PREVALENCE OF ANEMIA AMONG ELEMENTARY AND HIGH SCHOOL STUDENTS LIVING IN GORGORA

Melake Berhan Damena*,BSc.MPH, Habteab Besuamlac**, Asferd Mengesha**,Dawit Mihrete**, Asmelash Fisseha**, Yeshitila Hailu**

INTRODUCTION

Anemia may be defined as a state in which the level of hemoglobin in the blood is below that which is expected, taking into account both age and sex (1). Patients with anemia have significant reduction of red cell mass and a corresponding decrease in the oxygen carrying capacity of the blood. Normally blood volume is maintained at a nearly constant level, therefore anemia entails a decrease in the concentration of red cells or hemoglobin in peripheral blood. The presence of symptoms related to anemia depend partly on this severity but also on how rapidly the anemia has appeared.

The purposes of this investigation were to determine the point prevalence rate of anemia among elementary and high school students and to identify important determinants of its occurrence among students residing in Gorgora (south Gonder). This study is not aimed at identifying anemia of specific causes, but will use technologies appropriate to the field situation and search among risk factors known to be prevalent in the region.

METHODS

Study Design: A cross-sectional descriptive survey for the presence of anemia was conducted in the elementary and high schools located in Gorgora during the month of November, 1990. Gorgora is a small town in North Gondar Administrative Region, found 60 km southwest of Gonder-town in, the temperate, lowland region of the Lake Tana basin. Subjects found to be anemic were matched with normal subjects and a case-control analysis applied.

Population: All students attending any of Gregoras' elementary or secondary schools were eligible to enter this study. Subjects were selected on the basis of a multistage random sampling procedure. First, all students were classified by grade and three grades from each school were randomly selected. Next, from each school three student classes (sections) within each grade were randomly selected. From this procedure 300 students were selected of which 295 were enroled. This accounted for 24.0% of the eligible student population. Ages ranged from 7 to 31 years.

Measurement: Packed cell volume was determined by filling heparinized micro hematocrit tubes with blood from free flow finger pricks. The tubes were then sealed with plasticine and centerfuged in a micro-hematocrit centerfuge within two hours at 12,000 revolutions per minute. These were read immediately on a micro-hematocrit reading scale. Anemia is defined as the minimum point set forth by Harrision's principles of Internal Medicine (1). The PVC (%) cutoff points were as follows; $\leq$10 years, 31.0; 11 to 15 years, 34.0; $\geq$16 years, males 42.0 and females 37.0. A thin blood smear was taken from those found to be anemic and blood morphology examined by light microscope.

*Dept. of Community Health, Gondar College of Medical Sciences
**Senior Medical Student, Gondar College of Medical Sciences

A student found to be anemic (cases) was age and sex matched to a student with a normal PVC (control). An abdominal physical examination for organomegaly and a microscopic stool examination (formalin-ether method) was completed on all cases and controls.

An experienced laboratory technician from the Gondar College of Medical Sciences (GCMS) Hospital supervised all laboratory procedures and pretesting was done to minimize inter-observer bias.
Analysis: Descriptive statistics were used to calculate rates. T-test and chi-square statistics and odds ratio calculations were used in the bivariate analyses. A p-value ≤ 0.05 was taken as statistically significant.

RESULTS
There were 156 males (52.9%) and 139 females (47.1%) enroled in the study. The age distribution was as follows; 79 (26.8%) 7-10 years, 157 (53.2%) 11-15 years, and 59 (20.0%) 16 years and above.

The mean hematocrit values by age and sex are summarized in table 1. It can be seen the mean hematocrit value rose with age and was similar for males and females up to age 15, with the mean in women over 15 being approximately 4% less.

Table 1. Distribution of packed cell volume among the students by age and sex.

Age Group	Males			Females		
(years)	No.	PCV X ± S.D	Reference range	No.	PCV X ± S.D	Reference range
7-10	44	40.3±3.1	34.1-46.5	35	40.5±2.7	35.1-45.9
11-15	70	42.1±3.8	34.5-49.7	87	42.1±4.3	33.5-50.7
≥ 16	42	45.2±3.3	38.6-51.8	17	41.3±4.7	31.9-50.7

The number and percentage of anemic persons found are presented in Table 2. It is noted that no subjects 10 years of age and under were identified as anemic. The overall prevalence rate of anemia was 11.9% with the 95% confidence interval being 10.6% to 13.2%. From microscopic examination, 17 (48.6%) were microcytic-hypochromic and the remainder were normocytic-normochromic. Stool examination
and odds of exposure to specific parasites between cases and controls are summarized in table 3. The commonest parasites identified were ascaris lumbricoides, schistosoma mansoni and trichuris trichuria.

Those with microcytic-hypochromic anemia were compared with those with normocytic-normochromic anemic for odds of exposure to schistosoma mansoni infection. Those with microcytic-hypochromic anemia were 3.71 times more likely to have a stool exam positive for schistosoma. On physical examination only one anemic individual was found to have splenomegaly.

DISCUSSION
The age-sex specific mean hematocrit values obtained from each of the three age groups evaluated are generally comparable to those previously reported for Ethiopians (3-8). In general for each age group considered the mean packed cell volume exceed those levels obtained in comparable age groups in other tropical countries (9).

There were no significant differences in the mean hematocrit values of male and females children. Among adults, however, the sex differences were significant, ($P<0.01$). Again this is consistent with other developing and developed populations and may be attributed to the monthly menstrual blood loss.

The prevalence rate of anemia in our study was found to be lower than that reported by previous research carried out in the region (8). This could be due to the size and age range of the study population and differences in the methods applied, especially in the criterion used to define anemia. We chose PCV % because

Table 2. Prevalence of anemia among the students by age and sex.

Age Group	Males			Females				
	Anemic			Anemic				
(years)	Examined	No	%	Examined	No.	%	Total exmined	Percent anemic
7-10	44	0	0	35	0	0	79	0
11-15	70	14	20.0	87	15	15	157	18.5
$\geq$ 16	42	4	9.5	17	2	2	59	10.2
Total	156	18	11.5	139	17	17	295	11.9

of its ease of determination and wide use in clinics throughout Ethiopia. There were no significant sex or age differences in the prevalence rate of anemia ($P>0.05$).

In this study a high intestinal parasitic infestation rate was observed in both anemic cases and normal controls. There was a statistically significant difference between the anemics vs. controls in odds of exposure to schistosoma mansoni infestation. As well, there was a significantly decreased odds of exposure to a negative stool examination for parasites among those with anemia. Given the cross-sectional design of this study, it is not possible to determine the directionality of cause and effect in the parasite anemia relation.

Table 3. Odds of exposure to specific parasites in those with and without anemia.

Parasite	Anemia n(%)	Normal n(%)	Odds ratio	(95%CI)
Ascaris Lumbricoides	22(62.9)	20(57.1)	1.38	(0.53, 3.59)
Schistosoma mansoni*	15(42.9)	3(8.6)	8.00	(2.05, 31.2)
Trichuris trichuria	7(20.0)	3(8.6)	2.67	(0.63, 11.3)
Negative*	4(11.4)	12(34.3)	.247	(0.07, 0.87)

P<0.05

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