The Effect of Ethanolic Extract of Hyptis suaveolens in Malaria

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Abstract - The need to identify medicinal plants that can be used in the treatment and control of malaria and other protozoal and parasitic diseases is underscored by the increasing resistance of *Plasmodium* species to hitherto widely used anti-malarial drugs such as chloroquine and more recently quinine. Resistance to these drugs which occurs with increasing frequency consequently underlies the necessity to develop new agents for malaria chemotherapy. *Hyptis suaveolens* (family Labiatae) a plant traditionally used in the treatment of fever, as well as 'evil spirit' related diseases and for repelling mosquitoes was screened for this purpose in the present study. The activities of the ethanolic extract of the leaves of this plant was investigated against rodent Plasmodium infection, analgesic studies, pentobarbital (sleeping time), sub-acute toxicity, haematological evaluation as well as histopathology was carried out. A total of two hundred and fifteen animals, one hundred and fifteen Wistar rats and one hundred albino mice were used for the various aspect of the study. The LD_{50} of the extract was found to be 1264.91 $\pm$ 0.51mg/kg (I.P) in mice and rats. The leaf extract displayed a good antiplasmodial activity against plasmodium berghei (08.2 $\pm$ 2.70) corresponding to 51.05% suppression and (01.17 $\pm$ 0.75) corresponding to 94.58% curative. The analgesic models used showed that the extract inhibits the formalin noxious stimulation on both phases of the test but failed to exhibit significant effect in tail flick test ($P > 0.05$)..

Keywords : Ethanolic, leaf extract, Hyptis sauveolens, Malaria

1 INTRODUCTION

After the successful introduction of chloroquine, proguanil, pyrimethamine and primaquine in the decade following the Second World War, little active interest was shown either by academics or commercial investigators in prolonging the search for new anti-malarial drugs (Peters,1967). Interest in anti-malarial was revived first by the demand for new compounds which would better satisfy the needs of a mass eradication campaign and then by the emergence of strains of *Plasmodium falciparum*, originally in south America and later in Southeast Asia, which failed to respond to the standard administration of chloroquine. Bruce-Chwatt (1965) traced the progress made since this situation arose. The need for new drugs was underlined by a special committee convened to examine the problem (WHO, 1965). The mechanisms underlying the development first of chloroquine resistance and later of mixed drug resistance by *Plasmodium falciparum* are still completely unknown (Peters, 1967).

The fact that the recognition of such strains coincides both in time and place with a major war, and indeed that the disease in itself now presents a potentially serious military problem (Blount, 1964; Tigerit,1966), has resulted in an acute surge of interest and the allocation of large sums of moneys for research. Interestingly, the World Health Organization has recommended the integration of traditional medicines proved to be useful into National Health Care Programmers (WHO, 1976), set up guidelines for its study (WHO, 1991) and defined its roles under what it termed "Traditional Medicine/Complementary and Alternative Medicine (TM/CAM)" by developing a strategy to address issues of policy, safety, efficacy, quality, access and rational use (WHO, 2005). Traditional medicine practice is most popular in developing

countries (Elisabetsky, 1991) and unique in its own way because it takes a holistic view of patients situation (Jager, 2005). Several bioactive agents in modern pharmacopoeia were derived from products initially used in traditional medicine (Farnsworth, 1985; Astin, 1998; De Smet, 1998; De Silva, 2005).

The search for insecticides of plant origin has been limited in the Nigeria situation. However, Agbakwuru *et al.* (1978), Osisiogu and Agbakwuru (1978) and Iwuala *et al*. (1981) demonstrated that *Dennetia tripetala* oil was active against adults and nymphs of the cockroach, *Periplaneta americana* and the grasshopper, *Zonocerus variegatus* as well as weevils of stored cowpeas and maize (Anyanwu and Uloko, 2000).

In Nigeria, the drug of choice as therapy for *Plasmodium falciparum* is still chloroquine despite its adverse effects, including hypersensitivity reactions which result in itching. To avoid the adverse reactions, many people in both the rural and urban areas in Nigeria have resorted to treating the disease with local medicinal plants such as *Enantia chlorantha*, a member of the family Annoaceae (Agbaje and Onabanjo,1991). Although there is no scientific proof of the plant's efficacy as antimalarial. Therapy with decoction is known to be effective against many bacterial infections and to have striking antipyretic action (Oliver, 1960). Research on medicinal plants is now a popular subject that appeals to life scientists. Due to the problems of drug resistance and the cost of drugs, scientists especially in Africa and other developing countries are conducting research into local plants and herbs which are used in traditional medicine (Swain, 1972). Plants such as *Azadirachta indica* (Necm tree) and *Chromolaena adorata* are now reputed as efficacious anti-malarial plants (Ekanem, 1978; Narescon, 1992). *Zanthoxylum tsihanimposa* (Rutaceae) bitter plant endemic to Madagascar is used for the treatment of malaria in some parts of Madagascar (Milijaona *et al*, 2003).

2 THE MALARIA PROBLEM

Malaria is an infectious disease caused by the protozoan parasite *Plasmodium* of which there are four main species namely; *Plasmodium vivax, Plasmodium ovale, Plasmodium falciparum* and *Plasmodium malariae.* It is transmitted by the female anopheles mosquitoes. The disease can be treated in just forty eight hours, yet it can cause fatal complication if the diagnosis and treatment are delayed. Malaria is the number one priority tropical disease of the World Health Organization (Summary of Notifiable diseases, 1997). Malaria affects more than 2,400 million people, over 40% of the world population, in more than 100 countries of America to the Indian Peninsula. The tropics provide ideal breeding and living conditions for the *Anopheles* distribution. Every year, 300 million to 500 million people suffer from this disease 90% of them in sub Saharan Africa, two thirds occur in six countries namely India, Brazil, SriLanka, Vietnam, Colombia and the Solomon Islands. The World Health Organization (WHO) forecasts a 16% growth in malaria cases annually. About 1.5 million to 3 million people die of malaria every year, 85% of these in Africa. One child dies of malaria somewhere in Africa every twenty seconds and there is one malaria death every twelve seconds. Malaria kills in one year, what acquired immune deficiency syndrome (AIDS) killed in fifteen years. If five million have died of AIDS, fifty million people died of malaria. Malaria ranks third among the major infectious diseases in causing deaths after pneumococcal acute respiratory tuberculosis. It is projected that by the turn of the century, malaria would be the number one infectious killer; it accounts for 2.6 percent (2.6%) of the total disease burden of the world and is responsible for the loss of more than a million lives each year. Every year, more than thirty thousand visitors to endemic areas develop malaria and one percent of them may die. Estimated worldwide expenditure on malaria research is estimated at $58 million, one thousand of the $56 billion research annually, estimated worldwide expenditure per malaria fatality is

$65 million. Malaria was nearly eradicated from most parts of the world by the early sixties, owing largely to concerted anti-malaria campaign under the guidance of the World Health Organization (MMWR, 1997).

The following are some of the reasons for the resurgence of malaria.

i. Man-made: Complacency and laxity in anti-malaria campaigns, conflicts and wars, migration and poverty.
ii. Parasite: Drug resistance
iii. Vector: Insecticide resistance and ban on the use of DDT.
iv. Environment: Global warming increased breeding and life span of the insect vector.
v. Jet age: Shrinking world-spread of malaria from endemic areas to all other part of the world.

(Source: Summary of Notifiable Diseases United State, 1997).

2.1 Distribution of Malaria and Background

The documented history of malaria in parts of Asia goes back more than two thousand years, during which the disease has socioeconomic stages in many nation states as they waxed and waned in power and prosperity, has been seen in microcosm, a history of large fluctuations in endemicity and impact of malaria across the spectrum of mountains and plains that reflect the vast ecological diversity inhabited by this majority aggregation of mankind (Curtis, 1997).

The most dramatic changes in social and economic structure, population size, density and mobility and in politics played a part in the changing face of malaria in this (Asia) extensive region of the world. While the majority of global malaria threats in the form of the epicenter of multi drug resistant *Plasmodium falciparum* which is gradually encompassing the region reflects directly and vicissitudes of economic change over recent decades, particularly the mobility of population and personal fortunes or caught in the misfortunes of physical conflicts. The period from the 1950s to the 1990s eradication followed by resurgence of malaria in Srilanka, control and resurgence in India, the influence of wall resistance in combodia, increase in severe and cerebral malaria in Myanma during prolonged political turmoil, the disease from all, but forested border areas of Thailand where it remains for the moment intractable, the basis eliminate many provinces of Central China. Both positive and negative experiences have lessons to teach in the debate between alternative strategies. China has for years held high goal of 'basic elimination" eradication by another name. The Chinese experience makes it clear that, given community organization, exhaustive attention to and focus on elimination, plus the political will at all levels of society; it is possible both to eliminate malaria from the land and to implement surveillance necessary to maintain something approaching eradication status in those areas. But the international border region of the tropical south, where unfettered population movement confounds the program, to an extent (CDCMMWR, 1997). Vietnam has also reached essential elimination in their rice field plains by vigorous vertical programs between borders. Economics is central to the history of the rise and fall of nations and to the history of disease in the people's current love affairs with free market economics. The main driving force for the advance of national wealth has put several communities involved in malaria management. The task of malaria control or elimination needs to be clearly articulated on a macroeconomic process that preoccupies governments not to cloister away in the health sector (Curtis, 1994).

3 EFFORTS AT MALARIA CONTROL

There are effective anti-malaria drugs and the World Health Organization emphasizes early diagnosis and prompt treatment of malaria. However, there are major problems of drug resistance, particularly to chloroquine which has been the mainstay of malaria treatment, especially in Africa because of its low cost and relative freedom from side effects. Malaria is a major health problem in Nigeria as in other parts of sub-Saharan Africa. Estimates show that this disease accounts for no less than three hundred thousand (300,000) deaths from more than twenty million clinical attacks annually (Anon, 2000), while 10-20% of hospital admissions are due to malaria. Children under the age of five years and pregnant women are among vulnerable groups bearing the brunt of the disease (Molta, Daniel, Watila, Oguche, Out, Anneh and Gadzama, 2004). The problem of malaria is compounded by the declining sensitivity of *Plasmodium* species notably *Plasmodium falciparum* to the array of available anti-malarial drugs. Resistance to chloroquine has been widely documented in Nigeria. On the cool central highlands in the middle of a hot plain, the first organized anti-malarial drug

efficacy study was conducted by the National Malaria and Vector Control Division (NMVCD) of the Federal Ministry of Health (FMOH) at Miango, Plateau state in 1989 (Anon,1989). The study at that time confirmed that *Plasmodium falciparum* on that part of the plateau was fully sensitive to both chloroquine (CQ) and sulfadoxine pyrimethamine (SP).

One of the key strategies of the Roll Back Malaria (RBM) initiative of the World Health Organization (WHO) in endemic countries involves mapping anti-malarial drug resistance (Odutola, 1999). This strategy is useful for providing the necessary evidence for national malaria treatment policy formulation. It is also vital for achieving primary health care objectives of combating malaria induced morbidity and mortality through the use of effective anti-malarial drugs (Molta *et al.,* 2004). There is much interest in the development of malaria vaccines, but the only one which has been extensively field tested only gave a limited degree of protection (Alonso *et al.*, 1994). Between the 1940s and 1960s malaria eradication was achieved in the U.S.A, USSR, Southern Europe and most Caribbean islands mainly by vector control. Much progress was also made in the Indian subcontinent and parts of South America. There are some common anti-malarial drugs used worlds wide, these include:

i. Quinine: this has been used for more than three centuries and until the 1930s, it was the only effective drug for the treatment of malaria. It is a schizontocide that kills the asexual cells in the blood, but cannot act against the causative agent in other tissues.

ii. Fansidar and maloxine; these are combination drugs, each tablet containing sulphadoxine 500mg and pyrimethamine 25mg. they act by interfering with folate metabolism. The treatment of malaria patients in Nigeria with mefloquine, sulphadoxine, pyrimethamine combination was observed to have superior efficacy over chloroquine (Ekanem *et al.,* 2000).

iii. Proguanil, pamaquine, mepacrine and primaquine; these are drugs that proved to be useful for killing the causative organism in the liver and blood (Fisher and Chistic, 1973). In Nigeria, pyrimethamine and chloroquine have been the drug of choice for the prevention and treatment, especially of malaria infection during pregnancy. Resistance of *Plasmodium falciparum* to chloroquine and other anti-malarial drugs, including the relatively recent introduced mefloquine is reported in different place (Wellems, 1991; Okoyeh *et al*., 1993 ; Ejor *et al*., 1999).

Molta *et al.* (2004) demonstrated that chloroquine performed poorly with cure rate of only 43% against *Plasmodium falciparum* infection. Both low and high grade resistance of the parasite against the drug was demonstrated in 37.7% and 3.8% of the patients respectively. This finding has serious consequences for the effective implementation of the Roll Back Malaria (RBM) strategies of controlling malaria in Nigeria since chloroquine is the first-line drug of choice (Anon, 1990a; 1990b; 1991), as well as the cheapest, safest and most widely available anti-malaria drug in the area. The international consensus is that when the resistance level against a first-line drug exceeds 25%, then it is no longer suitable for the first-line treatment of the infection (Bloland *et al.,*1993). Clearly, therefore, chloroquine is not very useful in reducing malaria morbidity and mortality in the study area of the North Central Plateau.

On the other hand, Sulphadoxine and pyrimethamine produced a high cure rate (85%) against *falciparum malaria* in the Plateau area. This is good evidence supporting the existing treatment policy in Nigeria of using the drug as second-line therapy in the event of chloroquine failure against the parasites. The cure rate obtained with sulphadoxine pyrimethamine in the study area is close to 82% recorded by Lege-Oguntoye *et al*. in Zaria from June –December 1988, (Lege-Oguntaye *et al*., 1991). Both rates are at least two and half times higher than the 31.5% recorded recently in the rural Delta Region of Southern Nigeria (Anon, 2001).

4 MATERIALS AND METHODS

4.1 The Study Area

The geographical entity known as Nasarawa state came into existence on the 1st of

October, 1996. It has a central location in the middle belt region of Nigeria. Nasarawa state lies between latitude 7^0 45′ and 9^0 25′ N of the equator and between longitude 7^0 and 9 37′E of the Greenwich meridian. It shares boundaries with Kaduna state in the north, Plateau State in the east, Taraba and Benue states in the south while Kogi state and the Federal Capital Territory flank it in the west (Akwa *et al.,* 2007).

Nasarawa state fondly called "Home of solid minerals" has an altitude of 181.5m above sea level. Located in the north- central geo-political zone of

Nigeria, the state has a land area of 27, 137.8 square Kilometre with a Population of 1,863,275 according to 2006 provisional Census. It has 13 local Government areas (Figure 1).

Nasarawa is situated at the confluence of river Uke and river Ahini which are main tributaries of river Benue. The main access to Nasarawa town is the Keffi – Nasarawa-Toto road, which continues to Kotonkarfe in Kogi state. The highest temperature tends to occur at the end of the dry season. March has the highest temperature, the lowest temperature occur in the middle of the dry season in December or January when outgoing radiation is encouraged by low humidity clear sky and longer nights. The lowest monthly mean temperature of the year occur in the middle of the rainy season, when the daily minimum temperatures are low. Nasarawa town experiences a marked seasonal rainfall, a dry season without or with little rain from November to March and a wet season from April to October. The mean annual rainfall is 1,300mm (Akwa *et al*., 2007).

Tammah from where the experimental plants were collected is one of the district in Nasarawa local government area which is located within Nasarawa north, it is along Keffi-Toto road and the settlement is the headquarters of the district which is directly opposite the Federal Polytechnic Nasarawa main campus (Figure 2).

4.2 Preparation of the Plant Materials

The fresh Leaves of *Hyptis suaveolens* (labiatae) were collected from Tammah, Nasarawa Local Government Area, Nasarawa State, Nigeria and authenticated at the Taxonomy Unit, Department of Medicinal Plant Research and Traditional Medicine, National Institute for Pharmaceutical Research and Development (NIPRD) Abuja, Nigeria. A voucher specimen of the plant was deposited at the Taxonomy Unit of the Department. The leaves were plucked from the stem and air dried for seven days and milled to a coarse powder as described by Tona *et al* (2001).

5 PROCESSING OF THE PLANT MATERIALS

This was done according to the method described by Awe and Makinde (1997a). The coarse powder (200g) of *Hyptis suaveolens* leaves was obtained by pounding the air dried leaves with a morter and pestle. The coarse powder was transferred into the thimble of a soxhlet extractor blocked at the bottom with cotton wool. Absolute ethanol (350ml) was added to the extractor covered with cotton wool. The setup was allowed for soxhlet refluxing for 72hours. The ethanolic extract was collected in a flask and concentrated to dryness in a water bath at 40 -60^{o} C. The dried extract was weighed and stored in the refrigerator at 4^{o}C.

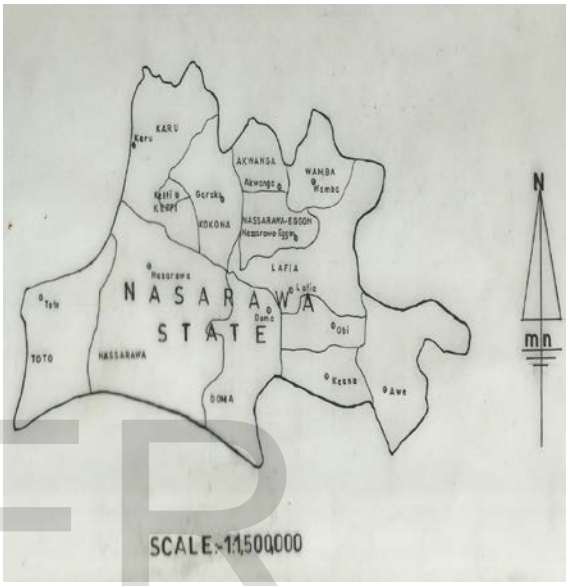

Figure 1: Map of Nasarawa State showing Nasarawa Local Govt. Area.

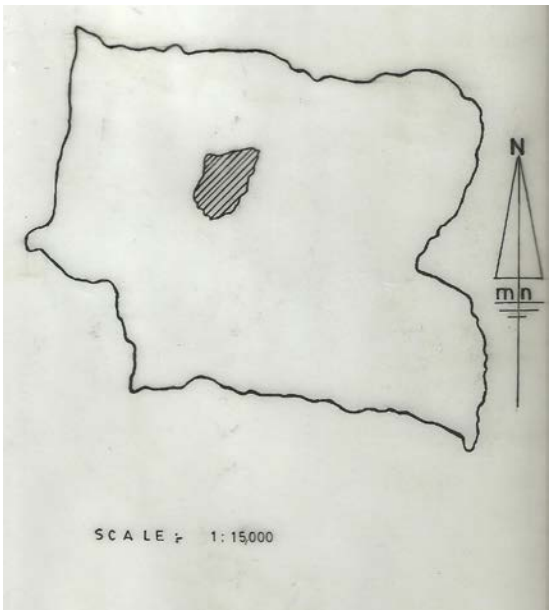

Figure 2: Map of Nasarawa Local Government Area showing Tammah, the study area

6 THE EXPERIMENTAL ANIMALS

Wistar rats and Swiss albino mice weighing 135-250g and 18-35g respectively of both sex maintained under standard conditions (room temperature and pressure) at the Animal Facility Center of the Institute for Pharmaceutical Research and Development (NIPRD) Abuja, were used for the experiments. The animals were fed with standard diet and had access to water.

7 EVALAUTION OF ACUTE TOXICITY OF *Hyptis suaveolens*

The safety of the extract was evaluated by determining its LD_{50} using the Lorke's (1983) method. Different geometric doses of the extract (10,100, 1000 and 2000mg/kg) were administered intraperitonial to four groups of mice. Another group was administered normal saline (10mg/kg i/p) and served as the control. The animals were all kept under the same conditions and mortality within 24 hours in each group was recorded. LD_{50} was estimated using the probit log analysis from the graph of percentage mortality plotted against log dose concentration of the extract.

8 ANTI-PLASMODIAL ACTIVITY

The mice were prescreened by taking blood from the tip of the tail. Thick and thin smears were made and observed to rule out the possibility of any test animal harboring rodent *Plasmodium* species. The antiplasmodial activity was assessed by suppressive and curative test procedures.

8.1 Source of the *Plasmodium berghei*

Drug sensitive *Plasmodium berghei* strain was obtained from National Institute for Pharmaceutical Research and Development, Abuja, Nigeria by inoculation of a set of previously uninfected mice with blood of mice harboring the parasite. The parasites were maintained by successive inoculation of parasite free albino mice every five or four days with 0.2ml of the diluted blood from the infected mice using 1ml syringe and needle.

8.2 Preparation of the Inoculums and Inoculation of Experimental Mice.

A donor mouse infected with rodent malaria parasite *Plasmodium berghei with* parasitaemia of about 20-30% was anaesthetized with chloroform and blood was collected through cardiac puncture with a sterile and aprogenic disposable needle and syringe. The blood was diluted with normal saline in such a way that 0.2ml of blood contained approximately 1 $x10^7$ *Plasmodium berghei* infected red blood cells (RBC).

8.3 Inoculation of Parasite into the Experimental Mice

Inoculation of the mice was done as described by Awe and Makinde (1997a,b). An inoculum of 0.2ml was given to each of the twenty uninfected mice intra-peritoneally.

Evaluation of Parasitaemia in Mice

Thin blood films of inflected mice were prepared and microscopically examined for parasitaemia level from day 4 to day 7, the parasitized cells were counted and the percentage parasitaemia calculated thus:

$$\% \text{ Parasitaemia} = \frac{\text{No. of parasitized red blood cells}}{\text{Total number of red blood cells}} \times 100$$

8.4 Suppressive Test

Treatment with extract commenced immediately after the mice had been inoculated (early infection) as described by Peters (1970). Twenty mice of either sex were chosen and divided into five groups of five mice per group (n=5). Inoculums of 0.2ml was given to each of the twenty five clean mice intra-peritoneal. The extract (100, 200, and 400mg/kg) administered was subcutaneously into the mice once daily for four days denoted as D_0 for the first day and D_1, D_2 and D_3 for the other three days respectively. A parallel test was ran using chloroquine (sigma USA) 5mg/kg and normal saline (NS) to serve as a reference from D_1 to D_4. Thick and thin films were made from the tail blood of the mice. The films were fixed with methanol and stained with 4% Giemsa stain at P^H 7.2 for 45 minutes. The slides were examined microscopically at the parasitology laboratory of Alpha Hospital Nasarawa –Nasarawa State. Five different fields were examined on each slide and the number of infected and uninfected RBC counted and the mean taken.

8.5 Curative Test

The procedure used for the curative test was similar to the one described for suppressive test, except that in curative test, treatment with the extract and chloroquine (100, 200 and 400mg/kg and 5mg/kg) respectively commenced on day four and by day seven, the mice were examined for parasite clearing. The increase/decrease in parasitaemia and the mean survival time (days) were recorded.

9 RESULTS AND DISCUSSION

9.1 Antiplasmodial Studies

chemo-suppressive activity

The result of this study indicated that, *in-vivo* ethanolic leaf extract of *Hyptis suaveolens* displayed some activity against *Plasmodium berghei* malaria parasite. The plant extract exhibited potent dose dependent activities at various doses (100, 200 and 400mg/kg) that resulted in causing 16.42%, 51.05% and 40.49% chemo-suppression respectively. The standard drug (chloroquine 5mg/kg) caused 67.76% suppression and this value is significantly ($P < 0.05$) higher than the chemo-suppression values obtained for the leaf extract of *Hyptis suaveolens* (Table 1).

Table 1: Effect of Ethanolic Extract of *Hyptis suaveolens* Leaf and Chloroquine (CQ) on *Plasmodium berghei parasitaemia* in Mice (%)

Treatment

		Mean parasitaemia		
	Dose mg /kg, i/p	Pre –treatment	Post –treatment	% Suppression.
ASA	-	21.75 ±4.21	16.75±3.40	00.00
H.S	100	10.00 ± 4.20	14.00±3.35	16.42
H.S	200	7.80 ± 2.61	08.20±2.70	51.05
H.S	400	8.25 ± 0.75	10.47±2.33	40.49
CQ	5	4.00 ± 2.35	05.40±2.58	67.76

HS – *Hyptis suavelens*
CQ – Chloroquine
Mean ± SEM
ASA - Acetylsalicylic acid
*P < 0.05

9.2 Curative Activity

The results on the curative potency of Hyptis suaveolens leaf extracts shows that the a dose dependent reduction in mean parasitaemia in mice, the extent of which is similar to that of chloroquine, on the contrary the control group showed daily increase in parasitaemia. As shown in (Table 2). Chloroquine 5mg/kg gave a percentage cure of 68.52% as compared to 86.90%, 94.58% and 87.64% observed with 100mg/kg, 200mg/kg and 400mg/kg doses of the extract respectively.

Table 2: Effect of Ethanolic Extract of *Hyptis suaveolens* Leaf and Chloroquine on *Plasmodium berghei* parasitaemia in Mice (curative test)

		Mean parasitaemia		
Treatment	Dose mg /kg	Pre-treatment	Post- treatment	% Curative
Control (NS)	5.00	15.40 ±2.42	21.60±4.16	00.00
HS	100	06.0 0±1.44	02.83 ±1.33	86.90
HS	200	07.83 ±1.54	01.17 ± 0.75	94.58
HS	400	04.33 ±1.87	02.67 ±2.28	87.64
CQ	5	04.00 ±2.35	0 6.80 ±2.80	68.52

Value are express as Mean + SEM
NS – Normal saline
HS – *Hyptis suaveolens*
CQ – Chloroquine

10 DISCUSSION

10.1 ANTIPLASMODIAL ACTIVITY

The suppressive activity of the ethanolic extract of *Hyptis suaveolens* against *Plasmodium berghei* showed that at doses of 100, 200 and 400mg/kg, the extract reduced the mean parasitaemia in mice to 16.42%, 51.25% and 37.49% inhibition respectively. However in the control groups treated with chloroquine and normal saline, the mean parasitaemia suppression were 67.76% and 00.00% respectively. These therefore suggest that the ethanolic extract of *Hyptis suaveolens* leaves possess some anti-plasmodial activity. The slight dose dependant, anti-plasmodial activities in the model adopted agreed with the work done by Etkin (1997) in his earlier report that *Erythrina senegalensis* extract had anti-plasmodial activity against *Plasmodidum falciparum in vitro*. This activity might be attributed to the presence of alkaloid, which has been reported by other authors to have effects on *Plasmodium* species (Webster,1990 ; Omulokoli *et al.*,1997). The curative activity of *Hyptis suaveolens* ethanolic leaf extract caused a dose dependant reduction in the mean parasitaemia in mice, the extent of which is

similar to those of chloroquine treated group in the model. This is supported by a report of Ajaiyeoba *et al* (1999) that showed significant antimalarial activity deduced from a study of extract of two plants using the four day suppressive *in vivo* assay method. The curative percentage for 100mg/kg, 200mg/kg and 400mg/kg were 86.90%, 94.58% and 87.64% respectively while for CQ and normal saline were 68.52% and 0.00% respectively $F[(3,23) = 3.03\ P<0.05]$. The study therefore, confirms the potency of the plant leaf extract as good anti-malarial and for the treatment of other illnesses related to malaria without any adverse effect. The antimalarial activity of *Hyptis suaveolens* leaf extract might be attributed to the presence of phytochemical constitutuents such as alkaloid, flavonoids earlier implicated in the antiplasmodial activities of many plants (Ajaiyeoba *et al*.,1999).

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