In-vivo Antiplasmodial activity of the Alkaloid fraction of the methanol root extract of *Andropogon schirensis* Hochst (Poacea) in *Plasmodium berghei* infected Mice

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Background

- Malaria is one of the major health problems in Nigeria and the increasing number of drug-resistant Plasmodium species continue to be a major concern
- Globally, there have been 247 million new malaria reported cases and 619,000 death, with Nigeria accounting for 28% of the cases and 31% of the death[1]
- Herbal medicines have been used in the treatment of malaria since time immemorial
- Andropogon schirensis is a perennial plant that is used traditionally in the treatment of malaria and dysentery
- Alkaloids have been reported to have antiplasmodial activity[2-5]

Aim

- This study evaluated the *in-vivo* antiplasmodial activity of the alkaloid fraction of methanol root extract of *Andropogon schirensis* in *Plasmodium berghi* infected mice

Method

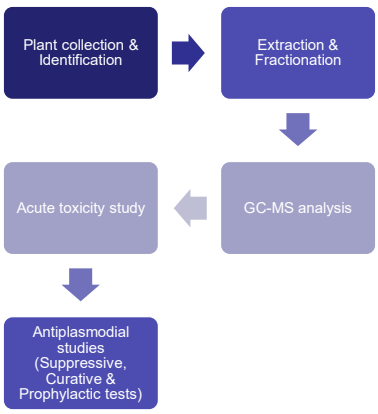

Figure 1: Study Flow chart

- Statistical analysis was done using SPSS software version 27, data presented as Mean ± SEM, analysed by One-Way ANOVA, compared by Dunnett *post hoc* test with significant at $p<0.05$

Results

- **GC-MS analysis**: 17 compounds were identified (Table 1)

Table1: Compounds found in the alkaloid fraction of the methanol root extract of *Andropogon schirensis*

S/N	RT (min)	Compound	Molecular formula	Molecular weight (g/mol)	Peak area %
1	13.20	11-(2-Cyclopenten-1-yl)undecanoic acid, (+)-	$C_{16}H_{28}O_2$	252.39	0.29
2	13.37	2-Pentyn-1-ol	C_5H_8O	84.12	0.11
3	14.51	7-Octenoic acid	$C_8H_{14}O_2$	142.2	1.67
4	15.41	Methyl 11-oxo-9-undecenoate	$C_{12}H_{20}O_3$	212.28	0.17
5	17.34	Acetylacetone, monooxime	$C_5H_9NO_2$	115.13	0.82
6	18.00	Bicyclo[10.1.0]trideca-4,8-diene-13-carboxamide, N-(3-chlorophenyl)-	$C_{20}H_{24}ClN$ O	329.9	1.12
7	18.19	3-Isopropyl-4-methyl-1-pentyn-3-ol	$C_9H_{16}O$	140.22	0.77
8	18.56	1-(Methoxymethoxy)-3-methyl-3-hydroxybutane	$C_7H_{16}O_3$	148.2	1.29
9	19.39	1,5-Heptadien-3-yne	C_7H_8	92.14	4.90
10	20.31	1,5-Hexadiene, 2,5-dimethyl-	C_8H_{14}	110.2	2.07
11	20.68	Pentadecanoic acid, 14-methyl-, methyl ester	$C_{17}H_{34}O_2$	270.5	18.40
12	22.12	1-Octyn-3-ol	$C_8H_{14}O$	126.2	0.51
13	22.71	Pentanoic acid	$C_5H_{10}O_2$	102.13	12.42
14	23.97	9-Octadecenoic acid (Z)-, methyl ester	$C_{19}H_{36}O_2$	296.5	37.30
15	24.56	7-Nonenoic acid, methyl ester	$C_{10}H_{18}O_2$	170.25	3.56
16	25.88	Cyclopentane, 1-methyl-2-(2-propenyl)-, trans-	C_9H_{16}	124.22	14.01
17	31.35	Pentafluoropropionic acid, octyl ester	$C_{11}H_{17}F_5O_2$	276.24	0.59

- **Acute toxicity test**: the oral median lethal dose (LD50) of the alkaloid fraction was estimated to be >5,000 mg/kg
- **Suppressive test**: the alkaloid fraction showed good parasitemia suppression which was statistically significant ($P<0.001$) when compared with the negative control group (Figure 2)

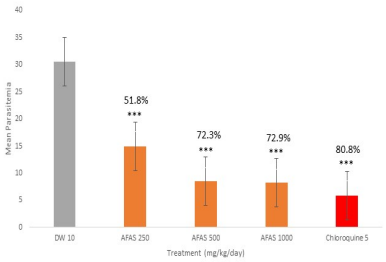

Figure 2: Effect of the Alkaloid fraction of methanol root extract of *Andropogon schirensis* on Suppressive activity in *Plasmodium berghei* infected mice

Data presented as Mean ± SEM, Analysed by One-Way ANOVA followed by Dunnett's *post hoc* test, ***$p<0.001$, compared to the negative control, DW= Distilled water, AFAS= Alkaloid fraction of methanol root extract of *Andropogon schirensis*, n=5, route of administration=oral

- **Curative test**: the fraction showed good parasitemia suppression which was significant ($P<0.001$) when compared to the negative control group (Figure 3)

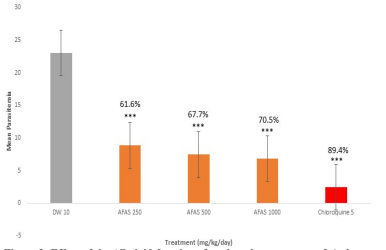

Figure 3: Effect of the Alkaloid fraction of methanol root extract of *Andropogon schirensis* on Curative activity in *Plasmodium berghei* infected mice

Data presented as Mean ± SEM, Analysed by One-Way ANOVA followed by Dunnett's *post hoc* test, ***$p<0.001$, compared to the negative control, DW= Distilled water, AFAS= Alkaloid fraction of methanol root extract of *Andropogon schirensis*, n=5, route of administration=oral

More Results

- The mean survival time of the mice at all the tested doses of the fraction after the curative test was over 28 days and it prevented malaria induced changes in PCV (Table 2)

Table 2: Effect of the Alkaloid fraction of methanol root extract of *Andropogon schirensis* on survival time and PCV in *Plasmodium berghei* infected mice after Curative test

Treatment	Dose (mg/kg/day)	Mean survival time (days)	PCV (%)
Distilled water	10ml	24.67±2.11	29.00±0.71
AFAS	250	28.00±0.00	36.60±1.83
AFAS	500	28.00±0.00	43.60±0.40***
AFAS	1000	28.00±0.00	45.20±2.27***
Chloroquine	5	28.00±0.00	46.80±1.98***

Data presented as Mean ± SEM, Analysed by One-Way ANOVA followed by Dunnett's *post hoc* test, ***$p<0.001$, compared to the negative control, AFAS= Alkaloid fraction of methanol root extract of *Andropogon schirensis*, n=5, route of administration=oral

- **Prophylactic test:** the fraction showed moderate parasitemia suppression which was statistically significant ($P<0.001$) compared with the negative control group (Figure 4)

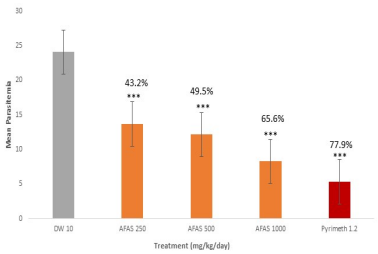

Figure 4: Effect of the Alkaloid fraction of methanol root extract of *Andropogon schirensis* on Suppressive activity in *Plasmodium berghei* infected mice

Data presented as Mean ± SEM, Analysed by One-Way ANOVA followed by Dunnett's *post hoc* test, ***$p<0.001$, compared to the negative control, DW= Distilled water, AFAS= Alkaloid fraction of methanol root extract of *Andropogon schirensis*, n=5, route of administration=oral

Conclusion

- The study showed that the alkaloid fraction has good suppressive and curative antiplasmodial activity with moderate prophylactic activity which may be due to the presence of the identified bioactive compounds

References

1. WHO 2022: World Malaria Report (WHO) https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022. Accessed September 11, 2023
2. Grellier P, Ramiaramanana L, Millerioux V, Deharo E, Schrevel J, Frappier F, Ikigalo F, Bodo B, Pousset J (1996) Antimalarial Activity of Cryptolepine and Isocryptolepine, Alkaloids isolated from Cryptolepis sanguinolenta *Phytotherapy Research* 10: 317-321
3. Campbell WE, Nair JJ, Gammon DW, Bastida J, Codina C, Viladomat F, Smith PJ, Albrecht CF (1998) Cytotoxic and Antimalarial Alkaloids from *Brunsvigia littoralis Planta Med* 64: 91-93
4. Addae-Kyereme J, Croft SL, Kendrick H, Wright CW (2001) Antiplasmodial activities of some Ghanaian plants traditionally used for fever/malaria treatment and of some alkaloids isolated from Pleiocarpa mutica; in vivo antimalarial activity of Pleiocarpine *Journal of Ethnopharmacology* 76 :99 – 103
5. Uzor PF (2020) Alkaloids from Plants with Antimalarial Activity: A Review of Recent Studies *Evidence-Based Complementary and Alternative Medicine* Article ID 8749083, 17 pages. https://doi.org/10.1155/2020/8749083

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