# Original article

# Nutritional status and hemoglobin level in elementary schoolchildren

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**ABSTRACT**  A study was conducted in 1999 to determine nutritional status and hemoglobin level and their correlation among students in two primary schools in at Binjai, North Sumatra, Indonesia. Nutritional status was measured based on weight for age (W/A), height for age (H/A) and weight for height (W/H) according to NCHS criteria. Anemia was defined as hemoglobin level of less than 12 g/dl as measured with cyanmethemoglobin. Ninety-six children were available for analysis. We found that based on W/A, H/A and W/H, there were 23 (23%), 16 (17%), 11 (12%) of children suffered from protein energy malnutrition (PEM), respectively. There were 48 (50%) children with anemia. Children with PEM and anemia were 13 (59%), 9 (56%) and 9 (82%) respectively. In conclusion we found that not all of new students in those primary schools were healthy. There was correlation between anemia and PEM based on W/H measurement, but not when compared to W/A and H/A criteria. **[Paediatr Indones 2001; 41:296-298]**

*Keywords: malnutrition, anthropometric measurements primary schools, hemoglobin levels*

HEALTH STATUS IS A BASIC INDICATOR OF HUMAN RESOURCE quality, while nutritional status become a prime indicator in health status.[1] Indonesia has four major nutritional problems, i.e., iodine deficiency, iron deficiency, vitamin A deficiency, and PEM (protein energy malnutrition).[2] One of our national development goal is to increase human resource quality, especially to high risk group, such as school age children that suffer from PEM and nutritional anemia.[3,4] Caused by low intake of food, that contain macro and micronutrients.[5-7] It may be regarded as a generalized disorder affecting structure and function of antibody. Changes in the hematologic system are common, and anemia has always been a constant feature.[8]

The various factors that influence anemia in PEM are (a) metabolic changes in the red cell, (b) protein deficiency and adaptation anemia, (c) iron deficiency. (d) deficiency of vitamins (folic acid, B12, etc.) or trace elements (copper, zinc), (e) erythropoietin deficiency, (f) infection and (g) chronic diseases.[8-10] The WHO criteria for anemia in children age 6-14 years is if Hb level < 12 g/dl,[10-12] Soemantri in his study found average Hb level were 10-12 g/dl in the same age group.[6] W/H parameter can determine the recent nutritional status, not depend on age, and explain the last nutritional state.[5] We conducted this study to determine the association of nutritional status and hemoglobin level in school age children.

## Methods

A cross sectional study was done in March 1999. Subjects of the study were new students from the 2 public elementary schools Kodya Binjai, North Sumatra. Data collection included sex, age, body weight, and body height. Student who did not have complete data, or who suffered from acute and chronic infections or malignancy

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were excluded. The venous blood specimen were taken ± 0.5 ml and collected in a bottle which is filled with EDTA. Hemoglobin level was measured by spectrophotometer at H. Adam Malik Hospital, Medan.

Hemoglobin value was expressed in g/dl. The nutritional status was evaluated according to Recommendation of Semiloka Antropometric 1991, with the parameter of W/A, H/A and W/H.[13] PEM was defined if the nutritional status were malnutrition in moderate or severe stages.[13] Anemia was defined if the hemoglobin was less then 12 g/dl. Data was processed with computer (Microstat). The association between qualitative variables were tested by chi squared test, with the significance level of p< 0.05.

## Results

The total number of new students who entered the two primary schools were 101. Ninety six of them were attended, 3 of them were sick and 2 had incomplete data. There were 57 (59%) boys and 39 (41%) girls, the youngest was 5 years 5 month, the oldest was 9 years 1 month. **Table 1** shows that students who suffered from anemia were 48 (50%). The percentage of students with PEM according to the W/A, H/A and W/H criteria were 22/96 (23%), 16/96 (17%), 11/06 (12%), respectively (**Table 2**).

**Table 3** shows that according to the W/A criteria, 22 students suffered from PEM, 13 students (59%) of them also suffered from anemia. According to H/A criteria, from 16 students with PEM, 9 of them also suffered from anemia. However, there was no association between this two types of anthropometric measurements with anemia.

While according to W/H criteria, out o f 11 students who suffered from PEM, 9 (82%) also suffered from anemia, and there was a reasonable connection with hemoglobin level (p < 0,05).

**TABLE 1. CHARACTERISTICS OF SAMPLE (N=96)**

| Characteristic | n (%) |
|---|---|
| Sex | |
| Male | 57 (59) |
| Female | 38 (41) |
| Age - mean: 7 years 5 months | |
| 5-6 years | 43 (45) |
| 7-8 years | 51 (53) |
| > 9 years | 2 (2) |
| Hemoglobin level (g/dL) – mean: 11.8 | |
| < 12 | 48 (50) |
| ≤ 12 | 48 (50) |

**TABLE 2. DISTRIBUTION OF NUTRITIONAL STATUS**

| Anthropometry Index | Non PEM n (%) | PEM n (%) |
|---|---|---|
| W/A | 74 (77) | 22 (23) |
| H/A | 80 (83) | 16 (17) |
| W/H | 85 (88) | 11 (12) |

## Discussion

The students in both primary school were mostly at the age of 7-8 years, 51 (53%) were boys, nearly the same with girls (41%). The children who suffered PEM according to W/A, H/A, and W/H measurements were 22 (23%), 16 (17%), and 11 (12%), respectively. This showed that prevalence of PEM was different in those 3 types of examination. The result of National Social Economy Survey (SUSENAS) in North Sumatra (1989) showed that the prevalence of PEM (W/A) was 14%, while the SUSENAS (1992) found low nutrient in 12% (W/A), and 6% (H/A).[14] Meanwhile 50% of students suffered from anemia and the lowest hemoglobin was 9,5 g/dl.

Husaini (1980-1989) reported that anemia in children at early primary school were 25-45%.[14] From our study the prevalence of PEM and anemia were high, this may be due to the economic crisis or to the difference of examination's techniques.

**TABLE 3. RELATION BETWEEN NUTRITIONAL STATUS AND HB LEVEL BASED ON W/A, H/A, W/H**

| Anthropometry Index | Nutritional Status | Hb level (g/dL) | | Total (%) | $x^2$ | d f | p |
|---|---|---|---|---|---|---|---|
| | | < 12 n (%) | > 12 n (%) | | | | |
| W/A | Non PEM | 35 (47) | 39 (53) | 74 (100) | 0.9435 | 1.48 | > 0.05 |
| | PEM | 13 (59) | 9 (41) | 22 (100) | | | |
| H/A | Non PEM | 39 (49) | 41 (51) | 80 (100) | 0.3000 | 1.48 | > 0.05 |
| | PEM | 9 (56) | 7(44) | 16 (100) | | | |
| W/H | Non PEM | 39 (46) | 46 (54) | 85 (100) | 5.0310 | 1.48 | > 0.05 |
| | PEM | 9 (82) | 2 (18) | 11 (100) | | | |

Table 3 shows that students suffered from PEM and anemia, according to W/A, H/A and W/H criteria were 13 (59%), 9 (56%) and 9 (82%), statistically there was significant correlation between nutritional status measured by W/H criteria and hemoglobin level (p < 0,05). It was assumed that only in chronic nutritional status, nutritional anemia could be seen.

Bengoa[15] stated that a child who suffered from PEM could also suffered from anemia, and non PEM could also suffer from anemia too. This usually happens in iron deficiency anemia, because the symptom of anemia occur gradually in the long period of time.[8,16] It is the same with protein deficiency which reduces total cell of precursor sensitive erythropoietin in chronic PEM.[17,18]

This study concluded that not all of primary school's students were in good health condition. There was significant correlation between anemia and PEM children measured by weight/height standard which showed chronic nutritional state.

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