Original Article

Vitamin A status of the minority ethnic group of Karen hill tribe children aged 1-6 years in Northern Thailand

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Vitamin A deficiency (VAD) is the most common cause of childhood blindness in the developing world. It is estimated that by giving adequate vitamin A, in vitamin A deficient populations, child mortality from measles can be reduced by 50%, and mortality from diarrheal disease by 40%. Overall mortality in children 6-59 months of age can be reduced by 23%. This paper reported results from a study of vitamin A status and malnutrition of the minority ethnic group 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. The Karen is the largest mountain ethnic minority ("hill tribe") group in Thailand. All children were examined by a qualified medical doctor and were assessed for their vitamin A intakes using 24 hours dietary recall. Thai food composition table from Ministry of Health, Thailand were used as references. The results were compared with the Thai Recommended Dietary Allowances. Children aged 1-3 years and 4-6 years were separately analysed due to the differences in Thai Recommended Dietary Allowances between the two age groups. A whole blood of 300 μL was obtained by "fingerstick" for determination of serum vitamin A. Community or village's vitamin A status was assessed by using Simplified Dietary Assessment (SDA) method and Helen Keller International (HKI) food frequency method. Descriptive statistics were used to analyse the data. All families of the study boys and girls had income lower than the Thailand poverty line (US $ 1,000/year). On average, 63% of children from Mae Hae Tai village, 1.5% of children from Mae Yot village and none of children from Mae Raek village had serum vitamin A <0.7 μmol/L which indicated VAD. 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. Both boys and girls from Mae Raek village and also girls from Mae Yot village consumed vitamin A more than the Thai RDA. Using SDA and HKI methods to assess vitamin A status of the villages to see whether VAD is a village's nutritional problem, it was found that all children from the three villages were at risk of VAD. In order to improve vitamin A status of the Karen children in Mae Chaem district, recommendations were made as follow: (1) increased use of fat and oil, particularly in areas with high risk of VAD; (2) more general work with Karen communities on how children's diets might be improved in a culturally acceptable manner, so as to bring vitamin A consumption closer to recommended allowance level.

Key Words: Nutritional status, Diet, Vitamin A, Intakes, Vitamins, Malnutrition, Karen, Children, Hill tribe, Thailand

Introduction

The body's immune system cannot function well without adequate levels of vitamin A. Lack of vitamin A damages the surfaces of the skin, eyes, and mouth, the lining of the stomach, and the respiratory system. A child with vitamin A deficiency (VAD) has more infections, which become more severe because the immune system is damaged.[1] VAD increases the risk that children will die or become blind. It is the most common cause of childhood blindness in the developing world.[2] It is estimated that by giving adequate vitamin A, in vitamin A deficient populations, child mortality from measles can be reduced by 50%, and mortality from diarrheal disease by 40%. Overall mortality in children 6-59 months of age can be reduced by 23%.[3] Current World Health Organization criteria for starting a supplementation program include a survey showing that more than 20% of children have low serum retinol levels or the presence of nightblindness either in children 2-6 years of age or in women of reproductive age, particularly pregnant women; or, any two indirect indicators, such as low availability or intake of vitamin A rich foods, high infant mortality (>100), high under five mortality (>75), high prevalence of underweight/stunting/wasting, or high mea-sles case fatality (>1%).[4] VAD can occur for a number of reasons. There may be too little vitamin A in the foods consumed, the body may absorb too little vitamin A, or vitamin A may be rapidly used up and then not replaced in time to avoid damage.

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When body stores of vitamin A are lost, blood levels fall, damaging the immune system. Later, the eyes are damaged. Infants born to women who consume too little vitamin A have low stores at birth. The breast milk of these women is also low in vitamin A. Children between the ages of 6 months and 6 years, and women especially during pregnancy and lactation, are most likely to develop vitamin A deficiency. Nightblindness is common in pregnant women. Infants and young children who are not breastfed are at very high risk. Infants and children who do not receive enough breast milk for at least 2 years are at high risk; 500 ml of breast milk provides about 45% of vitamin A requirements in the second year of life.[5] Diseases, such as measles, prolonged or severe diarrhea, and other infections, reduce blood levels and stores of vitamin A. The earliest symptoms of VAD are difficult to detect, but nightblindness is a good indicator. Most communities with VAD have a local term for nightblindness. Even at an early stage and well before any physical changes in eyes can be seen, VAD damages the immune system, making children less able to fight common infections. Interventions to prevent vitamin A deficiency are needed for all children living in areas where VAD is likely. Children who have a brother or sister with eye signs of VAD are ten times more likely to have severe VAD. Mothers of these children are five to ten times more likely to have night blindness. Children from the same neighborhoods and communities as someone with VAD are twice as likely to have or develop severe VAD.[6] This paper reported results from a study of vitamin A status and malnutrition of the minority ethnic group of Karen hill tribe children aged 1-6 years in the north of Thailand.

Methodology

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 tribe") group in Thailand. The study included 83 boys and 75 girls as shown in Table 1. All subject's 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.

Assessment of vitamin A status

A whole blood of 300 μL was obtained by "fingerstick" for determination of serum vitamin A. The results were compared with the reference values by age.[7] All children were assessed for their vitamin A intakes using 24 hours dietary recall. Thai food composition table from Ministry of Health were used as references.[8] The results were compared with the Thai Recommended Dietary Allowances (RDA).[9] Children aged 1-3 years and 4-6 years were separately analysed due to the differences in Thai Recommended Dietary Allowances (RDA) between the two age groups. Community or village's vitamin A status was assessed by using Simplified Dietary Assessment (SDA) method.[10] and Helen Keller International (HKI) food frequency method.[11] They were used to assess whether or not a village has a vitamin A deficiency problem. The criteria for SDA and HKI were as follow.

Table 1. Total number of subjects from 3 different villages

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

SDA method: Criteria: Risk index interpretation for Consumption Index (CI) & Usual Pattern of Food consumption (UPF)

Risk	CI	UPF
High risk (HR)	<5	<120
Moderate risk (MR)	5-7	120-210
Low risk (LR)	>7	>210

CI calculated from 24 hours food recall, then find the mean of the whole village. UPF calculated from food frequency questionnaire in the past 1 month, then find the mean of the whole village.

HKI food frequency method: Whether or not a community has a vitamin A deficiency problem either of two threshold values

=<4 days per week for mean frequency of consumption of animal source of vitamin A

=<6 days per week for mean frequency of total consumption of animal and plant sources of vitamin A (weighted by the source)

Data Analyses

Descriptive statistics, students' t-test, analysis of variance were used to analyse the data.

Results

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 $ 1,000/year).

Vitamin A status of the study children

Table 2 showed mean and standard deviation of all the study biochemical parameters by village for boys and girls, respectively.

On average, 63% of children from Mae Hae Tai village, 1.5% of children from Mae Yot village and none of children from Mae Raek village had serum vitamin A 0.7 μmol/L (Table 3) which indicated vitamin A deficiency.

Table 2. Mean and standard deviation of serum vitamin A (mole/L) for boys and girls by village

	Mae Hae Tai			Mae Yot			Mae Raek	
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Boys	27	0.60	0.17	23	114	0.26	31	1.14	0.22
Girls	24	0.63	0.13	31	1.16	0.28	18	1.20	0.21

Table 3. Percentage of children had serum vitamin A level above and below cut-off levels by village

Serum Vit A (μmol/L)	Mae Hae Tai		Mae Yot		Mae Raek	
	Boys	Girls	Boys	Girls	Boys	Girls
<0.7	67	58	-	3	-	-
0.7-1.5	33	42	93	91	94	89
>1.5	-	-	7	6	6	11
n	27	24	23	31	31	18

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. Both boys and girls from Mae Raek village and also girls from Mae Yot village consumed vitamin A more than the Thai RDA (Table 4).

Village's vitamin A status

Using SDA and HKI methods to assess vitamin A status of the villages to see whether vitamin A deficiency is a village's nutritional problem, it was found that all children from the three villages were at risk of vitamin A deficiency as shown in the Table 5.

Discussion

This paper reported results from a study of vitamin A status and malnutrition in 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$ 1,000 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, these children will face several kinds of problems such as health conditions, illnesses and malnutrition.

In the present study, most of the children from the three villages had malnutrition in various degrees, for example 85.5% of them by using weight-for-age, 73% by height-for-age (stunting) and 48.4% by weight-for-height (wasting) (not reported in the result section). These figures were much higher than the national nutrition survey of the preschool children in Thailand which is about only 12%.[12] Socio-economic status and cultural factors play important roles in determining food consumption patterns including vitamin A and malnutrition. As these are all Karen villages with little cash income, malnourishment of children could relate to low consumption of energy and protein and also vitamin A. Even though wild vegetables were found to be plentiful and have significant amounts of beta carotene, more than 60 percent of children in the

Table 4. Vitamin A (IU) consumption per day, by 24 hours dietary recall, of children aged 1-6 years from the 3 villages

	Mae Hae Tai			Mae Yot			Mae Raek			
	%RDA	Mean	SD	%RDA	Mean	SD	%RDA	Mean	SD	Thai RDA
Aged 1-3 Years										
Boys (n)	15			14			14			
	108.3	1408	2301	104.3	1356	1165	107.1	1392	963	1,300
Girls (n)	14			14			11			
	73.8	959	1917	49.6	645	893	163.0	2119	2852	1,300
Aged 4-6 years										
Boys (n)	11			9			16			
	58.4	778	1315	76.1	1015	1380	205.3	2737	2269	1,333
Girls (n)	9			15			8			
	44.4	592	714	126.8	1691	2020	126.9	1692	129	1,333

Table 5. Assessment of vitamin A status of the children (both sexes) by SDA and HKI methods whether vitamin A deficiency is a village's problem or not

Village	N	CI	UPF	HKI	Interpretation
Mae Hae Tai	57	3	139	2	HR: CI & HKI; MR: UPF
Mae Yot	53	7	192	3	MR: CI, UPF, HKI
Mae Raek	48	10	372	6	LR: CI, UPF, HKI

CI = consumption index, UPF = usual pattern of food consumption, SDA = Simplified Dietary assessment, HKI = Helen Keller International, HR: risk, MR: moderate risk, LR: low risk

Mae Hae Tai were found to have serum vitamin A deficiency. Indeed, SDA and HKI assessment methods found children of Mae Hae Tai village to be at high risk of vitamin A deficiency. In the Mae Reak village, on the other hand, the risk of vitamin A deficiency was assessed a low, and no children showed serum deficiency; risk in the Mae Yot village was medium, with only a very few children showing serum deficiency. This is consistent with dietary data which indicated that vitamin A levels consumed in Mae Reak 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 Hea Tai village.

These effects may be exacerbated in Mae Hae Tai children if fat consumption is low, since assimilation of beta carotene (precursor of vitamin A) is impossible if not enough fat is included in their diets. Earlier studies found that after supplementation with vegetable oil there was a 20% reduction in the number of children with either diarrhea or respiratory tract infection[13], and a 13 percent reduction in abnormal conjunctival impression cytology (CIC, a biophysical assessment of vitamin A deficiency).[14] Since supplementation with vegetable oil might increase absorption of fat-soluble vitamins, especially vitamin A,[13] such an approach may be particularly useful in groups where consumption is marginal.

Study findings appeared to provide evidence that related to more nutritional stress on children in the Mae Hae Tai than that seen in children from other villages. Children in this village had highest risk of vitamin A deficiency.

In conclusion, in order to improve vitamin A status of the Karen children in Mae Chaem district, It was recommended that (1) an increased use of fat and oil, particularly in areas with high risk of vitamin A deficiency; (2) more general work with Karen communities on how children's diets might be improved in a culturally acceptable manner, so as to bring vitamin A consumption closer to recommended allowance level.

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Original Article

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泰國北部 Karen 山區部落的少數種族 1-6 歲兒童維生素 A 營養狀況

維生素 A 缺乏(VAD)是開發中世界最常見兒童失明的原因。據估計在維生素 A 缺乏的族群，給予適量的維生素 A 可以降低兒童 50%痲疹死亡率及 40%腹瀉性疾病死亡率。並可降低 23% 6-59 個月大的兒童總死亡率。本文報告的結果泰國北部 Karen 山區部落少數族群 1-6 歲兒童的維生素 A 營養狀況及營養不良的情形。泰國北部湄蔣縣的三個 Karen 部落(Mae Hae Tai, Mae Yot, Mae Raek) 1-6 歲兒童(N=158；83 名男孩，75 名女孩) 均納入研究。Karen 是泰國比較大的山區少數民族(“山區部落”)。所有的兒童經過合格的醫生評估，並使用 24 小時飲食回憶評估他們維生素 A 的攝取量。以泰國衛生部食物成分表為參考。結果與泰國的膳食建議攝取量作比較。泰國對 1-3 歲及 4-6 歲這兩個年齡層的兒童有不同的膳食建議攝取量，故在分析時也將兩組分開。使用“指尖取血”收集 300μL 的全血以測量血清中維生素 A。社區或是村落的維生素 A 營養狀況評估採用簡易膳食評估(SDA)方法及海倫凱勒國際基金會(HKI)食物頻率方法評估。採用描述性統計分析數據。參與研究的男孩及女孩的家庭收入均低於泰國的貧窮線(1,000 美元/年)。平均 63%Mae Hae Tai 村落的兒童及 1.5%Mae Yot 村落的兒童血清維生素 A<0.7μmol/L，即為 VAD，至於 Mae Paek 的兒童則沒有 VAD。所有的男孩與 Mae Paek 村落的女孩其維生素 A 攝取量超過泰國的 RDA，但是 Mae Hae Tai 村落及 Mae Yot 村落的女孩維生素 A 攝取量則低於泰國的 RDA。所有 Mae Paek 的男女孩，與 Mae Yot 村落的女孩維生素 A 攝取量超過泰國的 RDA。以 SDA 及 HKI 方法評估維生素 A 營養狀況，探討 VAD 是否為村落中的營養問題，本研究發現這三個村落的兒童均有 VDA 的危險性。為了改善湄蔣縣 Karen 兒童的維生素 A 營養狀況，建議可以實行以下幾點方法: (1)增加油脂的使用，尤其是 VAD 高危險地區；(2)在 Karen 社區中，更一般性的工作應該是如何以文化可接受的方式去改善兒童飲食，以使維生素 A 的攝取量可以趨近建議量。

關鍵字：營養狀況、飲食、維生素 A、攝取、維生素、營養不良、Karen、兒童、山區部落、泰國。