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EFFICACY OF SYNTHESIZED SILVER NANO-PARTICLES USING PICRALIMA NITIDA CRUDE SEED EXTRACT (ABEERE) ON PLASMODIUM BERGHEI INFECTED MICE

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ABSTRACT

Malaria is a potentially fatal disease caused by Plasmodium parasites. The synthesis of silver nano-particles using plant extracts is getting more attention, due to their application in biomedical sciences such as anti-parasitic, anti-malarial, bactericidal and fungicidal activity. This study was designed to evaluate the efficacy of synthesized silver nano-particles using crude seed extract of Picralima nitida on Plasmodium berghei infected mice focusing on weight, percentage parasitemia, packed cell volume (PCV) and white blood cell (WBC) count. Thirty mice were randomly divided into six groups of five animals each. Infection was established using Plasmodium berghei, and treatment was administered following a 4-day curative protocol. The infected groups received 25 mg/kg and 50 mg/kg of P. nitida-synthesized silver nanoparticles, while comparison groups received 100 mg/kg and 200 mg/kg of P. nitida crude extract. Changes in weight, parasitemia, PCV, and WBC count were determined using standard hematological and microscopic techniques. Mice treated with 50mg/kg of Picralima nitida synthesized silver nano-particles showed significant improvement in weight, increased packed cell volume, decreased percentage parasitemia and white blood cell count at the post infection period. The findings demonstrated that Picralima nitida synthesized silver nano-particles is more effective as an antimalarial agent and preserves red blood cell integrity than Picralima nitida crude extract and hence can be used as an antimalarial drug.

Keywords: Extract; Malaria Treatment; Medicinal Plants; Mice; *Plasmodium Berghei*; Parasite

INTRODUCTION

Background of the Study

Malaria is one of the most prevalent and serious public health issues of tropical diseases worldwide (Lohitha *et al*., 2022). It is one of the common life threatening vector borne infectious diseases caused by single celled apicomplexan parasitic protozoa of the genus *Plasmodium* that is transmitted by the bite of infected female Anopheles mosquitoes to humans, predominantly affecting children and pregnant women in tropical, subtropical, and temperate regions of the world (Phillips *et al*., 2017).

Malaria is transmitted throughout Nigeria, with 97% of the population at risk of being infected with malaria. According to the 2024 World Malaria Report, Nigeria accounts for the highest percentage of the global malaria burden compared to any other country, with 25.9% of the global estimated malaria cases and 30.9% of the estimated deaths, as well as an estimated 55% of malaria cases in West Africa in 2023(WHO, 2024).

Of which 93% cases were from African region, 3.4% cases from South-East Asia Region, and 2.1% cases from Eastern Mediterranean Region (World Malaria Report, 2019).

Plasmodium berghei is a unicellular protozoan parasite that infects mammals other than humans. It was first described in the Belgian Congo. It is found in the forests of Central Africa, where its natural cyclic hosts are the thicket rat and the *Anopheles dureni* mosquito (Vincke *et al., 1948*). Like all malaria parasites of mammals, *P. berghei* infects the liver after being injected into the blood stream by a bite of an infected female mosquito. After a short period of development and multiplication, these parasites leave the liver and invade the erythrocytes. *P. berghei* infections may also affect the brain and can cause cerebral complications in laboratory mice (Kooij *et al*., 2006).

Previous studies by Ogbeide *et al*. (2025) and Nwankwo *et al*. (2017) reported that *Picralima nitida* exhibited significant antiplasmodial activity, characterized by an increase in packed cell volume and a reduction in white blood cell count in *Plasmodium berghei*-infected mice, although no significant changes were observed in body weight. *Picralima nitida* is a medicinal plant from the genus *Picralima* and plant family *Apocynaceae*. It is found in tropical African countries such as Ivory Coast, Nigeria, Uganda, and Gabon, and it is popularly known as Abeere in the Southwestern part of Nigeria among the Yoruba people (Amaeze *et al.,* 2018). The plant is used in traditional medicine for the treatment and management of malaria, abscesses, hepatitis, pneumonia, diabetes, and hypertension (Erharuyi *et al*., 2014). Different parts of *Picralima nitida* plant such as the seeds, stem bark, fruit and leaves are used as preparations for the treatment of ailments. The seeds are used as aphrodisiac, antipyretic, for the treatment of malaria, pneumonia and other respiratory tract diseases. The fruit is used for the treatment of gastrointestinal disorders, dysmenorrhea and fever. The leaves are used as a vermifuge and the leaf sap is applied to the ears for otitis. Preparation from the bark is used as laxatives/purgative, antihelmintic, febrifuges, treatment of venereal diseases and hernias. Its root extract is used as vermifuge, aphrodisiac, febrifuge, malaria, pneumonia and gastrointestinal disorders (Erharuyi *et al*., 2014). The seeds are usually ground to a fine powder with the aid of a local grinder and added to foods such as ogi (called pap in English) or taken as a decoction (Shittu *et al*., *2010*). Several studies have previously shown that various extracts of this plant are good sources of

phytochemicals such as glycosides, alkaloids, triterpenes flavonoids, polyphenols, saponins, and tannins. Alkaloids are the predominant bioactive compounds that have, so far, been isolated from the seeds of *P. nitida* (Alcover *et al.,* 2020).

Over the past decade, nanotechnology-based drug delivery systems have been extensively utilized to enhance the efficacy and bioavailability of therapeutic agents for various diseases. Several nano-formulations have already received approval from the U.S. Food and Drug Administration (FDA) for clinical use (Patra *et al*., 2018). Recently, nanotechnological approaches have gained increasing importance for targeted drug delivery, offering improved safety profiles and therapeutic effectiveness (Rizvi and Saleh, 2018). The application of nanotechnology in medicine, commonly referred to as nanomedicine, has had a profound impact on the biotechnology and pharmaceutical industries. It enables the design and development of nano-structured materials (ranging from 1 nm to 1000 nm) encapsulated with antimicrobial or therapeutic agents, providing a promising strategy to overcome limitations associated with conventional drug formulations (Zhu *et al*., 2014; Masri *et al*., 2019).

Nano-particles (NPs) are wide class of materials that include particulate substances, which have one dimension less than 100 nm at least (Laurent *et al*., 2010). NPs are broadly divided into various categories depending on their morphology, size and chemical properties. They can be used in variety of application like drugs and medications, manufacturing and materials, environment, electronics, energy harvesting and mechanical industries (Ali *et al*., *2016).*

The primary goal of the nanotechnology based malaria therapy is to deliver anti-malarial chemotherapeutic agent, which is encapsulated in nano-material to target parasite infected erythrocytes and intracellular parasitic vacuoles. Additionally, the use of nano-materials would permit augmented efficacy, safety, selectivity, alters the drug pharmacokinetic properties, improves solubility profile of drug, avert drug degradation, and endorse a constant release of drug directly at the target location. Numerous nano-particles like liposomes, solid lipid nano-particles (SLNs), nano-structured lipid carriers (NLCs), metallic nano-particles, nano-emulsions, and polymeric nano-particles have been explored and found to be very advantageous for drug delivery applications as nano-carriers (Naseri *et al*., 2015; Gedda *et al*., 2020). These nano-technological-based products may attest to exceed the limitations of existing therapies with respect to safety, efficacy and cost effectiveness, which certainly improves the patient's compliance to treatment (Chowdhury *et al*., 2017).

There is limited information on the synergistic effect of *Picralima nitida*-mediated silver nanoparticles and their comparative efficacy relative to the crude plant extract. The potential of combining the phytochemical properties of *P. nitida* with the nanoscale advantages of AgNPs to improve antiplasmodial performance has not been well investigated.

Hence, this study was designed to evaluate the efficacy of silver nanoparticles synthesized using the crude seed extract of *Picralima nitida* against *Plasmodium berghei*-infected mice

MATERIALS AND METHODS

Plant Preparation and Authentication

Plant Collection

The seeds of *Picralima nitida* was gotten from Malete market, Malete, Moro Local Government, Kwara State, Nigeria.

Plant Authentication

Authentication of the seed was done at the herbarium of the department of Plant Biology, University of Ilorin, Ilorin, Nigeria with voucher number UILH/001/1541/2022.

Plant Extraction

The seed were washed and air dried at ambient temperature for days until well dried. The air dried seed were pulverized into powder using laboratory blender and stored in an air tight container. One hundred gram (100g) of powdered sample were suspended in 600ml of 99.9% absolute methanol contained in 1000ml beakers. The beakers were covered with foil paper to prevent evaporation and enhanced fermentation for 72hrs and allowed to extract for 48hours. After 48hours the aqueous extract were filtered using Whatman No. 1 filter paper and the filtrate were passed through filter paper and concentrate using rotary evaporator. After being concentrate with rotary evaporator, the extract yield was 75g, and this were dissolved in freshly prepared normal saline (i.e. 1g of extract in 10ml of normal saline) and stored in the refrigerator for preservation (Lateef *et al*., 2018).

Synthesis of PN-AgNPs

1mL of the seed extract was reacted with 10mL of 1mM AgNO3 ratio (1:10) at an ambient condition (30 ± 2 ºC) for 20 min. The control consisted of 1mM AgNO3 alone. The change in colour was monitored for the bioreduction of the PN-AgNPs (Lateef *et al*., 2018).

Characterization of PN-AgNPs

The formation and physicochemical properties of the synthesized PN-AgNPs were assessed using multiple analytical techniques. The initial synthesis was monitored visually by observing colour changes in the reaction mixture. The appearance of a yellowish-brown colour indicated the reduction of Ag^+ ions and nanoparticle formation. This transformation was further confirmed using a UV–Visible spectrophotometer (Cecil, USA), where the characteristic surface plasmon resonance (SPR) absorption band of silver nanoparticles was recorded between 400–450 nm.

Particle morphology and size distribution were examined using Transmission Electron Microscopy (TEM), which provided high-resolution images of individual nanoparticles. The hydrodynamic diameter and polydispersity index (PDI) were determined using Dynamic Light Scattering (DLS), allowing evaluation of colloidal stability.To identify the phytochemical functional groups involved in the reduction and stabilization of the nanoparticles, Fourier Transform Infrared Spectroscopy (FTIR) analysis was performed. The resulting spectra were used to determine molecular interactions between *Piper nigrum* metabolites and the nanoparticle surface.

The crystalline structure of the PN-AgNPs was confirmed using X-Ray Diffraction (XRD). Peaks corresponding to the face-centered cubic (fcc) structure of metallic silver validated successful nanoparticle formation, and crystallite size was estimated using the Debye–Scherrer equation.

Together, these complementary techniques provided comprehensive confirmation of PN-AgNP synthesis, structure, stability, and surface chemistry.

Study Area

The experimental study was carried out at the animal holding unit of Kwara state university, Malete, Kwara State, Nigeria.

Ethical Consideration
Ethical approval was obtained from the Centre for Research and Development (CR&D), Kwara State University, Malete, Kwara State, Nigeria.

Experimental Animal
In this study, mice weighing 18-24 grams were selected. The mice were randomly divided into 6 groups consisting of 5 mice in each group which include the experimental groups, positive and negative control.
The animals were purchased from the Animal House Unit of the Department of Institute of Medical Research and Training (IMRAT), University Teaching Hospital, Ibadan, Oyo State. The animals were kept and maintained in a temperature-controlled environment (25±2^{o}C) with a 12-hour light cycle and made to acclimatize to the animal house condition for 7 days prior to the commencement of the experiment.
The animals were fed with palletized growers mash and water *ad libitum*. All animals received humane care in accordance to the ''Guide for the Care and Use of Lab animals'' (Folarin *et al*., 2014).

Parasite Strain
Chloroquine-sensitive strain of *Plasmodium berghei* ANKA was used in this study. Infection was initiated by intra-peritoneal (IP) injection of 1×10^{7} PbNK65 parasitized erythrocytes into ICR mice.

In Vivo Culture of *Plasmodium Berghei*
Plasmodium berghei infected blood from donor mice with rising parasitemia of 40% was used to infect the animals used for experiment. Parasitized blood was first diluted with normal saline as described by Kabiru *et al.* (2012). This inoculum was prepared such that each 0.2 ml contained approximately 1×10^{7} parasitized erythrocytes. The animals were then injected with 0.2 ml of this suspension on day 0 through intra-peritoneal route and were allowed to stand for five days so that infection will be fully established.

Curative Study
Tests were performed using a four-day curative standard test (David *et al*., 2004; Peter and Anatoli, 1998; WHO, 1980) and employing chloroquine sensitive *P. berghei* NK 65 strain. The mice were divided weight dependently into 6 groups of five each. All the groups were infected with the malaria parasites *P. berghei* (chloroquine sensitive strain) for a four-day suppressive test as shown in table 1. The *P. berghei* was subsequently maintained in the laboratory by serial blood passage from mouse to mouse. For this study, a donor mouse with a rising parasitemia of 40% was sacrificed and its blood was collected (in a slightly heparinized syringe) and the blood was diluted with Trisodium citrate (TC) medium so that each 0.2 ml contained approximately $1X10^{7}$ infected red blood cells (David *et al*., 2004; Peter and Antoli, 1998). Invariably each animal received inoculums of about $1X10^{7}$ parasites per kilogram body weight through needle passage and it produced infection in the mice. On commencement of the 4- day suppressive standard test, 3 hours after infecting the mice with the malaria parasites, the methanol seed extract of *Picralima nitida* was administered to the three test groups in divided doses, daily for 4 consecutive days, i.e. from Day 0 to Day 3 (David *et al*., 2004). The negative control group received no medication but was infected. All the drugs were given through intra peritoneal routes.

Blood Sample Collection
Thin smears of blood films were obtained from the tail end of each mouse on day 4 after infection and treatments (David *et al*., 2004 and WHO, 1980). The smears were placed on microscopic slides, fixed with methanol and stained with 10% Giemsa at pH 7.2 for 15 minutes, and examined under the microscope at X100 magnification to assess the level of parasitemia. The percentage parasitemia was calculated according to the method outlined by Iwalewa *et al*. (1997) as percentage parasitemia = (No. of parasites in treated /No. of parasites in control X100.

Table 1: Experimental Curative Study Table

Group	Treatment	No. of animals
1	Infected mice + 0.2ml of 100mg/kg (Low dose) of *Picralima nitida* crude extract only	5
2	Infected mice + 0.2ml of 200mg/kg (High dose) of *Picralima nitida* crude extract only	5
3	Infected mice + 0.2ml of 25mg/kg (Low dose) of Synthesized PN-AgNPs only	5
4	Infected mice + 0.2ml of 50mg/kg (High dose) of Synthesized PN-AgNPs only	5
5	Infected mice + 0.2ml of 10mg/kg of chloroquine (Positive control)	5
6	Infected mice + 0.2ml of distilled H_2O (Negative control)	5

Laboratory Diagnosis
Determination of Packed Cell Volume (PCV)
Packed Cell Volume (PCV) was determined to assess the efficiency of the test extracts in preventing hemolysis resulting from increasing parasitemia associated with malaria infection. The Wintrobe method as described by Murray *et al.* (2014) was employed for this analysis.

White Blood Cell Determination
The total white blood cell (WBC) count was determined to evaluate leukocyte response to *Plasmodium berghei* infection in both treated and control groups. This helped to assess the potential immunomodulatory effects of the extracts (Jain 1986; Dacie and Lewis 1991).

Determination of Percentage Parasitaemia
Parasitemia was monitored to evaluate the antiplasmodial efficacy of the treatments. Thin blood smears were prepared from tail blood, air-dried, and stained with 10% Giemsa. The number of parasitized erythrocytes was counted against 1,000 red blood cells under a light microscope, and the percentage parasitemia was calculated as described by Penna-Coutinho *et al.* (2011). Parasitemia levels were assessed on days 6, 8, and 10 post-infections.

Toxicity Screening
Toxicity screening of *Picralima nitida* extract was carried out by dividing the mice into 6 groups (2mice/group). Each group contained mice that received daily dose of 10mg/kg, 100mg/kg, 200mg/kg of the plant extract respectively for phase 1 and 2000mg/kg, 4000mg/kg, 6000mg/kg of the plant extract for phase 2 to determine the lethal and the therapeutic dose orally according to the modified method of Lorke (1983) based on the description of Khan *et al*. (2015).
Synthesized AgNPs toxicity screening was also carried out by dividing the mice into 3 groups (2mice/group). Each group

contained mice that received 5mg/kg, 25mg/kg, 50mg/kg of the AgNPs respectively to determine the lethal and the therapeutic dose orally using to the OECD method of toxicity screening.

Control mice were kept under the same condition without any treatment. The mice were then observed for signs of toxicity which include but not limited to salivation, paw licking, weakness, stretching of the entire body, respiratory distress, coma and death in the first 4 hours and subsequently daily for 7 days (Adebayo *et al*., 2022).

Lethality (Ld50) Test

The mean lethal dose (LD50) of the aqueous extract and AgNPs was determined in mice (weighing 20-30g) using the arithmetic-geometric-harmonic (AGH) methods of rough estimation as modified by Saganuwan (Saganuwan, 2005).

Statistical Analysis

All data were expressed as the means ± standard error of the mean (SEM), one-way analysis of variance (ANOVA) with subsequent dunnett's post-hoc analysis was used to detect further differences between groups using SPSS 16.0 version. Differences were considered statistically significant at P

RESULTS AND DISCUSSION

Effect of *Picralima nitida* and Synthesised *Picralima Nitida* AgNPS on Weight (kg)

Table 1 presents the effect of *Picralima nitida* extract and synthesized PN-AgNPs on the body weight of *Plasmodium berghei*-infected mice. A significant ($p < 0.05$) increase in body weight was observed in all treatment groups compared to the negative control, except for the group treated with the low dose (100 mg/kg) of *P. nitida* extract, which showed no significant difference.

No statistically significant difference ($p > 0.05$) was observed between the positive control and other treatment groups.

Table 1: Effect of Picralima nitida and Synthesised Picralima nitida AgNPS on Weight (Kg)

Group	Day 0	Day 6	Day 8	Day 10
Low Dosage of *P. nitida* extract (100mg/kg)	17.40±2.79[a]	14.80±1.10[b]	18.80±1.30[a]	19.40±4.28[a]
High Dosage of *P. nitida* extract (200mg/kg)	17.00±2.92[a]	18.20±1.92[a]	17.60±2.30[a]	20.40±3.51[a]
Low Dosage of Synthesized *P. nitida* AgNPs (25mg/kg)	19.80±2.17[a]	18.60±1.14[a]	19.80±3.14[a]	19.80±3.11[a]
High Dosage of Synthesized *P. nitida* AgNPs (50mg/kg)	19.40±2.88[a]	18.80±1.30[a]	18.80±1.30[a]	20.20±2.86[a]
Positive Control (10mg/kg Chloroquine)	19.20±2.95[a]	18.60±1.14[a]	18.00±2.35[a]	17.80±3.35[a]
Negative Control (0.2ml Distilled Water)	18.40±2.07[a]	18.80±1.30[a]	19.80±3.14[a]	17.80±4.34[a]

Data are Expressed as mean ± standard Deviation (n = 5). Means with Different Superscripts Differ Significantly **(**$p < 0.05$) when Compared with the Control Group

Effect of *Picralima nitida* and Synthesised *Picralima nitida* AgNPS on % Parasitemia

As shown in Table 2, there was a significant ($p < 0.05$) reduction in percentage parasitemia in the group treated with the high dose of synthesized *P. nitida* AgNPs (1.1%) compared to the negative control group (81.6%). The level of parasitemia observed in this group was comparable to that of the positive control (chloroquine-treated) group (1%), indicating strong antiplasmodial activity.

Table 2: Effect of *Picralima nitida* and Synthesised *Picralima nitida* AgNPS on % Parasitemia

Group	Day 6	Day 8	Day 10	%Parasitemia
Low Dosage of *P. nitida* extract (100mg/kg)	43.16±0.53[a]	7.84±0.13[b]	4.94±0.22[a]	7.2%
High Dosage of *P. nitida* extract (200mg/kg)	39.66±0.73[b]	11.29±0.49[a]	2.87±0.08[b]	4.2%
Low Dosage of Synthesized *P. nitida* AgNPs (25mg/kg)	36.04±0.18[b]	8.26±0.41[a]	2.78±0.36[a]	4%
High Dosage of Synthesized *P. nitida* AgNPs (50mg/kg)	39.07±0.52[a]	4.50±0.19[a]	1.33±0.32[a]	1.1%
Positive Control (10mg/kg Chloroquine)	44.58±1.36	1.89±0.16	0.74±0.29	1%
Negative Control (0.2ml Distilled Water)	41.04±0.87	44.82±0.53	56.28±0.55	81.6%

Data are expressed as mean ± standard deviation (n = 5). Means with different superscripts differ significantly **(**$p < 0.05$) when compared with the control group

Table 3: Effect of *Picralima nitida* and Synthesised *Picralima nitida* AgNPS on Packed Cell Volume (%)

Group	Day 0	Day 6	Day 8	Day 10
Low Dosage of *P. nitida* extract (100mg/kg)	43.00±2.55[a]	25.60±4.16[a]	28.20±1.30[a]	30.20±2.30[a]
High Dosage of *P. nitida* extract (200mg/kg)	41.80±2.95[a]	27.60±2.30[a]	25.60±4.16[a]	24.60±4.04[b]
Low Dosage of Synthesized *P. nitida* AgNPs (25mg/kg)	43.60±2.07[a]	24.20±4.76[a]	27.20±2.17[a]	27.20±4.21[b]
High Dosage of Synthesized *P. nitida* AgNPs (50mg/kg)	41.20±1.30[a]	25.60±4.16[a]	27.40±4.04[a]	30.40±3.70[a]
Positive Control (10mg/kg Chloroquine)	41.20±2.89[a]	27.60±2.30[a]	28.20±1.30[a]	25.00±6.04[a]
Negative Control (Distilled Water)	41.80±2.78[a]	28.20±2.49[a]	25.20±3.96[a]	21.20±6.02[a]

Data are expressed as mean ± standard deviation (n = 5). Means with different superscripts differ significantly **(**$p < 0.05$) when compared with the control group

As shown in table 3, there was significant difference when PCV was compared between the low dosage of Pi*cralima nitida*, high dosage of synthesized *P. nitida* AgNPs and control at $p<0.05$. There was no statistical significance difference between other groups and control at $p<0.05$.

Table 4: Effect of *Picralima nitida* and Synthesised *Picralima nitida* AgNPS on White Blood Cell count (10^9/L)

Group	Day 0	Day 6	Day 8	Day 10
Low Dosage of *P. nitida* extract (100mg/kg)	7.22 ± 0.37^a	41.94 ± 2.75^b	28.28 ± 0.44^b	12.28 ± 0.39^a
High Dosage of *P. nitida* extract (200mg/kg)	6.48 ± 0.36^b	48.38 ± 2.24^a	33.48 ± 0.43^a	10.74 ± 0.38^b
Low Dosage of Synthesized *P. nitida* AgNPs (25mg/kg)	6.95 ± 0.09^a	47.06 ± 0.24^a	26.18 ± 0.51^a	11.14 ± 0.44^a
High Dosage of Synthesized *P. nitida* AgNPs (50mg/kg)	6.54 ± 0.30^b	39.06 ± 0.71^b	21.94 ± 0.63^b	9.44 ± 0.37^b
Positive Control (10mg/kg Chloroquine)	7.22 ± 0.37^a	41.94 ± 2.75^b	26.98 ± 0.77^b	11.02 ± 0.31^b
Negative Control (Distilled Water)	6.88 ± 0.24^a	47.98 ± 1.99^a	49.32 ± 0.89^a	51.64 ± 0.96^a

Data are expressed as mean ± standard deviation (n = 5). Means with different superscripts differ significantly ($p < 0.05$) when compared with the control group

As shown in table 4, there was significant difference when WBC was compared between the high and low dosage of synthesized *P. nitida* AgNPs and negative control at $p<0.05$. There was no statistical significance difference between the extract group and negative control at $p<0.05$ and positive control.

Discussion

Findings from this study showed significant increase in the weight of the infected mice at the end of the treatment. The increment in the body weight observed may be due to constant feeding of the animals during the experimental period and not accrued to the treatment choice of infected mice. This is in agreement with that of Okpe *et al*., (2016) in which there was marked increase in body weight of the infected groups of mice and the non-infected group.

Findings from this study revealed that treatment with 50 mg/kg of synthesized silver nanoparticles derived from the crude seed extract of *Picralima nitida* significantly reduced the percentage parasitemia in infected mice from the onset of the curative study. This effect may be attributed to the intrinsic antiplasmodial properties of *P. nitida*. These findings are consistent with previous reports by Okokon et al. (2007) and Jiotsa et al. (2022), who demonstrated that *P. nitida* crude seed extract exhibited significant *in vivo* antiplasmodial activity in both the early (4-day suppressive) and established (curative) stages of infection. Although existing literature presents limited evidence on the use of *P. nitida* for nanoparticle synthesis, related studies by Jain et al. (2012) and Lohitha et al. (2022) have shown that nanoparticles synthesized from other medicinal plants effectively reduced parasitemia levels in infected models, further supporting the results of the present study.

This study revealed a decrease in the packed cell volume (PCV) of mice following infection with *Plasmodium berghei*, which may be attributed to the destruction of red blood cells by the parasite. The observed reduction in PCV across all infected groups aligns with previous findings that reported lowered PCV values in malaria-infected subjects (Saganuwan et al., 2011). However, treatment with 100 mg/kg of *Picralima nitida* extract and 50 mg/kg of synthesized silver nanoparticles derived from the crude seed extract of *P. nitida* resulted in a significant increase in PCV. This improvement may be due to the protection of red blood cell integrity and the stimulation of erythropoiesis following treatment. This finding corroborates earlier studies showing that administration of aqueous seed extracts of *P. nitida* significantly cleared infected erythrocytes, increased RBC count, and prevented hemolytic damage (Nwankwo et al., 2017; Jiotsa et al., 2022). Although previous literature has not reported the use of *P. nitida* in nanoparticle synthesis, the present study demonstrates that silver nanoparticles synthesized using *P. nitida* seed extract can effectively restore PCV levels in malaria-infected mice.

Moreover, this study showed that treatment with synthesised silver nano-particles using the crude seed extract of *Picralima nitida* causes more reduction in the WBC count after infection with the parasite. This may probably be due to the fact that most of the WBCs have been deployed and used up in the immune response of the body to the introduction of the parasitemia. It is in agreement with the studies in which the administration of aqueous seed extracts of *P. nitida* significantly reduced the white blood cell count which remarkably increased as a result of the parasitic infection as *Plasmodium* is known to colonise and lead to reduction in WBCs (Okokon *et al.*, 2007; Jiotsa *et al.*, 2022).

CONCLUSION

The findings of this study indicate that silver nano-particles at high dose (50mg/kg) showed no significant weight loss, strong antiplasmodial activity, reduction in White Blood Cell count and increase in packed cell volume of mice infected with *Plasmodium berghei* thereby establishing the relevance of the biosynthesized silver nano-particles for biomedical applications in the treatment of malaria.

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