

Inventory of Medicinal Plants The Treatment and Prevention of Malaria in The East Sentani District Jayapura Regency

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ABSTRACT

Traditional medicine is still widely used as an alternative medication in society especially in the form of plant material. Malaria is one of a communicable disease with the high number of its incidence in Papua. Traditional plants commonly used by people in Jayapura Regency for malaria treatment are papaya, *Carica papaya* L. (*C. papaya*), *sambiloto*, *Andrographis paniculata*, (*A. paniculata*) leaves, milk wood and turmeric. Each was prepared with different processing method including boiled, mashed and grated. However, the literature on the description of malaria treatment using traditional medicine is very limited. This research was carried out with the aim of carrying out an inventory of medicinal plants for the treatment and prevention of malaria in the East Sentani area, Jayapura Regency. This research was a descriptive study performed in 7 villages of East Sentani Timur District, with total sample were 210 respondent data. Respondent was given a questionnaire to collect data of plants used as prevention and medication for malaria. The results revealed the plants used by the community in East Sentani District in treating and preventing malaria were mostly *C. papaya* leaves (47.1%), *A. paniculata* leaves (44.3%) and other plants (under 5%) such as bitter melon (3.3%), and African leaves (1.9%). The plant parts used for the treatment and prevention of malaria were mainly the leaves (98.5%). The method of processing plants was mostly by boiling the plant (88.1%), brewing with hot water (4.8%) and squeezing (4.3%). The way to use of plants for the treatment of malaria was by drinking (97.6%). The dose used by most respondents was mostly by 1 cup (62.9%). The sources of antimalarial medicinal plants from the yard of the house were 108 respondents (51.4%). From this research, plants which widely used in the treatment and prevention of malaria by the people of the East Sentani district were *C. papaya* and *A. paniculata*.

Keywords: antimalarial; medicinal plants; Papua; traditional medicine

INTRODUCTION

Traditional medicine is still widely used as an alternative medication in society. Traditional medicine is an ingredient or ingredient in the form of plant material, animal material, mineral material, preparation of extract (galenic) or a mixture of these materials which have been used for generations for treatment, and can be applied in accordance with the prevailing norms in society (BPOM Indonesia, 2004).

The high price of synthetic drugs and the presence of adverse effects trigger people to use traditional medicines. Traditional medicine used by people in several regions in Indonesia is very diverse. Some examples of traditional medicines used in certain communities include Papuans using zodia, which are shrubs, to repel malaria mosquitoes. The Javanese people use the *Catharanthus roseus* (L.) Don plant to treat diabetes, hypertension, and leukemia, treat new wounds, cure swelling and cure boils (Darmastuti

& Sari, 2011). Plants are also widely used in the prevention and treatment of malaria.

Malaria is a parasitic disease transmitted by the bite of an *Anopheles* mosquito infected with *Plasmodium* species. Malaria in humans is caused by four types of *Plasmodium*, namely *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae*; and *P. knowlesi*. *P. falciparum* is the main cause of acute malaria which kills about 1 million sufferers every year. Plants can be used for the treatment of malaria because they contain secondary metabolites from the group of alkaloids, flavonoids, xanthenes, quassinoids, triterpenes and sesquiterpenes which have the ability to kill *Plasmodium*, and thus have potential as antimalarial drugs. Prevention of malaria needs to be done comprehensively to reduce morbidity and mortality due to malaria (Taek, 2020).

From a research at Jambi (Darmawan & Lipinwati, 2014) type of traditional medicine most widely used was *A. paniculata* (27.1%), the reason of using most stated by patients was relatively small side effects (35.7%), the method of concocting was the most chosen by patients namely by crushing, boiling with water and then drinking (80%), the method of obtaining the medical plants most preferred by patients was looking around the house (80%), the duration of use of traditional medicine which was most commonly stated by respondents was 3 days (41.4%).

Research at Palangka Raya (Widiarti et al., 2016), to determine the influence of behavioral factors on the use of local wisdom as traditional medicine by the people in the city of Palangka Raya, obtained respondents who use traditional medicine as the first choice as many as 78 respondents (60.9%), and those who using traditional medicine as a second choice as many as 50 respondents (39.1%). The influence of knowledge on the behavior of the people of Palangka Raya City in the use of local wisdom as traditional medicine obtained an OR value of 0.940, meaning that people who have high knowledge have 0.94 times the opportunity to choose traditional medicine as the first treatment compared to people who have low knowledge.

In 2019, there were 250,644 malaria cases in Indonesia with Papua Province contributing 86.3% of the total cases (216,380 cases). In the same year, the Jayapura District Health Office reported 21,872 malaria cases occurred in Jayapura district (Dinas Kesehatan Kota Jayapura, 2020). Traditional plants commonly used by people in Jayapura Regency were papaya leaves, *A. paniculata*, milkwood and turmeric, with each different processing method, namely boiled, mashed and grated. However, the literature on the description of malaria treatment using traditional medicine is very limited. This research was carried out with the aim of carrying out an inventory of medicinal plants for the treatment and prevention of malaria in the East Sentani area, Jayapura Regency.

METHODS

The research method used was a cross sectional study. The research was conducted at the the East Sentani district, Jayapura Regency from August to September 2022. The study was conducted by collecting information directly from the community in the East Sentani area of Jayapura Regency. The respondent in this study were villagers belonging to the East Sentani area, Jayapura Regency, with a total of 210 respondents from seven villages in East Sentani area (Harapan, Nolakla, Puai, Nendali, Asei Besar, Asei Kecil, Yokiwa). Sample were chosen using inclusion criteria as follow, ages ≥ 17 years, a house would only represent by a respondent who have contracted malaria and used plants as medication. From each village, we obtained 30 respondents as participant. Respondent were chosen used purposive sampling method.

The data were collected using a questionnaire. The validity of the instrument in this study was carried out using Pearson's Product Moment analysis and the reliability test of the research questionnaire was carried out using Cronbach's Alpha analysis. The valid and reliable questions were 4 questions related to plants for malaria prevention and 6 questions related to plants for malaria treatment. In this

questionnaire we also collected data about respondent demographic.

The data obtained was then analyzed simply using Microsoft excel to determine the percentage of each variable. Percentage is calculated by dividing the frequency in the variable divided by the total number of sample and multiplying by 100%.

RESULTS

Respondent Characteristic

Data on the characteristics of respondents from seven villages in the East Sentani District with a total of 210 respondents were shown in the following Table 1.

In general, it was shown that most of the respondents were in the age group of 36-45 years and 26-35 years, each with 55 respondents (26.2%) and 54 respondents (25.7%), respectively. Based on gender, most of the respondents found were female (54.3%) thus the type of work was dominated by housewives with 83 respondents (39.5%). For the education level, respondents were dominated by senior high school with 99 respondents (47.1%).

Plants For Malaria

The plants used by the community in East Sentani District in treating malaria were mostly papaya used by 99 respondents (47.1%), *A.*

paniculata by 93 respondents (44.3%) and other plants used below 5% such as bitter melon (3.3%), and African leaves (1.9%). The plants used to prevent malaria were mostly papaya used by 104 respondents (49.5%), *A. paniculata* by 88 respondents (41.9%), and other plants used below 5% such as bitter melon (4.3%), and African leaves (1.4%) as shown in the following Table 2.

According to the calculation results, the highest use value was owned by the papaya plant as can be seen in Table 3, with a value of 0.471, meaning that papaya was mostly used as antimalaria, followed by Sambiloto (*A. paniculata*) with a use value of 0.443. The Informant Consensus Factor (ICF) was calculated to identify community agreement regarding the types of plants used for certain categories of uses (Tariq et al., 2014). The Informant Consensus Factor value was obtained as follows:

$$ICF = \frac{N_{ur}-N_t}{N_{ur}-1} = \frac{210-9}{210-1} = 0.96$$

Where:

ICF : Informant Consensus Factor value
 n_{ur} : the number of useful reports in each category
 n_t : the number of species used as antimalarial

Table 1. Respondent Characteristic

Factor	Category	Frequency (n)	Percent (%)
Age	17-25	25	11.9
	26-35	54	25.7
	36-45	55	26.2
	46-55	37	17.6
	56-65	25	11.9
	>65	14	6.7
Sex	Female	114	54.3
	Male	96	45.7
Education level	Elementary school	43	20.5
	Junior High School	49	23.3
	Senior High School	99	47.1
	University	19	9.0
Occupation	Government employee	14	6.7
	Private sectors	79	37.6
	Others	34	16.2
	Housewife	83	39.5

Table 2. Plants For Malaria

No	Type of plants	Malaria treatment		Malaria prevention	
		Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
1.	African leaves (<i>Vernonia amygdalina</i>)	4	1.9	3	1.4
2.	Java tea (<i>Orthosiphon aristatus</i>)	2	1.0	2	1.0
3.	Lamtoru (<i>Leucaena leucocephala</i>)	2	1.0	1	0.5
4.	Noni (<i>Morinda citrifolia</i>)	2	1.0	1	0.5
5.	Bitter melon (<i>Momordica charantia</i>)	7	3.3	9	4.3
6.	Papaya (<i>Carica papaya</i>)	99	47.1	104	49.5
7.	Sambiloto (<i>Andrographis paniculata</i>)	93	44.3	88	41.9
8.	Lemongrass (<i>Cymbopogon citratus</i>)	1	0.5	-	-
9.	Bilimbi (<i>Averrhoa bilimbi</i>)	-	-	2	1.0
Total		210	100%		

The Part of Plants Used For Anti Malaria

As mentioned in Table 3, the parts of the plant that were usually used by the community in East Sentani District for malaria treatment were mainly the leaves (98.5%), and the rest uses the seeds (1%) and stems (0.5%). The plant parts used by the community in East Sentani District for malaria prevention were mostly leaves as many as 208 respondents (99%).

Processing Methods

The method of processing plants used by the community in East Sentani District for malaria treatment (Table 4) was mostly by boiling the plant which was chosen by 185 respondents (88.1%), followed by brewing with hot water by 10 respondents (4.8%) and squeezing by 9 respondents (4.3%). The method of processing plants used by the community in East Sentani District for malaria prevention was mostly by boiling, namely 182 respondents (86.7%).

Method of use

Based on Table 5, it can be seen that the plants used for the treatment of malaria by the people in the East Sentani District are mostly used by drinking (97.6%) while the rest used the plants by eating (1.9%) and inhaling the vapors (0.5%). The method of processing plants used by the community in East Sentani District for malaria prevention was mostly by boiling with 182 respondents (86.7%).

Dosage For Malaria Treatment

The dosage of plants used by the community in East Sentani District for malaria treatment varies by using a glass as a measuring tool or a spoon. There were also respondents who measure the dose of the number of plant parts used. Most respondents used a dose of 1 cup in consuming plants for the treatment of malaria, as many as 132 respondents (62.9%).

Table 3. Use Value of Anti Malaria Plants

No.	Type of Plants	ΣU	n	Use Value
1.	African leaves (<i>Vernonia amygdalina</i>)	4	210	0.019
2.	Java tea (<i>Orthosiphon aristatus</i>)	2	210	0.009
3.	Lamtoru (<i>Leucaena leucocephala</i>)	2	210	0.009
4.	Noni (<i>Morinda citrifolia</i>)	2	210	0.009
5.	Bitter melon (<i>Momordica charantia</i>)	7	210	0.033
6.	Papaya (<i>Carica papaya</i>)	99	210	0.471
7.	Sambiloto (<i>Andrographis paniculata</i>)	93	210	0.443
8.	Lemongrass (<i>Cymbopogon citratus</i>)	1	210	0.004

Table 4. Part of Plants Used For Anti Malaria

No	Part of plants	Malaria treatment		Malaria prevention	
		Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
1.	Stem	1	0.5	-	-
2.	Seed	2	1.0	1	0.5
3.	Leaf	207	98.5	208	99.0
4.	Flower	-	-	1	0.5
Total		210	100%	210	100%

Table 5. Processing Method For Plants Used For Antimalaria

No	Processing method	Malaria treatment		Malaria prevention	
		Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
1.	Boiling the plants	185	88.1	182	86.7
2.	Squeezing	9	4.3	8	3.8
3.	Pounded	1	0.5	1	0.5
4.	Brewing with hot water	10	4.8	10	4.8
5.	Without processing	5	2.4	9	4.3
Total		210	100%	210	100%

Table 6. Method of Use

No	Method of use	Frequency (n)	Percent (%)
1.	Drinks	205	97.6
2.	Inhaling the vapor	1	0.5
3.	Eating	4	1.9
Total		210	100%

Table 7. Dosage For Malaria Treatment

No	Dosage	Frequency (n)	Percent (%)
1.	1/2 cup	60	28.6
2.	1 cup	132	62.9
3.	> 1 cup	9	4.3
4.	> 3 leaf	4	1.9
5.	1 table spoon	5	2.4
Total		210	100%

DISCUSSION

Respondent Characteristics

Respondents who carried out malaria self-medication or malaria prevention were mostly in the adult age group, namely 36-45 years and 26-35 years, 55 respondents (26.2% and 54 respondents (25.7%). A person's age indicates the length of time a person's life is calculated from the time the person was born. A person's age usually influences their behavior in carrying out self-medication (self-medication) and also in

efforts to prevent malaria because the more experience the person has (Wedu, 2021).

Based on gender, most of the respondents encountered were female, namely 114 respondents (54.3%) so the type of work was dominated by housewives (IRT) as many as 83 respondents (39.5%). The results of this study were in line with research on the use of traditional medicines which were dominated by female respondents as in the study in NTT (Maja, 2021). Women tend to be more concerned about health conditions than men, so

women have a bigger role in determining treatment, including traditional medicine for malaria. In addition, female respondents were usually more cooperative to be interviewed during the research process. Women also tend to have more time at home than men, so they were more often encountered at the time of data collection (Maja, 2021).

Most of the respondents had completed high school education (47.1%). Generally, people with a higher level of education will tend to consider the efficacy of the drug they want to use and conduct information searches before use. In addition, with high knowledge, more consideration will be given to the risks of using these drugs (Suherman & Febrina, 2019).

Plants Used for Malaria

Medicinal plants are plants that have certain properties or plants that have the potential to be used as medicine. Medicinal plants themselves are widely used by the community for the manufacture of traditional medicines where the method of manufacture is by taking several parts of the plant and then mixing it with a certain dosage. However, there is also compounding in which it is mixed with other types of plants. The results of making traditional medicines can be in the form of powders or extracts and we often call them traditional medicines. Traditional medicines are usually mixed from raw materials that are still fresh or that have been dried. Traditional medicines that are mixed fresh are usually called jamu. Traditional medicine which is mixed by drying it is often referred to as simplicia (Handayani, 2021).

The plants used by the people in East Sentani District in treating malaria were mostly papaya used by 99 respondents (47.1%), *A. paniculata* by 93 respondents (44.3%) and other plants used under 5% such as bitter melon (3.3%), and African leaves (1.9%) The same plants were also used in preventing malaria, namely papaya (49.5%), *A. paniculate* (41.9%), Bitter melon (4.3%), and African leaves (1.4%). Research in Jambi (Darmawan & Lipinwati, 2014) also reported that *C. papaya* leaves

(22.9%) were the most preferred by malaria sufferers, followed by bitter melon 6 respondents (8.6%), *A. paniculata* 19 respondents (27.1%), Bratawali as many as 8 respondents (11.4%), and others 21 respondents (30%).

In ethnobotany knowledge, the Kenyah Dayak tribe, East Kalimantan and the Pesaguan Dayak tribe, West Kalimantan and the Serambai hamlet community, West Kalimantan use Papaya (*C. papaya*) as a treatment. According to Abdillah, the people of Seikepayang, North Sumatra use *C. papaya* and Guava (*Psidium guajava*) as malaria drugs and the results of testing *C. papaya* leaf extract and Guava leaf extract as antimalarials on *Plasmodium berghei* were obtained with IC₅₀ values 0.177 and 0.625 g/mL respectively (Abdillah et al., 2014).

There have been many studies on the antimalarial activity of papaya. Papaya is known to contain alkaloids, flavonoids, and glycosides. The mechanism of plant extracts containing alkaloids is to suppress the growth of protozoa in blood tissues. In addition, plant extracts containing flavonoids, saponins, and tannins have a mechanism for reducing the number of high leukocytes, and plants containing tannins and steroids have a mechanism to inhibit the growth of *Plasmodium* by decreasing TNF- α expression (Singh et al., 2020).

In addition, the *C. papaya* plant is a plant that has the potential as a natural insecticide, this is because the content of alkaloids, flavonoids, and saponins contained therein can be used as natural insecticides. *C. papaya* leaves contain active ingredients such as papain enzymes, karpain alkaloids, pseudocarpain, glycosides, carposids, saponins, flavonoids, saccharose, dextrose and levulose. Of these ingredients, which have potential as insecticides are the enzymes papain, saponins, alkaloid flavonoids, and karpain. These compounds cause various reactions in the larvae's body so that they can interfere with the growth and development of the larvae (Rehena, 2010).

A. paniculata is a herb that is often used as traditional medicine. The benefits of *A. paniculata* include pyrexia, inflammation, intermittent fevers, dyspepsia, dysentery, high

blood pressure, typhus, whooping cough, diabetes, and canker sores (Chauhan et al., 2019). Almost all parts of the *A. paniculata* can be used for traditional medicine (BPOM Indonesia; 2004). For example, its leave could be used for colic pain, fever, tuberculosis, diarrhea (Chauhan et al., 2019). The herbs have been used for centuries in Asia to treat ailments including malaria and the plants have been widely studied abroad, although not for malaria. *A. paniculata* has traditionally been used for the treatment of malaria in Indonesia. The antimalarial activity of *A. paniculata* is from 50% ethanol extract which inhibits the growth of *Plasmodium berghei* *in vitro* (100 mg/ml) and *in vivo* after intra-gastric administration to rats with *Plasmodium berghei* malaria at a dose of 1 g/KGBB (Darmawan & Lipinwati, 2014)

Bitter melon (*Momordica carantia* L.) contains alkaloids (momordisin), tannins, glycosides Bitter melon leaves can be used to facilitate menstruation, medicine for burns, skin diseases and intestinal worms. The antimalarial activity of bitter melon can be related to the synergistic and antagonistic effects of chemically active metabolites present in extracts such as alkaloids, saponins, flavonoids, tannins, quinones, steroids, triterpenoids and coumarins (Mozaniel et al., 2018). The mechanism of action of alkaloids in bitter melon is not known with certainty but is thought to be similar to one of the antimalarial drugs which is a blood schizonticid, namely quinine. Quinine acts as a blood schizonticide and a weak gametocide against *P. vivax* and *P. malariae* infections (Amutha et al., 2013). The mechanism of action of triterpenoids as antimalarials is not known with certainty but is thought to be involved in the destruction of cell membranes by lipophilic compounds (Tertiana, 2021)

African leaves (*Vernonia amygdalina*) have been used in Africa for the prevention of treatment of malaria. Several studies abroad have proven the anti-plasmodium activity of African leaves *in vitro* and *in vivo* (Abay et al., 2015). African leaves have secondary compounds in the form of alkaloids, flavonoids, steroids, saponins and tannins. The death of *Aedes*

aegypti larvae at all concentrations is thought to be caused by the active compounds contained in African leaves. African leaf extract contains alkaloids, flavonoids, steroids, saponins and tannins. Compounds contained in African leaf extracts such as tannins have been tested as stomach poisons in larvae. Tannin will enter through the digestive tract and then reduce the activity of digestive enzymes and absorption of food. As a result of a disturbed digestive system, the larvae will experience developmental delays, disrupted nutritional needs, which can lead to the death of the larvae. In contrast to tannins, flavonoids act on the respiratory system of the larvae as inhibitors. Flavonoids enter through the larval siphon and then wither the respiratory nerves which result in the larvae not breathing and eventually dying (Hasibuan, 2022).

According to the calculation results, the highest use value was owned by papaya plants as shown in table 3, with a value of 0.471, meaning that papaya is the most widely used in the treatment of malaria, followed by *A. paniculata* with a use value of 0.443. The utility value (UV) was used to indicate the relative importance of locally known plant species and determined the number of use reports described by each informant for each species (Napagoda et al., 2014). The higher UV (close to one or more than one), it can be seen that the species has the potential to be studied further. Use Value shows the species that are considered most important by a particular population (Silalahi, 2012). Use Value is based on the number of respondents who use or know and the number of respondents who state a particular species. Based on the value of use or Use Value (UV), plants that have high values are medicinal plants that have many benefits and are recognized by most respondents, while plants with low values are plants that have little or no efficacy recognized by respondents.

Informant Consensus Factor (ICF) was used to identify community agreement regarding the types of plants used for certain categories of use, obtained ICF = 0.96. Each disease category is calculated to identify community agreement regarding the types of plants used to treat certain diseases (Tariq et al., 2014). The ICF value will

be low (close to zero) if the informants do not exchange information about the use of these plants in traditional medicine. The score will be high (close to one) if there are well-defined selection criteria in the community and/or if informants exchange information (Phumthum & Balslev, 2018).

Part of the Plant Used

Communities in East Sentani District in utilizing plants for the treatment and prevention of malaria use more than one part of the plant. Some plants have different medicinal functions in each part, so one plant can have more than one property in healing disease. The results of the questionnaire data showed that there were four parts of the plant used as medicine by the people in East Sentani District, namely stems, seeds, leaves, and flowers, with 98%-99% of respondents using the leaves. This result consistent with a large-scale study aim to give information about traditional medicine used as antimalaria in Papua that stated that almost half of the respondents (44,38%) used leaves to treat malaria (Budiarti et al., 2020) The parts of the plant used contain secondary metabolites that have specific functions but are not essential. Secondary metabolites can be synthesized by certain plant organs, such as roots, leaves, flowers, fruits and seeds. Secondary metabolites in plants are generally very specific in terms of function and are not very important because if they are not produced, in the short term they will not cause death (Anggraito et al., 2018).

Leaves are plant organs that are widely used as a traditional medicine because leaves have soft fibers, making it easy to extract substances to be used as medicine. Part of the leaves (Folium) is easy to mix and easy to use to extract the essence or properties of plants. In the leaves also found more types of chemical compounds that have medicinal properties such as flavonoids, tannins, saponins, phenols, and alkaloids (Mawunu et al., 2022). With this chemical content, the leaves have quite a lot of medicinal potential (Eni et al., 2019). In addition, leaves are also the most widely used part of plant organs as a traditional medicine because leaves

are generally softly textured because they have a high-water content, besides that leaves are a place for the accumulation of photosynthesis which contains elements of secondary metabolites in curing various diseases (Beis et al., 2022; Mawunu et al., 2022).

Plant Processing Methods

The method of processing plants used by the people in the East Sentani District for malaria treatment was mostly by boiling the plants chosen by boiling or brewing with hot water. Processing of plants used as medicine was carried out by a decoction process, namely boiling the whole plant parts or crushing them first and then drinking the water regularly every day. Other processing was done by boiling the plant parts then the water was used for soaking (Mufidah & Zuhrotun, 2020)

According to Jumiyati et al., (2021) processing medicinal plants by boiling can reduce the tasteless and bitter taste compared to directly eating, and boiling was more sterile because it can kill germs or pathogenic bacteria. The boiling process can remove substances contained in plants and have a very fast reaction (Beis et al., 2022)

Plant Used Methods

Based on table 6, it was shown that the plants used for malaria treatment by the people in the East Sentani District were mostly used by drinking (97.6%) while the rest use the plants by eating (1.9%) and inhaling the steam (0.5%). According to respondents, how to use traditional medicine depends on how to mix the traditional medicine. Some traditional medicines were directly used by the community without being mixed or processed first.

The Dosage of Plant Used

The dosage of plants used by the people in East Sentani District for the treatment of malaria was vary, using measuring instruments such as cups and spoons to determine the amount of dose used. There were also respondents who measured the dose based on the number of plant parts used. Most

respondents used a dose of 1 glass in consuming plants for the treatment of malaria, namely as many as 132 respondents (62.9%), 1/2 cup by 60 respondents (28.6%), more than 1 cup by 9 respondents (4.3%), then 1 spoon as much as 5 respondents (2.4%). Respondents who calculated the dose based on the number of parts of the plant used, namely more than 3 leaves, were 4 respondents (1.9%).

In general, the use of traditional medicine among respondents was still carried out in traditional ways, such as measuring and processing. To measure doses of traditional medicine, they still use a hand-held system, knuckles, or the amount of pieces/fruit. The amount of ingredients used for each traditional medicine varies for each respondent. Some respondents use the principle of the number of ingredients with odd numbers. According to the respondent, the use of doses with an odd number was only based on the fact that it had often been carried out from generation to generation and there were testimonies that people believed in these doses. However, there are also people who do not use an odd calculation system and only use an adequate measure. Some people stated that the calculation of odd quantities was not mandatory, in fact, some respondents only mentioned the required amount of ingredients. In addition to the dosage and dosage for consuming medicinal plants must be right, the time of use must also be right to minimize the side effects that arise. One example is turmeric. Turmeric, which is believed to reduce pain during menstruation, can actually cause a miscarriage if consumed early in pregnancy (Sumayyah & Salsabila, 2017).

Plant Origin

For the treatment of malaria, people in East Sentani District usually collect plants from their yards and gardens. The medicinal plants used by the respondents were generally obtained from the location around the respondent's residences. With the customary village layout system, which leaves a field in the middle of the village, it is possible for some plants to grow wild.

CONCLUSIONS

This research found out that there were similar plants used by people in East Sentani District for the treatment and prevention of malaria that is *C papaya*, *A. paniculata*, bitter melon (*Momordica charantia*), and African leaves (*Vernonia amygdalina*).

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