

Original article

Dietary intakes of Karen hill triber children aged 1–6 years in northern Thailand

Tienboon P¹, Wangpakapattanawong P², Thomas DE³, Kimmins JP⁴¹Department of Pediatrics, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand²Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand³World Agroforestry Centre (ICRAF), Chiang Mai, Thailand⁴Department of Forest Sciences, Faculty of Forestry, The University of British Columbia, Vancouver, Canada**Abstract**

Malnutrition results from insufficient intakes of food including micronutrients such as vitamin A, iron, iodine, zinc, and folic acid. This paper reported the results from a study of dietary intakes of Karen hill tribe children aged 1–6 years in the north of Thailand. All children aged 1–6 years ($n = 158$; 83 boys, 75 girls) from the three Karen villages (Mae Hae Tai, Mae Yot, Mae Raek) of Mae Chaem district in the north of Thailand were studied. All children were examined by a qualified medical doctor and were assessed for their nutrient intakes using 24 hours dietary recall. All families had income lower than the Thailand poverty line (US \$ 1000/year). For children aged 1–3 years, the nutrients generally consumed were much less than the Thai RDA. Compared with the Thai RDA, all children consumed much less energy (28%–40.5% RDA) than protein (55.8%–96.1% RDA). Interestingly, all boys and only girls from Mae Raek village consumed vitamin A more than the Thai RDA but girls from Mae Hae Tai village and Mae Yot village consumed vitamin A less than the Thai RDA. For children aged 4–6 years, boys from Mae Raek village consumed protein (128.4% RDA) and vitamin C (143.1% RDA) above the Thai RDA. Girls from Mae Yot village also consumed vitamin C (132.9% RDA) above the Thai RDA. Both boys and girls from Mae Raek village and also girls from Mae Yot village consumed vitamin A more than the Thai RDA. Other nutrients were consumed much less than the Thai RDA by all children. All children consumed protein more than 10% of the total energy consumption per day. Most of the energy consumed by children came from carbohydrate. Nearly all children consumed carbohydrate more than 50% of the total energy consumption per day except boys aged 1–3 years from Mae Raek village (consumed 45%). All children from Mae Hae Tai village and boys aged 4–6 years from Mae Yot village (consumed 27%) consumed fat less than 30% of the total energy consumption per day. It appeared that the priority recommendations for improving nutrition in Karen villages in Mae Chaem would be increase energy consumption such as fat and oil. More general work is needed on how children's diets might be improved in a culturally acceptable manner, so as to bring consumption patterns closer to recommended allowance levels.

Keywords: diet ; protein ; fat ; carbohydrate ; vitamins ; minerals ; malnutrition ; children Karen ; hill tribe ; Thailand**INTRODUCTION**

Adequate nutrition is the intake and utilization of enough energy and nutrients, together with disease control, to maintain well-being, health, and productivity. Malnutrition includes generalized malnutrition, which manifests itself as stunting, underweight, and wasting in individuals, and deficiencies of micronutrients, such as vitamin A, iron, iodine,

Correspondence to: Prasong Tienboon, MD, Department of Pediatrics, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand.
prasong@chiangmai.ac.th

zinc, and folic acid. The most visible evidence of good nutrition is taller, stronger, healthier children who learn more in school and become productive; and happy adults, who participate in society. Too little or too much consumption of energy and nutrients causes health damage. Individuals who are within acceptable norms for body size and biological indicators of micronutrient status are considered adequately nourished. Malnutrition does not need to be severe to pose a threat to survival. Worldwide, fewer than 20 percent of deaths associated with childhood malnutrition involve severe malnutrition; more than 80 percent involve only mild or moderate malnutrition^[1]. Although the immediate cause of death in mild and moderately malnourished children may be pneumonia or diarrhea, and many children would not die if they were well nourished. Disease and inadequate dietary intake are the immediate causes of malnutrition in most individuals. The main underlying causes of malnutrition include inadequate access to food and nutrients, inadequate care of mothers and poor water sanitation, inadequate health services, and unhealthy environments^[1]. It is estimated that about 3.6 billion people worldwide have an iron deficiency problem, which can decrease physical productivity and affect learning ability^[2,3]. About 42 million children under age 6 suffer from vitamin A deficiency, which can cause blindness when extremely deficient. It is the number one cause of blindness in children in developing countries, while some suffer from loss of night vision^[4,5]. In Thailand, according to the national nutrition survey of the Thai population who live in the cities by the Min-

istry of Public Health, about 12% of preschool children aged 1-6 years were malnourished^[6]. The proportion of underweight children declined rapidly during the 1980s, from around 35% in 1982, to under 20% in 1987, to about 15% in 1990^[6]. The rate of malnutrition tends to be higher among vegetarian and mountain minority (hill triber) children^[7]. Several factors affect weight and height of children such as hemoglobin, hematocrit, amount of food eaten per day, birth weight, parental income, and parental age^[8]. This paper reported the results from a study of dietary intakes of the minority ethnic group of Karen hill tribe children aged 1-6 years in the north of Thailand.

MATERIALS AND METHODS

Study sites and subjects

All children aged 1-6 years ($n = 158$) from the three Karen villages (Mae Hae Tai, Mae Yot, Mae Raek) of Mae Chaem district were studied. Mae Chaem district is located about 160 kilometers southwest of Chiang Mai province in the north of Thailand. Chiang Mai is the second largest city in Thailand with a population of about 1.5 millions. The Karen is the largest mountain ethnic minority (hill triber) group in Thailand. The study included 83 boys and 75 girls as shown in Table 1. All subjects' parents were asked to complete a socio-demographic questionnaire. This research project was approved by Chiang Mai University Human Ethic Committee, Thailand. All children's parents were requested to sign or thumb printed a consent form.

Table 1 Total number of subjects from 3 different villages

Village	Boy	Girl	Total
Mae Hae Tai	27	24	51
Mae Yot	23	32	55
Mae Raek	33	19	52
Total	83	75	158

Dietary assessment

All children were assessed for their nutrient intakes using 24 hours dietary recall. Thai food composition table from Ministry of Health were used as references^[9]. The results were compared with the Thai Recommended Dietary Allowances (RDA)^[10]. Children aged 1-3 years and 4-6 years were separately analysed due to the differences in Thai RDA between the two age groups.

Data analyses

Descriptive statistics were used to analyse the data.

RESULTS

Sociodemography

None of the fathers and mothers from the study villages completed tertiary education. The percentages of fathers who completed primary and secondary schools

were more than the mothers (primary school: 32.7% vs 13.7%, $P < 0.05$; secondary school: 20% vs 1.8%, $P < 0.05$, respectively); and could speak Thai language more than the mothers (32% vs 15%, $P < 0.05$). All families of the study boys and girls had income lower than the Thailand poverty line (US \$ 1000/year).

Dietary consumption

Both boys and girls from Mae Raek village had more household vegetable garden than children from the other two villages as shown in Table 2. Both boys and girls from Mae Yot village had more household fruit garden than children from the other two villages as shown in Table 2. All children from Mae Hae Tai village Only ate their home-cooked foods (Table 2). Most household from the three village used lard for cooking (Table 2). Breast milk was consumed most by children from Mae Hae Tai village where as ultra heat treated (UHT) milk were consumed most by children from the other two villages (Table 2). Few children consumed fresh cow milk.

Table 3 and 4 showed the nutrients intakes of children aged 1-3 years by sex by village. Table 5 and 6 showed the nutrients intakes of children aged 4-6 years by sex by village. For children aged 1-3 years, the nutrients generally consumed were much less than the Thai RDA (Table 3,4). Compared with the Thai RDA, all children consumed much

less energy (28% -40.5% RDA) than protein (55.8% -96.1% RDA). Interestingly, all boys and only girls from Mae Raek village consumed vitamin A more than the Thai RDA but girls from Mae Hae Tai village and Mae Yot village consumed vitamin A less than the Thai RDA. For children aged 4-6 years, boys from Mae Raek village consumed protein (128.4% RDA) and vitamin C (143.1% RDA) above the Thai RDA (Table 5). Girls from Mae Yot village also consumed vitamin C (132.9% RDA) above the Thai RDA (Table 6). Both boys and girls from Mae Raek village and also girls from Mae Yot village consumed vitamin A more than the Thai RDA (Table 5,6). Other nutrients were consumed much less than the Thai RDA by all children (Table 5, 6).

Although, all children consumed energy less than the Thai RDA for energy for age, all children consumed protein more than 10% of the total energy consumption per day (Table 7). However, most of the energy consumed by children came from carbohydrate. Nearly all children consumed carbohydrate more than 50% of the total energy consumption per day except boys aged 1-3 years from Mae Raek village (consumed 45%). All children from Mae Hae Tai village and boys aged 4-6 years from Mae Yot village (consumed 27%) consumed fat less than 30% of the total energy consumption per day.

Table 2 Percentage of household vegetable and fruit gardens; food preparation and cooking oil used; and type of milk consumed

	Mae Hae Tai		Mae Yot		Mae Raek	
	Boy	Girl	Boy	Girl	Boy	Girl
Vegetable garden (n)	27	24	20	27	32	18
Yes	25.9	29.2	25	37	78.1	61.1
Fruit garden (n)	27	24	20	27	32	18
Yes	40.8	54.2	80	88.9	78.1	66.7
Food preparation (n)	27	24	20	27	32	18
Self cooking	100	100	75	78	66	72
Self cooking + Buy	-	-	25	22	34	28
Cooking oil (n)	27	24	19	23	32	18
Vegetable	4	8	32	13	3	16
Lard	89	79	42	57	97	84
Mixed	7	13	26	30	-	-
Type of milk consumed (n)	27	24	23	32	33	19
Breast milk	77	75	19	20	23	14
Fresh cow milk	-	-	-	5	-	-
UHT milk	23	25	75	75	68	53
Soy milk	-	-	6	-	9	33

UHT: Ultra heat treated

Tienboon P *et al.* Dietary intakes of Karen hill triber

Table 3 Nutrients consumption per day (24 hours dietary recall) of boys aged 1-3 years

	Mae Hae Tai			Mae Yot			Mae Raek			Thai RDA
	% RDA	Mean	SD	% RDA	Mean	SD	% RDA	Mean	SD	
Fiber (g)	-	0.7	0.5	-	0.8	0.6	-	0.7	0.6	-
Energy (kcal)	31.9	382.3	152.5	38.8	465.0	367.7	36.3	436.0	214.8	1200
Protein (g)	83.1	14.1	7.4	96.1	16.3	16.6	92.4	15.7	6.8	17
Fat (g)	-	10.9	5.0	-	15.6	22.2	-	19.8	17.5	-
Carbohydrate (g)	-	56.8	28.5	-	63.0	31.3	-	49.2	19.4	-
Calcium (mg)	10.4	82.8	75.1	30.6	245	484	27	215.6	240.1	800
Phosphorus (mg)	25.3	202.2	113.0	34.5	276	400	37.3	298.4	220.7	800
Iron (mg)	22.9	2.3	1.4	26.8	2.7	2.0	28.8	2.9	1.4	10
Vit. A (IU)	108.3	1408	2301	104.3	1356	1165	107.1	1392	963	1300
Vit. B1 (mg)	19	0.1	0.1	21.3	0.1	0.2	22.1	0.2	0.1	0.7
Vit. B2 (mg)	41.3	0.3	0.3	52.5	0.4	0.8	35.5	0.3	0.2	0.8
Niacin (mg)	30.4	2.7	3.3	20.6	1.9	1.8	25.9	2.3	2.0	9
Vit. C (mg)	36.2	16.3	27.5	41.9	18.8	20.3	53.0	23.9	31.1	45
<i>n</i>		15			14			14		

Table 4 Nutrients consumption per day (24 hours dietary recall) of girls aged 1-3 years

	Mae Hae Tai			Mae Yot			Mae Raek			Thai RDA
	% RDA	Mean	SD	% RDA	Mean	SD	% RDA	Mean	SD	
Fiber (g)	-	0.6	0.5	-	0.4	0.4	-	1.6	0.8	-
Energy (kcal)	28	336.3	125.4	25.4	304.6	112.0	40.5	485.7	186.6	1200
Protein (g)	55.8	9.5	6.1	67.9	11.6	5.7	99.4	16.9	7.9	17
Fat (g)	-	8.6	5.5	-	10.8	8.8	-	16.7	9.8	-
Carbohydrate (g)	+	55.4	25.8	-	39.2	13.9	-	67.0	40.5	-
Calcium (mg)	9.3	74.6	129.8	14	111.8	129.5	13.5	108.3	73.8	800
Phosphorus (mg)	17.8	142.0	135.1	18.8	150.4	74.4	30.5	243.7	98.1	800
Iron (mg)	17.5	1.8	0.9	15.5	1.6	1.0	35.7	3.6	1.5	10
Vit. A (IU)	73.8	959	1917	49.6	645	893	163.0	2119	2852	1300
Vit. B1 (mg)	18.3	0.1	0.1	12	0.1	0.03	39.4	0.3	0.1	0.7
Vit. B2 (mg)	21.6	0.2	0.1	24.6	0.2	0.1	42.3	0.3	0.3	0.8
Niacin (mg)	19.3	1.7	1.2	18	1.6	1.6	38.5	3.5	2.5	9
Vit. C (mg)	25.8	11.6	21.2	16.8	7.5	21.6	89.1	40.1	42.2	45
<i>n</i>		14			14			11		

Table 5 Nutrients consumption per day (24 hours dietary recall) of boys aged 4-6 years

	Mae Hae Tai			Mae Yot			Mae Raek			Thai RDA
	% RDA	Mean	SD	% RDA	Mean	SD	% RDA	Mean	SD	
Fiber (g)	-	1.0	0.7	-	0.6	0.6	-	2.0	1.1	-
Energy (kcal)	24.6	357.4	158.2	26.6	386.2	155.4	52.6	763	405	1450
Protein (g)	59.2	12.4	6.7	73.5	15.4	10.3	128.4	27.0	12.3	21
Fat (g)	-	7.5	13.0	-	11.4	9.8	-	29.4	19.4	-
CHO (g)	-	59.1	23.8	-	54.1	24.4	-	98.2	53.4	-
Calcium (mg)	12.4	99.2	68.0	28.9	231.4	277.2	51	408	458	800
Phosphorus (mg)	20.4	163.3	94.7	35.6	284.8	256.5	62.7	501.8	376.7	800
Iron (mg)	22	2.2	1.1	26.8	2.7	1.9	52.7	5.3	2.2	10
Vit. A (IU)	58.4	778	1315	76.1	1015	1380	205.3	2737	2269	1333
Vit. B1 (mg)	17.6	0.2	0.1	12	0.1	0.1	32.4	0.3	0.2	0.9
Vit. B2 (mg)	12.4	0.1	0.1	20	0.2	0.2	60.7	0.6	0.7	1.0
Niacin (mg)	19.6	2.2	1.5	24.5	2.7	2.5	45.4	5.0	2.6	11
C (mg)	35.3	15.9	15.3	52.1	23.4	27.9	143.1	64.4	57.5	45
<i>n</i>		11			9			16		

Table 6 Nutrients consumption per day (24 hours dietary recall) of girls aged 4-6 years

	Mae Hae Tai			Mae Yot			Mae Raek			Thai RDA
	% RDA	Mean	SD	% RDA	Mean	SD	% RDA	Mean	SD	
Fiber (g)	-	0.8	0.5	-	1.5	2.1	-	0.9	0.6	-
Energy (kcal)	19.2	277.7	188.6	33.9	491.6	321.0	38.5	558.7	142.4	1450
Protein (g)	50.1	10.5	7.2	97.9	20.6	16.0	125	26.3	16.3	21
Fat (g)	-	8.7	11.9	-	16.8	15.3	-	18.6	10.4	-
CHO (g)	-	39.5	19.5	-	62.8	31.4	-	71.2	24.3	-
Calcium (mg)	17.5	140.1	206.8	44.8	358	462	28	224.0	168.2	800
Phosphorus (mg)	26.7	213.3	207.7	38.4	307.5	353.6	38.9	310.9	110.7	800
Iron (mg)	17.9	1.8	0.9	31.2	3.1	1.9	38.1	3.8	1.4	10
Vit. A (IU)	44.4	592	714	126.8	1691	2020	126.9	1692	129	1333
Vit. B1 (mg)	14.8	0.1	0.2	19.3	0.2	0.2	34	0.3	0.3	0.9
Vit. B2 (mg)	13.2	0.1	0.1	41.3	0.4	0.8	25.7	0.3	0.1	1.0
Niacin (mg)	15.9	1.7	1.3	32.6	3.6	2.4	30.4	3.3	2.5	11
Vit. C (mg)	33.7	15.2	23.6	132.9	59.8	91.5	66.2	29.8	18.9	45
<i>n</i>		9			15			8		

Table 7 Percent caloric distribution of protein, fat and carbohydrate consumed by children P/F/C (%)

Aged	Mae Hae Tai	Mae Yot	Mae Raek
1-3 years			
Boy	15/26/59 (<i>n</i> = 15)	14/30/56 (<i>n</i> = 14)	14/41/45 (<i>n</i> = 14)
Girl	11/23/66 (<i>n</i> = 14)	15/32/53 (<i>n</i> = 14)	14/31/55 (<i>n</i> = 11)
4-6 years			
Boy	14/19/67 (<i>n</i> = 11)	16/27/57 (<i>n</i> = 9)	14/35/51 (<i>n</i> = 16)
Girl	15/28/57 (<i>n</i> = 9)	17/31/52 (<i>n</i> = 15)	19/30/51 (<i>n</i> = 8)

P/F/C; Protein/fat/carbohydrate

DISCUSSION

This paper reported results from a study of dietary intakes of a minority ethnic group of Karen hill tribe children aged 1-6 years in the northern part of Thailand. All children from the study villages came from families which had yearly income less than US \$ 1000 and low educational background. According to the government of Thailand, this income is below the poverty line. It is not surprised that in the future, the children will face several kinds of health problems such as viral and bacterial infections, parasitic infestations, malnutrition and other health conditions.

Few major differences were found in dietary patterns among children of villages. By answering to the questionnaires administered in the study villages, it revealed that the main diet of Karen children across villages include mostly rice (carbohydrate)

and vegetables (vitamins and minerals). Meat was only occasionally consumed, often associated with ceremonies, levels of protein consumed by children were closer to recommended levels than most other food categories. Only small amounts of cooking oil were used in cooking; Mae Yot village used considerably more vegetable oil than the other villages, which used mostly lard in their cooking. Nevertheless, it appeared that overall consumption levels of energy, carbohydrates, protein and fat were somewhat higher in the Mae Raek village, and lowest in the Mae Hae Tai village, which had the highest percentage of caloric consumption provided by carbohydrates, and the lowest provided by fats. While the differences were not very dramatic, this added some evidence that dietary stress levels might be greatest in the Mae Hae Tai village.

Home gardens producing vegetables for subsistence consumption were very prominent in the Mae

Raek village, whereas the Mae Hae Tai and Mae Yot villages depended more on their swidden fields for vegetable production. While fruit trees would be expected to follow a similar pattern, the Mae Yot village had substantially enriched fruit trees in its home gardens. However, socio-economic status and cultural factors also played important roles in determining food consumption patterns. Indeed, it appeared that villagers had been able to adapt to various conditions in order to maintain child dietary patterns that would appear to be a reflection of preferences associated with their cultural heritage. As these were all Karen villages with little cash income and had access to considerable sources of wild and domesticated vegetables, malnourishment of children could relate more to low consumption of fat and protein than to insufficient consumption of carbohydrate, minerals and vitamins.

Total energy consumption levels were generally well under half of the recommended allowances. While protein consumption appeared closer to the recommended daily allowance levels, similar cross-village trends were observed. Children in the Mae Yot village appeared to consume somewhat more fat and protein.

Vitamin A levels consumed in Mae Raek village were above recommended daily allowances, whereas some age and gender groups in the other villages had quite low consumption levels, especially in the 4-6 year age group in Mae Hae Tai. Children in the Mae Raek village appear to have consumed more iron in their diet. The 4-6 year age group in the Mae Hae Tai village also showed lowest levels of vitamin B₂, niacin and vitamin C consumption. Moreover, general patterns across villages showed consistent patterns wherein consumption levels of vitamins and minerals were substantially below the recommended allowances. Further dietary studies might be justified to focus on influence of cultural factors on dietary preferences, in order to develop practical approaches for addressing nutritional issues. Researchers will continue to examine the dietary data from this group in order to identify particular elements or patterns related to their vitamin consumption levels.

In conclusion, overall patterns in both of these villages indicated that energy consumption levels were very low. Consumption of vitamins and minerals was also generally below the recommended daily allowance levels. It appeared that the priority recommendations for improving nutrition in Karen villages

in Mae Chaem district would be: 1) Increased their socioeconomic status, 2) Increased use of fat and oil, 3) More general work with Karen communities on how children's diets might be improved in a culturally acceptable manner, so as to bring consumption patterns closer to recommended allowance levels.

ACKNOWLEDGEMENTS

This project was funded by the International Development Research Centre (IDRC), Canada, *via* the Ecosystem Approach to Human Health Program Initiative. We also thank Nimsakul S, Likit-ekaraj V for some data collection and the Karen villagers in Mae Chaem, Chiang Mai, Thailand, for their invaluable co-operation.

REFERENCES

- 1 World Health Organization. Malnutrition and the causes of childhood mortality (Based on Murray CJL, Lopez AD. The global burden of disease. Cambridge: Harvard University Press 1996; and Pelletier DL, Frongillo EA, Habicht JP. Epidemiological evidence of a potentiating effect of malnutrition on child mortality. *Am J Publ Health.* 1993; **83**: 1130-1133.
- 2 World Bank. World development report 1993: Investing in health. Washington: The World Bank. 1993.
- 3 **Kootathep S.** Serum carotenoids, vitamin A and vitamin E of children (1-12 years) living in Lumpoon province. *Chiang Mai Med Bull.* 1997; **36**: 88.
- 4 **Levin HM,** Pollitt E, Galloway R, McGuire J. Micronutrient deficiency disorders. In: Jamison DT, Mosley WH. eds. Disease control priorities in developing countries. New York: Oxford University Press (World Bank). 1993.
- 5 World Health Organization and UNICEF. Global prevalence of vitamin A deficiency. Micronutrient deficiency information system. Working paper no. 2. Geneva, Switzerland: World Health Organization. 1995.
- 6 Department of Health (Nutrition Division): The fourth national nutrition survey of Thailand. Bangkok: Ministry of Public Health. 1995.
- 7 **Tienboon P.** Nutritional status of children (1-12 years) living in Lumpoon province. *Chiang Mai Med Bull.* 1997; **36**: 95.
- 8 **Tienboon P.** Factors affecting current weight and height of preschool children. *Chiang Mai Med Bull.* 1995; **34**: 77-78.
- 9 Ministry of Health. Nutrient composition table of Thai foods. Bangkok: Ministry of Health. 1984.
- 10 Ministry of Health. Thai recommended dietary allowances. Bangkok: Ministry of Health. 1989.