QUETELET INDEX, HEMOGLOBIN AND PARASITIC INFECTION OF RURALWOMEN IN NORTHEAST THAILAND

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Abstract. The Quetelet index, hemoglobin and parasitic infection rates of adolescent and young women from 21 villages in Northeast Thailand were assessed. Data were collected in the hot, rainy and cold seasons of the year. The proportion of undernourished females varied between 10 and 15% when a cut-off point of 18.7 of the Quetelet index was chosen. 23 to 33% of the women had hemoglobin levels below 12 g%. Parasitic infection rates with various intestinal helminths were high but not related to the nutritional status or anemia.

INTRODUCTION

Adolescent and young females are especially prone to deliver babies with birth weights of 2,500g and below (Schelp *et al,* 1985). This might be due to a poor nutritional and health status before the onset of pregnancy. The Quetelet index, as proxy indicators of the nutritional status and hemoglobin, as well as intestinal parasite infections, as proxy indicator of the health status, of mainly adolescent and young non-pregnant women in one of the poorest part of Thailand were measured to obtain baseline data for the planning of an intervention project aimed at improving and promoting the health status of rural women before they become pregnant.

An investigation into the nutritional status of preschool children in the study area showed marked seasonal variations of wasting and stunting (Schelp *et al,* 1990). To detect or exclude seasonal variations also for the group of women, investigations were done in the hot, rainy and so-called cold seasons.

MATERIALS AND METHODS

Healthy adolescent and young women from 21 villages in the Maha Sarakham Province of Northeast Thailand were selected for the study. The province and the villages in this region were selected because they are typical for the area. Actual field work started in March 1986 and ended in April 1987. March and the beginning of April fall under the so-called "dry, hot season". Additional data were collected in September 1986 during the rainy season, and in January 1987 during the dry, cold season. For the village population, the busiest time of the year is during the rainy season when rice is being planted and around December when the rice is being harvested.

Single women were selected for this investigation. This group of females was considered most at risk to deliver children with low birth weights after marriage. Another group of women supposed to be at high risk to deliver babies with insufficient birth weights are those women already having one child under six months old. These women are in danger of becoming pregnant again soon after the birth of their first child, before they have time to recover from their foregoing pregnancy. At the start of the project, over 50% of all the women studied were 20 years of age or younger and 27% were 26 years of age or older. Census data were collected before the start of the project. The women surveyed in this study made up approximately 50% of all single women in the project area. All the women in the project area, who fulfilled the criteria for inclusion in the study, were invited to participate. From those women who were invited, some did not participate because they were either absent from the villages at the measuring times or, they did not wish to

join the study. According to the authors' observations, it is most likely that the women investigated represent the total target group.

A carefully calibrated beam balance (Detecto) was used to measure the body weight of the women dressed in light clothing. The height of the women was also measured. The nutritional indicator "Quetelet index" (or body mass index) was calculated from weight (kg) : height (m).

Blood was obtained by pricking the finger and drawn into Clay and Adam heparinized capillary tubes. The tubes were then kept in a cooling box for about 2 to 3 hours for further determinations. The cyanmethemoglobin method was used to measure hemoglobin concentrations in the whole blood.

To determine the presence of intestinal parasites, stool samples were examined using the merthiolate-iodine formalin concentration (MIFC) and Stoll's techniques (Stoll, 1923; Sapero *et al,* 1953; Blagg *et al,* 1955).

The statistical evaluation of the data was mainly done by using the statistical package MINITAB (Ryan *et al,* 1985). In cases where the medians were given, the 95% confidence interval was also calculated using the nonlinear interpolation method of Hettmansperger *et al* (1986). In Table 2 the McNemar-Test (chi-square test for significance of change) was used (Breslow and Day, 1980). Pairwise comparison of measuring points was considered. The Bonferroni (O) adjustment with the number of comparisons was also done (Miller, 1981).

RESULTS

The number of individuals together with the median age and confidence intervals investigated at different measuring points are given in Table 1. Whenever possible, the same individuals were investigated at each measuring point. The variation in the number of individuals at different measuring points is explained by the fact that a number of young women tended to move out of the villages to look for jobs or to settle down elsewhere.

Blood for hemoglobin determination was taken from a subsample of the women. The subsample comprised of non-pregnant adolescent and only young single women. The number of individuals and median age as well as confidence intervals are also given in Table 1.

Table 1

Median age (with 95% confidence interval*) of rural women under investigation at different measuring points.

Time of investigation parameters	Anthropometry and parasite investigations			Women with additional determination of hemoglobin		
	n	Median age	Confidence interval	n	Median age	Confidence interval
1 March 1986	683	20.0	19.0-20.0	266	19.0	19.0-20.0
2 September 1986	605	20.0	20.0-21.0	318	19.0	18.0-20.0
3 January 1987	549	22.0	21.0-22.0	269	20.0	20.0-21.0
4 April 1987	542	21.0	21.0-22.0	304	20.0	19.0-20.0

* Nonlinear interpolation

The seasonal variations of the proportion of undernourished and anemic women are given in Table 2. When a Quetelet index of 18.7 was chosen as the cut-off point, as suggested by WHO (1985), 15% of the women were found to be undernourished in the cold season. This differed significantly with the other three measuring points with a proportion of undernourished individuals at 10.8% in the hot, 12.2% in the rainy season, and 11.6% at the end of the study. When 12 g% hemoglobin was selected as the cut-off point, the highest proportion of anemic women (33.2%) was found at the beginning and 23.4% at the end of the study. In the rainy and cold seasons, the proportions were 13.2% and 14.5%, respectively, which was significantly lower than in the hot season in 1986. A statistically significant difference was also found between the rainy season in 1986 and the hot season in 1987.

Over 50% of all the women investigated were infected with liver flukes (*Opisthorchis viverrini*) (Table 3). Between 26% and 36% of the female population suffered from hookworm infection. Other important intestinal helminths in this area are *Echinostoma* and minute intestinal flukes. Parasitic infection did not alter the nutritional status as measured by the Quetelet index. Hemoglobin values were also not lowered by hookworm infection. Data on these findings are not presented here.

Table 2

Seasonal variation of the proportion (%) of undernourished and anemic rural women and p-values* of differences between measuring points.

Measuring points+	Quetelet index (kg/m²) n	cut-off point 18.7 n	%	Hb (g%) n	cut-off point 12g n	%
1	683	74	10.8	265	88	33.2
2	605	74	12.2	317	42	13.2
3	549	84	15.3	269	39	14.5
4	542	63	11.6	304	71	23.4
stat diff	n pairs		p-values	n pairs		p-values
1-2	310		0.8231	153		0.0000++
1-3	330		0.0002++	141		0.0000++
1-4	351		0.8619	172		0.0000++
2-3	371		0.0311	188		0.1456
2-4	392		0.5485	232		0.0019++
3-4	401		0.0258	216		0.0108

* Two-tailed McNemar-test (chi-square test for significance of change) with "Yates-correction". Bonferroni (Ó) adjustment with the number (6) of comparisons (6) 0.0017 for $p < 0.01$ and 0.0083 for $p < 0.05$.

\+ see Table 2.

++ statistically significant difference.

Table 3

Parasite infection rates of rural women.

Parasites		Measuring points (No. of individuals investigated)			
		1 (683)	2 (605)	3 (549)	4 (542)
Opisthorchis viverrini	N	373	359	319	377
	%	54.5	54.4	58.2	69.6
Necator americanus	N	245	158	133	143
	%	35.8	26.2	24.2	26.4
Echinostoma sp	N	121	94	72	102
	%	17.7	15.6	13.1	18.8
Minute intestinal flukes	N	73	133	104	158
	%	10.7	22.0	20.0	29.2
Strongyloides stercoralis	N	31	38	32	17
	%	4.5	6.3	5.8	3.1
Giardia lamblia	N	16	15	13	13
	%	2.3	2.5	2.4	2.4
Taenia species	N	14	6	10	5
	%	2.1	1.0	1.8	0.9
Entamoeba coli	N	12	12	9	9
	%	1.8	2.0	1.6	1.7
Trichuris trichiura	N	0	1	0	1
	%	0.0	0.2	0.2	0.2
Not identified	N	8	1	1	0
	%	1.2	0.2	0.2	0.0

DISCUSSION

For the rural women studied in this investigation, the nutritional problem is not a dramatic one. Nevertheless, it is serious enough to be considered of public health importance. Attention should be paid in a situation where between 10% to 15% of mainly adolescent and young females are found to be markedly undernourished. The median values of the Quetelet index varied around 21, which is just over the recommended value of 20.8 (WHO, 1985).

The high proportion of undernourished women in the cold and dry season cannot be explained by insufficient food intake because there was no food shortage in the villages during the course of the study. The significantly higher proportion of undernourished women at the third measuring point is probably due to the women's heavy workload during harvest. The proportion of wasted preschool children is highest in the rainy season because of the high rate of respiratory tract infections amongst the children at the time (Schelp *et al*, 1990). Seasonal variations of the nutritional status are threrefore different in these two vulnerable groups in the community.

According to WHO standards, by selecting 12 g% as the cut-off point to detect anemia, the rate of anemic women was found to be rather high, especially in the hot season. This phenomenon cannot be explained by the data evaluated in this study. Further investigations are needed. Females with hemoglobin values below 10 g% were treated whenever possible by the investigators. Therefore, the results for the second to the fourth measuring points are biased to a certain extent.

Liver fluke infection is particularly high in Northeast Thailand. This is because the population has a

habit of eating raw fish harboring the parasite in its infective stage. Although it was not possible to detect a relationship between parasitic infection, liver fluke or any other worms and the nutritional status, a healthy female population should be free from intestinal parasites, especially considering the chronicity of infection and its relation to cholangiocarcinoma, which is highly prevalent in the area.

The results of this investigation indicate that adolescent and young women should be considered as a vulnerable group in a community in need of special attention so that during pregnancy, the health of these women and their offsprings will not be endangered in any way.

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