

สถานะสุขภาพของเด็กนักเรียนชั้นประถมในอำเภอน้ำพอง จังหวัดขอนแก่นในปัจจุบัน

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Current Health Status of School Children in a Rural Area of Northeast Thailand

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หลักการและเหตุผล: โรคขาดสารอาหารและโรคติดเชื้อพยาธิ ซึ่งแสดงถึงสถานะสุขภาพยังคงเป็นปัญหาที่สำคัญ และพบได้บ่อยในประเทศไทย

วัตถุประสงค์: เพื่อประเมินสุขภาพปัจจุบันของเด็กนักเรียน เขตชนบทในภาคตะวันออกเฉียงเหนือของประเทศไทย

รูปแบบการศึกษา: การศึกษาเชิงพรรณนา

สถานที่ทำการศึกษา: โรงเรียนในหมู่บ้านนาคำน้อย อ. น้ำพอง จ. ขอนแก่น

กลุ่มตัวอย่าง: เด็กนักเรียนชั้นประถมศึกษาปีที่ 3 ถึง ชั้นประถมศึกษาปีที่ 6 อายุ 8-12 ปี

การรักษา: ยารักษาโรคพยาธิ

ผลการวิจัย: อุบัติการณ์ของภาวะโลหิตจาง 30.5 เปอร์เซ็นต์ นักเรียน 70 จาก 158 คน (45.2 เปอร์เซ็นต์) มีการติดเชื้อพยาธิอย่างน้อยหนึ่งชนิด ระดับของเฮโมโกลบิน และ เฮมาโทคริต เพิ่มขึ้นอย่างมีนัยสำคัญ ในการสำรวจครั้งสุดท้าย ทั้งในกลุ่มที่มีการติดเชื้อและไม่มีการติดเชื้อพยาธิ ในกลุ่มที่ไม่มีการติดเชื้อพยาธิมีการเพิ่มขึ้นของระดับเฮโมโกลบินและเฮมาโทคริต มากกว่ากลุ่มที่มีการติดเชื้อพยาธิ

สรุป: สถานะสุขภาพของเด็กนักเรียนโดยทั่วไปอยู่ในเกณฑ์ปกติ ปัญหาทางสุขภาพที่สำคัญคือ ภาวะโลหิตจาง และการติดเชื้อพยาธิ

Background: To assess whether nutritional deficiencies and parasitic infection, which can be used to indicate poor health status, are still important and common problems in Northeast Thailand.

Objective: To assess the current health status of school children in a rural area of Northeast Thailand.

Design: Descriptive study

Setting: Primary School in the village of Nakamnoi, Nampong district, Khon Kaen province.

Subjects: School children from pratom 3 to 6 aged 8-12 years

Intervention: Antihelmintic drugs

Results: The prevalence of anaemia at the end of the rainy season was 30.5 percent, however, during the hot dry season prevalence was only 5.3 percent. 70 out of 158 children (45.2 percent) were found to be infected with one or more parasites. Hgb and Hct values were found to increase significantly from the pre-antihelmintic treatment visit to the post-treatment visit in both infected and uninfected groups. The improvement was more significant in the uninfected group than the infected group.

Conclusion: The health status of the school children is generally good. The main health problems found were anaemia and parasitic infections.

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Introduction

Nutritional deficiencies and parasitic infections, which can be used to indicate poor health status, are still important and common problems in Thailand. During the past two decades, there have been many studies regarding nutritional status in Thailand. The main problems found were: anaemia in children and woman of child-bearing age¹⁻⁴, vitamin A deficiency in children^{3, 4} and thiamin (vitamin B₁), riboflavin (vitamin B₂), and pyridoxine (vitamin B₆) deficiencies^{1, 5-8} in both children and adults. The interaction of some specific micronutrient with the absorption and/or metabolism of other micronutrients was also found to be important. Previous studies in Northeast Thailand have shown interactions between iron and riboflavin⁹, iron and vitamin A⁴ and also vitamin A and zinc⁵. In addition, the prevalence of parasitic infections in Thailand has been shown to be quite high¹⁰⁻¹². A recent survey in 41 provinces of Thailand revealed that the overall parasitic infection rate was 41.7 per cent, hookworm was found to be the most common parasite (27.69 per cent), while *Strongyloides stercoralis* infection was only 0.20 per cent¹².

The objective of this study was to assess the current health status of school children in a rural area of Northeast Thailand. Certain anthropometric, haematological and nutritional parameters, together with an investigation into intestinal parasitic infection rate were measured both pre and post-antihelmintic treatment. This preliminary study may indicate factors which could effect the status of certain micronutrients in rural school children in Northeast Thailand.

Materials and Methods

The primary school visited in this study was located in the village of Nakamnoi, Nampong district, Khon Kaen province. The village was in a rural area of Northeast Thailand, with electricity and water supply. Children attending the school came from four neighbouring villages. Most of the school children's parents had only primary education and were rice farmers, some were also dairy farmers. Children from pratom 3 to pratom 6, aged 8-12 years, were included in this study. Written, informed consent was obtained from the children's parents before the study commenced and ethical approval was given by the ethical committee, Faculty of Medicine, Khon Kaen University. A number of visits were made to the school

but data presented here are from visit 1, at the end of the rainy season, and a subsequent visit in March at the start of the hot season.

In October 1994, the first visit, weight and height were measured with the subjects dressed in light clothing and without shoes. Physical examinations were carried out by physicians to detect any clinical nutritional deficiencies.

Blood samples were collected in an eppendorf tube containing ethylene diamine tetraacetic acid (EDTA). Clotted blood and heparinized blood were also collected. The determination of haematological values: haemoglobin (Hgb), haematocrit (Hct), red blood cell indices, white blood cell count and platelet count were done using a Coulter STKS autocounter and determination of glucose-6-phosphate dehydrogenase (G-6-PD) was performed using a screening test¹².

Hgb typing was determined by starch gel electrophoresis¹⁴, and haemoglobin A₂ (Hgb A₂), and haemoglobin E (Hgb E) levels were measured using DE-52 microcolumn chromatography¹⁵. Children who had Hgb A₂ levels higher than 4 per cent were classified as having β -thalassaemic trait and for Hgb E, children who had more than 80 per cent Hgb E were regarded as homozygous, whereas children found to have between 1-80 per cent Hgb E were regarded as heterozygous for Hgb E.

The presence of anaemia was judged according to WHO recommendations which give the lowest acceptable Hgb concentrations for children aged 6-14 years as 12 g/dl¹⁶.

Intestinal parasitic infections were measured using faecal samples collected from the children which were stored on ice as quickly as possible. The formalin-ether concentration faecal examination technique was used to detect the following parasites: hookworm (HW), *Strongyloides stercoralis* (SS), *Giardia lamblia* (GL), *Opisthorchis viverrini* (OV) and minute intestinal flukes (MIF)¹⁷, in addition, a culture technique was used to determine the presence of hookworm and *Strongyloides stercoralis*¹⁸ in the faeces.

After the first visit, any children who were found to be infected with intestinal parasites were given specific antihelmintic drugs. Children infected with hookworm were treated with a single dose of albendazole (400 mg) and those infected with *Strongyloides stercoralis* were treated with albendazole (400 mg)

for three consecutive days. For *Opisthorchis viverrini* and minute intestinal fluke infections, praziquantel (40 mg/kg body weight) was given to infected individuals. A single dose of tinidazole (2 gm.) was used for the treatment of children with giardiasis. At the final visit, in March 1995, blood and faecal samples were collected again and used to assess the same parameters as before. In addition, a range of nutritional parameters were measured at both visits. At the final visit there were fewer results for haematological parameters than there had been at the first visit. This difference can be observed in **tables 4 and 5** where the number of paired samples available for statistical analysis (96 pairs, both tables combined) was noticeably lower than the number given for uninfected and infected children in **table 3** (127 children in total). This discrepancy in numbers was due to the loss of either the EDTA blood samples, or else of the results of haematological measurements from these samples for all 23 children in one class from the school at the final visit. This leaves a further 8 children who were presumably not present at the final visit, but whom had given blood at the first visit.

Results

Tables 1 and 2 show the mean weight and height of both boys and girls of different ages in our study. When these values were plotted as weight-for-age and height-for-age they corresponded to those around the fiftieth percentile on Thai standard growth curves¹⁹.

Physical examination of the children revealed the

Table 1 Weight and height of boys by age group

Age (yr)	n	Weight (kg)	Height (cm)
8.1 – 9.0	8	22.94 ± 2.29	124.75 ± 5.51
9.1 – 10.0	15	24.90 ± 2.29	127.50 ± 3.57
10.1 – 11.0	17	29.79 ± 7.20	132.38 ± 6.60
11.1 – 12.0	28	30.57 ± 5.73	136.48 ± 6.90
12.1 – 13.0	14	35.36 ± 6.35	146.11 ± 8.16

Table 2 Weight and height of girls by age group

Age (yr)	n	Weight (kg)	Height (cm)
8.1 – 9.0	10	23.70 ± 3.27	125.50 ± 5.25
9.1 – 10.0	24	24.90 ± 3.17	129.67 ± 5.47
10.1 – 11.0	18	27.83 ± 5.54	133.89 ± 6.87
11.1 – 12.0	22	33.50 ± 7.15	140.98 ± 6.42
12.1 – 13.0	6	34.58 ± 5.18	143.67 ± 3.80

following prevalence rates for some clinical nutritional deficiencies: cheilosis 6.2%, pale conjunctiva 1.9%, follicular hyperkeratosis 1.7%, glossitis 1.2%, koilonychia 0.6% and bleeding gums 0.6%. Tests for other clinical deficiencies were negative.

Haemoglobin typing showed that only 76 (47.8%) out of 159 children tested had normal Hgb type. Of the remaining children, 9 had β -thalassaemia trait, 3 were homozygous for Hgb E and 71 were heterozygous for HgbE. In addition, out of the 161 children who were tested for G-6-PD deficiency, 10 were homozygous and 5 were heterozygous for the deficiency.

Results for anaemia are given after the exclusion of data from children who were homozygous for either G-6-PD deficiency or Hgb E and those who had β -thalassaemic trait, since the inclusion of data from these children affected the results. At the first visit, 40 children (30.5%) were found to be anaemic (Hb<12g/dl), whereas at the final visit, only 5 children (5.3%) were anaemic.

Comparisons between measurements from the parasite infected group and the group with no detectable parasite infections (uninfected), showed that the mean Hgb and Hct levels in the infected group were significantly higher than in the uninfected group (**Table 3**). There was an improvement in Hgb and Hct values in all children from the pre-treatment visit to the post-treatment visit ($p < 0.01$, t-test), and, when looked at by infection status, Hgb and Hct were found to increase significantly in both infected and uninfected children (**Tables 4, 5**).

Parasitic infections were found in 45.2% of 158 children tested, with 16.5% of 158 children tested being infected with more than one type of parasite. A breakdown of the prevalence of each parasite type found is given in **table 6**. However, in most children, the infections appeared to be fairly light (no data shown). Boys were found to have a higher prevalence of infection than girls, 54.5% and 35.9% respectively ($p=0.01$ chi-square). This sex difference was most noticeable with *Strongyloides stercoralis* infection, which occurred in 36% of boys and 14% of girls ($p=0.001$, chi-square) (**Table 7**).

Discussion

The mean weight for age, height for age, Hgb and Hct of the school children in this study were found to be comparable to values found in previous studies¹⁹⁻²¹

Table 3 Differences in haematological values between parasite-infected and uninfected children at visit 1 (Oct.), not including those who were homozygous for G-6-PD deficiencies or Hgb E or who had thalassaemic trait.

Variables	Uninfected (n=70)	Infected (n=57)	p-value, unpaired t-test
Hgb (g/dl)	12.24 ± 0.90	12.60 ± 0.83	0.02
Hct (%)	36.32 ± 2.22	37.04 ± 2.06	0.06
MCHC (g/dl)	33.69 ± 1.14	34.02 ± 1.23	0.11
RBC (x10 ⁵ cells/mm ³)	4.96 ± 0.48	5.09 ± 0.47	0.13
WBC (x10 ³ cells/mm ³)	8.18 ± 1.78	9.00 ± 2.18	0.02
Platelet (x10 ³ cells/mm ³)	335.33 ± 68.79	321.63 ± 68.53	0.27

Table 4 Differences in haematological values in children who were uninfected at the pre-treatment visit, not including those who were homozygous for G-6-PD deficiencies or Hgb E or who had thalassaemic trait.

Variables	Pre-treatment visit (Oct.) mean ± SD n=50	Post-treatment visit (Mar.) mean ± SD n=50	paired t-test t-value	p-value
Hgb (g/dl)	12.23 ± 0.81	13.30 ± 1.01	-15.3	< 0.01
Hct (%)	36.40 ± 2.15	39.27 ± 2.73	-12.93	< 0.01
MCHC (g/dl)	33.58 ± 0.83	33.87 ± 0.89	-2.71	< 0.01
RBC (x10 ⁵ cells/mm ³)	4.95 ± 0.45	5.03 ± 0.47	-2.77	< 0.01
WBC (x10 ³ cells/mm ³)	8.01 ± 1.74	7.88 ± 1.93	-0.47	0.64
Platelet (x10 ³ cells/mm ³)	325.20 ± 65.79	303.00 ± 70.24	2.39	0.02

Table 5 Difference in haematological values in children who were infected at the pre-treatment visit, not including those who were homozygous for G-6-PD deficiencies or Hgb E or who had thalassaemic trait.

Variables	Pre-treatment visit (Oct.) mean ± SD n=46	Post-treatment visit (Mar.) mean ± SD n=46	paired t-test t-value	p-value
Hgb (g/dl)	12.52 ± 0.72	13.25 ± 0.71	-8.79	< 0.01
Hct (%)	36.89 ± 1.84	39.16 ± 2.09	-8.61	< 0.01
MCHC (g/dl)	33.93 ± 1.16	33.84 ± 0.80	0.48	0.63
RBC (x10 ⁵ cells/mm ³)	5.08 ± 0.43	5.09 ± 0.43	-0.13	0.89
WBC (x10 ³ cells/mm ³)	9.14 ± 0.22	8.48 ± 1.83	-2.56	0.01
Platelet (x10 ³ cells/mm ³)	324.70 ± 67.93	312.13 ± 60.63	1.86	0.07

Table 6 The prevalence of parasitic infections overall, including children with abnormal haemoglobin and G-6-PD deficiency.

parasite type	Number of infected boys out of number tested	Number of infected girls out of number tested	per cent of all infected children	p-value chi-square*
SS	28/77	11/78	25.2	0.001
HW	16/77	11/78	17.4	0.27
GL	12/79	9/78	13.4	0.50
OV	4/80	5/78	5.7	0.70
MF	4/80	3/78	4.4	0.72
Total**	42/77	28/78	45.2	0.02

* Chi-square test to determine difference in infection frequency by sex.

** Total number children infected with one or more parasites.

and only a small number of the children were found to have clinical symptoms of possible micronutrient deficiencies. The results show that the health status of these school children is generally good and that the main health problems were anaemia and intestinal parasitic infections. The prevalence of anaemia in school children in the rural area from our study was found to be as high as 30.5 per cent at the end of the rainy season (Oct '94), despite having excluded those children with both abnormal Hgb and G-6-PD deficiency. Areekul et al. reported previously that the prevalence of anaemia from school children in Bangkok and Khon Kaen was 30.2 and 61.1 per cent, respectively²⁰, and Ratamabanangkoon et al. reported the prevalence of anaemia in children attending an out patient clinic in Bangkok to be 23 per cent²².

The overall intestinal parasitic infection rate found in our study was 45.2 per cent. The most common parasitic infection found was *Strongyloides stercoralis*, the second most common was hookworm. Chularerk et al. reported that the parasitic infection rate in school children from the central part Thailand was 62.5 per cent, and that the most common parasite was hookworm, *Strongyloides stercoralis* infection was not found¹¹. Jongsuksantigul et al. studied parasitic infection rates in children aged 5-9 years from 41 provinces of Thailand and found that infection with *Strongyloides stercoralis* was only 0.2 per cent in children aged 5-9 years¹². The large difference in *Strongyloides stercoralis* detection rates between these previous studies and our study may be

because previously, only the formalin ether technique was used to detect intestinal parasites, whereas in our study we also used a more sensitive culture technique to detect hookworm and *Strongyloides stercoralis*. From the results in **tables 3-5** it is suggested that there was no effect of parasitic infection on Hgb and Hct values, this might be due to the fairly light intestinal parasite infection load. However, the higher mean white blood cell count in the infected group, when compared with the uninfected group (**table 3**), would appear to have been a result of the parasitic infections, since this value decreased significantly in infected children after antihelminthic treatment (**tables 5**); an effect which was not seen over the same time period in the uninfected children (**tables 4**) (p-value = 0.02). The improvement of Hgb and Hct, and reduction in the number of anaemic children, observed between pre-treatment and post-treatment did not seem to be due to the elimination of parasites, since the improvement was slightly more significant in the children who had been found to be uninfected at the time of the first visit (paired t-test t-values **tables 5,6**). This improvement in Hgb and Hct values was in contrast to results from a previous study² of Northeastern Thai women, where anaemia was found to be more common during the hot season than the rainy season. The improvement in Hgb and Hct values from the rainy season to hot season which was observed in children in our study may have been due to seasonal variation in diet and/or to the presence of other infections in the children, which was more significant in the rainy season than the hot,

dry season according to our records of the number of days that each child was off school due to illness in the 2 weeks preceeding blood collection.

Conclusion

The children in this rural area of Northeast Thailand are still susceptible to infection with a number of parasites, in particular *Strongyloides stercoralis*, however their overall health status is apparently good. The biochemical status of many other micronutrients has yet to be determined and will hopefully give a better understanding of any problems related to nutritional status which may need to be addressed in children living in rural areas of Northeast Thailand.

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