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File name: Lia\_Amalia\_8218-24032-1-PB.docx  
File size: 64.21K  
Page count: 6  
Word count: 2,471  
Character count: 12,879  
Submission date: 10-May-2022 07:10PM (UTC-0700)  
Submission ID: 1833450913



**International Journal of Sciences:  
Basic and Applied Research  
(IJSBAR)**

ISSN 2307-4531  
(Print & Online)

<http://gsr.org/index.php/journals/formalOfBasicAndApplied>



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**Anemia Prevalence and Nutrition Status of Malaria  
Falciparum Children Patients Staying in Malaria  
Endemical Area**

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**Abstract**

The prevalence of malaria in Indonesia is still high, reaching 417,819 positive cases in 2012, currently 70 percent of malaria cases are found in eastern Indonesia. Malaria endemic areas in eastern Indonesia, spread over 84 districts / cities with a population of 16 million people at risk. The level of malaria endemicity in Gorontalo is done based on AMI and API size. The purpose of this study was to determine the prevalence of anemia and nutritional status of children with malaria. This was an observational analytic study with cross sectional study design. The sample is 105 children aged 7-12 years in SDN 5 East Sumalata. The independent variable is the incidence of anemia and nutritional status and the dependent variable is the incidence of malaria. The results showed anemia prevalence of 57.1% with mean Hb (10.6 gr / dL) and was in very mild anemia classification and for the most nutritional status with normal nutrition status was 87.6%. by using Chi-Square statistic test with 95% significance ( $\alpha = 0,05$ ) showed that there was correlation between occurrence of anemia with malaria incidence ( $\chi^2 = 40,082$  p value 0,000) and no relationship between nutritional status and malaria incidence ( $\chi^2 = 1,495$  p value 0,301), it is advisable to disseminate malaria-related information and anemia through increased knowledge of malaria, run iron supplementation programs and food fortification programs.

**Keywords:** Malaria; anemia; nutrition status.

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*by Lia Amalia, Laksmyn Kadir*

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**Submission ID:** 1833450913

**File name:** Lia\_Amalia\_8218-24032-1-PB.docx (64.21K)

**Word count:** 2471

**Character count:** 12879



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## Anemia Prevalence and Nutrition Status of Malaria Falciparum Children Patients Staying in Malaria Endemical Area

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### Abstract

The prevalence of malaria in Indonesia is still high, reaching 417,819 positive cases in 2012, currently 70 percent of malaria cases are found in eastern Indonesia. Malaria endemic areas in eastern Indonesia, spread over 84 districts / cities with a population of 16 million people at risk. The level of malaria endemicity in Gorontalo is done based on AMI and API size. The purpose of this study was to determine the prevalence of anemia and nutritional status of children with malaria. This was an observational analytic study with cross sectional study design. The sample is 105 children aged 7-12 years in SDN 5 East Sumalata. The independent variable is the incidence of anemia and nutritional status and the dependent variable is the incidence of malaria. The results showed anemia prevalence of 57,1% with mean Hb (10,6 gr / dL) and was in very mild anemia classification and for the most nutritional status with normal nutrition status was 87,6%. by using Chi-Square statistic test with 95% significance ( $\alpha = 0,05$ ) showed that there was correlation between occurrence of anemia with malaria incidence ( $\chi^2 = 40,082$  p value 0,000) and no relationship between nutritional status and malaria incidence ( $\chi^2 = 1,495$  p value 0,301), it is advisable to disseminate malaria-related information and anemia through increased knowledge of malaria, run iron supplementation programs and food fortification programs.

**Keywords:** Malaria; anemia; nutrition status.

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## **1. Introduction**

Malaria is an endemic disease that is common throughout the world, especially in the tropics. The groups at risk for exposure are children and pregnant women. The problem of malaria is one of the points discussed and set in the 2015 Millennium Development Goals (MDGs) agreement on the sixth point of resistance against HIV / AIDS, malaria and other diseases. Likewise, in the 60th World Health Assembly (WHA) meeting on May 18, 2007, there has been a global commitment to the elimination of malaria for every country. The guidelines for the implementation of malaria elimination have been formulated by the World Health Organization (WHO) in the Global Malaria Program [1, 2]. The MDGs program continues to demonstrate the success shown by the Annual Parasite Incidence (API) of malaria in Indonesia which has continued to decline since 2011-2015. In 2011, there were 1.75 cases of malaria per 1000 population, whereas in 2015, the number decreased to 0.85 malaria cases per 1000 inhabitants.

WHO [3] recorded incidences of malaria incidence in 2013 of approximately 198 million cases with deaths of approximately 584,000 cases (case fatality rate = CFR = 0.29%). The highest risk of transmission occurs in the African region with a total estimated death of about 528,000 cases (0.32%). The WHO 2014 report estimates that 3.3 billion people are at risk of being infected with malaria where its 1.2 billion is at risk with Annual Parasite Incidence (API) > 1 per 1000 population. *Plasmodium falciparum* and *vivax* are the most common plasmodium found worldwide.

The prevalence of malaria in Indonesia is still high, reaching 417,819 positive cases in 2012. Currently, 70 percent of malaria cases are found in eastern Indonesia, especially in Papua, West Papua, Maluku, North Maluku, Sulawesi and Nusa Tenggara, malaria endemic areas in Eastern Indonesia, spread over 84 districts / cities with a population of 16 million people at risk. Determination of malaria endemicity level in Gorontalo area is done based on Annual Malaria Incidence (AMI) and API. The value of AMI for malaria patients in Gorontalo Province, especially in the North Gorontalo is 9.3% and API 1.54%. The national standard of malaria endemicity determination in a region is said to be low if API <1%, AMI <25%, while API 1-5% or AMI 25 - 50% and high endemicity if API > 5% or AMI > 50%. Based on these standards, North Gorontalo is located at a moderate level of endemicity.

## **2. Materials and Methods**

This research was conducted at SDN 5 East Sumalata. This was an observational analytic study with cross sectional study design. The sample was 105 children aged 7-12 years. All the children were taken of blood and examined malaria microscopically and by Immunochromatographic Test (ICT). From the number of students who got 105 positive children malaria *falciparum* 79 people (75.2%). Positive samples counted the number of parasitemia and then the students who tested positive were given treatment with anti-malarial drugs ie Artemisinin Combination Therapies (ACT) and antacids to avoid nausea caused by taking malaria drugs and respondents are parents of children.

Dependent variable in this study is the incidence of malaria namely the respondents whose blood test results

showed positive results of one or a combination of plasmodium malaria from laboratory examination with a microscope, while the independent variables in this study is the incidence of anemia and nutritional status. The variable of occurrence of anemia is the occurrence of malaria based on Haemoglobin examination that is normal if the examination is 10,8-13,6 gr / dL, and for nutritional status based on the calculation of body mass index (IMT).

Data on the incidence of malaria, the incidence of anemia and nutritional status were taken at the time of laboratory examination. Data were analyzed using Chi-square test with 95% significance ( $\alpha = 0,05$ ).

### 3. Results

Malaria is a highly contagious infectious disease in the tropics and sub-tropics and can be deadly. At least 270 million people of the world suffer from malaria and more than 2 billion or 42% of the population of the earth has a risk of malaria. WHO notes every year that no less than 1 to 2 million people die from Anopheles mosquito-borne diseases. The source of infection for humans is another human who suffers from malaria with no symptoms or clinical symptoms. In endemic areas malaria-affected children have not developed immunity to malaria in their bodies when compared with adults, so the severity of malaria will be more severe. Conversely in areas with low endemicity, adults do not have the same sensitivity and severity as children and migrants from non-endemic areas of malaria.

Based on the research that has been done on 105 samples, the following research results are presented:

**Table 1:** Description of the variables studied (incidence of malaria, age, sex, educational level, occurrence of anemia and nutritional status) in students at SDN 5 East Sumalata

| Variabel                | n   | %     |
|-------------------------|-----|-------|
| Malaria occurrence      |     |       |
| Malaria                 | 79  | 75,2  |
| Not Malaria             | 26  | 24,8  |
| Age :                   |     |       |
| 7-9 year                | 22  | 20,9  |
| 10-12 year              | 83  | 79,1  |
| Sex                     |     |       |
| Female                  | 39  | 37,1  |
| Male                    | 66  | 62,9  |
| Parents education level |     |       |
| Basic school            | 25  | 23,8  |
| Junior high school      | 57  | 54,3  |
| Senior high school      | 21  | 20,0  |
| Higher education        | 2   | 1,9   |
| Anemia occurrence       |     |       |
| Anemia                  | 60  | 57,1  |
| Normal                  | 45  | 42,9  |
| Nutrition Status        |     |       |
| Less                    | 13  | 12,4  |
| Normal                  | 92  | 87,6  |
| Number                  | 105 | 100,0 |

**Table 2:** Description of the variables studied (age, gender, parental education level, occurrence of anemia, and nutritional status,) with malaria incidence in students at SDN 5 in East Sumalata

| Variabel                | Malaria    | Not Malaria | Number       |
|-------------------------|------------|-------------|--------------|
| Age :                   |            |             |              |
| 7-9 year                | 17 (21,5%) | 5 (19,2%)   | 22 (20,9%)   |
| 10-12 year              | 62 (78,5%) | 21 (80,8%)  | 83 (79,1%)   |
| Sex                     |            |             |              |
| Female                  | 30 (38,0%) | 9 (34,6%)   | 39 (37,1%)   |
| Male                    | 49 (62,0%) | 17 (65,4%)  | 66 (62,9%)   |
| Parents education level |            |             |              |
| Basic school            | 21 (26,6%) | 4 (15,4%)   | 25 (23,8%)   |
| Junior high school      | 46 (58,2%) | 11 (42,3%)  | 57 (54,3%)   |
| Senior high school      | 11 (13,9%) | 10 (38,5%)  | 21 (20,0%)   |
| Higher education        | 1 (1,3%)   | 1 (3,8%)    | 2 (1,9%)     |
| Anemia occurrence       |            |             |              |
| Anemia                  | 59 (74,7%) | 1 (3,8%)    | 60 (57,1%)   |
| Normal                  | 20 (25,3%) | 25 (96,2%)  | 45 (42,9%)   |
| Nutrition Status        |            |             |              |
| Less                    | 8 (10,1%)  | 5 (19,2%)   | 13 (12,4%)   |
| Normal                  | 71 (89,9%) | 21 (80,8%)  | 92 (87,6%)   |
| Number                  | 79 (75,2%) | 26 (24,8%)  | 105 (100,0%) |

From table 1 shows that out of 105 samples, there were 79 students (75.2%) who were malaria positive and 26 students (24.8%) were not malaria. Based on the age variable, it was found that most samples were 10-12 years old, 83 students (79,1%) and gender were 66 men (62,9%). For parents education level variable, most with last education junior high which is 57 people (54,3%). For the occurrence of anemia, most of the sample with Hb level <10,8 gr / dL that is 60 students (57,1%) while for nutrition status, most with normal nutrition status is 92 students (87,6%).

The result of this study also found that based on gender, malaria positive and non malaria, male was the most of the 49 students (62,0%) and 17 students (65,4%). Based on the variable of education level of parents showed that malaria positive and not malaria, low education level ( $\leq$  junior high school) is the highest level of education, each of 67 students (84,8%) and 15 students (57,7%). Based on the incidence of anemia, the malaria samples were distributed at Hb <10,8 gr / dL ie 59 students (74,7%) and non-malaria were distributed at normal Hb level of 25 students (96,2%) . Based on data analysis using Chi-Square statistical test obtained  $\chi^2$  count 40.082 > value  $\chi^2$  table 3,841. Because  $\chi^2$  count >  $\chi^2$  table and p value value (0,000 <  $\alpha$  0.05) this means that  $H_0$  is rejected means there is a significant relationship between anemia and malaria incidence.

**Table 3:** Results of Independent Variables and Dependent Variables

| Variabel          | $\chi^2$ | p value |
|-------------------|----------|---------|
| Anemia occurrence | 40,082   | 0,000   |
| Nutrition Status  | 1,495    | 0,301   |

For nutritional status variables, malaria and non-malaria samples were distributed in normal nutrition, 71 students (89.9%) and 21 students (80.8%) and based on data analysis using Chi-Square statistical test obtained  $\chi^2$  1,495 <value  $\chi^2$  table 3,841. Since  $\chi^2$  count < $\chi^2$  table and p value (0.301) >  $\alpha$  0.05) this means that H0 accepted means there is no significant relationship between nutritional status and malaria incidence.

#### 4. Discussion

##### 4.1 Relationship Level of Parents Education with Malaria Incidence

The results of analysis using Chi-Square statistical test obtained  $\chi^2$  count 8.409 > value  $\chi^2$  table 3,841. Since  $\chi^2$  count >  $\chi^2$  table and p value (0,000 < $\alpha$  0.05) this means that H0 is rejected means there is a significant relationship between parent education level and malaria incidence. Parents education is one important factor in determining the growth of children, because with good education then parents can receive all information from outside, especially on how to care for good, how to maintain health of children's health, education, diet and so forth. The level of education affects the knowledge of a person, in general, people who have a high level of education easier to know about malaria because it is easier to understand information about malaria. The result of the research shows that malaria occurrence is mostly happened in the sample having low educated parents ( $\leq$  SMP). This shows the low knowledge of parents about malaria.

Parents education level will greatly affect the level of knowledge and behavior of parents in maintaining the health of their children. Higher education can improve health behaviors and help prevent disease. A good level of education will affect the behavior of parents who lead to preventive measures of transmission of malaria. This study is in line with research conducted by Indarti [4] where low-educated people are at high risk of contracting malaria. In educational theory is a process that will result in a change in target behavior that is expected by a particular organization by providing formal or informal education to its members.

##### 4.2 The Relationship of the Genesis of Anemia with Malaria Occurrence

In this study to determine the anemia examined levels of hemoglobin (Hb). Hb levels of children in this study varied from 8.2 to 13.6 g / dL with an average Hb of 10.7 g / dL and were in very mild anemia classification. The results showed that the malaria samples were distributed at Hb <10,8 gr / dL ie 59 students (74,7%) and non-malaria were distributed at normal Hb level of 25 students (96,2%). Based on the data analysis using Chi-Square statistical test, the result of  $\chi^2$  40,082 and p value (0,000 < $\alpha$  0,05) means there is a significant correlation between anemia and malaria incidence.

Malaria parasites as well as all organisms need nutrients for their survival and the nutrients themselves can be obtained from environments that are then converted to other molecules or energy (catabolism). Other molecules and this energy will be used to maintain homeostasis, growth and reproduction of the parasite (anabolism). Energy sources are proteins. Malaria parasites require amino acids to synthesize their proteins. One source of amino acids is hemoglobin. Hemoglobin is an abundant protein in cytoplasmic erythrocytes that serves as a major source of parasitic amino acids [5,6]. Although the area of Dulukapa village is a coastal area that consumes a lot of fish that is a high source of iron, but the incidence of anemia is also high this is probably due

to low nutrients intake that can help the absorption of iron. The main factor that can help the absorption of iron is vitamin C (ascorbic acid).

#### **4.3 Relationship of Nutritional status with Malaria Incidence**

For nutritional status variables, malaria and non-malaria samples were distributed in normal nutrition, 71 students (89.9%) and 21 students (80.8%) and based on data analysis using Chi-Square statistical test obtained  $\chi^2$  1,495 <value  $\chi^2$  table 3,841. Since  $\chi^2$  count < $\chi^2$  table and p value (0.301) >  $\alpha$  0.05) this means that  $H_0$  accepted means **there is no significant relationship between nutritional status and malaria incidence.** In this study most children have good nutritional status when viewed based on body weight per height. This is in line with preliminary studies conducted in malaria endemic areas in Africa, it turns out that children with good nutritional status are more likely to suffer from malaria than those with mild, moderate and severe nutritional status [7-9]. This suggests that nutritional status is not associated with malaria incidence, children with moderate-to-severe malnutrition increased the risk for malaria infection despite the insignificant results that may be due to the role of micronutrients such as iron, zinc and vitamin A in immunity to malaria [10-12].

#### **5. Conclusion**

Based on the result of the research, it can be concluded that the prevalence of anemia is 57,1% with mean Hb (10,7 gr / dL) and is in very mild anemia classification and for the most nutritional status with normal nutrition status is 87,6%. there was a correlation between the incidence of anemia and the incidence of malaria ( $\chi^2 = 40,082$  p value 0,000) and no relationship between nutritional status and malaria incidence ( $\chi^2 = 1,495$  p value 0,301 in SDN 5 in East Sumalata of North Gorontalo Regency).

#### **6. Suggestion**

The results of this study can be used as one of the considerations in prevention malaria in children, disseminates information related to malaria and anemia through increased knowledge of malaria, runs iron supplementation programs and food fortification programs.

#### **References**



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