ANTI-INFLAMMATORY AND ANALGESIC PROPERTIES OF THE RHIZOME EXTRACT OF ZINGIBER OFFICINALE

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The rhizome extract of Zingiber officinale was investigated for anti inflammatory and analgesic properties in albino rats and Swiss mice respectively. The extract (50 and 100 mg/kg b.w) produced significantly (P<0.05) inhibition of the carrageenan – induced rat paw oedema and a reduction in the number of writhing induced by acetic acid in mice. The results show that rhizome extract of Z. officinale possesses anti inflammatory and analgesic agent(s).

Key Words: Z. officinale, anti-inflammation, analgesic

INTRODUCTION

Ginger, the rhizome of Zingiber officinale (Zingiberaceae) is a perennial herb with an aromatic pungent taste. The exact country of origin is uncertain, but was thought to be originally native of tropical south East Asia before it spread to Africa. It is now grown abundantly in Northern Nigeria.

The rhizomes of ginger are used as spice in food and beverages and in traditional medicine as carminative, antipyrexia and treatment of waist pain rheumatism and bronchitis. It is used for the treatment of gastrointestinal disorders and piles (Iwu, 1993). However it has no effect on gastric emptying rate (Phillips et al.1993), but has protective activity on gastric ulcerogenesis (Serthe et al. 1991). Organic solvent extract of ginger rhizomes has also been shown to cause significant inhibition of skin tumour (Katiyar et al, 1996).

On the basis of these common uses of this plant in traditional folk medicine and its above reported activities in the literature, we have evaluated the anti-inflammatory and analgesic properties of the rhizome extract of Z. officinale in rats and mice respectively.

MATERIAL AND METHODS

Animals: Adults male Wistar strain albino rats (180 – 190g) and Swiss albino mice (20-25g) were used for this study. The animals were bred and housed in the pre-clinical animal house, College of Medicine, University of Ibadan. The animals had free access to food (Ladokun Feeds, Ibadan) and water ad libitum.

Plant Material: The rhizomes of Zingiber officinale were purchased from Bodija market, Ibadan Nigeria. The plant material was authenticated in the Department of Pharmacognosy, University of Ibadan.

The rhizome were dried under shelter, finely cut, and then ground into powder. Cold extraction of this powder (50g) in a Soxhlet apparatus using absolute ethanol (200ml) was carried out. The collected extracts were concentrated and dried in vacuo. The pharmacological tests were carried out with the dry extract dissolved in 0.9% physiological saline solution.

LD50 Determination: LD50 determination was carried out according to the method of Meyer et al, (1982) using brine shrimp (Artemia Salina Leach). This method determines LD50 µg/ml values of Z. officinale ethanol extract, in the brine medium. Activities of a broad range of Z. officinale extract were manifested as
toxicity to the shrimp. Appropriate amounts of ethanol extract (100, 1000, 2000, 3000, 4000, 5000 µg/ml) were assayed (LD_{50} values were determined from 24 h counts using probit analysis.

**Carrageenan–induced paw oedema in rats:** Pedal inflammation in rats was induced essentially as described by Winter *et al* (1962). An injection was made of 0.1ml of 1% carrageenan suspension into the right hind foot of each rat under the subplantar aponeurosis. The test groups of rats were treated intraperitoneally with 50 and 100 mg/kg of ginger extract 1h before carrageenan injection.

The control group received only the vehicle (0.2ml normal saline) and the reference group received 150 mg/kg Aspirin (i.p). Paw volume measurement was done by wrapping a piece of cotton thread round the paw of each rat and measuring the circumference with a meter rule (Hess and Milonig, 1972; Bamgbose and Noamesi, 1981). This procedure was done prior to irritant injection, and 1, 2 and 3h later. The percentage of oedema inhibition in drug treated rats versus control was calculated using the following formula:

\[
\text{% Inhibition} = \frac{100 \times (C_t - C_0)_{\text{Control}} - (C_t - C_0)_{\text{Treated}}}{(C_t - C_0)_{\text{Control}}} 
\]

Where \(C_t\) is paw size 1h, 2 h or 2 h after carrageenan injection and \(C_0\) is paw size before carrageenan injection.

**Acetic acid – induced writhing in mice:** Swiss mice were divided into various treatment and control groups of five mice per group. Writhings were induced by the method of Koster *et al* (1959). The test groups were administered 50 and 100 mg/kg of ginger extract i.p, while the control group received 0.2ml normal saline. The reference group received 150 mg/kg aspirin, i.p. The animals were fasted for 16 h prior to the treatments. One hour after treatment, the mice were injected i.p with 0.2ml of 3% acetic acid solution to induce the writhing. The number of abdominal constrictions (writhing) and stretching with a jerk of the hind limb was counted between 5 and 15 minutes after acetic acid injection. The response of the extract and aspirin treated groups were compared with those of the animals in the control group (0.2ml saline).

Percentage protection against writhing movement (% inhibition of writhing) was taken as an index of analgesia and it was calculated as follows:

\[
\text{% Inhibition} = \frac{\text{Wr(Control)} - \text{Wr (test group)}}{\text{Wr (Control)}} 
\]

Where Wr = Mean number of writhing

**Statistical Analysis:** Data were expressed as mean ± S.E. The results were statistically analysed by the students \(t\) test; \(P<0.05\) versus respective control was taken as significant.

**RESULTS**

LD_{50} determination value for the ethanol extract of *Z. officinale* rhizome extract is 458 µg/ml.

**Carrageenan-induced paw edema in rats:** In the experimental conditions used in this study, the ethanol extract of *Z. officinale* shows a significant inhibition of carrageenan paw edema in rats (\(P<0.05\)). This inhibition appears to be dose- dependent and decreases at the third hour (Table 1).

The reference drug (150 mg/kg, aspirin) shows an analogous trend with comparable values at 100 mg/kg zingiber extract.

**Table 1:** Effect of *Z. officinale* extract on Carrageenan induced rat paw edema.

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>% Inhibition of edema (mean ± S.E)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1hr</td>
</tr>
<tr>
<td><em>Z. officinale</em></td>
<td></td>
</tr>
<tr>
<td>(50 mg/kg b.w, i.p)</td>
<td>43.0 ± 0.06</td>
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<tr>
<td><em>Z. officinale</em></td>
<td></td>
</tr>
<tr>
<td>(100 mg/kg b.w, i.p)</td>
<td>58.0 ± 0.08</td>
</tr>
<tr>
<td><em>Z. officinale</em></td>
<td></td>
</tr>
<tr>
<td>(150 mg/kg b.w, i.p)</td>
<td>62.0 ± 0.07</td>
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</table>
Acetic acid –induced writhings in mice: The results summarized in Table 2 demonstrate that Z. officinale extract administered i.p significantly (P<.0.05) protected mice against acetic acid-induced writhings.

DISCUSSION
This study showed that ethanol extract of Zingiber officinale rhizome inhibited carrageenan – induced suplantar edema in rats. Carrageenan – induced rat paw edema is a valuable test used in predicting the value of anti-inflammatory agents acting by inhibiting the mediators of acute inflammation (Mossa et al 1995). Many substances have been proposed as inflammatory mediators, released locally at the site of inflammation and having biological properties that cause or enhance the signs and symptoms of inflammation (Galti et al, 2001).

Table 2: Effect of Z. officinale extract on Acetic acid – induced writhings in mice

<table>
<thead>
<tr>
<th>Treatment group (i.p)</th>
<th>Number of writhings</th>
<th>Mean± S.E.</th>
<th>% Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0.2ml normal saline)</td>
<td>36.2±0.98</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Z. officinale (50 mg/kg b.w)</td>
<td>19.0±1.41*</td>
<td>47.51</td>
<td></td>
</tr>
<tr>
<td>Z. officinale (100 mg/kg b.w)</td>
<td>10.2±1.49*</td>
<td>71.82</td>
<td></td>
</tr>
<tr>
<td>Aspirin (150 mg/kg b.w)</td>
<td>10.0± 1.70*</td>
<td>72.38</td>
<td></td>
</tr>
</tbody>
</table>

* P<0.05

Perturbation of the neutrophil membrane is an important even elicited by an inflammatory stimulus. This usually produced highly reactive oxygen species such as superoxide. The effect of Zingiber extract becomes enhanced within 2 hours. This period is known to coincide with the nonphagocytic phase of carragenan-induced inflammation, when the mast cells release cytoplasmic enzymes and serotonin (Vinegar et al, 1987). Katiyar et al (1996) showed that water or organic solvent extract of ginger possesses antioxidant property, which inhibits tumour promotion in mouse skin. Thus zinger extract is postulated to probably contain anti-inflammatory agents with antioxidant activity.

The chief constituents of zinger include sequiterpene, gingerol, Cult 1403 and inoleoresin (Tanabe et al, 1993).

The extract of Z. officinale rhizome exhibited analgesic activity in mice, by inhibiting the acetic acid – induced writhing. This is a model of visceral pain (Vyklicky, 1979), which is a very sensitive test for analgesic drug development, but not a selective pain test.

The above findings corroborate the various use of Zingiber officinale rhizome in various ailments. Further studies in progress in our laboratory are expected to identify the bioactive component(s) responsible for the anti-inflammatory and analgesic activities of Zingiber rhizome.

ACKNOWLEDGEMENTS
The authors are grateful to Mr. Mummney Laja for technical assistance.

REFERENCES


Received: May 2002
Accepted: September 2002