



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

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**ABSTRACT:** Aqueous ethanolic and methanolic 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

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**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 reticulata* (Saleemetal, 2010). The plant contains many medicinally active components from different classes including coumarins, carotenoid, flavonoids (Ortunoetal, 2006) and essential oil (Singh et al,2010).

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

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

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

According to Haiquing, Anti-inflammatory activity of *Citrus sinensis* is due to the presence of

polymethoxyflavones. The polymethoxy flavones of content, especiallynobiletin, 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* inwistar 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 (Writer *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 injected 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 used 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 extract. (Table 1)

**Anti-inflammatory activity**  
**Table 1:** Effects of the Extract on the Carrageenan-Induced Rat Paw Oedema

Extracts	Doses(MG/KG) (P.O)	Change in Paw		%Activity		Average%Acti vity
		Oedema Mean	Sem			
Methanolic Extract	20	3.28+0.28	3.73+0.44	94.82	96.78	95.80
	40	1.33+0.25	2.80+0.39	87.22	95.71	91.47
Ethanolic Extract	20	1.25+0.35	1.53+0.34	86.40	92.26	89.33
	40	1.05+0.30	0.70+0.24	83.81	82.86	83.34
Indomethacin	10	0.85+0.30	0.93+0.37	80.00	87.09	83.55
Control 5%tween 80	0.3	4.62+2.67				

**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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