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Short communication

Phytochemical and Anti-Inflammatory Studies on Methanol Leaf Extract of *Scoparia Dulcis* Linn.

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ABSTRACT

Scoparia dulcis L is a well-known medicinal plant in Nigeria and has many applications in traditional medicines preparations. Phytochemical screening on the methanol leaf extract of *S. dulcis* was carried out to identify the phytochemicals present which could be attributed to its acceptability and usage in Nigeria. The extract was also investigated for its anti-inflammatory activity on carrageenan induced paw edema in Wistar albino rats. The phytochemical screening of the extract revealed the presence of carbohydrates, tannins, flavonoids, steroids/triterpenes, saponins, cardiac glycosides and alkaloids. The extract at doses of 500 and 1000mg/kg significantly reduced inflammation at the 3rd, 4th and 5th hours when compared to the control with a peak inhibition observed at the 4th hour. The methanol leaf extract of *Scoparia dulcis* contain bioactive phytochemical with anti-inflammatory activity which explains its use in the treatment of inflammatory conditions in Nigerian traditional medicine.

Keywords: *Scoparia dulcis, phytochemical, anti-inflammatory*

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INTRODUCTION

In Africa, traditional medicine is usually the first contact in meeting the primary health care needs of the people (Oguntibeju., 2018) this can be attributed to their safety, efficacy and cost effectiveness (Apu *et al*.,2012) .It has been reported that more than 70% of the developing world's population still depend on complementary and alternative systems of medicine, otherwise known as traditional medicine (Shaikh and Hatcher.,2005) for the management of various ailments including inflammatory conditions.

Inflammation usually occurs when infectious microorganisms such as bacteria, viruses or fungi invade the body, reside in particular tissues and/or circulate in the blood , inflammation may also happen in response to processes such as tissue injury, cell death, cancer, ischemia and degeneration (Azab *et al*.,2016). Steroid drugs, non-steroidal anti-inflammatory drugs (NSAIDs) and immune suppressants are usually used for the relief of inflammatory diseases, their use have been documented to be associated with various side effects such as bleeding gastrointestinal and peptic ulcer. (Amri *et al*.,2018). In recent years, anti-inflammatory activities of herbs have been comprehensively investigated and some medicinal plants or plant-derived chemical compounds are good sources of anti-inflammatory agents.(Tsai *et al*., 2015) , this could find importance in addressing some of the side effects associated with orthodox drugs such as the non-steroidal anti- inflammatory drugs(NSAIDs) .

Scoparia dulcis Linn belongs to the Plantaginaceae family, it is a perennial herb widely distributed in tropical and subtropical regions. It is known as sweet brom in English (Krishna *et al*.,2012) while in indigenous languages of Nigeria; it is known as rumafada in Hausa, mesenmesen gogoro in Yoruba and aiya in Ibo (Orhue and Nwanze.,2009). *S. dulcis* is a well-known plant in traditional medicine used in many cultures across the globe, Ethnobotanical studies in many parts of the world have revealed the use of *S. dulcis* for its anti-inflammatory activity (Pamunuwa *et al*.,2016). The plant has been reported to possess antisickling activity (Abere *et al*., 2015) , antibacterial and immunostimulatory activity (Abdulsalaam *et al* .,2013). The present study, was carried out to identify the phytochemicals present in the plant and evaluate its anti-inflammatory activity in order to validate its folkloric claim of its use in the treatment of inflammatory conditions.

MATERIALS AND METHODS

Collection, identification and preparation of *Scoparia dulcis*: The leaf of the plant *Scoparia dulcis* were collected in

the field around Yankarfe village, Sabon gari Local Government Area, Kaduna State, Nigeria, in the month of August 2016. The plant was identified and authenticated by Mallam Namadi Sunusi, in the Herbarium Unit of the Department of Botany, ABU, Zaria, Nigeria and voucher specimen (32034) was deposited. The plant was carefully cleaned with water to remove any foreign matter, The leaves were carefully plucked from the whole plant, They were then air dried under shade for about two weeks, comminuted to powdered form using a pestle and mortar. The powdered leaf sample gotten was then stored in an airtight container for further use.

Experimental Animals: Adult rats of both sexes (151-300g) were obtained from the Animal House, Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Nigeria. The animals were housed in well ventilated cages under standard environmental conditions (22 ± 2°C, 12:12 h dark/light cycle, frequent air change), fed with normal feed and allowed free access to water ad libitum. Ethical approval for the use of laboratory animals was obtained from Animal Rights Ethical Committee (ABUCAUC/2018/002).

Preparation of the plant extract: Extraction of the plant material was done using the method described by Kokate (1994). Five hundred grams (500 g) of the pulverized plant sample was extracted in 99.8% methanol(2 L) in a soxhlet apparatus at 50ºC , the filtrate gotten was further concentrated via rotary evaporator to recover solvent and final evaporation to dryness of the extract was done via the water bath after which it was stored in a desiccator for experimental use.

Phytochemical analysis: The phytochemical analysis of the methanol leaf extract of *S. dulcis* was carried out to identify the phyto-constituents present in the extract, this test was carried out according to guidelines described by Sofowora (2008) and Evans (2009).

Anti-inflammatory activity: Twenty- five rats of both sexes were randomly divided into five groups of five rats each. The phlogistic agent used in this study was carrageenan, which was administered into the sub plantar surface of the left hind paw of all the animals to induce inflammation , prior to the administration of carrageenan, the rats were pretreated; The control group were administered with 10 mL/kg of normal saline orally while rats in other groups (2, 3 and 4) were administered with 250, 500 and 1000 mg/kg of the methanol extract respectively. The rats in the fifth group were administered with Piroxicam 10 mg/kg body weight as the standard drug. After an hour , an injection of 0.1 mL of 1% carrageenan suspension was injected into the right hind paw of each rat under the sub plantar aponeurosis(Winter *et al*.,1962). Paw size was measured using venier caliper at 0,1,2,3,4,5 hours after carrageenan administration. The percentage inhibition (PI) at each time interval was calculated using the formula below.

$$PI = \frac{Control\ group - treated\ group}{Control\ group} \times 100$$

Statistical analysis: Data were expressed as mean ± standard error of mean (S.E.M). Significant differences between means of different groups were determined using one-way analysis of variance (ANOVA) followed by Turkey's post hoc. Differences were considered significant at $p < 0.05$.

RESULTS

Phytochemical analysis: The results of the phytochemical screening of methanol leaf extract of *S.dulcis* revealed the presence of carbohydrates, tannins, flavonoids, steroids/triterpenes ,saponins, cardiac glycosides and alkaloids as shown in Table 1.

Table 1:
Qualitative phytochemical constituent of methanol leaf extract of *Scoparia dulcis*

Constituents	Inference
Carbohydrate	+
Cardiac glycoside	+
Tannins	+
Flavonoids	+
Saponins	+
Anthraquinones	-
Steroid/ triterpenes	+
Alkaloids	+

Table 2:
Effect of methanol leaf extract of *Scoparia dulcis* on carrageenan induced paw edema in Wistar rats

	Mean paw edema thickness in diameter± SEM(mm)				
Treatment	1hr	2hr	3hr	4hr	5hr
Normal Saline (1mg/kg)	4.62±0.20	5.03±0.65	5.03±0.26	4.49±0.49	4.52±0.50
Extract (250 mg/kg)	4.44±0.32 (3.90)	4.67±0.19 (7.04)	4.26±0.70 (15.18)	4.26±0.70 (5.08)	4.13±0.83 (8.63)
Extract (500 mg/kg)	4.41±0.33 (4.50)	4.69±0.41 (6.68)	3.61±0.28* (28.20)	3.61±0.28* (19.64)	3.48±0.21* (23.02)
Extract (1000 mg/kg)	4.44±0.46 (3.90)	4.76±0.25 (5.59)	4.40±0.56* (12.44)	3.68±0.18 (18.04)	3.47±0.23* (23.15)
Piroxicam (10 mg/kg)	3.75±0.19* (18.87)	3.33±0.26* (33.77)	3.09±0.16* (38.55)	2.90±0.22* (35.46)	2.74±0.20* (39.40)

** P<0.05 significantly different from Normal saline group (One way ANOVA followed by Turkey's post hoc test). Data expressed as mean ±SEM. Values given in parentheses represent PI- percentage inhibition*

Anti-inflammatory activity of methanol leaf extract of *S. dulcis:* The extract showed significant ($p< 0.05$) anti-inflammatory activity against edema produced by carrageenan, At doses of 500 and 1000 mg/ Kg, the extract produced significant anti-inflammatory effect at the 3rd , 4th and 5th hours(Table 2). At the 4th hour, the effect produced was dose dependent. The extract at doses of 500 and 1000mg/kg showed significant ($p< 0.05$) reduction in paw size edema starting from the 3rd hour when compared to that of the control (normal saline) but percentage inhibition produced by the stardard drug (piroxicam 10mg/ Kg) showed a superior suppression of inflammation to that produced by the extract.

DISCUSSION

Medicinal values of important plant species are due to presence of some chemical substances which produce a definite pharmacological activity like alkaloids, tannins, flavonoids and saponin etc. (Khan *et al*.,2011; Edeoga *et al*.,2005). Preliminary phytochemical screening gives an insight on the presence or absence of pharmacologically important phytochemicals present in a plant extract. The result of the preliminary phytochemical screening of methanol leaf extract indicated the presence of carbohydrate, cardiac glycoside, tannins, flavonoids, saponins, steroid/ triterpenes and alkaloids (Table 1). This result further confirms findings by Abere *et al*, 2015. They reported the presence of tannins, flavonoids, saponins and alkaloids in the plant. These phytochemicals are known to exert various pharmacological effects.

The methanol leaf extract of *S. dulcis* was observed to significantly ($p< 0.05$) reduce paw edema in wistar albino rats at the peak of carrageenan induced edema in a dose dependent manner . The extract however did not produce a higher inhibition at all the doses tested when compared to that of the standard drug (piroxicam) but gave a significantly higher percentage inhibition when compared to that of the control (Table 2) .

Carrageenan induced inflammation is useful in detecting anti-inflammatory agents that are active orally (Kumar *et al*.,2008),development of edema due to carrageenan is a biphasic event (Vinegar *et al*.,1969). The edema formed is marked by the release of various inflammatory mediators such as serotonin, histamine, prostaglandins and bradykinin. These inflammatory mediators are released at different times. (DiRosa *et al*.,1971) The initial phase is attributed to the release of serotonin and histamine (Kumar *et al*.,2008) while in the late phase, prostaglandins are predominant in the acute edema. (Florentino *et al*.,2013).

The observed anti-inflammatory activity of the plant may be attributed to the presence of phytochemicals such as flavonoids, tannins, saponins, alkaloids, in the methanol leaf extract of *S.dulcis* ,these phytochemicals have been reported by some authors(Mohammed *et al*.,2014) to possess anti-inflammatory activity. Most flavonoids exert their anti-inflammatory activity by inhibition of enzymes that produce eicosanoids such as Lipooxygenases, phospholipase A2 and COX; other ways include inhibition of histamine release, phosphodiesterase, protein kinases and transcriptase activation. (Rathee *et al*.,2009) while the mechanisms in which tannins exert their anti-inflammatory action include free radical scavenging and inhibition of inflammatory mediators such as cytokines, inducible nitric oxide synthase and COX-2. (Mohammed *et al*.,2014)

From the results obtained in this study, it can be concluded that the methanol leaves extract of *Scoparia dulcis* contain phytochemical constituents with anti-inflammatory activity thus justifies its use in traditional medicine for the treatment of inflammatory conditions.

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