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Looking Into Malaria

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Looking into Malaria

History of Malaria

Diseases are everywhere, and every day scientists are discovering diseases, what causes them, how they are transferred, and what their symptoms are on the human body. We need to be aware of diseases, and find ways to treat or cure them, or at least control them when they happen. We need to gather as much information as we can in order to protect ourselves from such kind of diseases. Being aware of disease will help not only us but protect future generations. In this research paper, information is provided about malaria, the history of malaria, what causes it, how it is diagnosed, and how it could be treated.

According to the Centers for Disease Control and Prevention (CDC), malaria was noted for more than 4000 years. “The symptoms of malaria were described in ancient Chinese medical writings,” recorded by the CDC. Malaria is highly predominant in Africa, South America, and South of Asia. According to CDC, the first man who discovered the malaria parasite in someone’s blood, who was actually suffering malaria, was a French army surgeon, named Charles Louis Alphonse Laveran. He discovered the parasite in 1880 in Algeria. It was believed that two parasites are the actual cause of malaria disease. “The Italian investigators Giovanni Batista Grassi and Raimondo Filetti first introduced the names *Plasmodium vivax* and *Plasmodium malariae* for two of the malaria parasites that affect humans in 1890.” (The History of Malaria, An Ancient Disease, 2016). At the end of the 19th century in Italy, with

two million cases along with 15-20 thousand death every year pushed the two investigators Grassi and Filetti to discover the cause of the malaria disease (Majori, 2012). “On August 20th, 1897, Ronald Ross, a British officer in the Indian Medical Service,” was the first to discover that mosquitos are the host of the malaria parasite; and that the parasites is actually transmitted via mosquitos to humans (The History of Malaria, An Ancient Disease, 2016). CDC also added on their website that a team of Italian investigators including Amico Bignami and Giuseppe Bastianelli, discovered the genre of mosquitos that transmitted the malaria parasite was actually *Anopheles* species (The History of Malaria, An Ancient Disease, 2016).



Figure 1. Ronald Ross who discovered the transmission of malaria parasite via mosquitos (Mcneece Blog).

Epidemiology of Malaria

We mentioned previously that malaria parasites are transmitted by *Anopheles* mosquitos. Most commonly known, mosquitos are primarily existing in amazon areas and forests site like South America, Africa, and southern states like Florida, South Carolina, and Tennessee.

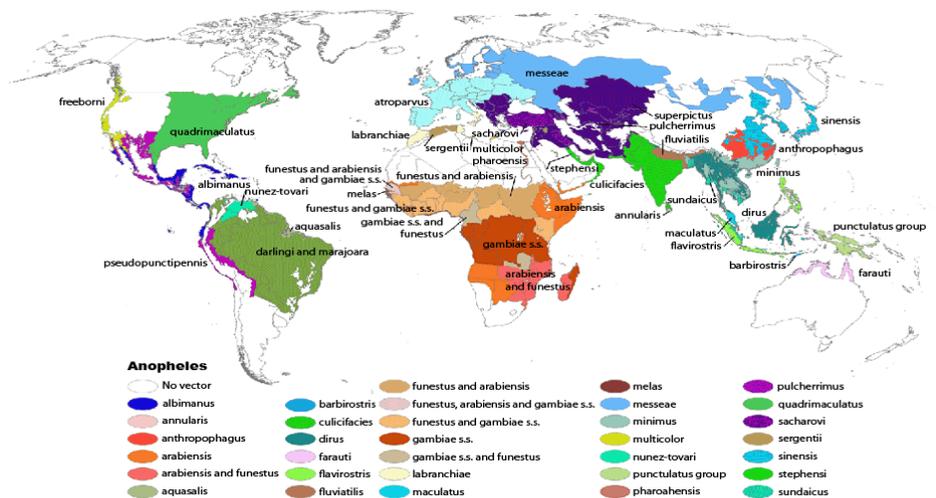


Figure 2. World map of Anopheles mosquitos population (CDC).

Research done by people who work at the Department of Epidemiology in Brazil (DEB), found that the climate variations highly affect mosquito's populations. For example, increasing the temperature will increase the population to some species over time. The research showed that certain species of mosquitos are highly abundant in parks and urbanized areas that vary widely in climate due to the factories and abundance of cars and airplanes. Researchers said "Certain mosquito species are well adapted to the urban environment, many of which reach high abundance and are important disease vectors." (Wilke et al., 2016). A study published in *Malaria Journal* stated that immigrants from Amazonian areas, led to many outbreak cases. Additionally, in non-endemic areas, where malaria is not yet present, lack of health professionals and neglect of the seriousness of the disease can lead to a rapid rise of the condition and then would spread out quickly in a population (Lorenz, et al., 2015). Therefore, malaria is an endemic disease; in which there are few cases in a population at one area.

Transmission of Malaria, Causes, and Treatments

As mentioned before, malaria uses *Anopheles* species mosquitos as a biological vector and is transmitted to mosquitos where the *Plasmodium* species replicates. Once the infected mosquito takes a blood meal, the protozoan is injected, and symptoms of malaria start to appear in the body. Sporozoites of the protozoa are formed and replicated in the mosquitos. If injected into human body, sporozoites will travel to the liver and will then start to convert to merozoites, which is a phase of the protozoan life cycle inside the blood cell. Eventually, they will turn into trophozoites. They will then start to attach to Red Blood Cell (RBCs) and cause them to rupture. Therefore, molecular oxygen (O₂) won't be attached well with a RBC, resulting in a reduced supply of oxygen to the tissues, called hypoxia. According to Prof. Tiffany Gibson, associate professor of microbiology at Parkland College, because of the rupture of RBCs, they stick to the

capillary walls, decreasing blood flow to tissues where it might lead to decrease in O₂ delivery to tissues and cells, like ischemic hypoxia (Gibson, 2016).

Control of disease might be sometimes hard. According to research conducted in Columbia, “Proper identification of malaria vectors is essential for any attempt to control this disease.” (Ahmuda et al., 2016). Using repellants could be a good a way to protect ourselves from a mosquito bite. Also, the understanding of spatial spreading of mosquitos can lead to a better way to control the transmission of malaria. For example, in Cambodia, mosquitos are found in dry and hot environment (Kerkhof et al., 2016). According to Prof. Gibson, the control of the disease might be done by the control of the mosquito’s population (Gibson, 2016). The control of the mosquito population might be a good way to prevent the spread of the disease, although it might have negative effects on the ecological system. A study that was done by a collaboration of researchers at different universities published in *Malaria Journal*, “Progress in malaria control has led to a significant reduction of the malaria burden.” The researchers added that Transmission-Blocking Vaccines (TBV) are being developed. TBV tries to affect the protozoan lifecycle at different stages, to prevent infection (Sandue et al., 2016). However, this vaccine hasn’t been approved to world stocks, so more commonly malaria is treated with antimalarial drugs. According to Prof. Gibson, treatment of malaria can include giving the patient chloroquine to prevent the symptoms. She added that CDC recommends mefloquine to be given along with doxycycline to prevent further infections. These drugs are given weekly to patients showing symptoms (Gibson, 2016). In addition to that, another article published by *Malaria Journal*, quinine was the first treatment of malaria from at least 1500s, and was introduced in Peru (Griffing et al., 2013).

Diagnosis and Symptoms of Malaria

Malaria has many symptoms and most of the time is systemic. As shown in figure 3, malaria can cause chills, fever, headache, shivering, increasing heart rate (CDC). According to Prof. Gibson's lectures, malaria can be diagnosed with a stained thin film blood smear made on slide of, and examined under the microscope. The protozoan is illustrated by dark blue spots appearing in the RBCs. Figure 4 shows a microscopic view of a slide showing infected RBCs with malaria. The spleen job is to try break down RBCs and make new ones. In this case, infected RBCs are broken down by the spleen, and they are replaced with newer ones to transport more Oxygen. The spleen is enlarged because it's doing more work in this case along with rapid rupture of malaria caused by *Plasmodium* species (Diakite et al., 2016).

In conclusion, malaria is a protozoan disease that affects the circulatory system and it's been studied and researched for centuries and decades. The goal of this research, is to make the reader aware of the disease and to know that it's prevalent.

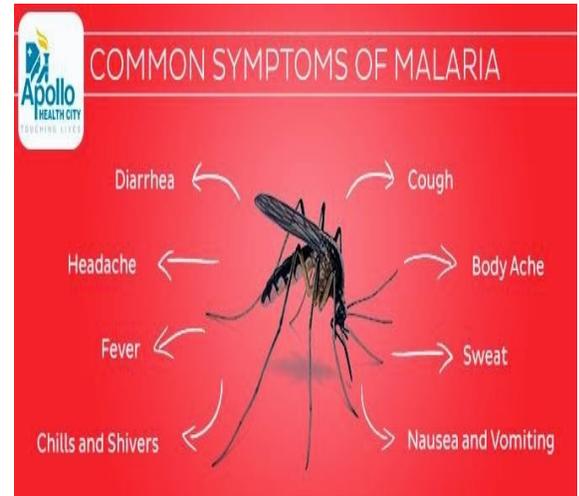


Figure 3. Common Symptoms of Malaria (Health and Disease)

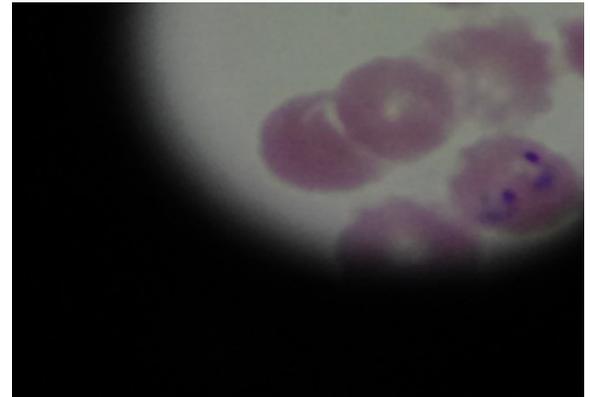


Figure 4. A picture of rupture RBC infected with malaria (Ahmad Ahmad).

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