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Research Article

Anti-inflammatory and Antipyretic Activities of *Panicum Maximum*

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ABSTRACT: Anti-inflammatory and antipyretic activities of leaf extract of *Panicum maximum* were evaluated to ascertain the folkloric claim of its use in fevers and inflammatory conditions. The crude leaf extract (48 – 144 mg/kg) of *Panicum maximum* was investigated for anti-inflammatory and antipyretic activities using various experimental models. The extract caused a significant ($p<0.05 – 0.001$) dose-dependent reduction in inflammation and fever induced by different agents used. The anti-inflammatory and antipyretic effects of this plant may in part be mediated through the secondary metabolites present in the plant.
Keywords: *Panicum maximum*, Anti-inflammatory, antipyretic

INTRODUCTION

Panicum maximum.Jacq (Poacace) is a perennial, tuft grass with a short, creeping rhizome. The stem of this robust grass can reach a height of up to 2m; the leaf sheath are found at the bases of the stems and are covered in fine hairs. It is widely distributed in Africa where it originates and almost all tropical parts of the world (Van Oudtshoorn, 1999). The plant (leaf) is used traditionally by the Ibibios of Akwa Ibom State, Nigeria in the treatment of various ailments such as malaria, infections, rheumatism pain, inflammation and diabetes. Antia *et al*.,(2010) reported the antidiabetic activity of the leaf extract. Antiplasmodial and analgesic activities of the leaf extract have also been reported (Andrew, 2011). Ethnopharmacological and scientific reports on this plant is scarce. To confirm its ethnobotanical uses in the treatment of these ailments, we investigated the anti-inflammatory and antipyretic properties of an ethanolic leaf extract of *Panicum maximum* in experimentally-induced inflammation and fever in rodents.

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MATERIALS AND METHODS

Plant materials

Fresh leaves of *Panicum maximum* were collected in July, 2010 at a farmland in University of Uyo, Uyo, Nigeria. The plant was identified and authenticated by Dr. Margaret Bassey, a taxonomist in the Department of Botany, University of Uyo, Uyo. Nigeria. Herbarium specimen was deposited at Faculty of Pharmacy Herbarium (FPH 76c). The fresh leaves of the plant were shade-dried for 2 weeks and reduced to powder. The powdered leaves (1kg) was macerated in 97% ethanol (3L) for 72 hours to give the crude ethanolic extract. The liquid filtrate was concentrated and evaporated to dryness in vacuo 40°C using rotary evaporator. The dry extract was stored in a refrigerator at -4°C until used for experiments reported in this study.

Phytochemical Screening

Phytochemical screening of the crude leaf extract was carried out employing standard procedures and tests (Trease and Evans, 1989, Sofowora, 1993), to reveal

the presence of chemical constituents such as alkaloids, flavonoids, tannins, terpenes, saponins, anthraquinones, reducing sugars, cardiac glycosides among others.

Animals

Albino rats (120-155g) and mice (18 – 23g) of either sex were obtained from the University of Uyo animal house. They were maintained on standard animal pellets and water ad libitum. Permission and approval for animal studies were obtained from the College of Health Sciences Animal Ethics committee, University of Uyo.

Determination of Median Lethal dose (LD_{50})

The median lethal dose (LD_{50}) of the extract was estimated using albino mice by intraperitoneal (i.p) route using the method of Miller and Tainter (1944). The animals were observed for manifestation of physical signs of toxicity such as writhing, decreased motor activity, decreased body/limb tone, decreased respiration and death. The number of deaths in each group within 24 hours was recorded.

Evaluation of anti-inflammatory activity of the extract

Carrageenin – induced mice hind paw oedema

Increase in the mice hind paw linear circumference induced by planar injection of the phlogistic agent was used as the measure of acute inflammation (Winter *et al*., 1962). Adult albino mice of either sex were used after 24 hours fast and deprived of water only during experiment. Inflammation of the hind paw was induced by injection of 0.1ml of freshly prepared carrageenin suspension in normal saline into the sub planar surface of the hind paw. The linear circumference of the injected paw was measured before and 0.5, 1, 2, 3, 4 and 5 hrs after administration of phlogistic agent. For routine drug testing, the increase in paw circumference at 0.5, 1, 2, 3, 4 and 5 hrs after administration of phlogistic agent was adopted as the parameter for measuring inflammation (Winter, *et al*., 1962; Akah and Nwambie, 1994; Ekpendu *et al.,* 1994, Besra *et al*., 1996). Edema (inflammation) was assessed as difference in paw circumference between the control and 0.5, 1, 2, 3, 4 and 5 hrs after administration of phlogistic agent [Hess and Milonig, 1992]. The extract (48, 96 and 144 mg/kg i.p) was administered to various groups of mice, 1 hr before inducing inflammation. Control mice received carrageenin only, while reference group received ASA (100 mg/kg) before induction of inflammation with carrageenin. The average (mean) oedema was assessed by measuring with vernier calipers.

Egg-albumin induced inflammation

Inflammation was induced in mice by the injection of egg albumin (0.1ml, 1% in normal saline) into the sub planar tissue of the right hind paw (Akah and Nwambie, 1994). The linear circumference of the injected paw was measured before and 0.5, 1, 2, 3, 4 and 5hrs after the administration of the phlogistic agent. The leaf extract (48, 96 and 144 mg/kg i.p) and ASA (100 mg/kg orally) were administered to 24 hrs fasted mice 1 hr before the induction of inflammation. Control group received 10 ml/kg of distilled water orally. Edema (inflammation) was assessed as the difference in paw circumference between the control and 0.5, 1, 2, 3, 4 and 5 hrs after the administration of the phlogistic agent (Hess and Milonig, 1972). The average (mean) edema was assessed by measuring with vernier calipers.

Evaluation of antipyretic activity of the extract

2, 4 – Dinitrophenol (DNP) induced pyrexia

Adult albino rats (132 – 175 g) of both sexes fasted for 24 hours but allowed water *ad libitum* were used for the experiment. They were randomized into groups of 6 rats each. DNP (10 mg/kg, i.p) was administered to the rats after obtaining the basal rectal temperatures. Hyperthermia developed within 30 min of DNP administration. Different doses of extract (48, 96, and 144 mg/kg i.p), aspirin (100 mg/kg) and distilled water (10 ml/kg, orally) were administered respectively to the treatment and control groups of animals. Rectal temperatures of the animals were obtained at an hour interval for 5 hrs (Backhouse *et al*., 1994; Winter *et al*., 1962; Mbagwu *et al*., 2007).

Yeast-induced pyrexia

Adult albino rats (124 – 180 g) of both sexes fasted for 24 hours but allowed water ad libitum were used for the experiment. They were randomized into groups of 6 rats each. At zero hour, the basal temperature of the rats was taken using digital clinical thermometer. Thereafter, each animal was administered subcutaneously with 20% W/V aqueous suspension of yeast at a volume of 10 ml/kg (Gural *et al*., 1955, Okokon and Nwafor, 2010). At suitable intervals beginning one hour after yeast injection, rectal temperature of animals were taken, animals with increase of 1°C were selected and grouped for the study. The extract understudy was administered i.p. after the pyrogen at doses of 48, 96 and 144 mg/kg to respective groups of rats. The control group received distilled water (10 ml/kg) and the reference group administered with ASA (100 mg/kg) both intraperitoneally. The rectal temperature of the groups was taken at 1hr interval for 5hrs.

Statistical analysis and data evaluation

Data obtained from this work were analyzed statistically using Students' t-test and ANOVA (One- or Two- way) followed by a post test (Tukey-Kramer multiple comparison test). Differences between means will be considered significant at 1 % and 5 % level of significance i.e $P \leq 0.01$and 0.05.

RESULTS

Phytochemical screening

The phytochemical screening of the ethanolic extract of the leaf extract of *Panicum maximum* revealed the presence of alkaloids, cardiac glycosides, tannins, saponins, terpenes and flavonoids.

Determination of Median lethal dose (LD_{50})

The median lethal dose (LD_{50}) was calculated to be 480.0± 4.91 mg/kg. The physical signs of toxicity included excitation, paw licking, increased respiratory rate, decreased motor activity, gasping and coma which was followed by death.

Anti-iflammatory activity

Carragenin-induced oedema in mice

The effect of ethanolic leaf extract of *Panicum maximum* on carragenin-induced oedema is shown in figure 1. The extract exerted a significant ($P<0.05$ – 0.001) anti-inflammatory effect in a dose –dependent manner which was comparable to the standard drug, ASA,100mg/kg.

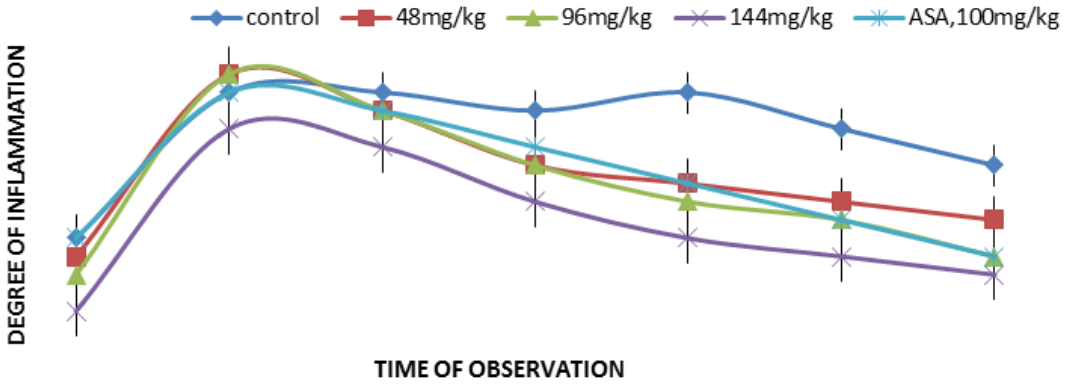

Figure 1:
Effect of *Panicum maximum* leaf extract on carrageenin- induced oedema in mice

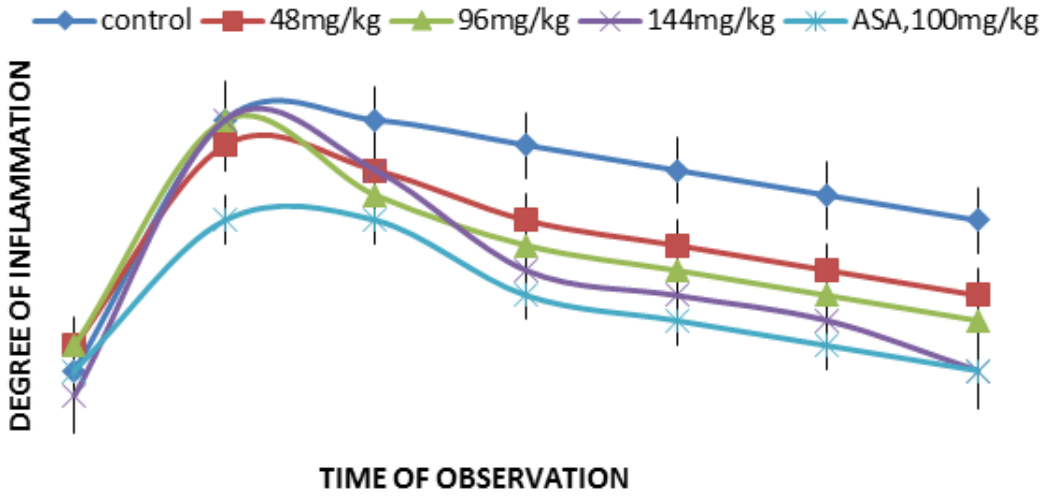

Figure 2:
Effect of *Panicum maximum* leaf extract on egg- albumin induced oedema in mice.

Egg albumin- induced oedema: Administration of leaf extract of *Panicum maximum* on egg albumin - induced oedema in mice caused a significant ($p<0.05 – 0.001$) dose-dependent anti-inflammatory effect against oedema caused by egg albumin .The effect was comparable to that of standard drug, ASA (100 mg/kg) (Figure 2).

Antipyretic test

Dinitrophenol induced pyrexia: The antipyretic effect of the extract on DNP induced pyrexia is shown in figure 3. Administration of the leaf extract of *Panicum maximum* (48, 96 and 144 mg/kg) in the presence of the pyrogen caused a significant ($P<0.05 – 0.001$) reduction in the temperatures of the extract treated rats when compared with the control. The antipyretic effect was dose-dependent and comparable to that of the standard drug, ASA (100 mg/kg).

Yeast-induced pyrexia: Figure 4 shows the effect of the extract against yeast-induced pyrexia.There was a dose-dependent reduction in the temperature of rats treated with the leaf extract. The reductions caused by the extract was significant ($P<0.005 – 0.001$) when compared to control and comparable to that of the standard drug, ASA (100 mg/kg).

DISCUSSION

The major folkloric uses of *P. maximum* have been in the treatment of malaria, infections, rheumatism pain, inflammation and diabetes (Antia *et al.*, 2010). The Ibibios of Niger Delta region of Nigeria have been using it to treat malaria and other febrille illnesses. These prompted the need to evaluate the anti-inflammatory and antipyretic potentials of the crude extract of the leaves of *P. Maximum* to ascertain the folkloric claims.

In this work, median lethal dose (LD_{50}) was determined to be 480.0± 4.91 mg/kg, and the extract was moderately safe (Homburger, 1989). In the carragenin induced oedema, the extract (48 – 144 mg/kg) exerted pronounced effect at the early stage of inflammation (1-2hr) indicating effect probably on histamine, serotonin and kinnins that are involved in the early stage of carragenin induced oedema (Vane and Booting,1987). The extract also reduced later stage of the oedema maybe due to its ability to inhibit prostaglandin which is known to mediate the second phase of carragenin induced inflammation (Vane and Booting,1987). However, ASA (100 mg/kg) a prototype NSAID, a cyclooxygenase inhibitor whose mechanism of action involves inhibition of prostaglandin, inhibited significantly the paw swelling due to carragenin injection.

The extract also inhibited egg albumin-induced oedema demonstrating that it can inhibit inflammation by blocking the release of histamine and 5-HT, two mediators that are released by egg albumin (Nwafor *et al*., 2007). However, ASA, a cyclooxygenase inhibitor reduced significantly oedema produced by egg albumin. Flavonoids are reported to be involved in antiinflammatory activity of plants (Parmer and Gosh,1978). These have been found to be present in the extract.

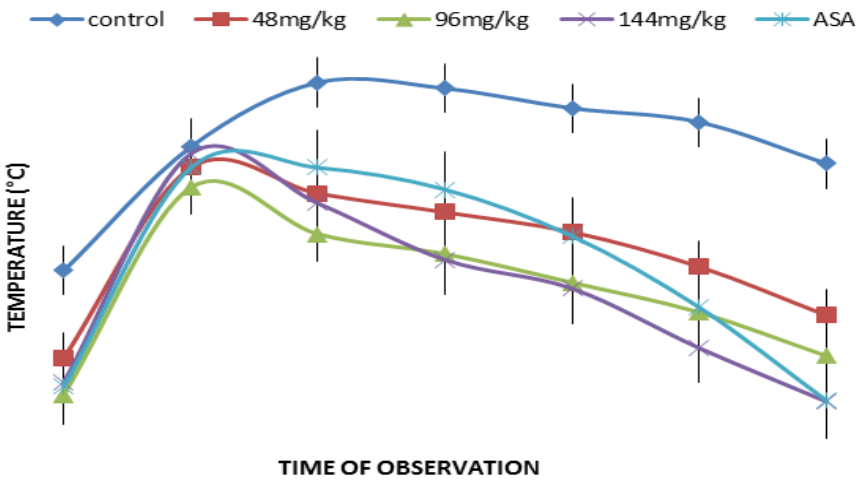

Figure 3:
Effect of *Panicum maximum* leaf extract on DNP induced pyrexia in rat

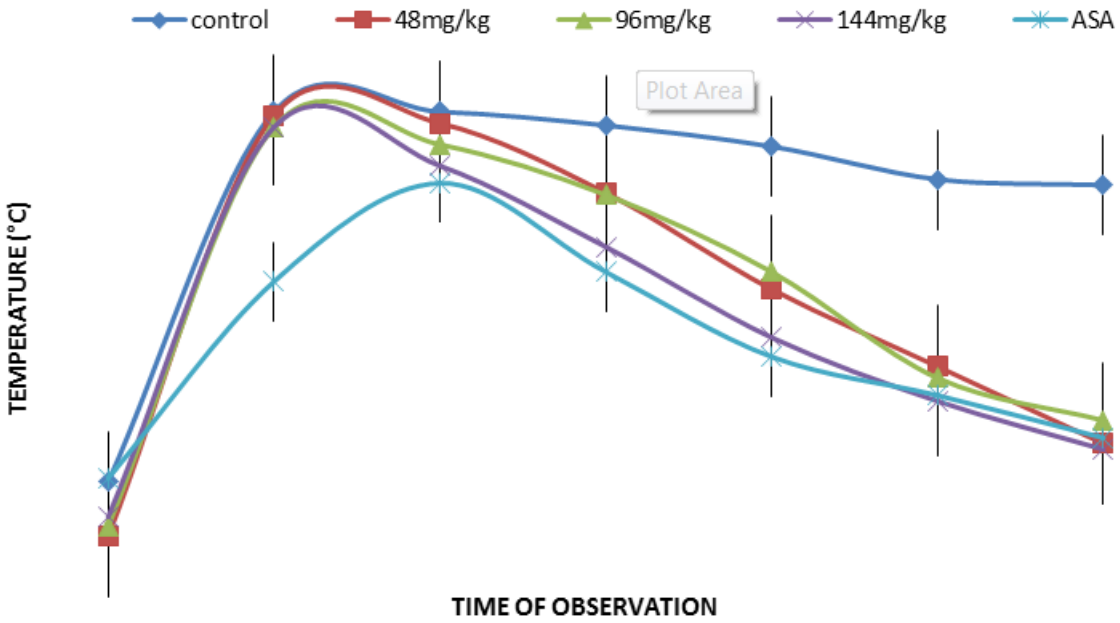

Figure 4:
Effect of *Panicum maximum* leaf extract on yeast induced pyrexia in rat

In this study, the extract was observed to inhibit greatly DNP- and yeast -induced pyrexia. The extract is likely to reduce pyrexia by reducing brain concentration of prostaglandin E_2 especially in the hypothallamus through its action on COX-3 (Botting and Ayoub,2005) or by enhancement of the production of the body's own antipyretic substances like vasopressin and arginine (Chandrasekharan,2002). This effect is due to the presence of the phytochemical compounds in the extract.

In conclusion, the results of this study support the ethnobotanical use of the plant in the treatment of febrile illnesses and inflammatory conditions. Further investigation is being advocated especially in elucidating cellular mechanisms and establishing structural components of the active ingredients with a view of standardizing them.

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