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PROFILE OF CHILDREN WITH MALARIA IN MAMBITUL PUBLIC HEALTH CENTER, CENTRAL SUMBA

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ABSTRACT

The morbidity and mortality due to malaria is still high, and 61% of the cases are children under five. East Nusa Tenggara is a malaria-endemic region in Indonesia, and Sumba Island has the highest number of people with malaria in East Nusa Tenggara. The aim of this study is to describe malaria profile in children at Mambitul Public Health Center, Central Sumba. A cross-sectional study was performed by collecting secondary data from the medical records of malaria's patients at Mambitul Public Health Centre. One hundred and nineteen children were enrolled. The highest proportion was male patients (54,6%), and aged 6 – 11,9 years old (49,6%). One hundred subjects (84%) were infected with Plasmodium vivax. The most clinical symptoms were fever on 112/119 subjects (94%), cough on 68/119 subjects (57,4%), and headache on 25/119 subjects (21%).

KEYWORDS: Malaria, Plasmodium, children, Sumba.

INTRODUCTION

Malaria is a parasitic disease caused by Plasmodium sp., and trasmited by female Anopheles mosquitoes as a vector. Plasmodium that causes malaria has several species, including Plasmodium falciparum, Plasmodium vivax, Plasmodium malaria, and Plasmodium ovale. Malaria has typical symptoms called the "trias of malaria", namely fever, chills and sweating.[1] Malaria is a health problem that occurs in tropical and subtropical countries. WHO reported 219 million cases in Africa with a death rate of 435,000 people, of which 61% were children under five years.[2]

East Nusa Tenggara (NTT), the highest endemic area in Indonesia, is in third place after Papua and West Papua. The region still has an API (Annual Parasite Incidence) number in 2015 of 7.04 with HCI 1 (High Cumulative Incidence) status.[3] Based on the health profile data of districts/cities in 2018 throughout the province of NTT, it shows that malaria confirmed by blood drop tests as a supporting examination was 17,150 patients, of which 69% of patients were on Sumba Island.[4] Sumba Island has many rural areas with high humidity as malaria habitat vectors. The age group 0-9 years is most susceptible to malaria.[5] In areas of high transmission, children have not yet developed immunity to malaria. Therefore anaemia, hypoglycemia and cerebral malaria are more often seen as symptoms of malaria in children than adults.

The purpose of this study is to describe the profile of pediatric patients diagnosed with malaria at the Mambitul Sumba Health Center, Central Sumba, East Nusa Tenggara.

LITERATURE REVIEW

Malaria is an infectious disease caused by Plasmodium parasites in the blood or tissues and is usually accompanied by fever symptoms.[6] Malaria infection can be proven by a positive microscopic examination, the presence of malaria antigen with a rapid test, and the finding of parasite DNA/RNA on PCR (Polymerase Chain Reaction) examination. Positive symptoms of malaria infection are fever, chills, anaemia and splenomegaly. It can be acute or chronic with severe or uncomplicated malaria complications.

According to the World Health Organization (WHO), malaria can be classified into 5, namely: a) Plasmodium falciparum. Plasmodium falciparum provides many complications, has a relatively severe clinical course, is easily resistant to treatment, and causes tropical/falciparum malaria. Plasmodium falciparum has a rapid development cycle that destroys red blood cells and blocks blood flow, making it the most dangerous malaria parasite because it can cause anaemia and cerebral malaria. Malaria is found in several countries such as Africa and Indonesia and dominates in sub-tropical and tropical areas; b) Plasmodium vivax. Plasmodium vivax is distributed in tropical and sub-tropical areas throughout the world. Living on red blood cells, the sexual cycle occurs at 48 hours. Plasmodium vivax causes mild malaria tertiana where fever occurs every three days. This parasite can be dormant in the

human liver called the hypnozoite stage to recur after several months or even years; c) Plasmodium ovale. Plasmodium ovale is found in Africa, especially West Africa and the islands of the Western Pacific. Morphology is similar to Plasmodium vivax and causes ovale malaria or benign tertiana ovale malaria and can be dormant in the human liver; d) Plasmodium malariae. Plasmodium malariae causes malariae or quartana malaria. The red blood cell cycle lasts 72 hours and produces a fever every four days.[1] and e) Plasmodium knowlesi. This parasite is a new case found only in Southeast Asia, transmitted through infected pigs and monkeys (long-tailed monkeys, coil-tailed monkeys). The developmental cycle is fast replicating within 24 hours and can be very severe. Plasmodium knowlesi can resemble either Plasmodium falciparum or Plasmodium malaria.[1]

Humans are positive for malaria infection when a female Anopheles mosquito bites and releases sporozoites into the bloodstream. Within 45 minutes, it will spread to the liver, and the rest die in the blood in small amounts. The asexual intrahepatic or pre-erythrocyte schizonts develop in the liver parenchyma cells. It takes 5.5 days for Plasmodium falciparum and 15 days for Plasmodium malaria to develop. In P. vivax and P. ovale, hypnozoites can survive for years, leading to relapse in malaria.

The antigenic factor Duffy Fya or Fyb is associated with receptors on P. vivax, and it results in harmful vivax malaria infection in people with negative Duffy blood type. Glycophorin is the receptor for P. falciparum, while P. malariae and P. ovale are unknown. A ring is a form of change from the parasite in less than 12 hours but in P. falciparum to form stereo-headphones containing chromatin in the nucleus surrounded by cytoplasm hemozoin. In P. falciparum, the erythrocyte wall forms a bulge which is later essential in the process of sitaderens and rosetting called a knob. Parasites turn into schizonts after 36 hours of invasion into erythrocytes. When the schizonts rupture will release 6-36 merozoites and are ready to infect other erythrocytes. For 48 hours in P. falciparum, P. vivax, and P. ovale, the sexual cycle lasted 72 hours in P. malaria.[7]

Some parasites will form male and female gametes in the blood, and a sexual cycle will occur in the mosquito's body when it sucks infectious human blood. The zygote will form after mating and become an ookinete that penetrates the mosquito's stomach wall. Finally becomes an oocyst form which will mature and release sporozoites which will migrate to the mosquito's salivary glands and are ready to infect humans.

Merozoites in 18-24 are released into the circulation by P. falciparum after passing through the liver tissue and enter the RES (The reticuloendothelial system). The cells in the spleen undergo phagocytosis and filtration, and those that escape will invade erythrocytes. Furthermore, the parasite reproduces asexually in this potential erythrocyte (EP) which is responsible for the pathogenesis of Malaria in humans.[1]

Host and parasites are factors that influence the pathogenesis of P. falciparum. Transmission intensity, parasite density and parasite virulence are included in parasitic characteristics. The level of endemicity in residence, genetics, age, nutritional status and immunological status have host factors. Erythrocytes can experience the ring stage in the first 24 hours and the mature setting in the second 24 hours. RESA antigen (Ring-erythrocyte surface antigen) appears on the surface of the ring stage EP and disappears after entering the adult stage. The surface of the mature stage EP membrane protrudes and forms a knob with Histidine rich protein-1 (HRP-1) as the main component. Furthermore, malaria toxin will be released in glycosylphosphatidylinositol (GPI) when the EP becomes merozoites. The glycosylphosphatidylinositol (GPI) will stimulate the release of TNF-a and interleukin-1 (IL-1) from macrophages.[1]

Immunity to malaria involves almost all immune system components, both specific and non-specific, humoral and cellular immunity, which arise naturally or are acquired due to infection or vaccination.[8] The form of immunity to malaria can be distinguished by clinical manifestations of Malaria, divided into two states, namely uncomplicated malaria manifestations and severe malaria manifestations.

Uncomplicated malaria manifestations - The patient's immunity and the high transmission of malaria affect the clinical manifestations of malaria. The severity of infection is influenced by a) the type of Plasmodium (P. falciparum often causes complications), b) the area of origin of disease (pattern of resistance to treatment), and c) age (older age and infants are usually more severe). There are several factors suspected of influencing the disease, including: genetic constitution, health and nutritional status, chemoprophylaxis and previous treatment. In other words, the clinical picture of malaria is determined by parasitic factors, host factors, social and geographic factors. Parasitic elements include drug resistance, speed of multiplication, mode of invasion, cytoadherence, rosetting, anthogenic polymorphism, antigenic variation (PfEMP1), and malaria toxin. Host factors, including immunity, speed of multiplication, genetics, and social-geographical factors (access to treatment, cultural and economic factors, political stability and intensity of mosquito transmission).[9]

Malaria is characterized by periodic fever, anaemia and splenomegaly. Prodromal complaints can occur before the onset of madness in the form of lethargy, malaise, headache, backache, joint and bone pain, low-grade fever, anorexia, abdominal pain, mild diarrhoea and sometimes cold. Prodromal complaints often occur in P. ovale and P. vivax, while in P. falciparum and P.

malariae, prodromal complaints are unclear, and symptoms can be sudden.[9]

The classic symptoms are the occurrence of: "trias of malaria" sequentially: cold period (15-60 minutes): begins to shiver, the patient often wraps himself in a blanket and when shivering constantly the whole body vibrates, followed by an increase in temperature, hot periods: the patient has a red face, rapid pulse, and the body temperature remains high for several hours, followed by a period of sweating: the patient sweats profusely, and the temperature drops and the patient feels well. The malaria triad is common in P. vivax infection. In P. falciparum, chills may be severe or absent. The unheated period lasted 12 hours in P. falciparum, 36 hours in P. vivax and P. ovale, 60 hours in P. malariae. The emergence of the triad of malaria symptoms is also influenced by high levels of TNF-a.[10]

Anaemia is a common symptom of malaria infection. The mechanism of anaemia is due to the destruction of erythrocytes by a) parasites, b) temporary inhibition of erythropoiesis, c) hemolysis due to complement-mediated immune complexes, d) erythrophagocytosis, e) inhibition of reticulocyte release and f) the influence of cytokines. Enlargement of the spleen (splenomegaly) is often found in malaria patients. The spleen will be palpable three days from an attack of acute infection. The spleen becomes swollen, and painful hyperemic. The spleen is an essential organ in the body's defence against malaria infection. Animal studies have shown the spleen to phagocytize infected erythrocytes through metabolic changes and antigenic from infected erythrocytes.[10] Bronchitis, pneumonia, and bronchopneumonia as pulmonary manifestations of malaria infection.

Severe malaria is a frequent complication of malaria caused by P. falciparum and is often referred to as a pernicious manifestation. The predisposing factors for the occurrence of severe malaria are children/toddlers, pregnant women, patients with low immunity (HIV/corticosteroid treatment), people who do not have malaria immunity (immigrants).[1]

Cerebral malaria, acute renal failure, hepatic impairment, hypoglycemia, blackwater fever, algid Malaria, bleeding tendency, pulmonary oedema, gastrointestinal manifestations, and hyponatremia are included in clinical manifestations. Clinical symptoms and microscopic examination are the most critical in making the diagnosis. Clinical signs have low specificity because they are non-specific and varied. Meanwhile, microscopic examination is a definite diagnosis as the standard and, if not possible, assisted by Rapid Diagnostic Test (RDT).[11;12]

Research Method

This research is a descriptive epidemiological study using a cross-sectional approach. Secondary data from medical records were collected to looking at the profiles of pediatric patients diagnosed with malaria. This study was conducted at the Mambitul Health Center, Central Sumba, East Nusa Tenggara in August 2019. The target population of this study were all pediatric patients aged 1-12 years diagnosed with malaria at the Mambitul Health Center, Central Sumba Regency. The sample size in this study was the subject of the population that met the inclusion and exclusion criteria. The sample selection was used by the total sampling method, i.e. all issues who came met the selection criteria intended in the study—methods of data collection using secondary data obtained from medical records at the Mambitul Health Center descriptively. The research instrument used in this study is descriptive medical records at the Mambitul Sumba Tengah Health Center. All data collected is then processed utilizing Electronic Data Processing (EDP) through a computer in the form of tables. The data that has been collected will be analyzed using univariate analysis. The univariate analysis describes the frequency distribution of the variables to be studied. The data will be compiled computerized using the Statistical Program For Social Science (SPSS) For Windows.

Result and Discussion

This research was conducted at the Mambitul Health Center, Central Sumba, by taking secondary data from the medical records of all pediatric patients aged 0-12 years in July 2018-March 2019. The study was conducted using the total sampling method, obtained a research sample of 281 patients. Patients who met the inclusion criteria were 119 patients, and 162 patients were excluded based on criteria. Data processing used univariate analysis to describe the profile of children with a diagnosis of malaria based on the variables of sex, age, clinical symptoms, living environment and type of Plasmodium. The results of the study can be seen in the table below:

Table 1: Distribution of malaria in children.

	Frequency (n)	%
Gender		
Man	65	54.6
Woman	54	45.4
Total	119	100.0
Age		
0 Months-5 years 11 months	43	36.1
6 Years-11 years 11 months	59	49.6
≥ 12 Years	17	14.3
Total	119	100.0
Residence		
Health Center Work Area	111	93.3
Outside the Health Center's Working Area	8	6.7
Total	119	100.0
Model of services		
Inpatient	20	16.8
Outpatient	99	83.2
Total	119	100.0

Based on the table above, it was found that children with malaria suffered the most by male sex with a total of 65 patients (54.6%) and on aged range of 6-11 years 11 months as many as 59 subjects (49.6%). Many pediatric patients with malaria live in the working area of the Puskesmas (94.1%), were found in outpatients with 99 people (83.2%) and just 16.8% was inpatient.

Table 2: Distribution of Malaria in children by type of Plasmodium.

Types of Plasmodium	Frequency (n)	%
Vivax	100	84.0
Falciparum	16	13.4
Mixture	3	2.5
Total	119	100.0

Based on the table above, most of the Plasmodium vivax types were found in children with malaria with a total of 100 subjects (84%), followed by Plasmodium falciparum in 16 subjects (13.4%), and Plasmodium mixed in 3 subjects (2.5%), while neither were found.

Table 3: Distribution of Malaria in children based on clinical symptoms.

Clinical symptoms	Frequency (n)	%
Fever	112	94.0
Shivering	6	4.2
Cough	68	57.4
Headache	27	23.0
Vomiting	15	12.6
Lossing appetite	12	10.0
Myalgia	7	5.8
Anaemia	3	2.5
Cerebral malaria	1	0.8
Acute kidney failure	0	0.0
Heart defects	0	0.0

Based on the table above, from 119 samples, 112 children got fever (94%) followed by cough in 68 subjects (57.4%), headache in 27 subjects (23%), vomiting in 15 subjects (12.6%), decreased appetite in 12 subjects (10%), myalgia in seven people (5.8%), anaemia in three people (2.5%), and cerebral malaria in 1 subject (0.8%). There were no cases with acute renal failure, liver abnormalities, haemoglobinuria, or bleeding in this study.

The results showed that 119 children were suffering from malaria at the Mambitul Public Health Center. The highest proportion based on gender was male as many as 65 patients (54.6%) while female sex as many as 54 patients (45.4%). This study is in line with research conducted by Dwithania et al. at Sungai Durian Health Center and Talawi Health Center Sawahlunto City from 2011 to 2012, where seven patients were male (53.85%), and six patients were female. (46.15%), with a total of 13 patients.[13]

It is different from the research conducted by Gusra et al. at the Tarusan Health Center and Balai Tuesday Pesisir Selatan District Health Center in 2013, where there were 16 more female patients (88.89%) than the male sex, amounting to 2 people (11.11%), with a total of 18 cases.[14] It was conveyed by Gunawan (2018) that the difference in sex prevalence is related to differences in the degree of immunity due to variations in exposure to mosquito bites.[15]

The results showed that most children with Malaria suffered from an age range of 6-11.9 years as many as 59 people (49.6%), followed by 0-5.9 years as many as 43 people (36.1%) and ≥ 12 years people (14,3%).[16,17] This study is in line with RISKESDAS (2018), which shows that the highest percentage of malaria occurs in children aged 0-9 years. The results of the same study in 2016 by Boy et al., at the GMIM Bethesda Tomohon Hospital

where the most malaria child patients were found in the 5-9 years age group were 29 children (31.5%) of the total 92 pediatric patients.[18] It is related to immunity to malaria, namely clinical immunity that can reduce the risk of death as in P. falciparum infection, where patients can acquire some degree of immunity to some aspects of severe Malaria after one or two infections.[15] Therefore, severe Malaria is often found with anaemia, hypoglycemia, and cerebral malaria.

Based on research data obtained from the Mambitul Public Health Center, in the period July 2018 to March 2019, in addition to serving patients from the work area (8 villages) with a total of 111 patients, it also served patients from outside the work area. It is stated by the data of 8 pediatric patients from another sub-district in Central Sumba. Patients who come from outside the work area are estimated because they have a place to live that borders the working area of the Mambitul Health Center.

Based on research data, children with malaria were primarily found in outpatients (83.2%). It is related to the degree of exposure of these patients, where it was found that inpatients are often the first patients to be exposed, so they have symptoms of severe malaria. On the other hand, outpatients have a history of recurrent infections, so that the symptoms are getting milder.[16,17]

The results showed that most of the children with malaria were Plasmodium vivax (84%), followed by Plasmodium falciparum (13.4%). This study is in line with research conducted in 2014 by Bantoyet, with a total of 75 samples found Plasmodium vivax 49 patients (65.3%), followed by Plasmodium falciparum 13 patients (17.3%), followed by clinical malaria 13 patients (17.3%).[19] A sample of 714 people found Plasmodium falciparum 542 people and Plasmodium vivax 172 people.[20] It happens because P. vivax is often found in subtropical areas related to the geographical condition of the Mambitul Health Center on Sumba Island which is close to Australia. It brings wind currents in June-September so that the climate in Sumba in that month can be compared to Australia. Besides being found in subtropical climates, P. vivax is also found in cold to tropical environments.[15,16,17,18]

The results showed that most children with malaria were found in the village that is the closest location to the Mambitul Health Center. In addition, environmental factors also influence, including the condition of the house that still has ched roofs, walls and floors made of bamboo. Under the house used for raising livestock and the house adjacent to rice fields, it is easy for mosquitoes/malarial vectors to breed.[21,22]

The results showed that the most common clinical features of malaria in children were fever (94%), accompanied by cough 68 (57.4%) and headache (21%). Symptoms of fever and chills are symptoms of the "trias of malaria", often found in uncomplicated malaria manifestations. Fever occurs due to a state of parasitemia in the process of the parasite's life cycle in the host's body. In addition, anaemia accompanied by pale skin is also a common manifestation due to the destruction of erythrocytes by a) parasites, b) temporary inhibition of erythropoiesis, c) hemolysis due to complement-mediated immune complexes, d) erythrophagocytosis, and e) inhibition of reticulocyte release and the influence of cytokines. The patient's cough is thought to be one of the clinical manifestations of the lung, namely pneumonia.[1]

Severe malaria is a complication caused by P. falciparum, where this parasite undergoes a scavenging process in vital organs and almost all tissues in the body. Some of the manifestations of severe malaria found in the study include cerebral malaria, namely an increase in brain intracranial, which was found to increase in children (80%). It was thought to be caused by blockage of the capillaries of the brain blood vessels, causing brain anoxia because erythrocytes containing parasites were challenging to pass through the blood vessels. Veins due to the process of cytoadherence and parasite sequestration. In this study, only 1 case was obtained from all research subjects.

Cough is one of the clinical features where some cases refer to symptoms of acute respiratory distress syndrome (ARDS). An excess fluid most often causes it due to pneumonia or pulmonary oedema. The diagnosis can be confirmed by discovering parasites, blood gas analysis showing hypoxemia, a picture of metabolic acidosis, and a chest x-ray examination.[23] Headache is thought to be a sign of hypoglycemia caused by the metabolic demands of the parasite depleting glycogen stores in the liver. Dyspepsia, vomiting and epigastric pain are gastrointestinal manifestations often found in malaria. Hypotension is thought to be a sign of algid malaria because of peripheral resistance and reduced tissue perfusion.

CONCLUSION

This study showed that the highest proportion of malaria sufferers in children by male gender, and an age range of 6-11.9 years. The most common type of Plasmodium infection is Plasmodium vivax. In malaria high endemic areas such as Central Sumba, children who have clinical symptoms of fever and headache should be suspected as malaria.

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