Anti-inflammatory Activity of Methanoilc and Ethanolic Extracts of *Citrus sinensis* peel (L) Osbeck on Carrageenan induced Paw Oedema in Wistar rats

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**ABSTRACT:** Aqueous ethanoic and methanoic extracts of *Citrus Sinensis* Peel were investigated for anti-inflammatory activity in carrageenan induced paw oedema in wistar rats, and compared to a positive control drug, Indomethacin. These extracts were given (IP) in a concentration of 20, and 70mg/kg with extract with a concentration which showed maximum (95%) inhibition on carrageenan induced rat paw oedema. The effect was significantly higher than that of the standard drug indomethacin (93%). Methanol extract with a concentration of 40mg/kg produced 95% inhibition, which was also high as compared to the standard drug. Ethanolic extracts with doses of 20mg/kg and 40mg/kg produce less percentage of inhibition as compared to the standard drug Indomethacin. ©JASEM

**Key words:** *Citrus Sinensis*, Anti-inflammation, Carrageenan, Peels, anti-inflammatory, ethanolic extract.

Many members of the Citrus genus are well known by the medicinal, Physiological and pharmacological activities including antimicrobial, antioxidant, anticancer and hypoglycemic activities (Ladaniya, 2008).

*Citrus sinensis* (L) Osbeck (Navel Orange) is a hybrid of two citrus species: *Citrus maxima* and *Citrus reticulate* (Saleem et al, 2010). The plant contains many medicinally active components from different classes including coumarins, carotenoid, flavonoids (Ortuno et al, 2006) and essential oil (Singh et al, 2010).

Many medicinal properties of orange peel extracts, such as against colic, upset stomach, cancer, diuretic, commutative, immune-enhancing, stomachich, tonic to digestive system, immune system and skin has been listed(Sapna et al, 2016). It is also used to treat and prevent vitamin deficiencies, cold, flu and scurry and helping to fight vita and bacterial infections(Grosso et al, 2013).

Antibacterial effects of orange peel have also been demonstrated in the literature. (Mehmood et al, 2015). Orange peel extract was also found to be effective against Klebsiella pneumonia(Akdemir et al, 2015).

It also exhibits insecticidal properties against mosquito, cockroach and housefly(Ezeonu et al, 2001). The presence of polymethoxy flavones, namely nobiletin,heptamethoxy flavones and tangeretin contributes to the antifungal properties of the plant(Ortuno et al, 2006).

According to Haiquing, Anti-inflammatory activity of *Citrus sinensis* is due to the presence of polymethoxyflavones. The polymethoxy flavones of content, especially nobiletin, appears to be responsible for the anti-inflammatory activities of certain citrus peel extracts (Haiquing et al, 2004). Sweet orange oil is a byproduct of the juice industry produced by pressing the peel. It consist of about 90% d-limonene (Omodamiro et al, 2013).

*Citrus sinensis* is widely known for health benefits and have found to produce antimicrobial effects, hence current research was planned to determine the anti-inflammatory effects of *Citrus sinensis* in wistar rats.

**MATERIALS AND METHODS**

**Plant Materials:** Fresh peel of *citrus sinensis* was collected from uselu market in Benin City, Edo state, Nigeria. It was identified at the Botany Department, Faculty of life science, University of Benin, Benin City where a voucher number 1758 is deposited. The peels were initially rinsed with distilled water, air dried in the laboratory under shade and ground into powder.

**Preparation of Plant Extracts:** The powdered mass of *1000g* of *Citrus sinensis* was extracted by soxhlet apparatus (Quickfit, England) using ethanol and methanol. The extract was concentrated under reduced pressure in a natory vacuum evaporator. Anti-inflammatory test was carried out on the extract.

**Pharmacological Evaluation**

**Anti-inflammatory Activity:** Anti-inflammatory activity will be measured using carrageenan-induced rat paw oedema assay (Witer et al., 1962; Adeyemiet al., 2002). Groups of 5 rats of both sexes (pregnant female excluded) were given a dose of a
test compound. After one hour 0.1ml, 1% 
Carrageenan suspension in 0.9% NaCl solution were 
jected into the sub-planter tissue of the right hand 
paw. The linear paw circumference was measured at 
hourly interval for four hours (Bamgbose and 
Noamesi 1981). Two groups of drug treated rats and 
one control group were used each test day and the 
mean paw oedema value for the test group being 
compared with the mean value for the control group 
for that day.

Anti-inflammatory activity (Duffy et al; 2001) will be 
measured as the percentage reduction in oedema level 
where drug was present, relative to control. 
Indomethacin (10mg/kg) was administered orally as 
reference drug, whereas 10% Tween 80 was uses as 
negative control.

Statistical Analysis: All data were expressed as the 
mean ± SEM, the student’s t-test was applied to 
determine the significance of the difference between 
the control group and the test compounds.

RESULTS AND DISCUSSION

Previous work revealed that the methanolic extract is 
highly active against Gram positive, Gram negative 
micro-organism and fungi at concentrations of 
100mg/mL, 150mg/mL and 200mg/mL respectively. 
At lower concentrations of 50mg/mL, the extract 
shows no activity except against Candida 
albicans.(Osarumwense et al., 2011).

From this study on the Anti-inflammatory activity at 
different doses, shows that the methanolic extract has 
percentage activities of 96.78% at 20mg/kg and 
95.71% at 40mg/kg, while the ethanolic extract has 
percentage activities of 92.26% at 20mg/kg and 
82.86% at 40mg/kg. The methanolic extract has a 
higher Anti-inflammatory activity than the ethanolic 
eextract. (Table 1)

<table>
<thead>
<tr>
<th>Anti-inflammatory activity</th>
<th>Table 1: Effects of the Extract on the Carrageenan-Induced Rat Paw Oedema</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extracts</td>
<td>Doses(MG/KG) (P.O)</td>
</tr>
<tr>
<td>Methanolic Extract</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Ethanolic Extract</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Indomethacin</td>
<td>10</td>
</tr>
<tr>
<td>Control</td>
<td>0.3</td>
</tr>
<tr>
<td>5%Tween</td>
<td>80</td>
</tr>
</tbody>
</table>

Values are mean ± S.E.M P<0.001
Significantly different from control, paired t-test(n=5), p.o= per oral.
%Activity= 100- [100 x (average drug treated/ average for control)]
Indomethacin (10mg/kg) was administered orally as reference drug. While 5% Tween 80 was used as negative control.

Conclusion: In conclusion, citrus sinensis peel here can be seen as a potential source of useful anti-inflammatory drugs. However, further studies can be done on these peels in order to isolate, identify, and characterize the structure of the bioactive compound.

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