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In vivo anti-schistosomal activity of the methanol extracts from *Searsia longipes* and *Lannea schimperi*

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ABSTRACT

Schistosomiasis is a disease caused by the flat worms under the genus *Schistosoma*. The disease is prominent in tropical and sub tropical countries and it is manifested in two forms; the acute and the chronic form. Treatment and control of the schistosomiasis is constrained with various factors including immerging worm resistance and selective efficacy of the current recommended drug of choice. This therefore calls for the search of new approaches to offset the problems. The aim of this study was to investigate the efficacy of the methanolic extract from *Searsia longipes* and *Lannea schimperi* against *Schistosoma mansoni* by using animal model. Swiss albino mice were used for the efficacy testing, whereby, for each extract, 5 groups of mice were used, and each contained 5 mice. Three different doses were administered to three groups, whereas the remaining two groups were used as negative and positive control arms. Efficacies were assessed based on the reduction of the worm eggs in the faeces and organs, body weight gain, loss of liver weight, as well as reduction of worm burden. Both extracts demonstrated significant egg and worm reduction, which was directly proportional to the dose increment. At the highest dose used, *Searsia longipes* expressed the higher percentage egg reduction (73.33 %), whereas *Lannea schimperi* demonstrated the higher worm burden reduction (68.53 %). The present study provides strong evidence of the anti-schistosomal activity of the extracts from both *S. longipes* and *L. schimperi*. These findings are a significant step forward, suggesting that these plants could be a promising alternative medicine for the treatment of schistosomiasis. However, further investigations are warranted to isolate the compound responsible for this activity and to assess the sub-acute toxicity of the plant extracts. This next phase of research is crucial for advancing our understanding and potential use of these plant extracts.

1. Introduction

Schistosomiasis commonly known as bilharzia, is an acute and chronic neglected disease caused by the intravascular parasite of the genus *Schistosoma* (Gryseels et al., 2006; Fadladdin, 2021; WHO, 2023). It is prominent in tropical and sub-tropical countries, particularly in communities that are short of safe water as well as inadequate sanitation (Gabrielli and Garba Djirmay, 2023).

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Schistosomiasis is endemic to 78 countries, with estimated global morbidity cases of around 251 million (WHO, 2023). Most of these are Caribbean, Eastern Mediterranean, South American, and African countries. However, reports show that Africa, particularly the sub-Saharan region, is leading with regard to the disease burden, having 90 % of all global cases. Tanzania is among the schistosomiasis burdened countries in the sub-Saharan region, with an estimated 19 million cases (Mazigo et al., 2021). The disease in Tanzania was first identified in the 19th century, and since then, its prevalence has significantly increased (Mazigo et al., 2012). The country is typically endemic to both urogenital and intestinal schistosomiases, which are caused by *Schistosoma mansoni* and *Schistosoma haematobium,* respectively. For more than a decade, the country has gone through several rounds of disease control interventions, mainly preventive chemotherapy using praziquantel mass drug administration. The interventions were focused on vulnerable groups, including pre-school and school-aged children and women of reproductive age (Mazigo et al., 2022). However, the disease magnitude is still high, with more impact in the regions surrounding Lake Victoria, which includes Mwanza, Mara, Simiyu, Geita and Kagera (Mazigo et al., 2012). The persisting pronounced prevalence of the disease is attributed to the high infection force of the disease as well as the potential tolerance of the schistosome worms to the existing drug of choice (Neves et al., 2015). Given that, searching for new anti-schistosomal drugs is of paramount importance.

Traditional medicine (TM) holds immense promise in the management of various ailments, and it is embraced by more than 80 % of the global population for primary health care (Peltzer, 2009; Shey Nsagha et al., 2020). TM serves as an alternative to contemporary drugs and a source of vitamins and essential minerals for the most marginalized communities in developing nations (Peltzer, 2009; Ayele, 2018). Importantly, traditional medicine has also played a crucial role in the control of parasitic diseases, including schistosomiasis, which accounts for a significant proportion of the disease burden in developing nations, particularly African countries (Mwangi et al., 2017). Moreover, TM serves as a potential source of contemporary drugs, with more than 30 % of drugs originating from traditional medicine, including medicinal plants. Notably, some studies have reported cases presented in endemic regions which demonstrated tolerance to conventional schistosomiasis treatment. Therefore, if these plants are well explored, they can potentially serve as a source of new drugs for the management of schistosomiasis, and indeed, other soil transmitted helminthic infections (Ismail et al., 1996; Gryseels et al., 2001; Melman et al., 2009).

Lannea schimperi and *Searsia longipes/ Rhus longipes* are both trees under the plant family *Anarcadiaceae*. These plants have been reported to possess an array of medicinal values (Moffett, 2007; Okoth and Koorbanally, 2015). *Searsia longipes* is used in folklore for the management of asthma, malaria, infertility, diabetes, pain, cancer, wounds, schistosomiasis and constipation, to mention some (Mbugi, 2019; Olorunnisola et al., 2017; Maroyi, 2011; Chhabra et al., 1984; Olasunkanmi and Adegbola, 2019; Olasunkanmi and Afuye, 2022). At the same time, the decoction from *Lannea schimperi* is used for the treatment of tumours, peptic ulcers, toothache, dysentery, diarrhoea, chest problems, malaria, mental disorders, intestinal parasites, schistosomiasis, pains, gynaecological problems, diabetes, influenza and asthma (Mbugi, 2019; Jeruto et al., 2008; Haule et al., 2012; Nshimo and Muhoro, 1999). In addition, both plants have been reported to possess various phytochemical compounds including terpenoids, flavonoids, phenolic glycosides, alkaloids, tannins and saponins (Mbugi and Chacha, 2019; Egbe et al., 2015). Furthermore, a recent study conducted by Mbugi and coworkers has reported *in vitro* activities of both L. *schimperi* and *S. longipes* methanolic extracts against different life stages of *Schistosoma mansoni* (Mbugi, 2019). No studies were conducted to assess the *in vivo* activity of the extracts from these plants. Therefore, the present study investigated the anti-schistosomal activity of the methanolic extracts from both plants by using an animal model towards the development of the new anti-schistosomal drug. This underscores the need for further research in this promising area.

2. Material and methods

2.1. Collection and identification of the plant samples

Stem bark samples were collected from Endasaki ward in the Manyara region during the month of May 2023. Prior to sample collection, the plants were identified by a taxonomist (Mr Emmanuel Mboya) and voucher specimens of both *Lannea schimperi* and *Searsia longipes* were deposited at the National Herbarium of Tanzania (voucher specimen number NM 01 and NM 02, respectively).

2.2. Sample processing and extraction

Collected stem barks were cleaned by using running tape water, dried under shade and extracted as described in the protocol given by Alsarayreh et al., 2022 with small modifications (Alsarayreh et al., 2022). The dried plant materials were triturated using an electric grinder into powder. The coarsely powdered plant material (500 g) was immersed in the 99.9 % *v*/v methanol (1 L) for three days with constant sharking. The solution was filtered using filter paper number one, and the filtrate was concentrated by using a rotary evaporator under reduced pressure and a temperature of 55 °C. The obtained crude extracts were stored in the refrigerator at 4 °C, ready for subsequent procedures.

2.3. In vivo efficacy testing of the plant extracts against S. mansoni

2.3.1. Laboratory animal

Animals used in the present study were Swiss albino mice procured from KEMRI (Kenya Medical Research Institute). A total of 80 mice with the body weight ranging between 30 and 35 g and the age of 6 to 8 weeks were employed. In the course of experimentation, all mice were kept at a standard condition of 25 °C and the light condition of 12 h light and 12 h dark.

2.3.2. Extraction of the Cercariae and mice infection

Cercariae used to infect mice were extracted from the Infected *Biomphalaria pfeifferi* snails. *B. pfeifferi* were collected from the shores of Lake Victoria at Kisumu, and some were lab-infected snails obtained from KEMRI (Kenya Medical Research Institute). The snails were immersed in fresh water and then screened for cercariae shedding under the presence of sunlight. Positive snails were identified and used for cercariae extraction. Cercariae extraction was done by using 24 well plates, whereby, snails were placed in the wells containing mineral water. The plates were subjected to sunlight for one hour to allow cercariae shedding. Afterwards, the cercariae were pulled together into a beaker. The obtained cercariae were enumerated and used to infect mice. Each mouse was infected with approximately 150 cercariae using paddling methods for 30 min (Frandsen, 1981). After infection, mice were maintained for 7 weeks to allow the maturation of the larvae into an adult worm meanwhile; they received water and food *ad labitum*.

2.3.3. Efficacy testing

Efficacy tests were conducted *in vivo* on infected mice in line with the previously published protocol by Alemu and coworkers in 2018 with minor modifications. Briefly, 7 weeks post-infection; mice were screened for *S. mansoni* eggs on their faeces by using Kato-katz method. Approximately 41.7 mg of the faeces collected in a container containing double saline were placed on the slide by using a template, and then cellophane with malachite green was covered on top of the faeces. The slide was compressed gently to spread the faeces on the slide, and thereafter, egg counting was done using a light microscope (two stool samples were checked per mouse). Positive mice were sorted and grouped into 5 groups, each containing five mice. Three groups received extract doses of 1200 mg/kg, 600 mg/kg and 300 mg/kg body weights, respectively. The remaining two (2) groups were employed as positive and negative control, thus received drug vehicle (distilled water) and 400 mg/kg body weight of praziquantel (SIGMA-ALDRICH), respectively. All doses were administered for three consecutive days by using an oral gavage and each mouse received 0.2 mL of the respective doses. During this study, animals were maintained in a standard condition of 12 h light/ 12 h dark and a room temperature of 25 °C while receiving water and food (animal pellets) *ad libitum*.

Two weeks post treatment; mice were screened for eggs on their faeces as described above and then 0.2 mL of the mixture of pentobarbital sodium and Heparin was used to induce loss of consciousness. Thereafter, the chest and the abdomen of the mice were opened and the mesenteric and portal vein was perfused by applying the perfusion fluid (mixture of 0.75 % Sodium citrate and 0.85 % Sodium chloride) gently to recover adult worms. The recovered worms in a perfusate from each mouse were counted by using a dissecting microscope (Olympus). The following formulas were used to determine the Percentage worm Burden Reduction (PBR) as well as Egg Reduction Rate (ERR).

Percentage Worm Burden Reduction (PBR) = (Mean worm recovered from untreated control - mean worms recovered from the treatment group)/mean worms recovered from the untreated control group *100 %.

Egg Reduction Rate (ERR) = Egg count before treatment – egg count after treatment / egg count before treatment*100 %.

Since epidemiological studies have reported the existing association between schistosomiasis and stunting growth, the weight gain of the animals after treatment with different extract doses and controls was determined. Further, a gross examination of the mice's livers was done to assess the anti-inflammatory and hepatoprotective effect of the plant extracts against periportal fibrosis caused by Schistosoma eggs lodging on the mentioned organ. The liver weights were also measured, and the comparisons were done between the treatment groups and the controls.

2.3.4. Data analysis

Data were expressed as mean ± standard error of the mean. Comparisons of the measured parameters across groups were computed using the Kruskal-Wallis test. Wilcoxon rank sum test was used for paired comparison between treatment groups and control. Results were considered statistically significant at a *p*-value of less or equal to 0.05. All statistical analyses were conducted by using Microsoft Excel and R softwares.

2.3.5. Ethical clearance

Ethical clearance for the conduction of this study was obtained from the Kibong'oto-Nelson Mandela-Cedha Health Research

Table 1
Effect of the plant extract on worm's eggs production.

Treatment groups	BT	AT	ERR (%)
1200 mg/kg *Lannea schimperi*	293.76 ± 7.99	113.91 ± 13.85ab*	61.22
600 mg/kg *Lannea schimperi*	269.78 ± 15.09	155.88 ± 15.48ab	42.22
300 mg/kg *Lannea schimperi*	269.78 ± 22.69	191.85 ± 9.79ab	28.89
1200 mg/kg *Searsia longipes*	269.78 ± 21.15	71.94 ± 7.99ab*	73.33
600 mg/kg *Searsia longipes*	269.78 ± 31.53	119.9 ± 9.79ab	55.56
300 mg/kg *Searsia longipes*	299.76 ± 11.99	161.87 ± 5.99ab	46
400 mg/kg PZQ	271.78 ± 31.97	11.99 ± 7.99a	95.59
Distilled water (DW)	269.78 ± 21.15	311.75 ± 21.15b	

Key: BT = Before treatment, AT = After treatment, ERR (%) = Percentage of eggs reduction rate, PZQ = Praziquantel, a = significant difference between treatment and the untreated control (*p*-value <0.05), b = significant difference between treatment and the positive control (*p*-value <0.05), ab = significant difference between treatment and both untreated and negative control control (*p*-value <0.05), * significant deference between same doses of *Lannea schimperi* and *Searsia longipes* (p –value = 0.05).

Ethical Committee (KNCHREC). After ethical approval, the study was given an ethical clearance number KNCHREC00008/09/2023.

3. Results

Both plant extracts were evaluated for their ability to reduce worm eggs lying. At different doses, the extracts and the positive control demonstrated a significant reduction of mean worm eggs in the faeces of infected mice at a p-value of ≤0.05 (Table 1). The observed mean egg reduction in the treatment groups for both extracts was dose dependent, whereby it was high as the concentration of the plant extracts increased (Table 1). *Searsia longipes*, in particular, showed a high efficacy in reducing egg production compared to *Lannea schimperi*, with a percentage reduction rate of 73.33 % at the highest dose used (1200 mg/kg body weight) (Fig. 2 and 1). A pairwise comparison of the mean egg reduction between *Lannea schimperi* and *Searsia longipes* at their highest dose revealed the significantly high efficacy of the latter at a p–value = 0.05 (Table 1). At the lowest dose used (300 mg/kg body weight), *Lannea schimperi* demonstrated minimal effect on egg production with an egg reduction rate of 28.89 % (Fig. 1). The positive control (400 mg/kg body weight, Praziquantel) had more effect on worm egg reduction relative to all tested plant extracts, with a percentage egg reduction rate of 95.59 (Fig. 1 and 2).

3.1. Worm burden after treatment with various concentrations of the plants extracts

Worm burdens were assessed to evaluate the effect of the plant extracts from *S. longipes* and *L. schimperi* on adult *Schistosoma* worms. Both extracts expressed substantial activity against adult worms (Fig 3 and 4). The divulged potency differs based on the plant extracts, with *Lannea schimperi,* at the highest dose used, demonstrating the highest activity with a percentage worm reduction of 68.53 (Table 2). The percentage worm reduction of *Searsia longipes* at the highest dose was 63.57 (Table 2). As expected, the positive control used (400 mg/kg BWT Praziquantel) has shown the highest activity of all extract doses tested with a worm burden reduction rate of 69.47 (Table 2). In addition, both extracts reduced worm burden in dose-dependent order. *Lannea schimperi* extract has shown significant activity for all tested doses when compared with the untreated control (*p*-value <0.05) (Fig. 3). In contrast, *Searsia longipes* extract at the dose of 300 mg/kg BWT did not show significant activity (p-value > 0.05) (Fig. 4). At the doses of 1200 and 600 mg/kg, both extracts did not show significant differences with the positive control (Table 2). Furthermore, the mean number of recovered male worms was high relative to their female counterpart (Table 2)

3.2. Animal weight prior and after treatment

The extracts at different doses and the positive control have expressed a positive effect on the body weight of the treated mice, whereby the weight gained after two weeks following treatment was greater than 1 g. Meanwhile, the negative control group had minimal body weight increment with weight gain of less than 1 g (Figs. 5 and 6). The group treated with 1200 mg/kg of *Searsia longipes* had the highest weight gain relative to other tested doses, with an average gain of 2.5 g (Fig. 6).

3.3. Liver weight

For both extracts, the liver weight of the mice decreased proportionally to the increase in the extract doses (Fig. 7). The liver collected from infected mice treated with positive control (PZQ) had the lowest mean weight relative to other groups, whereas the liver from untreated control had the highest mean weight (Table 3). However, the observed difference between treatment groups and control was not significant at a *p*-value of 0.05. *Searsia longipes* had more effect on the reduction of the liver weight at all tested doses compared to the *Lannea schimperi* (Fig. 7).

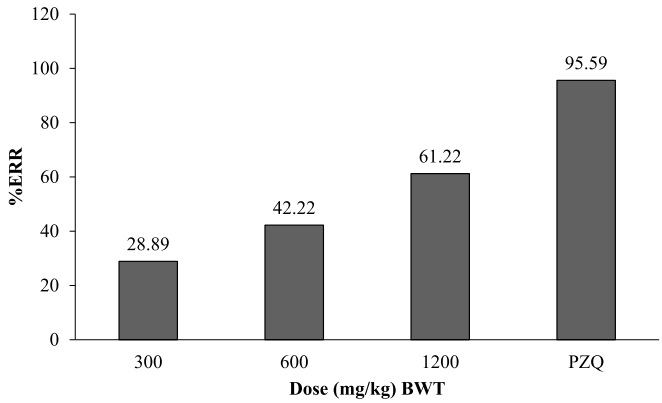

Fig. 1. Eggs Reduction Rate following mice treatment with *Lannea schimperi* extract (Source: Table 1).

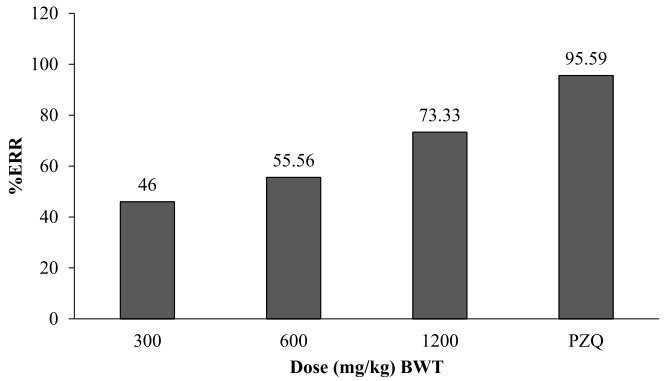

Fig. 2. Eggs Reduction Rate following mice treatment with *Searsia longipes* extract (Source: Table 1).

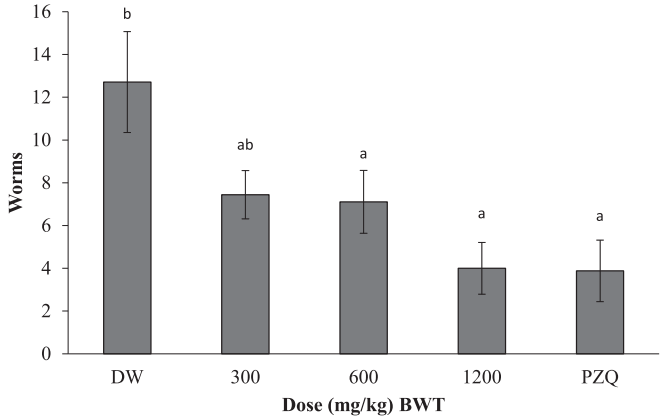

Fig. 3. Mean deference's of the recovered worms between treatment (various concentrations of *Lannea schimperi*) and control groups (Source: Table 2).

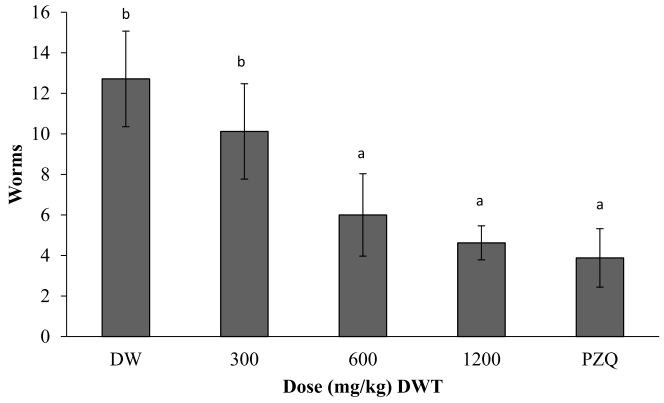

Fig. 4. Mean deference's of the recovered worms between treatment (various concentrations of *Searsia longipes*) and control groups (Source: Table 2).

3.4. Gross examination of the liver

The livers of mice treated with the RLM 300 and LSM 300 had a high number of granulomas represented as small white spots on the surface of the liver lobs (Fig. 8: B, F). The observed granulomas were comparable with those of the untreated control group (A). Furthermore, there were no granulomas on the liver treated with RLM 600, RLM 1200 and LSM 1200 (H, G and D). This observation is similar to that of the positive control (E). Granulomas were not seen on the liver of the mice treated with LSM 600; however, the signs

Table 2
Mean number of adult worms obtained by mice perfusion from the treatment and control groups.

Treatment groups	MW	FW	TW	WBR (%)	WR (%)
1200 mg/kg *Lannea schimperi*	2 ± 0.60	2 ± 0.65	4 ± 1.21a	68.53	31.47
600 mg/kg *Lannea schimperi*	3.44 ± 0.71	3.67 ± 0.76	7.11 ± 1.47a	44.06	55.94
300 mg/kg *Lannea schimperi*	3.89 ± 0.51	3.56 ± 0.69	7.44 ± 1.13ab*	41.46	58.53
1200 mg/kg *Searsia longipes*	2.5 ± 0.42	2.13 ± 0.44	4.63 ± 0.84a	63.57	36.43
600 mg/kg *Searsia longipes*	3.13 ± 1.06	2.88 ± 0.97	6 ± 2.03a	52.79	47.21
300 mg/kg *Searsia longipes*	5.25 ± 1.26	4.88 ± 1.13	10.13 ± 2.35b*	20.3	79.7
400 mg/kg PZQ	2 ± 0.78	1.88 ± 0.67	3.88 ± 1.44a	69.47	30.53
Distilled water (DW)	6.14 ± 1.12	6.57 ± 1.27	12.71 ± 2.36b		

Key: MW = Male worms, FW = Female worms, TW = Total worms, WBR = Worm Burden Reduction, WR = Worm Recovery and PZQ = Praziquantel, a = significant difference between treatments and the untreated control (p-value <0.05), b = significant difference between treatments and the positive control (p-value <0.05), ab = significant difference between treatments and both untreated and negative control, * significant deference between same doses of *Lannea schimperi* and *Searsia longipes* (p –value <0.05).

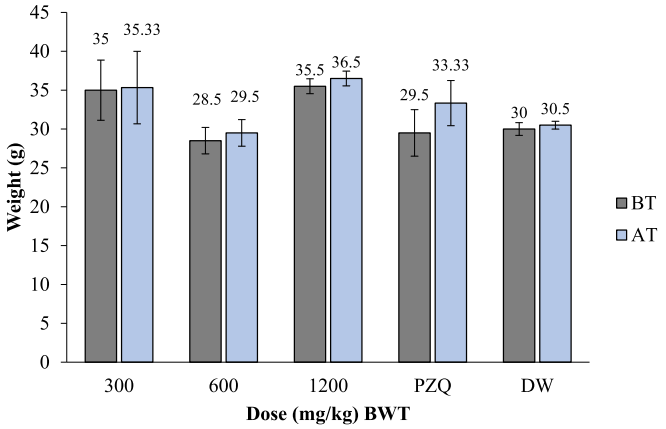

Fig. 5. Body weight of mice before and after treatment with different doses of *Lannea schimperi* extract.

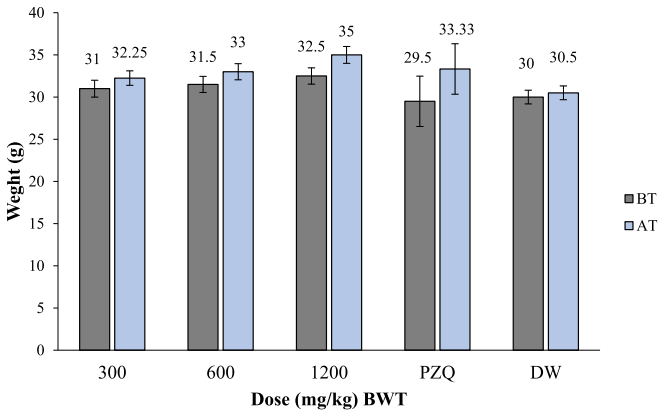

Fig. 6. Mean body weight of mice before and after treatment with different doses of *Searsia longipes* extract.

of its recovery from periportal fibrosis were manifested, ie. Formation of extensive scar tissues on the surface of the liver (C).

4. Discussion

Drug resistance to various ailments causing agents such as bacteria, fungi and parasites is among recent significant public health threats (Laxminarayan and Heymann, 2012). The problem is more prominent in developing nations, whereas in the developed world is modest. Generally, drug resistance increases morbidity and mortality as well as prolongs the infectiousness time, which in turn increases the risk of the disease. In view of this, recent studies at most shifted their focus to investigating new therapeutic agents to offset

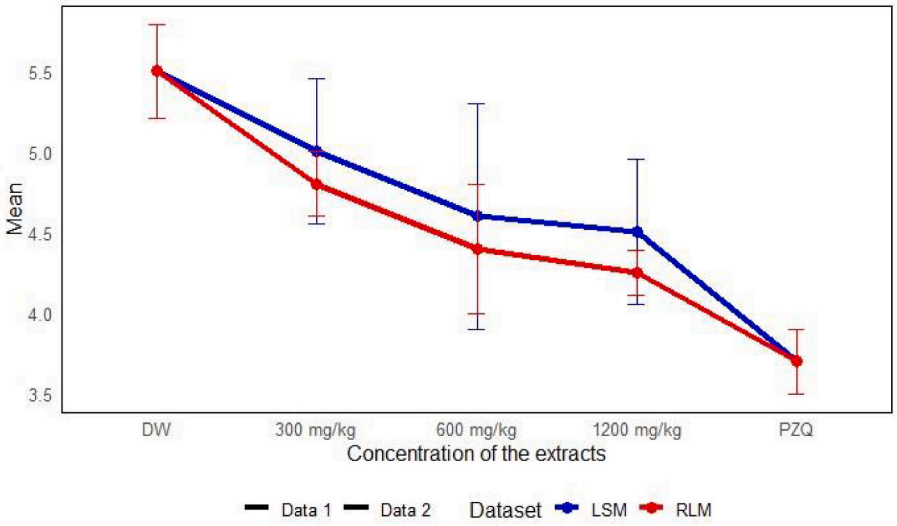

Fig. 7. Line graph showing the weight of the mice following treatment with disparate doses of *Lannea schismperi* (LSM) and *Searsia Longipes* (RLM) (Source: Table 3).

Table 3
Liver weights following treatment with the plant extracts and the control.

	Weight (g)				
Plants	300 mg/kg	600 mg/kg	1200 mg/kg	PZQ	DW
Lannea schimperi	5 ± 0.45	4.6 ± 0.70	4.5 ± 0.45	3.7 ± 0.2	5.5 ± 0.29
Searsia longipes	4.8 ± 0.2	4.4 ± 0.4	4.25 ± 0.14	3.7 ± 0.2	5.5 ± 0.29

PZQ = Praziquantel, DW = Distilled water.

this growing health problem. Schistosomiasis is among the significant parasitic infections experiencing such problems as some studies have reported cases presented in endemic regions which demonstrated tolerance to conventional treatment (Ismail et al., 1996; Gryseels et al., 2001; Melman et al., 2009). Therefore, in complement to the aforementioned efforts, the present study investigated the efficacy of the extracts from *Searsia longipes* and *Lannea schimperi* against *Schistosoma mansoni* adult worms, offering a potential ray of hope in the fight against drug resistance.

In this context, we have assessed various efficacy indicators, including egg reduction rate, worm burden reduction, granulomata reduction and animal weight gain after treatment. The egg counts in all tested doses, as well as the praziquantel, were low compared to the untreated control. However, the egg density varied based on the concentration of the plant extracts. Notably, *Searsia longipes* plays a more significant role than *Lannea schimperi* in inhibiting the fecundity of parasites. In line with previous studies, the reduction of the egg count and worm burden, among other factors, are the key indicators of the effectiveness of anti-schistosomal drugs. Therefore, the observed reduced density of the worm's eggs is a strong indication of the potency of the tested plant extracts. The noted high egg reduction rate is attributed to the reduced worm burden following treatment with disparate doses of the plant extracts, low productivity of the female worms, as well as destruction of the produced worm eggs by enhanced host immune response (Alemu et al., 2018). These promising results align with the study conducted by Alemu et al. (2018), which reported the ability of the crude extract from the *Echinops kebericho Mesfin* root and *Hagenia abyssinica (Bruce) J.F Gmel* flower to induce dose-dependent worm eggs reduction (Alemu et al., 2018). This reaffirms the validity of our findings and their alignment with previous research.

The percentage of worm burden reduction from the positive control group was high, indicating the effectiveness of the praziquantel in killing adult worms. Similarly, the plant extracts at all tested doses also induced significant worm burden reduction, demonstrating the good efficacy of the tested extracts. The higher activity of the praziquantel compared to the extracts, even at their highest dose tested, may be due to its good bioavailability. Conversely, lower activities of the plants crude extracts could be due to potential antagonistic effects of existing compounds, which diminish their efficacies. The average number of male worms recovered from the treatment groups was high relative to the females, suggesting the high sensitivity of the latter to the tested extracts. This observation, which is similar to that of de Oliveira Penido et al. (2008), who also reported a higher sensitivity of female worms than male worms when treated with aminoalkanethiols, aminoalkanethiosulfuric acids and the corresponding disulfides, raises intriguing questions about the potential implications of this gender-based sensitivity.

The body weight of the animals before and after treatment did not show any significant difference, however, the groups treated with plant extracts and praziquantel demonstrated greater weight increment relative to the untreated group. This result indicates that

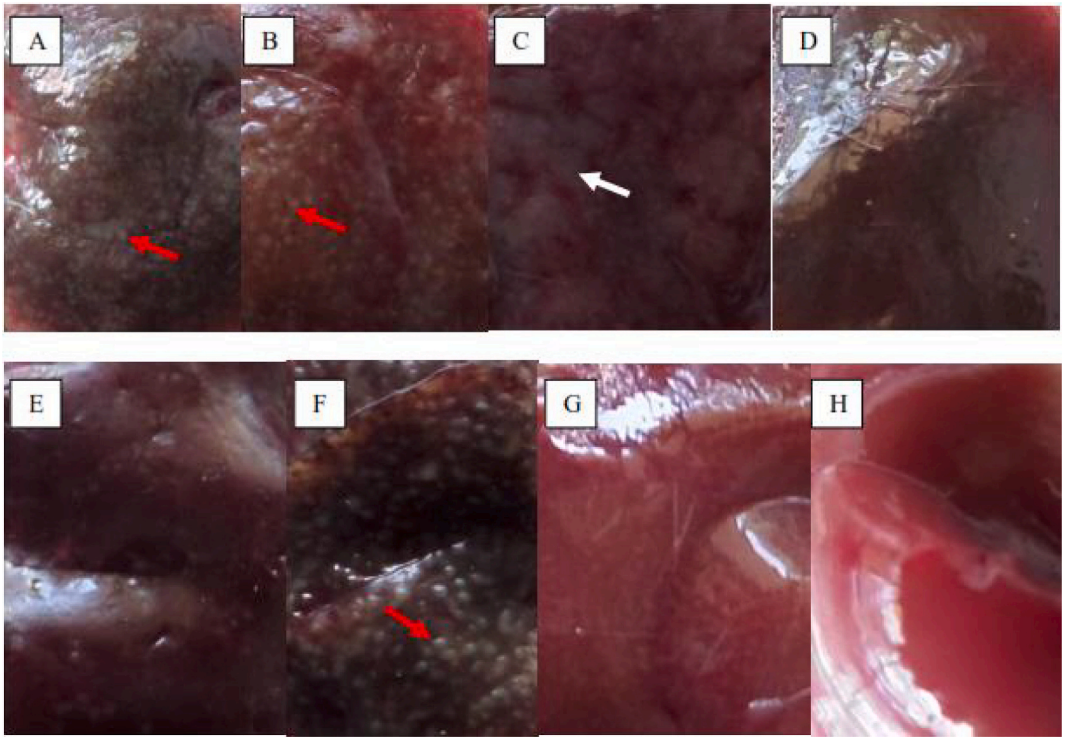

Fig. 8. (A) Negative control (Red arrows indicates granuloma), (B) LSM 300 (Red arrows indicates granuloma), (C) LSM 600 (white arrow indicates scar tissue section of the liver as it recovering from periportal fibrosis), (D) LSM 1200, (E) PZQ, (F) RLM 300 (Red arrows indicates granuloma), (G) RLM 600, (H) RLM 1200. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Praziquantel and both plant extracts improve the growth of the mice infected with *S. mansoni*. As has been reported in several studies, weight gain is among the early indicators of a good response to treatment (Gler et al., 2013). Therefore, the observed high weight gain from the treatment groups and the positive control further reiterate the potential of the tested extracts to manage disease morbidity. These promising findings were also reported by Jasta and coworkers, 2015, with the *Clerodendrum umbellatum* leaves aqueous extract (Jatsa et al., 2015). On the other hand, both plants extract at different concentrations tested, and the control, demonstrated the ability to reduce liver weights. The increased liver weight is normally attributed to the deposition of worm eggs as well as other metabolites that affect hepatic tissues. The observed reduction of the liver weight of the treated mice further suggests potential impact of the plant extracts and praziquantel on the worm burden as well as the fecundity of the female worms. Similar results were reported by Rizk et al., 2012, whereby, the essential oil of *Melaleuca armillaris* leaves divulged the ability to reduce the high liver to body weight ratio of the mice infected by *S. mansoni* (Rizk et al., 2012).

A gross examination of the mice's liver revealed the hepatoprotective ability of the plant extracts. Whereby, at the extracts doses above 300 mg/kg body weight and the Praziquantel, reduction of the granulomata were observed. As explained above, the observed result is attributed to the reduction of the worm burden and the fecundity of the female worms induced by the plant extracts and the control. Furthermore, the result reiterates the anti-inflammatory potential of the tested extracts.

5. Conclusion and recommendation

Crude extracts from both *Lannea schimperi* and *Searsia longipes* have shown significant potential for the management of schistosomiasis. They demonstrated significant anti-schistosomal activity *in vivo* by using an animal model. Both extracts were able to reduce the egg density and worm load significantly. Reductions in both worm load and egg density were directly proportional to the increase in the extract doses. They have also exhibited hepatoprotective and anti-inflammatory effects on *S. mansoni* infected mice. This result proves the schistosomacidal property of the methanolic extracts from both *Lannea schimperi* and *Searsia longipes*. Therefore, decoction from the aforementioned plants can be a beacon of hope for the management of schistosomiasis in marginalized communities where health services are limited. The plant extracts have reduced efficacies relative to praziquantel, even at the highest dose tested. The observed reduced effectiveness of both extracts may be attributed to the antagonistic effect exerted by existing compounds. In view of this, prospective studies should focus on isolating and testing the anti-schistosomal potential of pure compounds from the extracts of these plants. Furthermore, sub–acute and chronic toxicity assessments are also warranted.

CRediT authorship contribution statement

Nicolaus Omari Mbugi: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Geoffrey Maina:** Writing – review & editing, Methodology. **Musa Chacha:** Supervision. **Ernest Mbega:** Supervision.

Declaration of competing interest

Authors declares to have no conflict of interest.

Data availability

Data for the present study are available from the corresponding author upon request.

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