



Published by DiscoverSys

The effect of *Sargassum duplicatum* extract on SGPT level in *Rattus norvegicus* infected by *Plasmodium berghei*



CrossMark

Herin Setianingsih,^{1*} Dimas Bathoro Bagus Pamungkas,¹ Prawesty Diah Utami²

ABSTRACT

Background: Malaria still becomes a major health problem in Indonesia, especially in the eastern part of Indonesia. The occurrence of *Plasmodium* resistance against antimalarial medications increases the difficulty of malaria wipe-out effort. As regard with such a great potential *Sargassum* production that Indonesia possesses, it is very likely to develop *Sargassum* as adjuvant therapy to prevent and even to stop the resistance.

Aim: This research aims to develop adjuvant therapy of *Sargassum* extract to avoid the resistance of malaria therapy on the SGPT level. Method: There were 24 white rats (*Rattus norvegicus*) that had been infected by *Plasmodium berghei* and were given dihydroartemisinin-piperazine (DHA-PPQ) therapy as antimalarial therapy at the dose of 3mg/KgBW for three consecutive days. The rats were later divided into three groups. Group 1 received only (DHA-PPQ), group 2 received

Sargassum duplicatum extract as adjuvant therapy at the dose of 100 mg/KgBW for ten consecutive days. Group 3 also received *Sargassum duplicatum* extract as adjuvant therapy but the dose was at 300 mg/KgBW for ten consecutive days.

Result: SGPT level decreased more significantly in groups in which the rats received dihydroartemisinin-piperazine and 100 mg/kgBW *Sargassum* extract as adjuvant therapy and on the other hand only received *Sargassum* extract at the dose of 300 mg/kgBW. After ten days of therapy the blood SGPT level was examined from all rats. The data were analyzed using one-way ANOVA test.

Conclusion: *Sargassum duplicatum* (100 mg/kgBW) showed a more significant decrease of SGPT level in *Rattus norvegicus* (Wistar strain) inoculated by *Plasmodium berghei* as against those in the dose 300 mg/kgBW.

Keywords: *Sargassum duplicatum*, malaria, SGPT

Cite this Article: Setianingsih, H., Pamungkas, D.B.B., Utami, P.D. 2019. The effect of *Sargassum duplicatum* extract on SGPT level in *Rattus norvegicus* infected by *Plasmodium berghei*. *Bali Medical Journal* 8(2): 454-456. DOI:10.15562/bmj.v8i2.1485

¹Department of Anatomy, Medical Faculty, Universitas Hang Tuah, Surabaya

²Department of Parasitology, Medical Faculty, Universitas Hang Tuah, Surabaya

INTRODUCTION

Malaria is one of the public health problems that can cause death, especially in high-risk groups like infants, children, and pregnant women. This disease is still endemic in most parts of Indonesia.¹ Malaria is a disease caused by *Plasmodium* parasites that belong to the subphylum of *Apicomplexa*. There are four species of *Apicomplexa* that drive some diseases in humans, namely *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae*.²

The occurrence of specific fever characterizes malaria infection. Each species causes cyclic fever due to parasite release from erythrocytes where they develop and multiply.² Malaria is still found in all provinces in Indonesia. Based on the stratification of the region conducted by API (parasite index), it results on the fact that the eastern part of Indonesia is the high stratification of malaria, medium stratification is in some areas in Kalimantan, Sulawesi, and Sumatra while in Java and Bali are included in low stratification, although villages with high malaria incidence were found.¹

Data released by the Indonesian Ministry of Health in 2011 showed that the API from

2008 - 2009 decreased from 2.47/1000 people to 1.85/1000 people. When viewed by each province from 2008 - 2009, regions with the highest API are West Papua, East Nusa Tenggara, and Papua. There are 12 provinces which are above the API national standard.¹ The mortality rate due to malaria is quite high. According to the Household Health Survey 2001, there are 15 million cases of malaria with 38,000 deaths annually. An estimated 35% of Indonesians live in areas at risk of malaria infection. As from either 484 districts or cities in Indonesia, 338 are endemic malaria areas.¹

The kinds of malaria disease can be different due to the differences in *Plasmodium* species. Data from the Indonesian Ministry of Health 2011, the highest cause of malaria in 2009 is *Plasmodium vivax* (55.8%), then *Plasmodium falciparum*, but *Plasmodium ovale* is unreported. These data are in contrast to data from Riskesdas Indonesia 2010, which resulted in the fact that 86.4% cause of malaria is *P. falciparum* and *P. vivax* is as much as 6.9%.¹ Malaria is an infectious disease which had been tried to be solved by all countries in the world since the early 20th century. However, WHO finds

*Correspondence to:
Herin Setianingsih; Department of Anatomy, Medical Faculty, Universitas Hang Tuah, Surabaya
herin.setianingsih@hangtuah.ac.id

it is challenging to eradicate the spread of malaria due to the quite high ability of *Plasmodium* to adapt to antimalarial medicines that eventually bring up parasitic resistance to drugs. This medicine resistance can be a threat of malaria eradication program by WHO.³

Development of *Plasmodium* resistance to medicine changes the selection of antimalarial medication. As from 1632 to 1900, the only antimalarial drug was quinine which was the extract of cinchona. In 1934, chloroquine was derived from quinine which was produced and used as the top drug of choice for malaria. Unfortunately, in 1957, resistant parasites of chloroquine emerged in Southeast Asia and South America and reached Africa in 1978.³

The next drug of choice after the use of chloroquine is a combination of sulphadoxine-pyrimethamine (Fansidar). Unfortunately, resistance to this drug grew faster in 1967. The growing resistance to Fansidar eventually culminated in the usage of mefloquine recommended officially by the Thai government in the year 1984. Then, in 1990, resistance against mefloquine appeared. Finally in 1999, WHO succeeded in developing the latest malaria drug, artemisinin, along with some of its derivatives. This medicine was extracted from the plant of *Artemisia annua*. Nowadays, artemisinin is becoming the best medicine to overcome malaria, as recommended by WHO.³

The emergence of *Plasmodium* resistance against chloroquine and some other synthetic medication leads to the difficulty of malaria eradication. One way to overcome is by searching for new medicine ingredients originating from nature, especially plants. The success of both quinine as an antimalarial and artemisinin as the most potential anti-malaria

originated from the plant, have encouraged various researches on plants as antimalarial agents.⁴ One of the estimated compounds which have an antimalarial effect is a compound class of flavonoids.⁴ The flavonoids have antiplasmodial effects directly against some strains of *P. falciparum*.⁵

As the world's largest archipelago country with the island reached 17,499 and sea area of 5.8 million km², Indonesia has a huge marine wealth.⁶ In 2010, Indonesia was able to export seaweed as much as 123,075 tons or worth the US \$ 135.9 million. Seeing these enormous amounts of value, then the potential of seaweed production in Indonesia is tremendous, allowing for the development of antimalarial medicine from seaweed sources.⁶

MATERIALS AND METHODS

The research was an experimental study conducted at the Parasitology Laboratory, Faculty of Veterinary Medicine, Airlangga University of Surabaya for 11 weeks. The study was approved by ethical committee of Universitas Hang Tuah (LPPM) (05/HC/DU/KEPUHT/1X/2014). The sample is 150 grams *Rattus norvegicus* white rats (10-12 weeks old). The plant material is brown seaweed *Sargassum duplicatum*. Rats received dihydroartemisinin-piperazine at a dose of 3 mg/kgBW for three consecutive days. Group 1 was male malaria-infected *Rattus norvegicus* receiving dihydroartemisinin-piperazine at a dose of 3 mg/kgBW for three consecutive days. Group 2 was at a dose of 3 mg/kgBW for three days combined with *Sargassum duplicatum* extract at a dose of 100mg/kgBW orally every day for ten consecutive days. At least, group 3 was a similar one as group 2, but the extract was 300 mg/kgBW. The levels of SGPT in all three groups of rats are the focus on the topic in the study and evaluated by analytical one-way ANOVA test.

RESULT

After both of malaria inoculation process and malaria treatment for each group, their level of SGPT then was described as shown in Table 1.

The data above clearly showed the decrease of SGPT level in group infected by *Plasmodium berghei* and receiving *Sargassum duplicatum* (group 2 and 3) as adjuvant therapy, compared to group infected by *Plasmodium berghei* without *Sargassum duplicatum* (group 1). The decrease of SGPT level in group 2 is more significant than group 3.

Table 2 above showed the significant difference ($p=0.027$) between rats treated by artemisinin only and those treated by both artemisinin and *Sargassum duplicatum* (100 mg/kgBW) as adjuvant

Table 1 The characteristics of SGPT level for each group

Groups	Mean (mg/dL)	Minimum (mg/dL)	Maximum (mg/dL)
A	73.2	42	83
S1	56.2	45	67
S2	61.8	57	69

Table 2 The result of anti-malaria treatment within three groups

Treatment		Mean Difference	Std. Error	Sig. (p)*
Artemisinin	Sargassum 100	17.200	6.816	0.027
	Sargassum 300	11.400	6.816	0.120
Sargassum 100	Artemisinin	-17.200	6.816	0.027
	Sargassum 300	-5.800	6.816	0.411
Sargassum 300	Artemisinin	-11.400	6.816	0.120
	Sargassum 100	5.800	6.816	0.411

*Significant $p < 0.05$

therapy. However, the different result was not significant in the group treated by both artemisinin and 300 mg/kgBW of *Sargassum duplicatum* ($p=0.120$). Moreover, the different result is also confirmed between group 3 and 2 ($p=0.411$). It was clear that the effectivity of the *Sargassum duplicatum* does not always run with the dose given.

DISCUSSION

Plasmodium infection in the human body may cause massive and fatal dysfunction. It is because the parasites in the infected body have their different cell targets, such as hepatocyte and erythrocyte. The SGPT level of infected patients increases due to the release of SGPT enzyme to the blood circulation when the cells dysfunction occurred.⁷ *Sargassum* has been proved to contain flavonoid agent.⁸ Flavonoid is predicted to have antimalarial activity.⁴ Its agent shows its antimalarial effect by blocking the growth of intra-erythrocytic parasites. It has an inhibitory effect on New Permeation Pathway (NPP), a way used by the erythrocytic parasite to transport the nutrients needed for growing into erythrocyte as well as on food vacuole of the parasite. The vacuole detoxifies the remaining heme which is toxic to the parasite, so the inhibition of the vacuole kinetic function can kill the parasite.⁴

This theory is in line with the present study that the two groups with *Sargassum duplicatum* extract as an adjuvant therapy decreased SGPT level as against less effective using only artemisinin. Furthermore, the antiplasmodial activity shows more significant SGPT level decrease in *Sargassum duplicatum* 100 mg/kgBW than 300 mg/kgBW one.

CONCLUSION

A hundred mg/kgBW *Sargassum duplicatum* shows more decrease SGPT level significantly in *Rattus norvegicus* inoculated by *Plasmodium berghei* than in the dose of 300 mg/kgBW. Therefore, it

is recommended to all researchers who want to research a similar topic to find out the most effective dose of *Sargassum duplicatum* as adjuvant therapy for malaria.

ACKNOWLEDGMENT

The authors wish to thank the Hang Tuah University of Medical Science for its financial support.

CONFLICT OF INTEREST

The authors declared that they have no conflicts of interest.

REFERENCES

1. Pusat Data dan Informasi & Direktorat Pengendalian Penyakit Bersumber Binatang. Epidemiologi Malaria di Indonesia. *Buletin Jendela Data dan Informasi Kesehatan* 2011; 1, 1–16.
2. Satoskar, A. R. & Simon, G. L. *Medical Parasitology*. Landes Bioscience. USA: Texas; 2009.
3. Yusuf, Y. Anti-Malarial Drug Resistance. *MKA* 2014; 37.
4. Saxena, S, Pant, N, Jain, DC, Bhakuni, RS. Antimalarial agents from plant sources. *Curr Sci*. 2003; 85, 1314–1329.
5. De Monbrison, F, et al. In vitro antimalarial activity of flavonoid derivatives dehydrosilybin and 8-(1;1)-DMA-kaempferide. *Acta Trop*. 2006; 97: 102–107.
6. Bakorkamla. *Surat Keputusan Kepala Pelaksana Harian Badan Koordinasi Keamanan Laut Republik Indonesia*; 2010.
7. Galatang, A., Alex Pangkahila, J., Ngurah Nala, I., Tirtayasa, K. Interval Running Exercise Reduces Running Time of 800 Meters Dash Without Causing Increased Level of SGOT – SGPT in Male Students of the Faculty of Sports Sciences, Manado State University. *Indonesia Journal of Biomedical Science* 2012; 3(2).
8. Liu, L, Heinrich, M, Myers, S, Dworjanyan, SA. Towards a better understanding of medicinal uses of the brown seaweed *Sargassum* in Traditional Chinese Medicine: A phytochemical and pharmacological review. *J Ethnopharmacol*. 2012; 142: 591–619.



This work is licensed under a Creative Commons Attribution