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Antiplasmodial and Toxicological Effects of *Carica papaya and Allium sativum* on Albino Rats Infected with *Plasmodium berghei*

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Abstract: ***Malaria is still one of the greatest global public health problems especially in sub Saharan Africa.The aim of this study is to evaluate the anti-plasmodial and toxicological effects of the ethanolic extracts of Carica papaya and Allium sativum using an in vivo animal model. Malaria infection in rat was initiated by intraperitoneal (IP) inoculation of 0.5 ml blood, diluted to contain 2 x ^{107}/ml parasitized red blood cells from a donor mouse infected with P. berghei for four days. Three control groups were created viz: non-inoculated, inoculated but untreated and standard control (inoculated and treated with 10mg/kg Combisunate). Experimental groups consists of two categories with five sub-groups were created with each category representing the ethanolic extracts of Carica papaya and Allium sativum respectively. The five sub-groups in each category represent the five concentrations of 100, 300, 500, 800 and 1000mg/kg administered for five days of treatment. The average suppressive effectswere obtained. Result showed that the parasitemia level for the treated groups decreased progressively for the five days period. The result of the biochemical markers showed that the plant extracts posed no toxicity effects. Hence, the ethanolic extracts of Carica papaya leaves and Allium sativum bulbs showed moderate anti-plasmodial properties and are less toxic to the body.***

Keywords: Toxicological, antiplasmodial, *Carica papaya, Allium sativum Plasmodium berghei*

1. Introduction

The World Health Organization (WHO) lists malaria, human immunodeficiency virus (HIV), and tuberculosis as the three major infectious diseases throughout the world [1]. In 2015, WHO reported 214 million malaria cases and 438000 deaths due to the disease. Unfortunately, 70% of all malaria deaths occur in children less than five years of age [2]. This can be partly attributed to the development of resistance by malaria parasites to most of the established anti-malarial drugs such as chloroquine, sulphadoxine/pyrimethamine and amodiaquine. Currently, fixed dose artemisinin-based combination therapies are being used as first-line treatment. Unfortunately, recent reports indicate a decline in efficacy of artemisinin derivatives. New classes of anti-malarial agents are therefore urgently needed given that the resistance of the parasite is likely to eventually compromise the efficacy of currently available anti-malarial drugs. Identification of lead anti-malarial agents from medicinal plants could boost the search.
Plant sources as anti-malarial agents has gain a lot of interests since the discovery of artemisinin, a compound found to be very active against drug resistant malaria parasites, from herb plant *artemisiaannua*[3]. This plant has been used to treat malaria and fever for thousands of years in China. This medicine was the starting that leads to the isolation of artemisinin, which has now become the therapy for malaria in combination with currently available antimalarial drugs such as piperaquine, mefloquine, lumefantrine, naphthoquine etc. [4]. Nigeria has a huge biodiversity and some plants have been identified to possess medicinal values. Screening of plants for their pharmacological and medicinal properties has not been fully explored and therefore creates the need for investigations. This study is aimed at investigating the anti-malarial properties of herbal plant extracts so as to find a better and more efficient way of totally eradicating malaria from Africa and other affected countries.

1.1 Aims and Objectives

This study attempts to discover new natural active extract(s) against malaria parasites, in order to achieve this, the study aimed at evaluated the antiplasmodial properties of selected plants (*carica papaya* and *Allium sativum*on albino rats infected with *plasmodium berghei*.

The following objectives were set:
1) Inoculate rats using NK 65 strain of *Plasmodium berghei*
2) Determine the plasmodium inhibition/clearance effect of the extracts of the selected plants in rat.
3) Determine the effect of the extracts kidney and liver markers in rat.

1.2 Significance of the Study

The burden of malaria makes a serious contribution to the depression and/or decline of the economy of countries. This is most felt in rural areas of sub-Saharan Africa where poverty and deprivation are prevalent. The availability of natural products like medicinal plants will greatly help to solve the healthcare problems of these rural communities. Over the years, *carica papaya* and *Allium sativum* have been used as drink and spice respectively, which have generated a lot of interest throughout human history as a medicinal panacea. This research will be particularly relevant in our society where importance of *carica papaya* and *Allium sativum*as food is neglected or underused and their cultivations is considered not important.

1.3 Some Selected Plants Under-Going Research for Antimalarial Properties

carica papaya and *Allium sativum* are under exploited plant species, although they are common and largely available plants. Their medicinal properties have been previously reported. These plants are used in some parts of Southern Nigeria in the treatment of malaria, hence the need to investigate these therapeutic potentials. The availability of natural products like medicinal plants will greatly help to solve the healthcare problems of these rural communities. This research will be particularly relevant in our society where importance of *carica papaya* and *Allium sativum*as food is neglected or underused and their cultivations is considered not important. It is more like a case of using available resources to solve a threatening problem.

2. Materials and Methods

2.1 Plant Samples and Extraction

For *Allium sativum*, the bulb of the plant was used, whereas for*Carica papaya*, the leaves parts were used. The plants were bought from fruit garden D-Line in Port Harcourt and were identified by the herbarium unit of the department of Plant Science and Biotechnology University of Port Harcourt. The dried powdered bulb or leaves of these plants were extracted using absolute ethanol as a solvent in a soxhlet extractor. The solvent was completely removed with the aid of a rotary evaporator. The ethanol extracts were stored at −20°C until used. Before experiments, the extracts were then dissolved in appropriate volume of water to give the desire doses.

2.2 Acute Toxicity of *Carica papaya* and *Allium sativum*

The acute toxicity of Carica papaya and Allium sativum was tested in rats, which were dosed in a stepwise procedure using the fixed doses of 1000, 2000, 3000, and 5000 mg/kg body weight were administered orally according to the OECD guideline. The animals were fasted overnight before the administration. The animals were then observed for 3 h for general behavioral, neurological, and autonomic profiles and every 30 min for the next 3 h and finally for mortality after 24 h till 7 days.

2.3 Experimental Animals

Pathogen-free White male albino rats (*Rattusnorvegicus*) weighing about 120–130 g were used throughout this study. The rats were obtained from the Animal Housing Unit, university of Port Harcourt and allowed access to food (feeding pellets ad libitum) and water. Rats were handled with care especially when they are been transferred from the animal house to laboratory at least an hour prior to use, in order to reduce the effects of stress. They were kept under observation (Acclamatization) for about 10 days before the onset of the experiment to exclude any form of infection. The chosen animals were housed in plastic well aerated cages at normal atmospheric temperature (25 ± 5 °C) and normal 12 hour light/dark cycle.

2.4 Rodent Malaria Parasite and Malaria Infection

Rodent malaria parasite *Plasmodium berghei* ANKA strain was originally obtained from the Nigerian Institute of Medical Research in Yaba Logos. The parasite has been maintained at the Malaria research Laboratory of the University of Port Harcourt by a combination of passage in male rat and plasma storage. Malaria infection in rat was initiated by intraperitoneal (IP) inoculation of 0.5 ml blood, diluted to contain 2 x 10^7/ml parasitized red blood cells (PRBC) from a donor mouse infected with *P. berghei*. Controls to malaria-infected rat were given an equivalent volume and dilution of normal uninfected red blood cells.

2.5 Parasitaemia Measurement

To Measure the parasitaemia levels in the animals, thick and thin film smears were made on slides for microscopic viewing. A drop of blood through venesection of the tail from each malarial animal, onto the edge of a microscope slide (single, 76 x 26 mm thickness). The blood was drawn across a second slide to make a thin blood film. The slide was left to dry at room temperature before staining with Giemsa stain. Slides were studied under light microscopy with oil immersion (1000x magnification). The average percentage (%) Parasitaemia was calculated as follows:

$$\%\ \boldsymbol{parasitemia} = \boldsymbol{number\ of\ parasitised\ red\ blood\ cells} * \frac{\mathbf{100}}{\boldsymbol{number}} \boldsymbol{of\ total\ red\ blood\ cells}$$

The average results from five different fields were then taken as the final percentage of parasitaemia. The average percentage parasite inhibition was obtained using the formula:

$$\boldsymbol{Av.\%\ Inhibition} = \boldsymbol{Av.parasitemia\ in\ untreated\ group} - \boldsymbol{Av.parasitemia\ in\ treated\ group\ x}\ \mathbf{100}/ \boldsymbol{Av.parasitemia\ in\ untreated\ group}$$

2.6 Experimental Design

Rats were infected with *P. berghei* as described above and were divided into thirteen groups in a plastic wire cages. combisunate was used as a standard and was dissolved in distilled water and a dose of 10mg/kg (oral administratiom) were given in a single daily dose at midday starting from day 1 until day 4 following four days of inoculation. Normal Control group was introduced which were exposed to the same experimental conditions as others and were allowed access to food and water only, the group is also known as the uninfected rat group. An untreated group was also created. That is, a group inoculated with P. berghei for four days like every other inoculated groups but was not treated when others are receiving treatment for four days post inoculation process. Two categories with five sub-groups were created with each category representing the ethanolic extracts of *Carica papaya and Allium sativum*respectively. The five sub-group in each category represent the five serial dilutions of 100, 300, 500, 800 and 1000mg/kg ethanolic extracts administerterd for four days for the treatment of the parasite.

2.7 Estimation of Suppressive Test Against *p. berghei* Infection in Rat

Ethanol extracts of the two plant species were assessed for *in vivo* activity in a four- day suppressive test against *P. berghei* infection in rat. Rats were inoculated with 0.5ml of 2 x 10^7 PRBC intraperitoneally as described above. All extracts were dissolved in 2.5% tween 80 and diluted with water to provide doses of 100, 300, 500 and 1000 mg/kg body weight. The extracts were administered in a single daily dose orally according to their body weight from day 1 until day 4 post infection. Parasitaemia development in the infected rat was monitored on the first, third and fifth day of the treatment.

2.8 Biochemical Estimation

After four days of treatment, the rats were sacrificed on the fifth day using chloroform. Blood was collected directly from the heart of the animals through 2 ml syringe into heparinized bottles in order to obtain plasma for biochemical analysis. The colorimetric method is used for the determination of AST, ALT and ALP in plasma. Randox kits were used, adopting the method of [5]. The Biuret method is used for the in vitro determination of total protein in serum. The Randox kits were used for the manual evaluation. For Total Bilirubin, The colorimetric method employed here is based on that described by Jendrassik and grof [6]. The Berthelot method is used for the in vitro determination of urea in serum. The Randox kits were also used for this manual evaluation.

2.9 Statistical Analysis

Statistical analysis of the data obtained in this study was performed by one-way ANOVA using the SPSS version 20 software followed by a single post hoc test. P<0.05 was taken as statistically significant. Values are average mean and standard error mean (SEM) of four variables.

3. Result

3.1 Acute Toxicity Studies (LD_{50})

The ethanolic extracts of *Carica papaya leaves*and *Allium sativum bulbs* administered orally in rat during acute toxicity study. Four doses of 1000, 2000, 3000, and 5000mg/kg body weight were administered and observed for activity after the first 30 minutes of administration. No mortality was observed after seven days in all categories of extracts and as well all through the four concentrations so chose. Though, behaviors like paw licking, restiveness, aggressive behaviors and at times extreme calmness were also observed. Loss of weight associated with reduction in food consumption was observed in groups administered with 3000mg/kg and 5000mg/kg garlic. The reverse happened in other groups were increase in concentration lead to a rise in appetite and subsequently a recorded increase in body weight after seven days.

3.2 Suppressive Effect of Ethanolic Extracts of Carica papaya and Allium sativum on Parasitemia Level

The ethanolic extracts of*Carica papaya*and *Allium sativum showed* dose dependent antimalarial effect against *P. berghei* infection in rats and caused a significant ($p < 0.05$) inhibition when compared to the untreated group. The highest inhibition (99.67%) was observed in combisunate treated group. However, the rats were not completely cured from the infection in all treatment doses. The results of the standard 4-day suppressive test against P. berghei infected rats were summarized below.

Table 1(a): Average Percentage Suppression of control groups against *Plasmodium berghei*

S/N	GROUP	Av % parasitemia	Av % Inhibition
1	Normal Control	0.00±0.00	100.00
2	Negative Control	18.15±1.49	0.00
3	Positive Control	0.06±0.06	99.67

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different (p<0.05) when compared to the normal control. Values with superscript b, are significantly different (p<0.05) relative to the negative control. While values with the superscript c, are significantly different (p<0.05) compared to the positive control.

Table 1(b): Average Percentage Suppression of *Carica papaya, (leaf)* ethanolic extracts against *Plasmodium berghei*

S/N	Group	Administration of ethanolic extracts in mg/kg of *C. papaya*	Av % parasitemia	Av % Inhibition
4	GA1	100	1.35±0.29	92.56
5	GA2	300	1.18±0.09	93.50
6	GA3	500	0.72±0.15	96.03
7	GA4	800	0.34±0.08	98.13
8	GA5	1000	0.21±0.03	98.84

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different (p<0.05) when compared to the normal control. Values with superscript b, are significantly different (p<0.05) relative to the negative control. While values with the superscript c, are significantly different (p<0.05) compared to the positive control.

Table 1(c): Average Percentage Suppression of *Allium sativum (leaf)* ethanolic extracts against *Plasmodium berghei*

S/N	Group	Administration of ethanolic extracts in mg/kg of *A. sativum*	Av % parasitemia	Av % Inhibition
1	GB1	100	0.71±0.07	96.09
2	GB2	300	1.08±0.35	94.05
3	GB3	500	0.73±0.13	95.98
4	GB4	800	0.40±0.08	97.80
5	GB5	1000	0.30±0.04	98.35

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different (p<0.05) when compared to the normal control. Values with superscript b, are significantly different (p<0.05) relative to the negative control. While values with

the superscript c, are significantly different ($p<0.05$) compared to the positive control.

3.3 Effects of Ethanolic Extracts of *Carica papaya* and *Allium sativum* on Some Biochemical Indices of Rats

Table below shows the activity of AST, ALT and ALP and other biochemical markers in control and experimental groups. The AST activity was significantly lower in the rats feed with feed and water only 9.00±0.70 (Normal control) as compared with the treated groups and as compared with the inoculated but untreated 40.75±1.88 control group. However, there was a significance difference ($P > 0.05$) in each category of plant extracts as they show a progressive decrease in the value of AST with increase in concentrations having the least AST activity in the 1000mg/kg group administered with Allium sativum 11.25±0.47 ethanolic plant extracts. Table also shows ALT activity in the control groups 10.50±0.50, 28.25±1.93 and 20.00±0.81 for normal, negative and positive control groups respectively and as compared with the treated groups. The activity of ALP is similar to that observed in AST and ALT. There was slightly or no significance difference ($P > 0.05$) between total protein and Albumin activity when comparing the groups relative to increase in concentrations of the extracts. Values here show no linearity as they are not dose dependent. The level of total protein is highest in normal control (fed with feed and water only) group and lower in experimental groups. The Total Bilirubin concentrations were shown to be 5.50±0.28 and 18.75±1.25 for the normal control and non-treated group respectively. Comparing the T.Bil concentration for the normal control to the non-treated group showed a statistically significant ($p<0.05$) increase. The T.Bil concentration for the treated groups were significantly ($p<0.05$) lowered when compared to the non-treated group. The Urea concentrations were shown to be 2.42±0.08 and 4.90±0.18 for the normal and non-treated group respectively. Comparing the Urea concentration for the normal control to the non-treated group showed a statistically significant ($p<0.05$) increase. The Urea concentration for the treated groups were significantly ($p<0.05$) lowered when compared to the non-treated group. TheCreatinin concentrations were shown to be 61.25±1.75 and 72.50±1.70 for the normal and non-treated group respectively. Comparing the Creatinin concentration for the normal control to the non-treated group showed a statistically significant ($p<0.05$) increase. The Creatinin concentration for the treated groups were significantly ($p<0.05$) lowered when compared to the non-treated group

Table 2(a): Effects of Ethanolic Extracts of *Carica papaya (leaf)* on Some Biochemical Indices of Rats

S/N	GROUP	Administration of ethanolic extracts in mg/kg of *C. papaya*	AST	ALT	ALP	T.P
1	Normal Control	FEED AND WATER ONLY	$9.00±0.70^{bc}$	$10.50±0.50^{bc}$	$118.75±1.49^{bc}$	$69.25±1.03^{bc}$
2	Negative Control	UNTREATED	$40.75±1.88^{ac}$	$28.25±1.93^{c}$	$192.00±2.97^{ac}$	$53.00±1.87^{ac}$
3	Positive Control	COMBISUNATE	$25.75±1.65^{ab}$	$20.00±0.81^{ab}$	$146.00±3.58^{ab}$	$59.25±1.10^{ab}$
4	GA1	100	$31.00±02.27^{abc}$	$23.00±1.08^{abc}$	$179.00±1.47^{abc}$	$52.25±1.65^{abc}$
5	GA2	300	$23.25±1.65^{abc}$	$19.25±1.25^{abc}$	$172.00±2.97^{abc}$	$56.75±1.10^{abc}$
6	GA3	500	$18.50±0.86^{ab}$	$15.00±1.08^{ac}$	$165.00±2.67^{abc}$	$60.50±0.64^{abc}$
7	GA4	800	$13.50±0.64^{abc}$	$13.75±1.75^{ac}$	$154.75±2.05^{abc}$	$61.75±0.75^{abc}$
8	GA5	1000	$11.50±0.64^{bc}$	$9.50±0.50^{abc}$	$144.50±2.78^{abc}$	$61.50±1.04^{abc}$

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different ($p<0.05$) when compared to the normal control. Values with superscript b, are significantly different ($p<0.05$) relative to the negative control. While values with the superscript c, are significantly different ($p<0.05$) compared to the positive control.

S/N	Group	Administration of ethanolicextracts in mg/kg of *C. papaya*	ALB	T.BIL	C.B	U	CRE
1	Normal Control	Feed and Water Only	$37.75±0.85^{bc}$	$5.50±0.28^{bc}$	$2.50±0.28^{bc}$	$2.42±0.08^{bc}$	$61.25±1.75^{bc}$
2	Negative Control	Untreated	$25.50±1.32^{ac}$	$18.75±1.25^{ac}$	$9.25±0.47^{ac}$	$4.90±0.18^{ac}$	$72.50±1.70^{ac}$
3	Positive Control	Combisunate	$33.00±1.29^{ab}$	$17.50±0.86^{ab}$	$7.25±0.62^{ab}$	$3.15±0.10^{ab}$	$67.50±1.04^{ab}$
4	GA1	100	$28.75±0.62^{abc}$	$16.00±0.70^{abc}$	$6.50±0.64^{abc}$	$4.77±0.11^{abc}$	$70.00±0.81^{abc}$
5	GA2	300	$28.75±0.47^{abc}$	$13.25±1.10^{abc}$	$5.75±0.47^{abc}$	$4.22±0.11^{abc}$	$70.75±2.32^{abc}$
6	GA3	500	$29.50±1.04^{abc}$	$12.25±0.85^{abc}$	$6.25±0.85^{abc}$	$3.77±0.08^{abc}$	$68.50±2.32^{abc}$
7	GA4	800	$32.50±0.64^{abc}$	$10.25±0.25^{abc}$	$4.00±0.00^{abc}$	$3.35±0.10^{abc}$	$62.25±1.25^{abc}$
8	GA5	1000	$32.75±1.10^{abc}$	$10.50±0.64^{abc}$	$4.75±0.47^{abc}$	$3.12±0.11^{abc}$	$60.50±1.70^{abc}$

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different ($p<0.05$) when compared to the normal control. Values with superscript b, are significantly different ($p<0.05$) relative to the negative control. While values with the superscript c, are significantly different ($p<0.05$) compared to the positive control.

Table 2 (c): Effects of Ethanolic Extracts of *Allium sativum (leaf)* on Some Biochemical Indices of Rats

S/N	GROUP	Administration of ethanolic extracts in mg/kg of *A. sativum*	AST	ALT	ALP	T.P
1	Normal Control	Feed and Water Only	9.00±0.70^{bc}	10.50±0.50^{bc}	118.75±1.49^{bc}	69.25±1.03^{bc}
2	Negative Control	Untreated	40.75±1.88^{ac}	28.25±1.93^{c}	192.00±2.97^{ac}	53.00±1.87^{ac}
3	Positive Control	Combisunate	25.75±1.65^{ab}	20.00±0.81^{ab}	146.00±3.58^{ab}	59.25±1.10^{ab}
9	GB1	100	22.50±1.44^{abc}	22.00±0.81^{abc}	193.50±2.53^{abc}	49.00±1.47^{abc}
10	GB2	300	20.00±1.63^{ab}	17.00±1.08^{abc}	184.75±2.86^{abc}	55.50±0.64^{abc}
11	GB3	500	14.75±0.85^{ab}	12.25±0.85^{abc}	171.50±3.37^{abc}	56.50±1.55^{abc}
12	GB4	800	12.50±0.64^{bc}	10.50±0.64^{abc}	157.75±2.65^{abc}	59.50±1.19^{abc}
13	GB5	1000	11.25±0.47^{bc}	10.00±0.40^{abc}	145.75±2.95^{ac}	61.75±0.85^{abc}

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different ($p<0.05$) when compared to the normal control. Values with superscript b, are significantly different ($p<0.05$) relative to the negative control. While values with the superscript c, are significantly different ($p<0.05$) compared to the positive control.

Table 2(d): Effects of Ethanolic Extracts of *Allium sativum (leaf)* on Some Biochemical Indices of Rats

S/N	Group	Administration of ethanolic extracts in mg/kg of *A. sativum*	ALB	T.BIL	C.B	U	CRE
1	Normal Control	Feed And Water Only	37.75±0.85^{bc}	5.50±0.28^{bc}	2.50±0.28^{bc}	2.42±0.08^{bc}	61.25±1.75^{bc}
2	Negative Control	Untreated	25.50±1.32^{ac}	18.75±1.25^{ac}	9.25±0.47^{ac}	4.90±0.18^{ac}	72.50±1.70^{ac}
3	Positive Control	Combisunate	33.00±1.29^{ab}	17.50±0.86^{ab}	7.25±0.62^{ab}	3.15±0.10^{ab}	67.50±1.04^{ab}
9	GB1	100	27.75±0.47^{abc}	15.00±0.40^{abc}	5.50±0.28^{abc}	4.87±0.17^{abc}	74.25±2.13^{abc}
10	GB2	300	29.00±0.40^{abc}	11.50±0.64^{abc}	4.50±0.28^{abc}	4.52±0.14^{abc}	74.00±2.41^{abc}
11	GB3	500	30.50±0.64^{abc}	10.50±0.64^{abc}	4.75±0.25^{abc}	4.02±0.17^{abc}	68.25±1.88^{abc}
12	GB4	800	31.75±1.03^{abc}	10.00±0.81^{abc}	4.00±0.45^{abc}	3.50±0.12^{abc}	62.50±1.04^{abc}
13	GB5	1000	32.50±0.64^{abc}	11.25±0.62^{abc}	5.00±0.40^{abc}	2.82±0.06^{abc}	63.00±1.87^{abc}

Data are expressed as Mean ± SEM. n=4. Values found in a column with common superscript letter a, are significantly different ($p<0.05$) when compared to the normal control. Values with superscript b, are significantly different ($p<0.05$) relative to the negative control. While values with the superscript c, are significantly different ($p<0.05$) compared to the positive control.

4. Discussion

Plants are considered as a source for the development of effective antimalarial agents. Since drug resistance is a significant challenge in the fight against malaria, developing new drugs to control malaria is absolutely critical. The antimalarial plants studied in this work had previously been described as useful medicinal plants for several disease conditions, when used alone or in combination with other plants. Carica papaya has been used for the treatment of various skin disorders and wounds, particularly burns [7] and as an antibiotic in the treatment of chronic skin ulcers [8] and for gastroenteritis, uretritis, otitis media. *Allium sativum* has been used as an antioxidant, antitumor, anti-allergic, anti- inflammatory, antidiabetic, antiboneresorption, antiviral, antifungal, antibacterial and antiparasitic agent [9]. *Allium sativum* has been used to soothe nerves and to treat conditions associated with stress, including anxiety, insomnia, hysteria, colds, nasal congestion, throat irritation, headaches, sinus headache, migraine headache, palpitations, hypertension, incontinence, hepatitis, colitis, rheumatism, hemorrhage, abscesses (ulcuscruris), as well as a diuretic and antispasmodic agent [10]. Malaria is a common ailment in Nigeria and most sick persons do not go to the clinic because they can apply self-medication and advices are freely offered for every new method thought to be effective against malaria. Therefore, the use of these herbs for the treatment of malaria should be encouraged, but the practice should be standardized. This study selected two plants and evaluated their antiplasmodial activity. Following *Carica papaya* and*Allium sativum* administration, the suppression rates of parasitemia in albino rat were 98.84% and 98.35% respectively at 1000mg/kg doses. They plants showeddose dependent antimalarial effect against P. berghei infection in rats and caused a significant ($p < 0.05$) inhibition when compared to the untreated group. The highest inhibition (99.67%) was observed in group treated with combisunate. However, the rats were not completely cured from the infection in all treatment doses. Several studies have attributed the antiplasmodial properties of plants to their alkaloids, flavonoids, terpenoids, anthraquinones, and glycosides contents (Akbar, 2011). The effects on biochemical parameters demonstrated the lowering of the activity of liver markers (ALT, AST, ALP and TB).

5. Conclusion

The investigation of the antiplasmodial property of the ethanolic leaf extracts of *Carica papaya* and *Allium sativum* showed that the extracts possessed antimalarial activity as revealed by the significant percentage parasitemia clearance. The effects on biochemical parameters demonstrated the lowering of the activity of liver markers (ALT, AST, ALP and TB). These further established the antimalarial potential of the plant extracts considering that antiplasmodial activity is closely related to hematopoietic activity and the lowering of liver enzymes concentrations. The antiplasmodial, hepatic-enhancing and renalgesic effects of *Carica papaya*and *Allium sativum*might therefore be as a result of any one or combination of the phytochemicals present in the plants and showed no toxicity at all levels of administration.

The use of the plant material in folkloric medicine is thus verified by this study.

6. Contribution to Knowledge

- The plant extracts showed high antimalarial properties.
- The plants showed a dose dependent anti-plasmodial property.
- It provides a basis for multilevel treaties, partnerships collaborations and curriculum design on global level.
- It provides a guideline for evaluation of leadership

7. Recommendations

On the basis of the findings of this survey, the following are recommended:

1) Further work should be done to ascertain the use of the plant in preventive malarial therapy.
2) The plant should be used in combination with other plants with known antimalarial activity to understand how this synergy can boost the antimalarial property of the plant.
3) Attempts should be made to isolate the active substance responsible for specific therapeutic action.

References

[1] World Health Organization (2010). World malaria report. Availabe at: http://WWW.who.int/ malaria/world-malaria-report-2010/en/
[2] World Health Organization (2015). World malaria report Geneva. 2015. Availabe at: http://http://www.who.int/malaria/publications/world-malaria-report-2015/
[3] Klayman, D.L (1985). Qinghaosu (artemisinin): an antimalarial drug from China. Science, 228:1049-1055
[4] Nadjm, B. and Behrens, R. (2012). Malaria: an up-date for physicians. *Infectious Disease Clinics of North America.* 26 (2): 243-59.
[5] Reitman, S and Frankel, S. (1957). A colorimetric method for the determination of serum glutamate oxaloacetate and pyruvate deaminases. *American Journal of Clinical Pathology*, 28:56-68.
[6] Jendrassik, L and Grof, P. (1938). Estimation of total serum bilirubin level spectrophotometrically in serum and plasma. *BiochemZeitschrift*, 297:81-89.
[7] S Gurung., N Skalko-Basnet.(2009). Journal of Ethnopharmacology, 121, 338-341
[8] G. Dawkins, H. Hewitt, Y. Wint, P.C.M Obiefuna, B. Wint. (2003) West indian med journal, 52, 290-291
[9] Rohner, Andres.,Ried, Karin., Sobenin, Igor A., Bucher, Heiner C., Nordmann, Alain J. (March 1, 2015). "A Systematic Review and Metaanalysis on the Effects of Garlic Preparations on Blood Pressure in Individuals with Hypertension". American Journal of Hypertension. 28 (3): 414–423. doi:10.1093/ajh/hpu165. ISSN 1941-7225. PMID 25239480.
[10] Stabler, Sarah N., Tejani, Aaron M., Huynh, Fong, Fowkes, Claire (August 2012). "Garlic for the prevention of cardiovascular morbidity and mortality in hypertensive patients". Cochrane Database of Systematic Reviews. 8 (8): CD007653.
[11] Akbar S. (2011). Andrographispaniculata: A review of pharmacological activities and clinical effects. *Alternative Medicine Reviews 16, 66-77.*

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