

VITAMIN B1, B2 AND B6 DEFICIENCY IN PRIMARY SCHOOL CHILDREN INFECTED WITH HOOKWORM

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Abstract. One thousand and seven hundred thirty-six school children from two districts in Nakhon Si Thammarat Province were screened for hookworm infection using the Kato-Katz stool examination technic. Two hundred students who have at least 2,000 eggs per g of stool were recruited into the program. The students were divided into six groups : groups 1, 2 and 3 were from Tha Sala district while groups 4, 5 and 6 were from Rongpibul district. Three milliliter blood samples were obtained from the cubital vein of each subject and were evaluated for erythrocyte transketolase activity (ETK) for vitamin B1, erythrocyte glutathione oxidoreductase activity (EGR) for vitamin B2, and erythrocyte aspartate aminotransferase activity (EAST) for vitamin B6. The school children were divided into three groups : those infected only with hookworm, those with both hookworm and *Trichuris trichiura*, and those whose stools show no parasite eggs. The results show that 10-20% of the school children are vitamin B1 deficient, about 40% to 80% are vitamin B2 deficient, and about 14% to 23% are vitamin B6 deficient. No correlation could be made between vitamin deficiencies and parasitic infection.

INTRODUCTION

Soil-transmitted helminthiases (STH) are common parasitic problems in the south of Thailand. The Community Disease Control Department, Ministry of Public Health reported that among the population in 14 provinces in the south of Thailand, 49.1%, 24.4% and 5.9% had hookworm, *Trichuris trichiura*, and *Ascaris lumbricoides*, respectively (Jongsuksuntigul, 1992). Patients with hookworm infections usually have mild symptoms, but children with heavy infections are likely to develop iron deficiency anemia, malnutrition, and retarded growth rate (Stephenson, 1985). Vitamin B12 and folic acid deficiencies in patients admitted at the Hospital for Tropical Diseases, Faculty of Tropical Medicine with heavy hookworm infections were variously reported at 18.5% (Devakul, 1970) and 46.0% (Areekul, 1972). Approximately 20-35% of 100 school children were found to be deficient in vitamin B2 and B6 in the northeast of Thailand : major factors involved were suggested to be the insufficient intake of nutrients and a high prevalence of parasitic infections (Schreurs, 1976). This study aimed to show the status of vitamin B1, B2 and B6 in three groups of school children in the south of Thailand : those infected only with hookworm, those with hookworm and *Trichuris*

trichiura, and those who were found not to harbor parasite eggs.

MATERIALS AND METHODS

One thousand and seven hundred thirty-six school children from two districts (Tha Sala and Rongpibul) in the southern Province of Nakhon Si Thammarat, Thailand, were screened for hookworm infection using the Kato-Katz stool examination technic. One hundred and eighty school children aged 6 to 12 years harboring more than 2,000 hookworm eggs per g feces were recruited into the study. Fifty of them also harbored *Trichuris trichiura*. Fifty-eight school children whose feces were not positive for hookworm eggs were included as controls. Three ml of blood were collected from each subject and hemolysates were prepared from red blood cells, then stored at -20°C until analysis for vitamin status could be performed. Activities of erythrocyte transketolase (ETK), glutathione oxidoreductase (EGR), aspartate aminotransferase (EAST) and their activation co-efficients (α) after stimulation with their respective coenzymes were calculated in order to estimate vitamin B1, B2 and B6 status. The following values : α ETK \geq 1.25, α EGR \geq 1.50 and α EAST \geq 3.07 indicated vitamin B1, B2 and B6 deficiencies, respectively.

Statistical analysis

The statistical analyses were done by Fisher's exact test and Mantel-Haenszel test.

RESULTS

Table 1 shows that the number and percentage of children at Tha Sala with vitamin B1 deficiency (α ETK ≥ 1.25) was higher among those with combined hookworm and *Trichuris trichiura* infection than among those with only hookworm, and among those found not to harbor any parasite eggs. However, no significant differences in the ETK were found between the groups ($p > 0.05$).

Table 2 shows that the number and percentage of children at Ronpibul with vitamin B1 deficiency (α ETK ≥ 1.25) and B2 deficiency (α EGR ≥ 1.50) was higher among those with pure hookworm infection than in the other two groups. There were no significant differences in the ETK and EGR between the groups ($p > 0.05$).

Table 3 shows that among all the school children (238 cases), 13.0%, 64.6% and 17.6% of those with pure hookworm infection had vitamin B1, B2 and B6 deficiency, respectively. In those with combined hookworm and *Trichuris trichiura* infection, 16.0%, 44.0% and 18.0% had vitamin B1, B2 and B6 deficiency, respectively. And among those not found to harbor parasite eggs, 12.0%, 55.1% and

Table 1
Vitamin B1, B2 and B6 deficiency in school children at Tha Sala district,
Nakhon Si Thammarat Province.

Group	No. of samples examined	B1 deficiency (α ETK ≥ 1.25)		B2 deficiency (α EGR ≥ 1.50)		B6 deficiency (α EAST ≥ 3.07)	
		No.	%	No.	%	No.	%
I : infected with hookworm ($> 2,000$ eggs/g feces)	57	6	10.5	46	80.7	8	14.0
II : infected with both hookworm ($> 2,000$ eggs/g feces) and <i>Trichuris trichiura</i> ($> 1,000$ eggs/g feces)	30	6	20.0	14	46.7	5	16.7
III : not found to harbor parasite eggs	27	4	14.8	21	77.8	5	18.5

Table 2
Vitamin B1, B2 and B6 deficiency in school children at Ronpibul district,
Nakhon Si Thammarat Province.

Group	No. of samples examined	B1 deficiency (α ETK ≥ 1.25)		B2 deficiency (α EGR ≥ 1.50)		B6 deficiency (α EAST ≥ 3.07)	
		No.	%	No.	%	No.	%
I : infected with hookworm ($> 2,000$ eggs/g feces)	73	11	15.1	38	52.1	15	20.5
II : infected with both hookworm ($> 2,000$ eggs/g feces) and <i>Trichuris trichiura</i> ($> 1,000$ eggs/g feces)	20	2	10.0	8	40.0	4	20.0
III : not found to harbor parasite eggs	31	3	9.7	11	35.5	7	22.6

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Table 3

Vitamin B1, B2 and B6 deficiency in school children at Tha Sala and Ronpibul district, Nakhon Si Thammarat Province.

Group	No. of samples examined	B1 deficiency (α ETK \geq 1.25)		B2 deficiency (α EGR \geq 1.50)		B6 deficiency (α EAST \geq 3.07)	
		No.	%	No.	%	No.	%
I : infected with hookworm (> 2,000 eggs/g feces)	130	17	13.0	84	64.6	23	17.6
II : infected with both hookworm (> 2,000 eggs/g feces) and <i>Trichuris trichiura</i> (> 1,000 eggs/g feces)	50	8	16.0	22	44.0	9	18.0
III : not found to harbor parasite eggs	58	7	12.0	32	55.1	12	20.6

12.0% had vitamin B1, B2 and B6 deficiency, respectively.

DISCUSSION

The results of this study suggested that vitamin intake was generally low in the two villages of Tha Sala and Ronpibul. Vitamin B1, B2 and B6 deficiency were found in both school children with hookworm infection alone and in those with combined hookworm infection and trichuriasis : 13-16% (B1), 44-64% (B2) and 18% (B6), respectively. Children found not to have parasite eggs were also found to be similarly deficient in these vitamins. These children may or may not have the parasites, or their vitamin intake may actually be insufficient. Heavy infection due to hookworm has been reported to interfere with nutrient utilization of the host, leading to anemia (Migasena *et al*, 1984) and vitamins B1, B2 and B6 were reported to be at low normal levels in 12.5%, 35.6% and 30.0% of children with hookworm infection at Lam Takong Land Settlement (Harinasuta, 1983). However, no significant differences in B1, B2 and B6 deficiencies were found among children infected with hookworm, combined hookworm and trichuriasis, and the egg negative group ($p > 0.05$). Therefore, on the basis of this evidence alone, it is not possible to allocate causation of the vitamin deficiencies to the parasitic infections.

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