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MALARIA INFECTION DETECTION AND PERCENT PARASITEMIA IN GUNUNGSARI DISTRICT

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ABSTRACT

Malaria is an infectious disease caused by parasites of the genus Plasmodium sp. Malaria parasite infection can cause a variety of symptoms, ranging from none, very mild to severe illness and even death. Plasmodium falciparum is the cause of severe infection, it can even cause a variety of acute manifestations and if not treated, can cause death. This study aims to detect the disease, determine the percent parasitemia and determine the type of Plasmodium species that infects the most people in the Gunungsari sub-district. The research design used is descriptive explorative which aims to describe the state of a phenomenon which is tabulated in tabular form. The sampling technique used was accidental sampling where every patient who came to check for malaria at the Gunungsari Health Center was a test sample. The results showed that 3 out of 57 people tested positive for malaria. The species infected with Plasmodium falciparum and the percent parasitemia value in the sample 001, 002, 003 were 2.0%, 2.3%, and 0.8%, respectively. The patient's Hb value was 001, 002, 003 of 10.8 mg/dl, 11.7 mg/dl and 11.4 mg/dl. The conclusion is that there are still people in the Gunungsari sub-district who are infected with Plasmodium falciparum, with the main symptom of anemia.

KEYWORDS : Malaria, Percent parasitemia, Gunungsari

INTRODUCTION

Malaria is an infectious disease caused by parasites of the genus Plasmodium sp. According to the Word Health Organization (WHO), in 2019 there were an estimated 229 million cases of malaria worldwide, the estimated number of deaths from malaria reached 409,000 (WHO, 2019). 250,644 of these cases occurred in Indonesia. Approximately 2.9 million Indonesians still live in areas with the potential for high levels of malaria infection (Ministry of Health, 2019). Data from the West Nusa Tenggara Health Office, the number of malaria suspects in 2019 was 76,478 people, 954 of whom tested positive. data from the West Lombok District Health Office, confirmed positive malaria cases reached 1,015 cases. For this reason, taking into account public safety, the West

Lombok District Government declared an extraordinary event (KLB) of malaria for the three working areas of Puskesmas Meninting, Puskesmas Gunungsari, and Puskesmas Penimbung (West Lombok Health Profile, 2018).There are five species of Plasmodium sp. that can cause malaria in humans. P. falciparum, P. vivax, P. ovale, P. malariae, and P. Knowlesi. Symptoms include fever, chills, anemia, and splenomegaly in acute or chronic conditions that are transmitted to humans through the bite of an infected female Anopheles mosquito (Harijantho, 2014).

Many factors can influence the severity of clinical manifestations of malaria, these factors are agent, host and environment. Plasmodium parasite species, parasite density in patients is one of the agent and host factors that affect severity. Malaria parasite infection can result in a variety of symptoms, ranging from none, very mild to severe illness and even death. When treatment of malaria is inappropriate and incomplete, it can result in relapse (relapse) (Soewarmo, 2002).

Based on the results of preliminary observations at the Gunungsari Health Center, data was obtained from January - April 2020, 355 people showed clinical symptoms, and 10 of them were positive for malaria. However, it is not yet known exactly which type of Plasmodium infects the most and the level of parasite density in the community in the Gunungsari sub-district area. Based on the description of the background, the researcher is interested in conducting research on Malaria Disease Detection and Percent Parasitemia in Gunungsari District.

LITERATURE REVIEW

Malaria is an infectious disease caused by Plasmodium sp., a one-celled organism that belongs to the protozoan group. Malaria is transmitted through the bite of a female Anopheles mosquito that contains Plasmodium in it. Plasmodium carried through the mosquito bite will live and multiply in human red blood cells. This disease affects all age groups, both men and women. People affected by malaria will have symptoms of fever, chills, sweating, headache, nausea or vomiting. Patients who show clinical symptoms must undergo laboratory tests to confirm their positive malaria status (Kemenkes RI, 2016).

The life cycle of Plasmodium sp. that causes malaria consists of two phases, namely the sexual phase and the ansexual phase. The sexual phase (in mosquitoes) is a sporogenic cycle that occurs inside the mosquito's body. The parasite reproduces sexually, which begins with microgametocytes penetrating macrogametocytes and producing zygotes. Then, the zygote transforms into a motile ookinet and invades the mosquito's midgut wall and develops into an oocyst. The oocyst will then rupture and release sporozoites that will enter the mosquito's salivary glands.

The asexual phase (in humans) consists of two phases, namely:

1) Liver Phase

In the exoerythrocytic cycle, sporozoites will invade hepatocytes, replicate asexually and undergo maturation into schizonts. schizonts then rupture releasing merozoites into the bloodstream. Patients are asymptomatic during the exoerythrocytic cycle. The exoerythrocytic cycle lasts 8-25 days for Plasmodium falciparum, 8-27 days for Plasmodium vivax, 9-17 days for Plasmodium ovale, and 15-30 days for Plasmodium malariae. A number of Plasmodium vivax and Plasmodium ovale sporozoites do not immediately develop into merozoites in the exoerythrocytic cycle, but instead become hypnozoites. Hypnozoites are able to survive (dormant) in hepatocytes for a long time, namely several weeks to several years. After the dormant phase, hypnozoites can reactivate and produce merozoites to be released into the blood circulation. Hypnozoites cause relapsing malaria cases.

1) Red blood cell phase

Erythrocytic Cycle, the merozoite then infects the erythrocyte which marks the beginning of the erythrocytic cycle. Merozoites then develop into immature trophozoites (rings), mature trophozoites, finally into schizonts which when ruptured again release merozoites and re-infect normal erythrocytes. Some parasites in the form of immature trophozoites differentiate into microgametocytes (males) or macrogametocytes (females). The gametocytes will enter the body of Anopheles sp. mosquitoes when they bite humans. The duration of the erythrocytic cycle varies depending on the Plasmodium species which has implications for fever symptoms that appear every 24 or 48 hours.

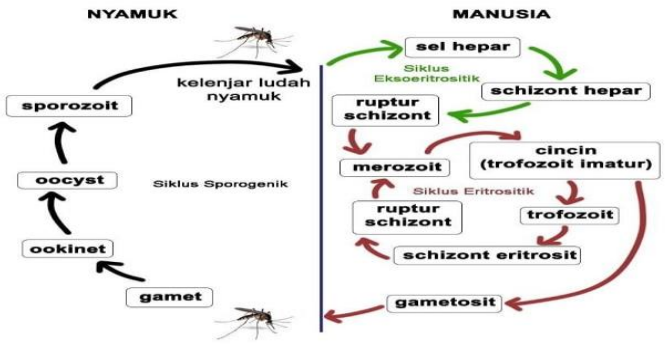

Figure 1. Life cycle of Plasmodium sp. (Soegijanto, 2004)

The pathophysiological features of malaria include fever, anemia, immunopathology and tissue anoxia, caused by the adhesion of infected erythrocytes to the capillary enothelium. Paroximal fever is different for the five species depending on the duration of schizont rupture. Fever attacks are caused by the rupture of erythrocytes during the erythrocytic schizogony phase and the entry of merozoites into the blood circulation. Fever results in vasoactivity produced by the parasite. After the merozoites enter and infect new erythrocytes, the fever drops rapidly so that the patient feels hot and sweats profusely. Anemia is caused by excessive erythrocyte destruction, hemolysis. Autoimmune and erythropoesis disorders. It is suspected that there is malaria toxin that causes disruption of erythrocyte function and some erythrocytes break when going through the spleen and the parasite comes out. Splenomegaly is caused by an increase in the number of parasite-infected erythrocytes resulting in the activity of the RES system to phagocytose both infected and non-infected erythrocytes. Pathological abnormalities of capillary blood vessels are caused because infected erythrocytes become stiff and sticky, their passage in capillaries is disrupted so that they adhere to the capillary endothelium, thymnul hypoxia or tissue anorixia also occurs monocytes or macrophages are always the most important participants in phagocytosis of infected erythrocytes (Soegijanto, 2004).

Anemia is mainly caused by erythrocyte rupture and phagocytosis by the reticuloendotetial system. The severity of hemolysis depends on the type of plasmodium and the immune status of the host. Anemia is also caused by autoimmune hemolysis, sequestration by the spleen of both infected and normal erythrocytes and impaired erythropoisis. Hyperglycemia and hyperbilirubinemia are common. Hemoglobinuria and hemoglobinemia are found when hemolysis is severe. Pathologic abnormalities of capillary blood vessels in tropical malaria are caused because infected red blood cells become stiff and sticky, their passage in capillaries is disrupted so that they adhere to the capillary endothelium because there is a protrusion of the erythrocyte membrane. After the accumulation of cells and cell fragments, capillary flow is obstructed and tissue hypoxia occurs, there is a disturbance in capillary integrity and fluid seepage can occur instead of bleeding into surrounding tissues and can cause cerebral malaria, pulmonary edema, renal failure and intestinal malabsorption (Band Dj, 2004).

Malaria symptoms generally consist of the main symptoms, namely: 1) Fever and periodic chills, sweating. Fever starts with the rupture of blood schizonts that secrete various antigens. These antigens will stimulate macrophages, monocytes or lymphocytes which in turn become sporozoites that are infective and ready to be transmitted to humans (MOH RI, 2005). 2) Headache and 3) Muscle pain. Fever occurs after the incubation period, where the incubation period varies between 9-30 days depending on the type of parasite and the mode of transmission. Other clinical symptoms include: The body feels weak and pale due to lack of blood, decreased appetite, nausea which is sometimes followed by vomiting, and continuous severe headaches, especially in infections due to Plasmodium falciparum. If malaria is chronic, the symptoms mentioned above are accompanied by enlarged lymph, enlarged spleen caused by an increase in the number of parasite-infected erythrocytes, activated reticuloendothelial system to phagocytose parasite-infected erythrocytes

and residual erythrocytes due to hemolysis (Soewarmo, 2005). While in severe malaria cases, accompanied by convulsions and decreased consciousness and coma (Irianto, 2009).

METHOD

This research was carried out in stages, where sampling and preparation began in February-March 2021 in the Gunungsari sub-district area, and observation of smears with a microscope from March-April 2021 in the laboratory of Politeknik Medica Farma Husada Mataram. The samples used in this study were venous blood from patients who performed malaria examinations at the Gunungsari health center. The samples obtained were 3 people positive for Plasmodium infection out of a total of 57 people. Venous blood samples were made thin blood smears, where thin blood smears were fixed using methanol. Then proceed with staining using giemsa and observed under a microscope with an objective lens magnification of 100 x.

The research design used in this study is Descriptive explorative research which describes a situation, symptoms and phenomena, by collecting primary data and secondary data on people in the Gunungsari sub-district area who conduct examinations at the Gunungsari Health Center. This research was conducted in two places, where sampling was carried out at the Gunugsari Health Center and microscopic examination was carried out at the Medica Farma Husada Mataram Polytechnic Laboratory. The population of this study were all patients who tested for malaria at the Gunungsari Health Center. The sample in this study is the entire total population of 57 patients who have met the criteria by showing clinical symptoms and are recommended to do Malaria examination, sampling was carried out in February-March 2021. The data that has been collected is processed in three stages, namely Editing, Coding, and Tabulation.

The data collection technique of this study is the collection of primary data and secondary data, where primary data is done by direct examination of patients who come to do malaria examination at Gunungsari Health Center. While secondary data by taking data taken from the Laboratory medical record book at Gunungsari Health Center which includes gender, age and Hemoglobin value.

RESULT AND DISCUSSION

RESULTS

Based on the results of the study (Table 1), there were 57 people who checked for malaria at the Gunungsari Health Center and 5.26% of them were declared infected with Plasmodium, while 94.73% were negative.

Table 1. Malaria testing results in Gunungsari sub-district

No	Inspection results	Total	Percentage
1	Positif (+)	3	5,26 %
2	Negatif (-)	54	94,73 %
	Total	57	100 %

Furthermore, in table 2 in sample 001, using a thin blood smear, Plasmodium falciparum was found in the tropozoite and gametocyte phases. In thin blood preparations, the size of infected erythrocytes is the same as the size of normal erythrocytes. The tropozoite phase is characterized by a ring-shaped morphology, various sizes, and the cytoplasm appears blue. In the gametocyte phase in erythrocytes, the morphological characteristics of gametocytes are shaped like a banana fruit called a "crescent" and have a nucleus in the center. Multiple infections in red blood cells (erythrocytes) are very characteristic.

Table 2: Types of parasites that infect people in Gunungsari sub-district.

Sampel	Type Parasite	Parasite stage
001	*Plasmodium falciparum*	Tropozoit dan Gametosit
002	*Plasmodium falciparum*	Tropozoit
003	*Plasmodium falciparum*	Tropozoit

In samples 002 and 003, using thin blood smears, Plasmodium falciparum was found in the tropozoite phase. Multiple infections in red blood cells (erythrocytes) are very characteristic. In thin blood smears, the size of infected erythrocytes is the same as the size of normal erythrocytes. The tropozoite phase is characterized by ring-shaped morphology, various sizes, and blue cytoplasm.

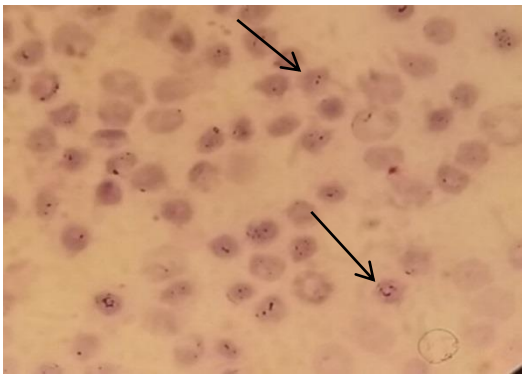

Figure 2. Morphology of Plasmodium falciparum Tropozoite stage in sample 001 (Personal documents, 2021)

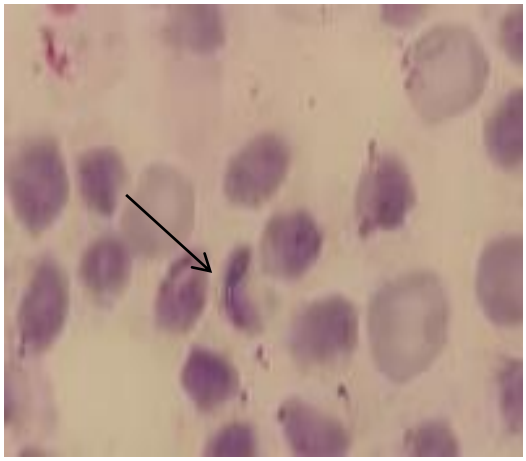

Figure 3 Morphology of Plasmodium falciparum Gametocyte stage in sample 001 (Personal documents, 2021)

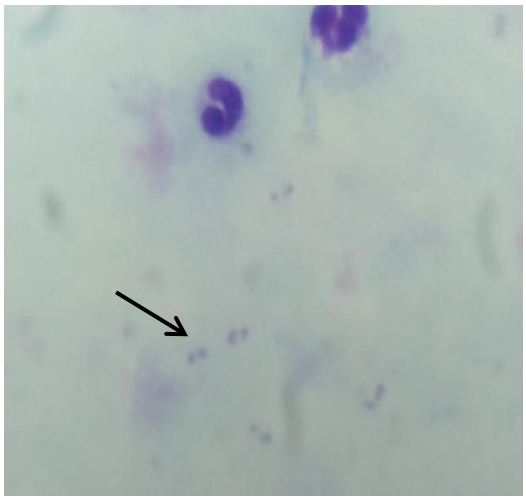

Figure 4 Morphology of Plasmodium falciparum Tropozoite stage in sample 002 (Personal documents, 2021)

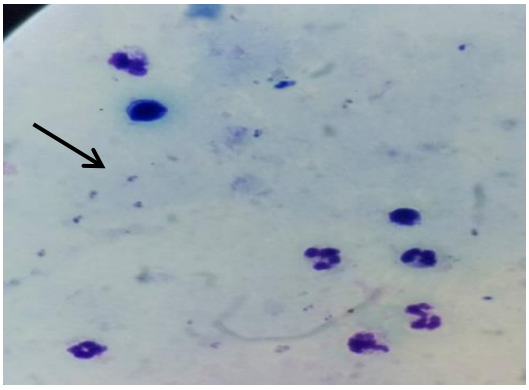

Figure 5 Morphology of Plasmodium falciparum Tropozoite stage in sample 003 (Personal documents, 2021)

Table 3 Percent of community parasitemia in Gunungsari sub-district

Sampel	Percent parasitemia	Category of parasitemia
001	2,0 %	hiperparasitemia
002	2,3 %	hiperparasitemia
003	0,8 %	Parasitemia sedang

Based on the results of table 3 in sample 001, the number of parasite density found 20 infected erythrocytes in 1000 normal erythrocytes with a percent parasitemia of 2.0%, so it is classified in the hyperparasitemia category. Sample code 002 smear found 23 infected erythrocytes in 1000 normal erythrocytes with a percent parasitemia of 2.3%, so it is classified in the hyperparasitemia category. While in sample code 003 parasites found 8 infected erythrocytes in 1000 normal erythrocytes with a percent parasitemia of 0.8%, so it is classified in moderate parasitemia.

Table 4 Patient characteristics by age, gender and Hb value

Sampel	Gender	Age (year)	Normal Value	Hb value	Category
001	Male	22	14-18 mg/dl	10,8 mg/dl	Anemia
002	Female	24	12-16 mg/dl	11,7 mg/dl	Anemia
003	Female	20	12-16 mg/dl	11,4 mg/dl	Anemia

Research results in table 4, the most positive malaria patients at Gunungsari Health Center are in the age range of 20 - 24 years. In positive patients with falciparum malaria, the Hb levels were 10.8 mg/dl (sample code 001), 11.7 mg/dl (sample code 002), 11.4 mg/dl (sample code 003).

DISCUSSION

Malaria is a parasitic infectious disease caused by Plasmodium that attacks erythrocytes and is characterized by the discovery of asexual forms in the blood. Malaria infection can occur with complications or without complications. One of the complications that occurs is severe anemia caused by the lysis of directly infected erythrocytes, the density of the number of infecting parasites in the blood, and an increase in the process of destruction of erythrocytes containing parasites (Harijanto, 2009).

Based on the results of the study there were 57 people who checked for malaria at the Gunungsari Health Center and 3 people were declared infected with Plasmodium at 5.26%, while 54 people were negative with a percentage of 94.73%. The results of this study may be caused by community behavior that is difficult to change. The number of work-related activities that are impossible to leave behind. The influence of the season also has a role in the number of mosquito vectors that cause malaria. At the time of sampling in this study, it was included in the rainy season, so that mosquito vectors would increase. This statement is reinforced by Harijanto (2000) that rain will facilitate the development of mosquitoes and the occurrence of malaria epidemics. Rain interspersed with heat will increase the possibility of breeding Anophles mosquitoes.

The habit of being outdoors at night can significantly increase the risk of developing malaria because Anopheles sp. mosquitoes have the characteristic of biting outdoors (exophagic) from dusk to morning which is also influenced by temperature, air humidity to environmental conditions where mosquitoes habitat (Stefani A et al, 2019).

There are five Plasmodium species that can cause malaria in humans. P. falciparum, P. vivax, P. ovale, P. malariae, and P. Knowlesi. Symptoms include fever, chills, anemia, and splenomegaly in acute or chronic conditions (Harijantho, 2014). The number of parasites seen in peripheral blood varies with each species. Plasmodium falciparum has the largest number, at one time it can inhabit 10-40 percent of red blood cells (Irianto, 2011).

Based on the data from the results of research that has been conducted using venous blood samples from patients who show clinical symptoms of malaria at the Gunung Sari health center, the genus Plasmodium was found with the species Plasmodium falciparum. These results are in line with the research of Hasta, et al. (2018) which states 53, 84% of the total cases at the Meninting Health Center of West Lombok NTB were infected with Plasmodium falciparum. This is in accordance with the report of the Indonesian Ministry of Health (2018) where Plasmodium falciparum is the dominant species that contributes about 52% of the total malaria cases in Indonesia. Variations in

the dominant species that cause malaria in each region can occur due to differences in geographical conditions and ecological conditions for breeding parasites and vectors even in the same country (Kemenkes RI, 2018).

Based on the smears of samples 001, 002 and 003 using thin blood smears, Plasmodium falciparum was found in the tropozoite phase. In thin blood preparations, the size of infected erythrocytes is the same as the size of normal erythrocytes. Tropozoite phase with morphological characteristics of ring shape and various sizes. Especially for sample 003, multiple infections in red blood cells (erythrocytes) are very typical.

In sample 001, in addition to the tropozoite phase, the gametocyte phase was also found in erythrocytes with morphological characteristics of gametocytes shaped like a banana fruit called a "crescent" and has a nucleus in the center. This is in accordance with the theory (Sahat, 2014) which states that in Plasmodium falciparum, only the tropozoite and gametocyte stages are found in peripheral blood, while schizonts are rarely found. Schizonts found in peripheral blood indicate the state of infection is already severe. This is in line with (Soegijanto, 2004) which states the morphology of Plasmodium falciparum in the trophozoite phase is ring-shaped with a size of 1/5 of the erythrocyte, accole (cytoplasm on the edge of the erythrocyte), and often the ring has 2 nuclei. Erythrocytes are not enlarged, there are Maurer points, and pale blue cytoplasm. Microgametocytes are shaped like bananas and scattered chromatin, while macrogametocytes have a crescent shape and dense chromatin in the center (Soegijanto, 2004).

Parasite density can help in determining prognosis and ongoing examination, can help in determining parasite response to therapy. Sample 001 and sample 002 were classified as hyperparasitemia, with parasite densities of 2.0% and 2.3% respectively. Where 20 infected erythrocytes were found in 1000 normal erythrocytes in sample 001 and 23 infected erythrocytes were found in 1000 normal erythrocytes in sample 002. Meanwhile, sample code 003 was categorized as moderate parasitemia, with a parasite density of 0.8% where 8 infected erythrocytes were found in 1000 normal erythrocytes. This is in line with Wahyuni (2005), which states that parasite density values <2.0% are categorized as mild parasitemia, 0.2-2.0% as moderate parasitemia and >2.0% as hyperparasitemia (Wahyuni, 2005).

The highest number of positive malaria patients at Gunungsari Health Center is in the age range of 20 - 24 years. This is in accordance with data from the Indonesian Ministry of Health (2018) which states that the high number of malaria cases in the adolescent and adult age groups, which are productive ages, is related to the many activities outside the home such as working, moving from place to place, or even traveling to malaria endemic areas, thus increasing the opportunity to come into contact with malaria vectors (Indonesian Ministry of Health, 2018).

The dominance of productive age in malaria cases in Gunungsari can be attributed to the working age of the population in this region. This is supported by data from the West Lombok Central Bureau of Statistics which states that the productive working age population is in the age range of 15 - 64 years (BPSKLB, 2017). These results are in line with the research of Afdhal et al. (2014) in Padang, West Sumatra where the largest percentage of malaria patients were in the age group of 20 - 40 years, namely 44.8%. Similar results were also obtained by Ghanchi et al., (2019) who examined 294 malaria patients in Pakistan, where145 malaria patients were in the age group of 16-40 years (Ghanchi NK, 2019).

In positive patients with falciparum malaria, the Hb levels were 10.8 mg/dl (sample code 001), 11.7 mg/dl (sample code 002), 11.4 mg/dl (sample code 003). This is in line with the theory of Tusy (2014), anemia is one of the hematological complications of malaria that arises due to the activity of Plasmodium parasites through increased erythrocyte destruction or production disorders. The type of Plasmodium species has been known to have a role in the severity of anemia caused because each Plasmodium species has different characteristics when infecting erythrocytes. Plasmodium falciparum is known to attack all forms of erythrocytes while Plasmodium vivax only attacks mainly reticulocytes. Therefore, the decrease in hemoglobin levels in malaria patients can be influenced by the type of Plasmodium that infects (Tusy, 2014).

Anemia or a decrease in blood hemoglobin levels to below normal values in malaria is caused by excessive destruction of red blood cells by malaria parasites (Sucipto, 2015). Anemia is one of the complications seen in malaria. It has been reported that most causes of death in malaria are caused by the level or severity of anemia (Akinbo et al, 2009). This is in line with Tusy Zulfian's research (2014) which states the average hemoglobin value in mild anemia is 11.66 g/dl, moderate 8.72 g/dl and severe 5.25 g/dl.

CONCLUSION

In the community in the Gunungsari sub-district area, 3 out of 57 people who conducted examinations at the Gunungsari Health Center were infected with malaria with a percent parasitemia value in samples 001, 002, 003 respectively of 2.0%, 2.3%, and 0.8%, where the most infectious type of Plasmodium falciparum species.

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