

Malariometric Survey Among Elementary School Children Aged 6-9 Years in Sangihe Besar

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Abstract One of the most common classification of malaria transmission in particular area is based on the levels of endemicity. It could be quantified by determination of children with enlarged spleens and parasitemia. A "Cross sectional study" was carried out with the purpose of finding out the proportion of elementary school children aged 6-9 years with enlarged spleen and parasitemia and the influence of frequency of illnesses related to malaria. The samples were selected by basing on "standard cluster sampling technique". Out of 500 elementary school children, the spleen rate, parasite rate and average of enlarged spleens (AES) were 12.2 %, 8.6 % and 1.49, respectively. The highest spleen rate and parasite rate were found in Manalu subdistrict. There were significantly correlation between enlarged spleens and parasitemia ($p < 0.05$); parasitaemia and frequency of illnesses ($p < 0.05$); frequency of illnesses and enlarged spleens ($p < 0.005$). [Paediatr Indones 1996;36:115-120]

Introduction

During the major effort to eradicate malaria from many parts of the world that began in the late 1950s, it was important to establish mechanisms to detect all malaria infections. Malaria is considered as endemic, when there is a "constant meas-

urable incidence both of cases and of natural transmission over a succession of years". An attempt to determinate the endemicity of malaria in an area is required in relating to the malaria control program.

Several malariologists have classified the endemicity of malaria on the basis of spleen rates and parasite rates, which has been adapted by WHO since 1955, i.e., Kampala classification; Matselaar and van Thiel classification.

The utilization of the spleen examination as a tool of malaria evaluation is

considered as one of the most effective and efficient method existing which yield immediate and practical results in several antimalaria program.

Determination of malaria endemicity is still questioned in District of Sangihe Talaud, while a representative data yielded spleen rate particular among elementary school children have not yet been done.

This study was conducted with the purposes of investigating the spleen rate; parasite rate and relating factor i.e., frequency of illnesses among elementary school children aged 6-9 years in District of Sangihe Talaud, Province of North Sulawesi.

Methods

A cross sectional study was carried out in Sangihe Besar, which is one of the islands in District of Sangihe Talaud. The study was performed during April - May 1994, which according to surveillance notifications is a peak incidence of malaria. A standard cluster sampling technique was used to select the study population, the sample size was calculated from :

- n = sample size
- p = Proportion of target population with enlarged spleen
- d = Accuracy rate (14%)

We chose 500 pupils = + 5 % of total population (more than calculated sample size) because we would like to increase the external validity. Eligibility of study sample are those of healthy pupils aged

6-9 years. A questionnaire was designed to obtain information on age; gender and frequency of illnesses within one year.

Physical examination includes : - selection of healthy pupils (free from fever)

- exclude other diseases which would be caused
- spleen examination; and
- investigations of signs of malnutrition

The ages was obtained from the school records based on date of birth.

Frequency of illnesses were also obtained from the list of pupil's attendance.

Spleen examination :

- the subject lie on his back and flex the legs to relax the abdominal muscles
- the classification of enlarged spleen was based on Hackett's classification, which consists of 5 classifications i.e. : H0; H1; H2; H3; H4.

Parasite investigation method is using:

- Blood thick test which obtained from finger prick and stained with Giemsa;
- Parasite examination is required between 100 and 200 high power microscope fields;
- Spleen rate was calculated from

$$\frac{\text{Number of having enlarged spleen}}{\text{Total studied individuals}} \times 100\%$$

Average of Enlarged Spleen (AES) was determined by multiplying the number of individuals of each class by the spleen class number. The total is added and divided by the number of individuals having enlarged spleen.

Parasite rate was calculated from:

$$\frac{\text{Number of positive blood film}}{\text{Total blood films}} \times 100\%$$

Data were collected and analyzed using Epi-info version 5.01 b.

Results

During this study period, a total of 500 elementary school children were enrolled. There were 255 (51.3%) males and 242 (48.7%) females of different ages (Table 1).

The highest spleen rate as well as parasite rate were found in subdistrict of Manalu. The percentage of enlarged spleen of the subjects have risen directly with age, but this was no significantly difference ($p > 0.05$). As in enlarged spleen, there was also progressive rose in percentage of positive blood film by age.

Table 2 displays the relationship between frequency of illness and size of spleen, more frequent of the child experienced illness the more the increasing of spleen ($p < 0.05$). The percentage of positive blood film also shows the same relation ($p < 0.05$) (Table 3).

Most of positive blood film was found in children with enlarged spleen and this was statistically significantly (Table 4).

Discussion

The level of endemicity of the region could be quantified by determination of children with enlarged spleens and malaria parasites in their blood. The results of this study showed that the overall spleen rate and parasite rate were 12.2 % and 8.6 % respectively. This discrepancy between spleen rate and blood parasite rate is commonly noted.^{3,8} Several longitudinal studies in endemic malarious areas

revealed that in many persons, the blood parasitemia can only be demonstrated intermittently, it is more likely due to low grade infections caused by the development of immunity or technical error during preparation of the slide or the use of antimalarial drugs or the age of children.^{3,5-7}

The average of enlarged spleen (AES) was 1.49 among the elementary school children, while spleen rate was 12.2 %. These two variables indicate that this area suffered from stable malaria.^{6,7} Based on splenic indices (12.2 %) among this studied elementary school children aged 6-9 years, we could define the degrees of malaria endemicity in Sangihe Besar as meso-endemic malaria area.⁶

The highest spleen rate as well as parasite rate were found in Manalu subdistrict. It would be likely due to low socio-economic; poor environment sanitation (many pools of water, many houses constructed with semi-open bamboo or stick walls); poor sleeping habits (outdoor sleeping, sleep without bed nets); poor health seeking behaviors (initial treatment from traditional healers). This situation needs attention to health services to improve the malaria control program.

The results of this study showed that the percentage of enlarged spleen as well as parasite rate have risen directly with age, but there were statistically no significant differences ($p > 0.05$). Thomas (1981)⁹ conducted a sero-epidemiological studies of malaria and concluded that there was a positive correlation between antibody and spleen rate up to the age 9 years.

Strickland et al (1988)⁸ stated that parasitemia were significantly higher in infected children with moderately en-

Table 1. Distribution of sample according to age, gender and subdistrict

Subdistrict	Age (years)						Total		
	6		7		8		9		
	M	F	M	F	M	F	M	F	
Tahuna	0	1	8	5	20	20	17	12	83
Manganitu	4	3	8	17	16	17	16	5	86
Tamako	2	2	11	12	15	21	18	14	96
Manalu	6	11	17	18	22	18	18	10	120
Kendahe	2	7	14	11	18	15	23	25	115
Total	14	24	58	63	91	91	93	66	500

Table 2. Correlation between frequency of illnesses and size of spleen

Frequency of illnesses	Size of spleen					Total
	Ho	H1	H2	H3	H4	
Never	258	6	0	0	0	264
1 - 3 x	101	21	6	3	0	131
3 - 5 x	66	9	2	4	0	81
> 5 x	14	6	1	2	1	24
Total	439	42	9	9	1	500

Chi Square=66.60 df = 12 p < 0.001

Table 3. Correlation between results of blood film investigation and enlarged spleen

Blood Film investigation	Size of spleen					Total
	H0	H1	H2	H3	H4	
Negative	410	35	7	4	1	457 (91.4%)
Positive	29	7	2	5	0	43 (8.6%)
Total	439	42	9	9	1	500 (100.0%)

Chi-Square = 33.16 df = 4 p = 0.001 (< 0.05)

Table 4. Correlation between results of blood film investigation and frequency of illnesses

Frequency of illnesses	Blood film investigation		Total
Never	260	4	264
1 - 3 x	122	9	131
3 - 5 x	58	23	81
> 5 x	17	7	24
Total	457	42	500

Chi-Square = 66.36; df = 3; p = <0.001

larged spleens than in infected children with non palpable spleens or to those with minimal or extensive splenomegaly, while Archibald et al (1990)¹ found that increasing spleen size was associated with an increasing likelihood of malaria parasitemia in children 0-4 years old, however those of 5-9 years old showed the two variables were unrelated. Our study goes with previous studies that parasitemia are most found in moderately enlarged spleens (class 2 & 3), however the extensive enlarged spleens (class 4) did not found any parasitaemia.

In malarious area, every malaria infection, the spleen size increases.^{3,6,7,10} Our study goes with their opinions that there was a correlation between the enlarged spleens and frequency of illnesses. On the other hand, the child is exposed continuously to infections of malaria would have a low grade parasitemia is eventhough with very few clinical symptoms or even none.^{3,6,7} As in this study showed that there was a correlation between parasitemia and frequency of illness, the more the frequent of the child with illnesses, the higher the percentage of positive blood film.

Conclusion

Sangihe Besar could be defined as a meso-endemic malaria area. The highest rate was found in Manalu subdistrict, which needs more attention to Health services of improving the malaria control program.

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