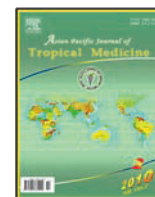


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Anti-inflammatory effects of *Moringa oleifera* lam extract in rats

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ABSTRACT

Objective: To investigate the acute and delayed anti-inflammatory effects of *Moringa oleifera* lam (MOL) crude methanolic extract. **Methods:** Compared the anti-inflammatory effects of MOL with that of standard anti-inflammatory agents like indomethacin and hydrocortisone using Air Pouch Model. **Results:** In both acute and delayed inflammation, the MOL extract produced dose dependent anti-inflammatory effect [acute IC_{50} = (399.30 ± 5.43) mg/kg; delayed IC_{50} = (510.26 ± 4.53) mg/kg]. The order of anti-inflammatory potency for the three drugs was hydrocortisone > indomethacin > MOL. **Conclusions:** These observations indicate that MOL possesses potential anti-inflammatory property.

1. Introduction

Moringa oleifera lam (MOL) is a West African plant used in folk medicine for the treatment of inflammatory which responses to tissue injury (swellings). Fresh ground roots of the plant is applied topically as a poultice on the swelling and left overnight, after that the swelling becomes considerably reduced.

Earlier studies have demonstrated that crude methanolic extract of MOL possesses anti inflammatory effects on acute paw oedema. Because of its high potency in attenuating inflammatory swellings, we decided to study the anti-inflammatory effects of the MOL crude extracts. The results obtained will be compared with those of standard anti inflammatory agents like hydrocortisone and indomethacin which are clinically important drugs.

2. Materials and methods

2.1. Animals

Young (4–8 weeks old) Albino rats of both sexes weighing

100–150 g were used. The animals were obtained from the animal house of the University of Port Harcourt and kept in the departmental animal house for at least 7 days before use. They were fed on chicken mash supplied by Superfeeds Nigeria Ltd and were given drinking water ad libitum.

2.2. Drugs and reagents

Diethylether, indomethacin, hydrocortisone, and carrageenin were obtained from Sigma Chemicals UK. Indomethacin and hydrocortisone were dissolved in Na_2CO_3 solution. 1 % carrageenin solution was prepared by dissolving 1 g of carrageenin in 100 mL of saline. Freud's adjuvant was obtained from Difco, U.S.A.

2.3. Preparation of MOL extracts

Fresh roots of *Moringa oleifera* lam was grounded and extracted over 48 hours with methanol. The extract was filtered and freeze-dried to yield a brown solid crude extract. The solid extract was then weighed out and dissolved in normal saline and used.

2.4. Preparation of animals

Air Pouch Model: Rats were anaesthetized with diethylether, thereafter were injected subcutaneously with 20 mL equivalent of air using a syringe and needle. After 3 days, the air pouch was replenished by injecting another 10 mL

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equivalent of air subcutaneously.

Acute inflammation was induced by injecting 0.2 mL of 1% carrageenin solution into the air pouch. Delayed inflammation was induced by injecting 0.2 mL Freud's adjuvant into the air pouch. The counting of white blood cells was done using the improved nebulae counting chamber.

Rats were divided into control and treated groups. Five rats were placed in the control group and given saline. The treated group was further subdivided into groups with each sub-group having 5 rats and receiving dose of drug or MOL extract. MOL extracts, hydrocortisone or indomethacin was given orally one hour before the induction of inflammation. For acute anti-inflammatory experiments, observations were made 4 hours after the induction; while, for the delayed anti-inflammatory experiments, observations were made 24 hours after induction of inflammation. The difference in the volume of fluid and the number of white blood cells which accumulated in the air pouch between the drug treated and the saline treated rats were used to quantitate either the percentage of anti-inflammatory potency of the drugs. The white cells were counted using Ezeilo and Green Blood Cell Counting Technique [1]. In experiments to determine the comparative anti-inflammatory potency of MOL extract, hydrocortisone and Indomethacin, the concentration of all drugs used were less than the IC_{50} of the drugs (MOL = 350 mg/kg for acute study, 450 mg/kg for the delayed study; indomethacin=10 mg/kg and hydrocortisone = 10 mg/kg).

2.5. Statistical analysis

Student's *t*-test was used to test for statistical significance. *P* value of 0.05 or less was considered statistically significant. Where indicated, the inhibition data were reported as Means \pm Standard Error (SE).

3. Results

Figure 1 showed that MOL extract produced a dose-dependent inhibition of both acute and chronic inflammatory reactions (fluid accumulation and migration of white blood cells into the air pouch). The concentration of MOL extract which produced 50% inhibition of the acute inflammatory reaction (AIC_{50}) was (398.53 ± 6.30) mg/kg for fluid accumulation and that of migration of cells was (400.06 ± 4.56) mg/kg. Thus average AIC_{50} was (399.30 ± 5.43) mg/kg.

Similarly, the concentration of MOL extract which produced 50% inhibition of the delayed inflammatory reaction (DIC_{50}) was (520.5 ± 5.6) mg/kg for fluid accumulation and that of migration of cells was (500.26 ± 4.53) mg/kg. Thus the average DIC_{50} was (510.26 ± 4.53) mg/kg.

Figures 2 and 3 showed that all the drugs used in this study like MOL extract, hydrocortisone and indomethacin significantly inhibited the inflammatory reactions in both delayed and acute inflammation. The order of potency was hydrocortisone>indomethacin>MOL extract.

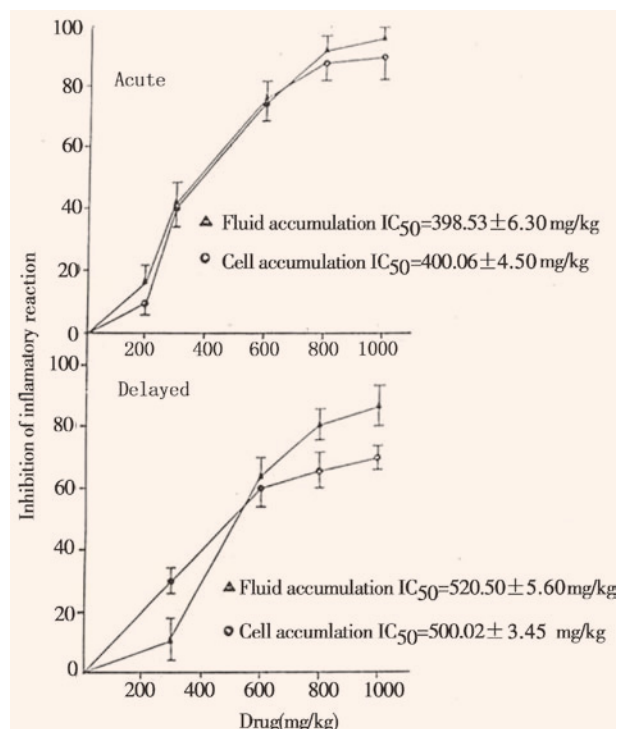


Figure 1. The inhibitory effect of MOL extract on acute and delayed inflammatory reactions using the air pouch model in rats ($n=5$).

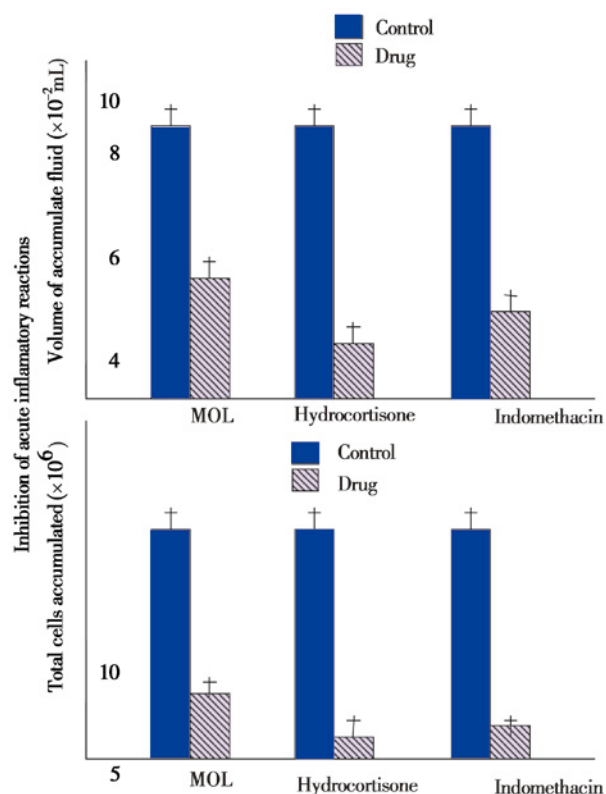


Figure 2. The inhibitory effects of MOL extract (350 mg/kg), hydrocortisone (10 mg/kg) and indomethacin (10 mg/kg) on acute inflammatory reactions (volume of accumulated fluid and total number of cells accumulated) using air pouch model in rats ($n=5$). * $P<0.05$ as compared with control.

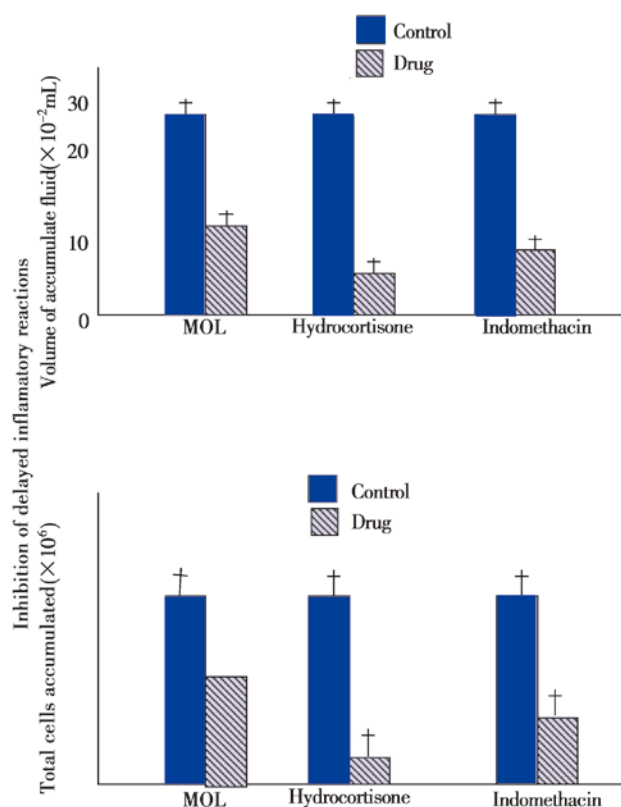


Figure 3. The inhibitory effects of MOL extract, hydrocortisone and indomethacin on delayed inflammatory reactions (volume of accumulated fluid and total number of cells accumulated) using air pouch model in rats ($n=5$).

4. Discussion

The results of this study demonstrate that MOL extract possesses anti-inflammatory properties in both delayed and acute inflammation. The anti-inflammatory properties of MOL extract was dose dependent. By comparison of the concentrations which produced 50% inhibition of the acute and delayed inflammatory reactions, it is clear that the MOL extract produced greater effect in acute inflammation. This suggests that the extract has to be given more than once in delayed inflammation rather than the single dose used in this study.

It is not clear why the MOL extract is more potent in acute inflammation than in delayed inflammatory reaction. Part of

the reason may be due to the fact that the active principle in the MOL extract has a short half life and easily eliminated from the body. The IC_{50} of MOL extract is very high [$AIC_{50} = (399.30 \pm 5.43)$ mg/kg, $DIC_{50} = (510.26 \pm 4.53)$ mg/kg] when compared with the concentrations of indomethacin (10 mg/kg) and hydrocortisone (10 mg/kg) used. This may be explained by the fact that MOL extract is a crude extract and possibly is a mixture of several compounds. Therefore, a fractionation of the extract could yield a more active anti-inflammatory substance comparable in potency to indomethacin and hydrocortisone.

At the concentrations used (MOL 350 mg/kg for acute and 450 mg/kg for delayed, indomethacin 10 mg/kg and hydrocortisone 10 mg/kg, the order of potency was hydrocortisone > indomethacin > MOL extract. This observation is in accordance with the findings of Hambleton *et al*[2]. The findings of this study also agree with the view that drugs such as hydrocortisone which inhibit both lipooxygenase and cyclooxygenase pathways do have superior anti-inflammatory actions[2–4]. The findings in this study indicate that the methanol extract of *Moringa oleifera* lam contains a potential anti-inflammatory agent and this may account for its (MOL) usefulness in the treatment of anti-inflammatory conditions in folk medicine[1]. The findings also encourage more study of the extract.

Conflict of interest statement

We declare that we have no conflict of interest.

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