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Risk Factors of Malnutrition among Karen Children in Chiang Mai, Thailand

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Abstract

The objective of this study was to determine the risk factors of malnutrition and its association with iron deficiency anaemia (IDA) among Karen hill tribe children. We conducted a study on blood samples from children from Baan Yang Poa School, Chiang Mai, Thailand aged between 9 and 15 years old. Of 193 children, 31 (16.1%) had malnutrition and 12 (6.2%) had IDA. Children who had at least five family members were found to have a significantly higher risk of malnutrition (P = 0.005), a reflection of the importance of socioeconomic factors in the problem of malnutrition. We also found that malnutrition was not associated with IDA although the assessment of the association of malnutrition and other types of anaemia is still of interest.

Keywords

Iron Deficiency Anaemia, Karen Hill Tribe Children, Consumption Behaviours, Knowledge, Belief

1. Introduction

Good nutrition is a well-known factor in human growth, health and development, albeit many people have malnutrition resulting from dietary insufficiency [1]. Insufficient essential vitamins and minerals in the diet increase the risk of infectious diseases and can eventually lead to nutritional deficiency, poor growth and anaemia. Malnutrition, defined as the outcome of insufficient food intake, hinders both intellectual and physical development, and is a serious public-health problem in developing countries [2]. Several studies have suggested that the factors that can lead to malnutrition in children include socioeconomic factors, poor eating habits of families and parental age [2]-[5]. In Thailand, according to a report from the United Nations Children's Fund (UNICEF), between 2008 and 2012, the prevalence of underweight children was 7.6%, 16% were stunted, and 5% were wasted [6].

Low haemoglobin/haematocrit levels resulting from malnutrition are often associated with anaemia, a global health problem in both developing and developed countries. Iron-deficiency is one of the leading causes of anaemia and so iron deficiency anaemia (IDA) is often used synonymously for anaemia. Globally, the World Health Organization (WHO) has estimated that 1.62 billion people (24.8%) are anaemic, with the highest prevalence (47.4%) being in preschool-age children [7]. In Thailand, the highest prevalence of IDA (12%) was found among Karen hill tribe children living in Chiang Mai [8]. IDA has been identified as a priority issue related to malnutrition in Thailand [9]. The numerous minority hill tribe children growing slower than expected suffer from anaemia because they do not get enough nutrients in their diet for normal growth and development, and for maintaining a healthy immune system [10]-[12].

Since many areas in Northern Thailand are mountainous, people live there outside of the influence of normal Thai society, which has led many of them to lack knowledge of or misunderstand the need for good nutrition. Because of these problems, this study has focused on Karen children in Northern Thailand and aimed to determine the risk factors of malnutrition and its association with IDA among them.

2. Materials and Methods

2.1. Study Participants

Karen school children studying at Baan Yang Poa School, Omkoi District, Chiang Mai, Thailand in the academic year 2013 who gave blood samples were enrolled in the study.

The nutritional status of the children was evaluated according to the standards of the Bureau of Nutrition, Department of Health, Ministry of Public Health, Thailand. The children were considered to be suffering from malnutrition if they had at least one symptom of malnutrition: underweight (weight-for-age < -2 SD), stunted (height-for-age < -2 SD), or wasted (weight-for-height < -2 SD) [13].

Serum iron parameters, including serum iron (SI), total iron binding capacity (TIBC) and serum ferritin, were measured using an automated chemistry analyser (Dimension® EXL™ 200 Integrated Chemistry System; SIEMENS, Munich, Germany). Transferrin iron saturation was calculated using the formula (SI/TIBC) × 100. Children were diagnosed with IDA if they had serum iron < 50 μg/dl, transferrin iron saturation $< 10\%$, ferritin level ≤ 10 ng/ml or TIBC > 400 μg/dl [14].

Nutritional status (weight-for-age, height-for-age, and weight-for-height) and IDA status data of the children were collected at the Faculty of Associated Medical Sciences, Chiang Mai University, Thailand. Socioeconomic factors, nutritional consumption behaviour, and knowledge of and belief about nutritional consumption by children were adapted from the questionnaire of the consumption behaviour assessment form of the

Department of Health, Ministry of Public Health, Thailand. Ten millilitres of whole blood samples were collected and delivered to the Clinical Service Center, Faculty of Associated Medical Sciences, Chiang Mai University, for haematological and biochemical analysis. Haematological parameters were measured using an automated blood counter (NIHON KOHDEN MEK-8222K, Tokyo, Japan).

2.2. Data Analyses

Of 226 children who gave blood samples and answered the questionnaire, children who had anaemia other than IDA (n = 33) were excluded from the study, which left a sample of 193 children (see Figure 1).

Baseline characteristics were presented as means and standard deviations (SD) for continuous variables and counts and percentages for categorical variables. Potential risk factors taken into consideration included demographic and socioeconomic factors (age, weight, height and gender; whether suffering from a congenital disease; the number of people in the child's family; and the child's caregiver, the caregiver's occupation and educational level), nutritional consumption behaviour, and knowledge of and belief about nutritional consumption. Characteristics between children with and without malnutrition were compared using a chi-squared test, Fisher's exact test for categorical variables and Student's t-test for continuous variables. Risk factors of malnutrition were assessed using logistic regression. Factors with a p-value lower than 0.25 in the univariable analysis were included in the multivariable analysis. The possible association between malnutrition and IDA was assessed using Fisher's exact test. All analyses were performed using statistical software package SPSS 16.

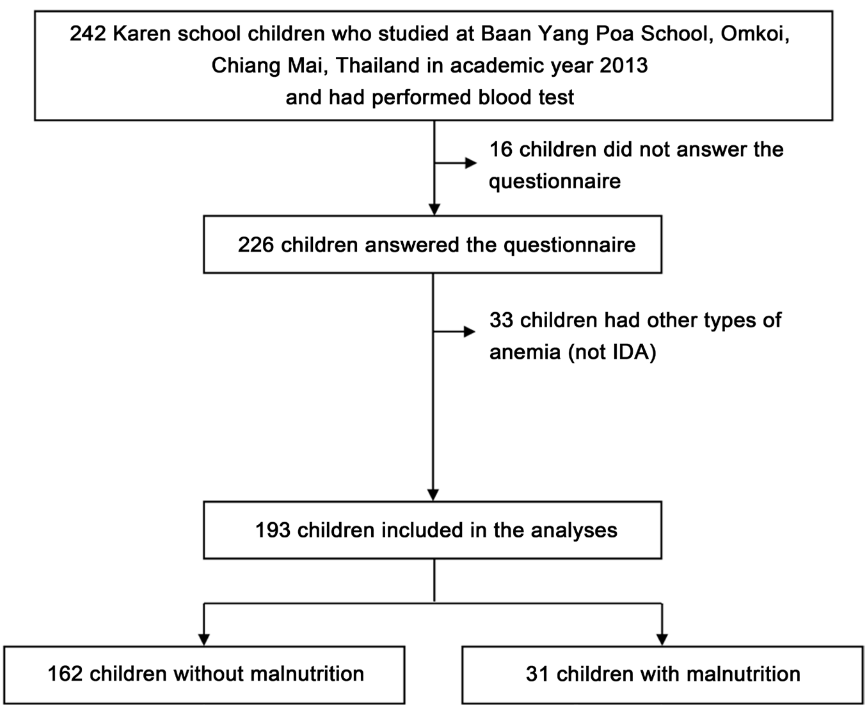

Figure 1. Patient disposition.

3. Results and Discussion

3.1. Characteristics

Of the 193 children included in the analysis, 31 (16.1%) were found to be malnourished with 1 (0.5%) underweight, 19 (9.8%) stunted, 2 (1.0%) wasted, and 9 (4.7%) both underweight and stunted. Twelve children (6.2%) were diagnosed with IDA. As shown in Table 1, the weight ($P < 0.001$) and height ($P < 0.001$) were more highly significant in non-malnourished than malnourished children. The proportion of malnutrition was high for children with at least five family members ($P = 0.001$), and if the father was a farmer ($P = 0.023$), while the level of correct belief about food consumption was correlated with malnutrition ($P = 0.042$).

3.2. Risk Factors of Malnutrition

Table 2 shows that children who had at least five family members (OR = 5.45; 95% CI = 1.82 - 16.29; P = 0.002) and a low-level of correct belief about food consumption (OR = 2.48; 95% CI = 1.01 - 6.09; P = 0.047) were at a significantly higher risk of malnutrition when analysed using a univariable logistic regression. At least five family members was confirmed to be associated with a higher risk of malnutrition under multivariable analysis (OR = 6.13; 95% CI = 1.75 - 21.51; P = 0.005).

3.3. Association between Malnutrition and IDA

Of 162 non-malnourished children, 10 (6.2%) had IDA whereas 2 of 31 malnourished children (6.5%) had IDA. There was no association between malnutrition and IDA (see Table 3).

The focus of this study was on risk factors of malnutrition and their association with iron deficiency anaemia in a group of Karen children in Northern Thailand. The community is located in a remote area surrounded by high mountains and it is thought that most of the population lack an accurate understanding of nutrition. However, our results showed that the percentage of Karen children who have malnutrition is similar to the percentage reported nationally by the WHO and the Thai Government.

The results in knowledge of and belief about food consumption by children found that 48 of 193 children (24.9%) had a low level of accurate knowledge and 118 of 193 children (61.1%) had a low level of accuracy in their beliefs about food consumption. Therefore, Karen children had incorrect knowledge about the nutritional value of the food they ate which, along with traditional beliefs, keeps them from making healthy choices. Our results illustrate that, because of traditional beliefs, Karen children are likely to eat food that is not beneficial, which can lead to health problems [15]-[18].

Based on a survey conducted by the Princess Mother's Medical Volunteer Foundation, most of the Karen people were found to suffer from iron deficiency since they, as a rule, do not eat a lot of meat, entrails, milk, green vegetables and grains, which could lead to anaemia. In this study, we found that malnutrition was not associated with IDA, which differs from the findings of the previous study [3]. However, we only assessed the association of malnutrition with IDA. It is possible that children who participated

Table 1. Characteristics of non-malnutrition and malnutrition children (N = 193).

Characteristics	Non-malnutrition (n = 162)	Malnutrition (n = 31)	P-value
Demographic and Socioeconomic			
Age (year): mean	11.8 (1.8)	12.1 (1.7)	0.317[a]
Weight (kg): mean	34.6 (8.1)	28.8 (6.6)	<0.001[a]
Height (cm): mean	140.7 (10.9)	131.7 (9.5)	<0.001[a]
Gender:			0.855[b]
Male	55 (84.6%)	10 (15.4%)	
Female	107 (83.6%)	21 (16.4%)	
Congenital disease (n = 173):			0.425[c]
Yes	2 (66.7%)	1 (33.3%)	
No	142 (83.5%)	28 (16.5%)	
Caregiver (n = 189):			0.058[c]
Father and/or mother	149 (85.1%)	26 (14.9%)	
Relatives	9 (64.3%)	5 (35.7%)	
Number of members in family (n = 190):			0.001[c]
<5 people	71 (94.7%)	4 (5.3%)	
≥5 people	88 (76.5%)	27 (23.5%)	
Father's occupation (n = 179):			0.023[b]
Farmer	110 (80.9%)	26 (19.1%)	
Other	41 (95.1%)	2 (4.9%)	
Mother's occupation (n = 186):			0.098[b]
Farmer	119 (82.1%)	26 (17.9%)	
Other	38 (92.7%)	3 (7.3%)	
Father's education (n = 176):			0.085[c]
Primary school or lower	121 (80.7%)	29 (19.3%)	
Higher that primary school	25 (96.2%)	1 (3.8%)	
Mother's education (n = 184):			0.132[c]
Primary school or lower	132 (81.5%)	30 (18.5%)	
Higher that primary school	21 (95.5%)	1 (4.5%)	
Consumption behaviours			
3 meals a day (n = 191):			0.553[b]
Yes	126 (85.1%)	22 (14.9%)	
No	35 (81.4%)	8 (18.6%)	
Dishes per meal (n = 190):			0.739[b]
<3 dishes	82 (82.8%)	17 (17.2%)	
≥3 dishes	77 (84.6%)	14 (15.4%)	

Continued

2 snacks a day (n = 192):			0.354[b]
Yes	44 (88.0%)	6 (12.0%)	
No	117 (82.4%)	25 (17.6%)	
Daily vegetables intake:			0.321[b]
Yes	94 (86.2%)	15 (13.8%)	
No	68 (81.0%)	16 (19.0%)	
Daily fruits intake:			0.363[b]
Yes	44 (88.0%)	6 (12.0%)	
No	118 (82.5%)	25 (17.5%)	
Daily meat intake:			0.508[b]
Yes	57 (86.4%)	9 (13.6%)	
No	105 (82.7%)	22 (17.3%)	
Daily milk intake:			0.284[b]
Yes	129 (85.4%)	22 (14.6%)	
No	33 (78.6%)	9 (21.4%)	
Fishes intake :			0.476[c]
<3 days a week	147 (83.1%)	30 (16.9%)	
≥3 days a week	15 (93.8%)	1 (6.2%)	
Eggs intake:			0.370[b]
<3 days a week	130 (82.8%)	27 (17.2%)	
≥3 days a week	32 (88.9%)	4 (11.1%)	
Iron-rich foods intake:			1.000[c]
<3 days a week	152 (83.5%)	30 (16.5%)	
≥3 days a week	10 (90.9%)	1 (9.1%)	
Grains intake:			1.000[c]
<3 days a week	156 (83.9%)	30 (16.1%)	
≥3 days a week	6 (85.7%)	1 (14.3%)	
Sugar added in foods (n = 192):			0.332[b]
Yes	56 (87.5%)	8 (12.5%)	
No	105 (82.0%)	23 (18.0%)	
Sugar intake per meal (teaspoon): mean	1.2 (0.4)	1.1 (0.4)	0.755[a]
Level of corrected knowledge in food consumption			0.125[b]
Low	36 (75.0%)	12 (25.0%)	
Moderate	70 (88.6%)	9 (11.4%)	
High	56 (84.8%)	10 (15.2%)	
Level of corrected belief in food consumption			0.042[b]
Low	94 (79.7%)	24 (20.3%)	
High	68 (90.7%)	7 (9.3%)	

[a]P-values from Student's t-test; [b]P-values from chi-square test; [c]P-values from Fisher's exact test.

Table 2. Association between potential risk factors and malnutrition.

Variables	n/N (%)	Univariable analysis		Multivariable analysis	
		OR (95% CI)	P-value*	OR (95% CI)	P-value*
Gender					
Male	10/65 (15.4)	1.0	-		
Female	21/128 (16.4)	1.08 (0.48 - 2.45)	0.855		
Caregiver					
Father and/or mother	26/175 (14.9)	1.00	-	1.00	-
Relatives	5/14 (35.7)	0.31 (0.10 - 1.01)	0.052	0.27 (0.05 - 1.57)	0.144
Number of member in family					
<5 people	4/75 (5.3)	1.00	-	1.00	-
≥5 people	27/115 (23.5)	5.45 (1.82 - 16.29)	0.002	6.13 (1.75 - 21.51)	0.005
Father's occupation					
Other	2/43 (4.9)	1.00	-	1.00	-
Farmer	26/136 (19.1)	4.85 (1.10 - 21.33)	0.037	3.78 (0.83 - 17.22)	0.085
Mother's occupation					
Other	3/41 (7.3)	1.00	-	1.00	-
Farmer	26/145 (17.9)	2.77 (0.79 - 9.66)	0.110	0.18 (0.02 - 1.96)	0.158
Father's education					
Primary school or lower	29/150 (19.3)	1.00	-	1.00	-
Higher than primary school	1/26 (3.8)	(0.78 - 46.05)	0.085	3.06 (0.28 - 33.12)	0.357
Mother's education					
Primary school or lower	30/162 (18.5)	1.00	-	1.00	-
Higher than primary school	1/22 (4.5)	4.77 (0.62 - 36.89)	0.134	4.87 (0.59 - 40.27)	0.142
Daily vegetables intake					
Yes	15/109 (13.8)	1.00	-		
No	16/84 (19.0)	1.48 (0.68 - 3.19)	0.323		
Daily fruits intake					
Yes	6/50 (12.0)	1.00	-		
No	25/143 (13.3)	1.55 (0.60 - 4.04)	0.366		
Daily meat intake					
Yes	9/66 (13.6)	1.00	-		
No	22/127 (17.3)	1.33 (0.57 - 3.07)	0.509		
Daily milk intake					
Yes	22/151 (14.6)	1.00	-		
No	9/42 (21.4)	1.60 (0.67 - 3.80)	0.287		

Continued

Iron-rich foods intake					
<3 days a week	1/11(9.1)	1.00	-		
≥3 days a week	30/182 (16.5)	1.97 (0.24 - 16.00)	0.524		
Level of corrected knowledge					
High/Moderate	10/66 (5.1)	1.00	-		
Low	21/127 (16.5)	1.08 (0.48 - 2.45)	0.855		
Level of corrected belief					
High	7/75 (9.3)	1.00	-	1.00	-
Low	24/118 (20.3)	2.48 (1.01 - 6.09)	0.047	2.20 (0.84 - 5.76)	0.109

n, Number of undernutrition children; N, Total number of malnutrition children; %, Transmission rate; OR, Odds ratio; CI, Confident interval; *P-values from logistic regression.

Table 3. Association between malnutrition and iron-deficiency anaemia.

Malnutrition	Iron-deficiency anaemia		Total	P-value*
	No	Yes		
No	152 (93.8%)	10 (6.2%)	162	1.000
Yes	29 (93.5%)	2 (6.5%)	31	
Total	181 (93.8%)	12 (6.2%)	193	

*P-value from Fisher's exact test.

in our study had other types of malnutrition not based on iron deficiency. Therefore, it would be of interest to study the association of malnutrition and other types of anaemia.

Blood samples from the children were taken in September 2013 whereas we carried out our study in December 2013, so we assumed that the nutritional consumption behaviour of the children was similar over this period. Moreover, the questions in the questionnaire were retrospective, which might offer some limitations to the quality of the data from the children.

4. Conclusion

A child in a family of at least five people was confirmed to be at a higher risk of malnutrition than a child from a smaller family, which is probably because, with similar wealth, a big family might have more of a problem with wealth management. This reflects the importance of socioeconomic factors to the malnutrition issue. To deal with this problem, the government should be more supportive by educating the people in hill tribe areas about nutrition and family planning.

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