Chula Med J Vol. 50 No. 11 November 2006

Prevalence of anemia in pre – school children in Krabi Province

Sirirat Suwantaroj*

Yenta Betset** Supatchari Promsang**

Suwantaroj S, Betset Y, Promsang S. Prevalence of anemia in pre – school children in Krabi Province. Chula Med J 2006 Nov; 50(11): 789 - 97

Introduction : *Iron deficiency anemia (IDA) affects the learning process and natural resistance of a child. The prevalence of IDA among pre-school population in Thailand has not been known since 1991.*

Objective : *To determine the prevalence of anemia and IDA of pre-school children in Krabi province as well as evaluate whether IDA is a significant health problem of southern pre-school children.*

Setting : *Rural areas of Krabi Province*

Research design : *A cross-sectional prospective study*

Materials : *Healthy rural children 1-4 years from 8 districts in Krabi selected by cluster sampling with probability to size between July 2001 and February 2002. Those who were malnutrition (second to third degree), or had chronic illness, malaria, prematurity and blood dyscrasias were excluded.*

Methods : *Hemoglobin and serum ferritin levels of 300 venous blood samples (166 boys, 134 girls) were determined. The results were compared based on age and genders.*

* Department of Social and Preventive Medicine, Krabi Provincial Hospital

** Nursing Department, Krabi Provincial Hospital

Results : *The prevalence of anemia is 28 % (boys 63.1 %; girls 36.9 %). The prevalence in boys higher than girls with no statistical significance [Odd Ratio = 0.64 (0.37-1.12)]. IDA of the anemic children and the most severe IDA was found, 53.6 % and 2.4% respectively. The prevalence of IDA in both sexes was highest at two years old. The difference of IDA prevalence in both sexes was statistically significantly decreased when the age increased (p-value = 0.006).*

Conclusions : *IDA in Krabi was moderately severe, both in boys and girls. The high prevalence of IDA among anemic groups and its highest prevalence at two years old are identified. IDA prevention programs should be launched and target for children before one year old and continue until they reach two years old. Proper therapeutic program should be considered with children within five years old who are anemic. The remaining research agendas to assess and quantify other causes of anemia are required.*

Keywords : *Anemia, Deficiency anemia, Thailand, Children.*

Reprint request : Suwantaroj S. Department of Social and Preventive Medicine, Krabi Provincial Hospital, Krabi Province.

Received for publication. June 6, 2006.

ศิริรัตน์ สุวันทโรจน์, เย็นตา เบ็ดเสร็จ, สุพัชรี พรหมแสง. โครงการสำรวจปัญหาโลหิตจางของเด็กอายุ 1–4 ปี ในจังหวัดกระบี่. จุฬาลงกรณ์เวชสาร 2549 พ.ย; 50(11): 789 – 97

บทนำ : *โลหิตจางจากการขาดธาตุเหล็กทำให้การเรียนรู้และภูมิต้านทานของเด็กมีความบกพร่อง สำหรับเด็กวัย 5 ปีแรก ตั้งแต่ พ.ศ. 2534 เป็นต้นมายังไม่มีข้อมูลใหม่ของโลหิตจางจากการขาดธาตุเหล็กในเด็กวัย 5 ปีแรกของประเทศไทย*

วัตถุประสงค์ : *เพื่อศึกษาความชุกของโลหิตจางและโลหิตจางจากการขาดธาตุเหล็กในเด็กวัย 5 ปีแรกและสำรวจว่าโลหิตจางจากการขาดธาตุเหล็กเป็นปัญหาสุขภาพที่มีความสำคัญในเด็กภาคใต้วัย 5 ปีแรกหรือไม่*

สถานที่ทำการศึกษา : *พื้นที่นอกเขตเทศบาลของ 8 อำเภอในจังหวัดกระบี่*

รูปแบบการวิจัย : *ศึกษาไปข้างหน้าแบบตัดขวาง*

กลุ่มตัวอย่างที่ศึกษา : *เด็ก 1-4 ปีที่ไม่มีภาวะขาดสารอาหารระดับ 2 หรือ 3 ไม่มีประวัติคลอดก่อนกำหนดไม่เป็นโรคเรื้อรัง, มาลาเรีย หรือมีปัญหาโรคทางโลหิตวิทยา ซึ่งคัดเลือกโดยการสุ่มตัวอย่างแบบแบ่งกลุ่ม ระหว่าง เดือนกรกฎาคม 2544 และ กุมภาพันธ์ 2545*

วิธีการศึกษา : *เก็บตัวอย่างเลือดจากเส้นเลือดดำของเด็กชาย 166 คนและเด็กหญิง 134 คน ตรวจฮีโมโกลบินและเฟอร์ริตินในเลือด วิเคราะห์ระดับปัญหาเปรียบเทียบอายุและเพศ*

ผลการศึกษา : *เด็ก 1-4 ปี ที่อยู่นอกเขตเทศบาล มีปัญหาโลหิตจางร้อยละ 28 เป็นเด็กชายร้อยละ 63.9 และเด็กหญิงร้อยละ 36.1 เด็กชายมีความชุกของโลหิตจางสูงกว่าเด็กหญิง โดยไม่มีนัยสำคัญทางสถิติ [Odd Ratio = 0.51(0.24-1.05)] เด็กที่มีโลหิตจางเป็นเด็กที่มีโลหิตจางจากการขาดธาตุเหล็กร้อยละ 53.6 เด็กที่มีโลหิตจางจากการขาดธาตุเหล็กรุนแรงมากมีจำนวนร้อยละ 2.4 ทั้งเด็กชายและเด็กหญิงมีความชุกของโลหิตจางจากการขาดธาตุเหล็กสูงสุดที่อายุ 2 ขวบ และพบลดลงเมื่อเด็กมีอายุเพิ่มขึ้นโดยมีนัยสำคัญทางสถิติ (p-value = 0.006)*

วิจารณ์และสรุป : *ปัญหาโลหิตจางที่พบในเด็กของจังหวัดกระบี่มีความรุนแรงในระดับปานกลาง สัดส่วนของปัญหาโลหิตจางจากการขาดธาตุเหล็กพบสูงเกินกึ่งหนึ่งของโลหิตจางทั้งหมด เด็กชายและเด็กหญิงในจังหวัดกระบี่มีปัญหาโลหิตจางจากการขาดธาตุเหล็กสูงที่สุดที่อายุ 2 ปี บ่งว่าโลหิตจางจากการขาดธาตุเหล็กเป็นปัญหาสุขภาพที่สำคัญของเด็กวัย 5 ปีแรกของจังหวัดกระบี่ ซึ่งควรให้ความสำคัญในการป้องกัน โดยให้การป้องกันก่อนเด็กมีอายุครบ 1 ปีต่อเนื่องไปจนมีอายุ 2 ปี ให้การรักษาอย่างเหมาะสมแก่เด็กอายุ 5 ปีแรกที่มีโลหิตจาง และมีการศึกษาวิจัยต่อเกี่ยวกับสาเหตุอื่นของปัญหาโลหิตจางในเด็ก 5 ปีแรกในจังหวัดกระบี่*

คำสำคัญ : *โลหิตจาง, ประเทศไทย, เด็กวัย 5 ปีแรก*

Iron deficiency anemia (IDA) is the most common type of anemia worldwide.[1] It is recognized as a major public health problem throughout the world because of its adverse effects, especially among young children. Its adverse effects are: impaired cognitive function, increased morbidity and child growth defects, reduced physical work capacity and productivity and lower cellular immunity.[2-5] This impairment is irreversible in children even though their iron status has become normal. The epidemiological data of IDA among young children in many reports showed high prevalence and mostly above 10 %, e.g., 13.7 % (Jerusalem) [6], 23 % (England) [9], and 69 % (Egypt).[10] The prevalence varies from country to country due to nutrition, child rearing pattern and genetic backgrounds. IDA in southern Thailand is a complex situation especially among young children because of a mixture of hemoglobinopathy genes and ovalocytosis.[11] Since1991, no observed data of IDA in southern Thailand has been reported. This assessment gives new data of IDA in children living in southern Thailand.

This paper reports the prevalence of anemia and IDA in pre-school children at the age of 1 to 4 years old in Krabi Province, southern Thailand. The assessment was done between July 2001and February 2002.

Materials and Methods

Study type and site

This study was done in the rural areas of all 8 districts of Krabi Province, southern Thailand.

Target Population

The target population was pre-school children aged 1 to 4 years old who were healthy. Children who were malnutrition (second to third degree) and those who had chronic illness, malaria and blood dyscrasias as well as those with history of prematurity were excluded. Children with history of illness within 2 weeks before the study started, or had blood transfusion or iron supplement were also excluded.

Sampling

A cluster sampling with probability proportional to size technique was used to select target population. Thirty enrolled village clusters were randomly selected then ten children were chosen from each cluster. Children with exclusion criteria were selected out during random sampling were done and new children with inclusion criteria were randomly chosen until the participants in each cluster reached ten. This sample size ensured with the probability of 95 % that the estimated prevalence would be within 5 % of the true prevalence, irrespective of the prevalence value and assuming a design effect of 1.2.

Data Collection

Parents or caregivers were face-to-face informed about the study protocol of blood samples drawn from their children. Three hundred rural children were recruited in the study. All children had their parents' consent forms signed before they participated in the study. Field activities were performed from July 2001 to February 2002. Venous blood samples were drawn from peripheral veins of each subject, and Hb and serum ferritin were measyred. The children were interviewed for their history; physical examinations were done to confirm that they had no conditions of exclusion criteria.

Diagnostic criteria

Levels of anemia were classified as : severe, moderate, and mild, based on their hemoglobin (Hb) concentration in the blood samples and according to criteria developed by the World Health Organization (WHO). Hb less than 11.0 gm/dL was the cut-off value for anemia. Serum ferritin (SF) less than 12 gm/dL was the cut-off value for ID. The condition occurred with anemia was considered IDA. Hb less than 7.0 gm/dL were considered severe anemia.

Data Analysis

Hb concentrations and serum ferritin levels of three hundred venous blood samples were measured. Automated cell analyzer at Krabi Hospital laboratory determined Hb concentrations. SF levels were measured at Rhamathibodi laboratory by ferritin test kits method. The database was computed with Epi-info 6.02. Relation of age and sex to anemia were analyzed.

Results

The total number of enrolled children was 300 (166 boys and 134 girls). All of them had complete blood sampling and interviewed. Their mean age was 2.1 $\pm$ 0.99 years old. Fifty-six percent of the children were Buddhists and 43.7 % Muslims (Table 1).

Table 2 shows the anemic characteristics of the studied subjects. Using the Hb concentrations below 11 gm/dL as cut-off value for anemia, the anemic prevalence in this population was high (28.0 %). Boys had higher prevalence rate of anemia than girls with no statistical significance [Odd ratio = 0.64 (0.37- 1.12)]. The mean Hb of the anemic children was 9.7 $\pm$ 1.1 gm/dL. Using SF below 12 microgram/L as cut-off value of ID, IDA was 53.6 % of the anemic children and severe IDA was 2.4 %. Boys had higher IDA rate than girls with no statistical significance [Odd ratio = 0.51(0.24-1.05)]. Both sexes had decreased IDA rate when the children were grown up with statistical significance (p=0.006).

Table 1. Socio-demographic data of the study.

Characteristics		No.	%
Residence :	Muang	60	20.0
	Lanta	20	6.7
	Klongtom	60	20.0
	Ao-luk	40	13.3
	Kao-panom	40	13.3
	Plaipraya	30	10.0
	Lamtab	10	3.3
	Nua-klong	40	13.3
Sex :	Boy	166	55.3
	Girl	134	44.7
Mean age $\pm$ SD (years)		2.1 $\pm$ 0.99	
Religion :	Buddhists	168	56.0
	Muslim	131	43.7
	Others	1	0.3

Table 2. Anemia pictures of the studied samples.

Anemia data	%	Cases / Total	p-value / Odd ratio
Hb level < 11 gm/dL(Anemia) :			
Total	28	84/300	
Sex			0.64(0.37-1.12)
Boys	63.1	53/84	
Girls	36.9	31/84	
Hb level < 7 gm/dL (severe anemia) :			
Total	0.7	2/300	-
serum ferritin < 12 microgram/L			
with anemia (IDA) :			
Total	53.6	45/84	
Sex :			0.51(0.24-1.05)
Boys	68.9	31/45	
Girls	31.1	14/45	
Age :			0.006
1 year	33.3	15/45	
2 years	35.6	16/45	
3 years	20.0	9/45	
4 years	11.1	5/45	
serum ferritin < 12 microgram/L with			
severe anemia (severe IDA) :			
Total	2.4	2/84	
Mean Hb	9.7 $\pm$ 1.1 gm/dL		

Discussion

Defining anemia with WHO criteria of the anemia and anemic severity grading scale [14], we found that 28 % of total children were anemic. IDA was account to 53.6 % of the total anemic children. Severe IDA was 2.4 %. It gave a conclusion that IDA in pre-school children in Krabi was moderately severe. The mean Hb level of the anemic children was 9.7 $\pm$ 1.1 gm/dL. The prevalence of anemia found in our study was higher than reports from New Zealand (23.5 %), [7] England (23 %), [9] and southern Thailand in 1991 (21.7 %) [12] but lower than that from Europe (37 %), [8] Egypt (69 %) [10] and a previous report of southern Thai children in 1986 (44.9 %).[13] Boys (63.1 %) had higher rate of anemia and IDA than girls (36.9 %) with no statistical significance [Odd ratio = 0.64 (0.37-1.12) and 0.51 (0.24-1.05), respectively]. Our result is different from previous reports in Thailand, which the prevalence in boys was higher than girls with statistical significance.[9, 13] The prevalence of IDA in both sexes was highest at two years old. The result was different from a previous report from Thailand in

1986 that the prevalence was among first year group [13] and was the same as in the one from Egypt.[10] The lowest prevalence was found in four years old. The prevalence of IDA in both sexes decreased when the children grew older with statistical significance (p=0006). Many reports from Europe showed that hemoglobinopathies enroll on anemic prevalence and IDA diagnosis. Evidences of ovalocytosis and mixtures of hemoglobinopathies genes in southern Thailand are common. These genetic backgrounds may be other causes of anemia that was found 46.4 % in this study. These causes need to be further explored to solve the problems of anemia among pre-school children in Krabi Province.

Conclusion

IDA was an important public health problem in Krabi rural pre-school children due to high prevalence was found among the anemic children and both sexes had highest prevalence at two years old. The anemic status was moderately severe. More exploration of risk factors should be done to solve the problems of IDA and other anemia problems. IDA prevention programs should be launched for the children. Prevention programs should target children before one year old and continue until they reach two years old. Proper therapeutic program should be considered with children within five years old who are anemic. The remaining research agendas to assess and quantify other causes of anemia are required.

Acknowledgements

The work was funded by HSRI, Krabi Hospital and Krabi Provincial Health Office. We would like to express our deepest gratitude to the staff of the Krabi Health Center personals at thirty rural areas in Krabi Province for their assistance. Further, we wish to forward our thanks to Dr. Nipon Pohpatanachai, the Director of Krabi Provincial Hospital and Dr. Tawekiat Bunyapaisalcharoen, the Director of Krabi Provincial Health Office for allowing us to run the study. We express our deepest thank to Dr. Virasak Chongsuvivatvong of Prince Songklanakarin University for his kind and continuous advices and encouragement until the study was finished. We wish to thank all staff members of the Epidemiologic Department of Prince Songklanakarin for their suggestions and helps on statistical analysis. Lastly, we would like to thank Dr. Viroj Tangcharoenstein and Dr. Kriangsak Jirapet for their kind advices and encouragement in English writing.

References

1. Stolzfus RJ, Dreyfuss ML. Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia. Washington, D.C.: ILSI Press, 1998
2. Nokes C, van den Bosch C, Bundy DAP. The Effects of Iron Deficiency and Anemia on Mental and Motor Performance, Educational Achievement and Behavior in Children. An Annotated Bibliography. Washington, D.C.: International Nutritional Anemia Consultative Group, 1998
3. Scholz BD, Gross R, Schultink W, Sastroamidjojo S. Anaemia is associated with reduced productivity of women workers even in less-physically-strenuous tasks. Br J Nutr 1997 Jan;77(1):47-57

4. Scholl TO, Hediger ML. Anemia and iron-deficiency anemia: compilation of data on pregnancy outcome. Am J Clin Nutr 1994 Feb;59 (2 Suppl):492S-500S
5. Beard JL. Iron deficiency: assessment during pregnancy and its importance in pregnant adolescents. Am J Clin Nutr 1994 Feb;59 (2 Suppl):502S-8S
6. Gofin R, Palti H, Adler B. Time trends of haemoglobin levels and anaemia prevalence in infancy in a total community. Public Health 1992 Jan;106(1):11-8
7. Crampton P, Farrell A, Tuohy P. Iron deficiency anaemia in infants. N Z Med J 1994 Feb; 107(972):60-1
8. Klem K. [Anemia in 1-year old infants—still a problem?]. Tidsskr Nor Laegeforen 1993 Jan; 113(3):327-8
9. Emond AM, Hawkins N, Pennock C, Golding J. Haemoglobin and ferritin concentrations in infants at 8 months of age. Arch Dis Child 1996 Jan;74(1):36-9
10. Sayed NE, Gad A, Nofal L, Netti G. Assessment of the prevalence and potential determinants of nutritional anemia in Upper Egypt. Food Nutr Bull 1999 Dec;20(4):417-21
11. Institute of Medicine. Iron nutrition during pregnancy. In: Nutrition During Pregnancy. Washington, D.C.: National Academy Press, 1990: 272-98
12. กรมอนามัย กองโภชนาการ.การสำรวจภาวะโลหิตจางและการขาดธาตุเหล็กในเด็ก 0-72 เดือน. นนทบุรี: กองโภชนาการ กรมอนามัย, 2534
13. กรมอนามัย กองโภชนาการ. การสำรวจภาวะโภชนาการระดับชาติครั้งที่ 3. นนทบุรี: กองโภชนาการ กรมอนามัย, 2529
14. WHO (2001). Iron Deficiency Anemia Assessment, Prevention, and Control: A Guide for programme managers. WHO/NHD/01.3.WHO Document, 2001