiamin pyrophosphate effect and the thiamin status of the neonatal babies was normal even though the mother was found to have deficiency. To judge the thiamin status, the three methods, that is, mesurements of 1)blood thiamin concentration, 2)urine thiamin concentration and 3)erythrocyte transketolase activity are considered. Among these three methods, measurement of blood thiamin concentration is the useful and sensitive index of the thiamin status.

To clarify the thiamin status of inhabitants of rural Thailand, a survey study was carried out at a farm village (Don Deang village) with a population of 910 in Khon Kaen province and at a company with employee of 350 in Udon Thani province of northeast Thailand in 1983 and 1984. Determination of blood thiamin and calculation of dietary nutrients intakes in these inhabitants were designed in this study to clarify their thiamin status.

MATERIALS AND METHODS

For this study, 81 school children of 9–12 years old (36 boys and 45 girls), 146 villagers (80 men and

66 wemen) of Doeng Dean village, Khon Kaen province, and 308 employees (286men and 22 wemen) of a sugar company, Udon Thani province, Northeast Thailand were sellected (Fig. 1). The temporary clinics were opened at the survey sites from November to December 1984.

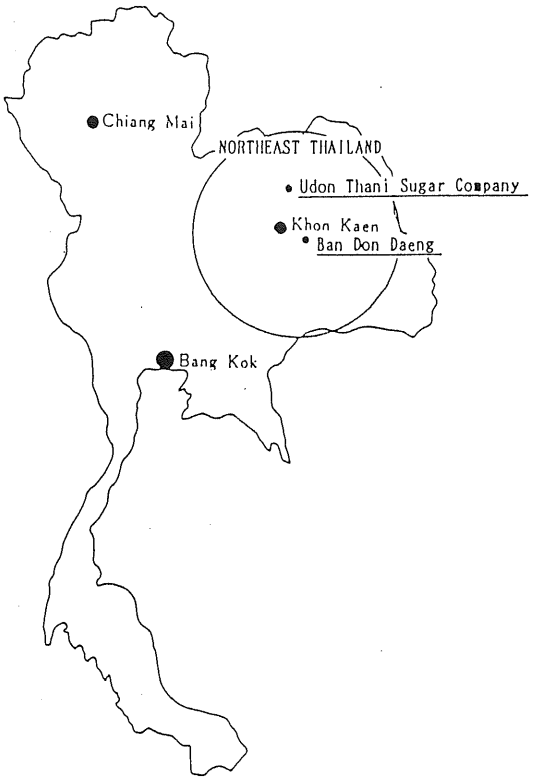

Fig. 1. Map of khon kaen province.

Blood biochemical studies carried out include determinations of 24 kinds of serum tests and 4 kinds of blood tests. And blood thiamin concentration was determined[12]. On admission, physical examination including body measurements, blood pressure, electrocardiogram etc., a history record, mental test and diet record of each families by weighing method were performed. From dietary record, 24 nutrient intakes and 18 food group intakes were calculated by a personal computor. For statisitical analysis, SAS program was used at the Computor Cener, Kyoto University.

RESULTS AND DISCUSSION

Foods for this villagers were mainly glutinous rice and immature papayas, and some fishes, chicken, chilli and leaf vegetables. These simple food intake patterns are based on traditional food habits in Northeast Thailand. Nutrients intakes of the villagers are shown in Table1. Intakes of fat, calcium, vitamin B_1, and vitamin B_2 were insufficient as compared to Thailand recommended allowance. Fig. 2 shows distributions of vitamin B_1, vitamin B_1/1000kcal and energy intakes. Avearge vitamin B_1 intake was 0.56 ± 0.21 mg/day that is, 56% of the recommended allowance in

Table 1. Nutrients intake

		Thai mean ± S. D.	Thai (min.~ max.)	Japan* mean
Energy	(kcal)	2441 ± 670	(1148 ~ 3700)	2223
Fat	(g)	45.1 ± 25.2	(4.7 ~ 130.9)	52.6
Carbohydrate	(g)	430 ± 117	(84 ~ 693)	338
Fiber	(g)	5.1 ± 2.5	(1.5 ~ 14.4)	–
Protein	(g)	72.4 ± 22.7	(35 ~ 138)	81.6
Calcium	(mg)	254 ± 98.2	(90 ~ 496)	585
Phosphorus	(mg)	847 ± 249	(349 ~ 1515)	–
Iron	(mg)	14.2 ± 6.9	(6.9 ~ 53.6)	11.5
Vitamin A	(IU)	4186 ± 2643	(26 ~ 11032)	2192
Vitamin B_1	(mg)	0.56 ± 0.21	(0.27 ~ 1.6)	1.36
VB_1/1000kcal		0.23 ± 0.07	(0.13 ~ 0.47)	0.55
Vitamin B_2	(mg)	0.67 ± 0.27	(0.25 ~ 1.5)	1.23
Vitamin C	(mg)	85.3 ± 50.9	(14 ~ 255)	147

*data of rural area in Japan (1984)

Thailand. Distribution of vitamin B_1 intake is shown in Fig. 2-a. Vitamin B_1 intake was insufficient for 95% families. Average vitamin B_1/1000kcal intake was 0.23 ± 0.07 mg/1000kcal, very low as compared to recommended allowance, of 0.4 mg/1000kcal (Fig. 2-b). Vitamin B_1/1000kcal intake was also insufficient for 95% families. Distribution of energy intake is shown in Fig. 2-c. Vitamin B_1 intake of this villagers was lower than that (0.79 ± 0.18 mg/day, 0.43 mg/1000kcal) of villagers in Khon Kaen province reported by Kumazawa *et al.*[11], and of preschool children and expectant women (1.57 mg/day, 0.79 mg/1000 kcal) in Nakorn Rajsima province in Thailand reported by Chandrapanond *et al.*[12].

Table 2 shows their blood thiamin concentration. Average thiamin concentration was 17.38 ± 8.0 ng/ml in the school children, 22.5 ± 12.4 ng/ml in the villagers and 29.0 ± 10.1 ng/ml in the employees, which was lowest in the school children and highest in the employees. But in all groups, concentrations were low as compared to normal (50ng/ml). Fig. 3 shows distributions of blood thiamin concentration by the school children (3-a), the villagers (3-b) and the employees (3-c). These data show that there are thiamin deficiency in these groups especially in the school children and the villagers lived in Don Daeng village. It has been reported that the vitamin B_1 status of pre-school children[13] and school children[8] in Khon Kaen province judged by erythorcyte transketolase activity was sufficient. Also in 42% of the pregnant women in a low socioeconomic group of Bangkok, thiamin deficiency was found, but thiamin status in their umbilical cord and

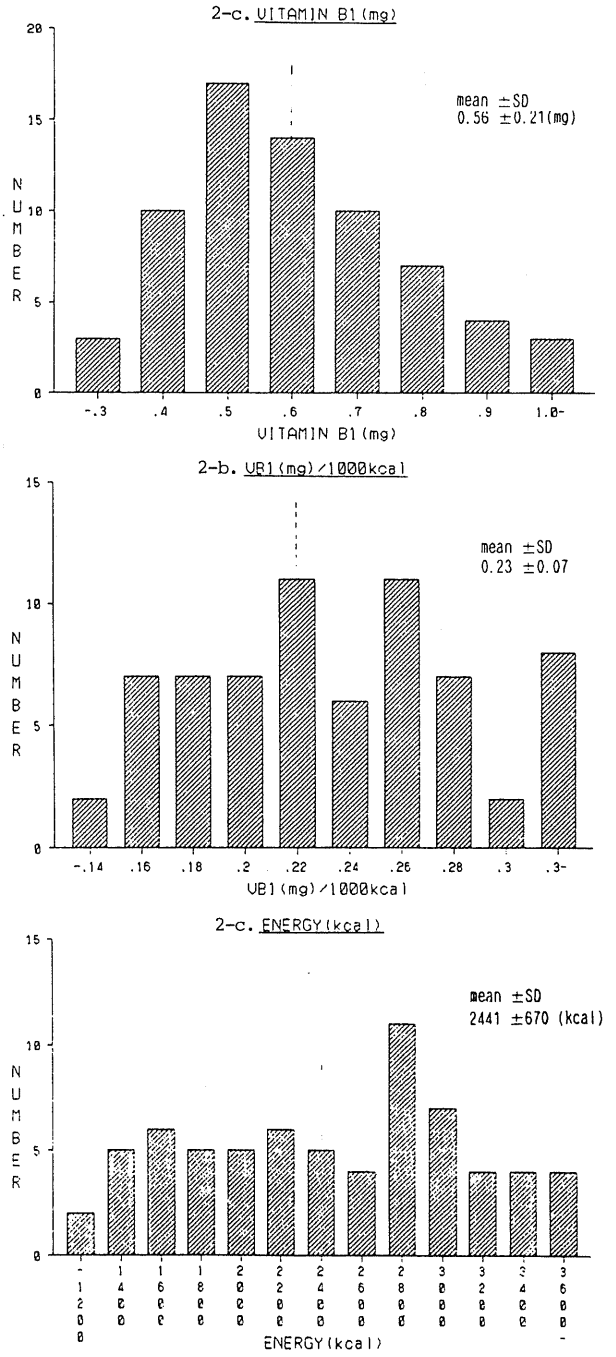

Fig.2.Distribution of vitamin B1, vitamin B1/1000 kcal and energy intakes in Doeng Dean villagers.

Table 2. Blood thiamin concentration in rural inhabitants of Northeast Thailand

			thiamin concentration (ng/ml)	(min.~max.)	age (year)
village	men	(n = 59)	22.15 ± 11.20*	(3.6 ~ 61.6)	48.89 ± 19.19*
	wemen	(n = 47)	22.97 ± 13.90	(4.6 ~ 70.1)	47.40 ± 19.16
	all	(n = 106)	22.51 ± 12.40	(3.6 ~ 70.1)	48.25 ± 19.18
company	men	(n = 279)	28.86 ± 10.26	(6.1 ~ 63.9)	38.13 ± 10.27
	wemen	(n = 21)	31.45 ± 8.07	(17.1 ~ 44.8)	30.38 ± 7.87
	all	(n = 300)	29.04 ± 10.11	(6.1 ~ 63.9)	37.59 ± 10.10
average	(all)	(n = 406)	27.34 ± 11.13	(3.6 ~ 70.1)	40.29 ± 13.85
all	men	(n = 338)	27.69 ± 10.72	(3.6 ~ 63.9)	40.07 ± 13.00
	wemen	(n = 68)	25.59 ± 12.95	(4.6 ~ 70.1)	41.54 ± 18.05

*mean ± S. D.

newborn baby's blood were sufficient[9] as juged by erythrocyte transketolase acitivities. We have reported from a survey study that average thiamin concentrations in blood were 35.57 ± 1.61 ng/ml in a farm village, and 34.73 ± 1.83 ng/ml in a fishing village of rural West Japan and 45.27 ± 2.95 ng/ml in urban West Japan[14]. Average dietary thiamin intakes were 0.58 mg/day, 0.28 mg/1000kcal in the farm village and 0.79 mg/day, 0.33 mg/1000kcal in the fishing village. As the cause of their low blood thiamin concentration so low thiamin intake was considered.

Correlation coefficients between blood thiamin concentration and other biochemical or physical data are shown in Fig. 4. Between blood thaimin concentration and blood magnesium, serum iron, sodium, urea nitrogen, HDL, albumin, albumin/globlin ratio, total-bilirubin concentrations, dyastolic blood pressure, girth of chest, body weight, positive significant correlations were found, and between blood thiamin concentration and blood calcium concentration, negative correlation was found. The analytical data that there was positive correlation between blood thiamin concentration and blood magnesium concentration, supports our report[15] that blood thiamin concentration decreased in magnesium deficient rats. The positive correlation between blood thiamin concentration and blood magnesium concentration and the negative correlation between blood thiamin concentration and blood calcium concentration suggest that magnesium/calcium ratio is important for thiamin status. The positive correlation between blood thiamin concentration and plasma total-protein, albumin, albumin/globulin ratio, urea nitrogen, suggests that protein nutritional status influences the thiamin status.

In chest X-ray, of 48.1% the subjects were found with enlarged heart.

From these results, it is postulated that various marginal nutritional deficiences, especially thiamin deficiency are prevalent in this area.

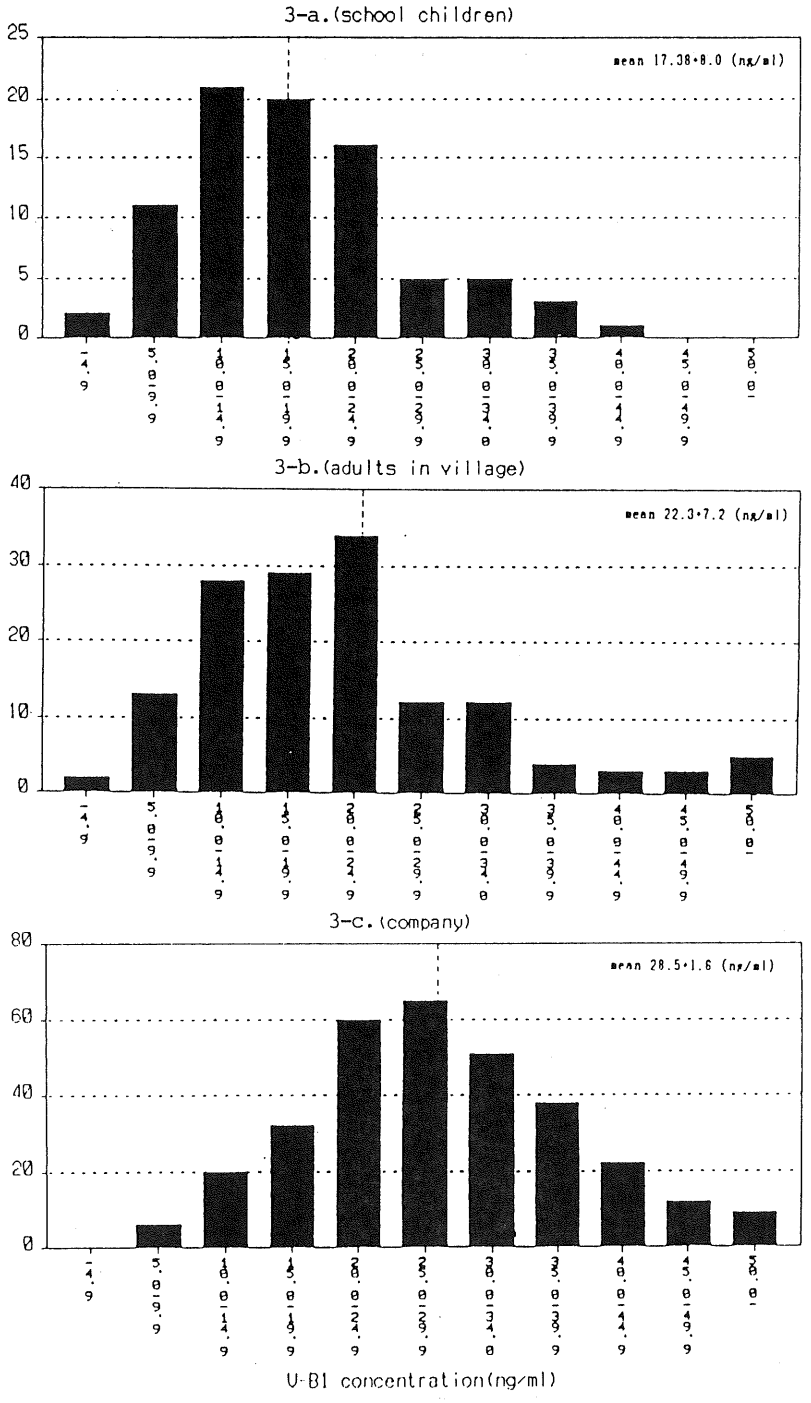

Fig. 3. Distribution of blood thiamin concentration.

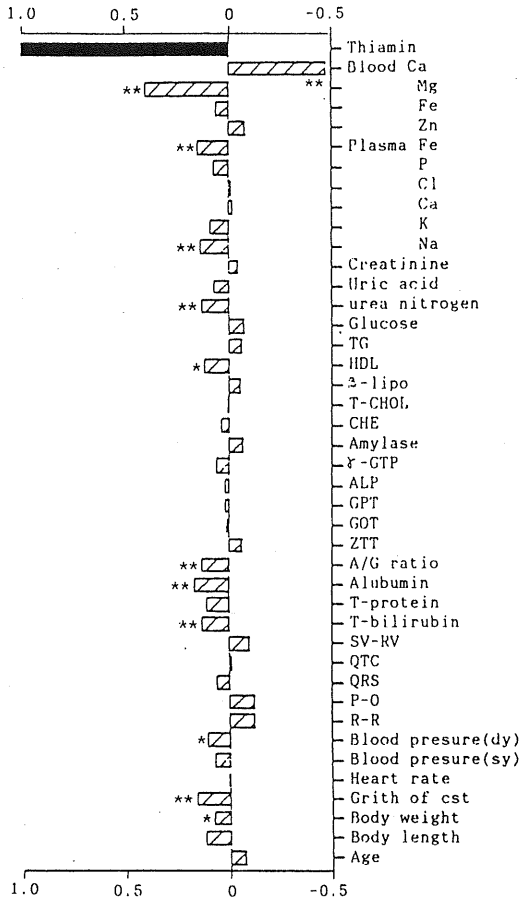

Fig.4.Correlation coefficients between blood thiamin concentration and other biochemical or physical data.

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