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Anti-inflammatory and Antinociceptive (Analgesic) Properties of *Momordical balsamina* Linn. (Balsam Apple) Leaves in Rats

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Abstract: The effect of aqueous leaves extract of M. *balsamina* on acetic acid induced writhes/stretches (Anti nociceptive/analgesic effect) and egg albumen induced edema (Anti-inflammatory effect) was studied. Three different doses of the leaves extract were administered to three groups of rats 30 minutes prior to the administration of acetic acid. Pentzocin was used as the standard Analgesic drug. Another Randomized Block Design of three blocks was administered with three different doses of the leaf preparation 30 minutes prior to the induction and oedema with egg alburnen. Pure aspirin was used as the standard anti-inflammatory agent. The treatment with the plant preparation cause dose dependent significant ($p<0.05$) protection against the writhes/stretches produced by acetic acid administrations and oedema induced by egg albumen. These protections were found to be superior to those of the standard drugs used. The result of the findings establishes the analgesic and anti-inflammatory effect of the aqueous extract of *M. balsamina* and concludes therefore, that there was a positive correlation (r = 90) in the dose response relationship for both analgesic and anti-inflammatory effect.

Key words: Anti-inflammatory, anticeptive, *M. balsamna,* oedema, paw diameter, writhes/stretches

Introduction

Momordica balsamina Linn which belongs to the family *cucurbitaceae is* a climber that grows over native huts. It is annual to perennial herb found wild throughout Borno State of Nigeria (Bokhari and Ahmed, 1980). Different parts of the plant have been used for different medicinal purposes. In the Indian peninsula, the roots are used as an abortifacient, the roots and fruits are used for same purpose in Nigeria and Ghana. The plant is sometimes used as an ingredient in aphrodisiac preparations (Akinniyi *et al.,* 1986 and Sofowara, 1982). The wollofs in Senegal have used the fruits as purgative agents and vermifuge (Sofowara, 1982). The fruits and leaves are used for treatment of Wounds in Nigeria and in Syria as hemostatic antiseptic. The whole plant is Used as sponge in treating skin disease such as scabies and as tranquilizer (Akinniyi *et al.*, 1986 and Sofowara, 1982) in the treatment of mental illness, The aqueous leaves extract of *M. balsamina* has also been used in reducing and relieving period pain in young girls (Seaforth *et al*., 1980). The natives also use the seed of the plant in arrow poison. The whole plant extract has insecticidal properties. The pulverized plant is applied externally against malignant ulcers (Dalziel, 1958).

Young peeled fruits are cooked and eaten, they are often steeped in salt water after peeling and before cooking to remove its bitter taste (Bokhari and Ahmed, 1980). The fruits are common ingredients in Indo Pakistan pickles and are often used in curries and meat dishes. Tender shoots are usually consumed with Okra soup by the Kanuris of Borno State where the plant is locally known as dagdawu. Phytochemical Screening of *M. balsaming Linn.* has reveal the presences of tannins, saponins and lectins (Akinniyi *et al*., 1986). The seed of *M. balsamina* is known to contain glycosides, saponin and steroids. The leaves and fruits were observed to have hypoglycemic effects in rats (Karumi and Bobboi, 1999 and Karumi *et al*., 1999). The leaves were found to be highly hemolytic and hepatoxic in rats (Karumi *et al*., 1999). Further more, the fruits were observed to be toxic to various organs and tissues of rats in very high dose (Shettima *et al*., 2001).

In view of the fact that the plant is used by the traditional healers to alleviate pain among the natives, the present study is therefore aimed at determine any possible analgesic and anti-inflammatory effects of leave extract of the plant in rats.

Materials and Methods

Collection, identification and preparations of extract of the plant material: The plant material used in this study was collected from University of Maiduguri Campus during rainy season in August 2002. It was identified and

authenticated by a botanist with the department of Biological Sciences, University of Maiduguri. The fresh leaves were air dried and subsequently pulverized into fine powder. The extraction was by standard method of Mittal *et al.* (1981) and WHO (1992), Two hundred grams of powder was mixed with 1 l of distilled water and boiled for 2 min. then allowed to cool to 40°C and then filtered using glass wool. The filtrate was collected in a beaker and evaporated until the, volume was reduced to 100 ml so that 1 ml of the extract represents 2 g of the dried weight.

Animals: Fifty (50) white Wistar strain rat weighing between 150-200 g were used. They were obtained from the animal house unit of the Department of Biochemistry, University of Maiduguri. The animals kept under good laboratory conditions, fed on standard diet (grower mash ECWA Feeds Nig. LTD Jos, Nigeria) and were allowed tap *water ad-libitum.*

Analgesic effect: Method of corea *et al.* (1996) was adopted for this study. Five groups (ABCD and E) of five rats were injected intraperitoneally (IP) with 0. 1 ml of 0.6% acetic acid. Group A which was control group received only distilled water, while groups B, C and D were treated with extract at the following doses respectively, 100, 200 and 400 mg kg^{-1} body weight, 30 minutes prior to administration of acetic acid. Group E rats were treated with 30 mg kg^{-1} body weight pentazocine 30 min. prior to acetic acid administration. The number of stretches or writhes per 10 min. were counted and recorded for each rat in each group. Using the number of writhes/stretches, the percentage protection was calculated using the following formula:

$$\text{Percentage protection} = \frac{(\text{mean writhings of control group}) - (\text{mean writhings of treated group})}{\text{Mean writhings of the control group}} \times 100$$

as reported by Hernandez - Pecez *et al.* (1995)

Anti-inflammatory effect: The method of Basia *et al.* (1996) was used for the study. Twenty five male rats weighing between 150-200 g were used. They were placed in 5 groups of five rats each (Groups A, B, C, D and E). Group A served as control while groups B, C and D where treated with 100, 200 and 400 mg kg^{-1} body weight of plant extract, respectively.

Group E was given 25 mg kg^{-1} body wt of pure aspirin. Thetile extract and drug treatments were by intraperitoneal injection 30 min. prior to the induction of oedema, Oedema was induced by injecting 0.1 ml of egg albumen into right paw of the rats. Using venier Caliper, the diameter of the paws were measured after every hour for 5 h, with a final reading taken at 24 h after oedema induction.

Results

The effects of different doses of the plant on the number of writhes/stretches movement induced by acetic acid in rats are shown in Table 1. The intraperitoneal administration of the extract at various doses (100-400 mg kg^{-1}) caused an increase in pain threshold of all the rats when compared with the control. The effect was dose dependent. At doses of 100 mg kg^{-1} and 400 mg kg^{-1} the numbers of writhes were 35.60±3.26 and 17.80±3.54, respectively when compared with control 62.00±6.90. These decreases were significant ($p<0.05$) and conferred 37.7 and 71.3% protection on the rats respectively. The group that received pentazocin (30 mg kg^{-1}) intraperitoneally responded to challenge with 0.6 acetic acid (0.1 ml) with 34.20±6.94 stretches indicating 44.8% protection.

Table 1: Effect of aqueous extract of m. Balsamina leaves on stretches (writhes induced by acetic acid (0.6%)

Treatment	Extract dose (mg kg^{-1})	Number of writhes 10^{-1}	Percentage protection (%)
Control	-	62.00±6.90	0
Extract+Acetic Acid	100	38.60±3.26*	37.70
Extract+Acetic Acid	200	27.40±4.54**	55.80
Extract+Acetic Acid	400	17.80±3,54***	71.30
Extract+Acetic Acid	30	34.20±6.94*	44.80

N = 5 (Number of rats in a group) * $p<0.05$ ** $p<0.01$
***$p<0.005$ significantly different from controls (students t - test)

Table 2 shows the effect of different dosages of the plant extract and standard aspirin on the oedema induced by egg albumen. The result indicated that the extract has some anti-inflammatory effect as shown by the reduction in the mean diameter of the paw when compared with the control and the aspirin treated rats. The extract produced dose dependent reduction of increased paw diameter induced by egg albumen. One h after the administration of egg albumen, the percentage increase in paw diameter in rats treated with the extract at 100, 200 and 400 mg kg^{-1} were 27.52±8.67, 23.28±6.48 and 13.33±7.06%, respectively when compared with the control (35.49±13.91%). Five hours post extract treatment percentage difference in paw diameter of treated rats were 23.16±9.58, 13.82±6.46 and -11.07% for 100, 200 and 400 mg kg^{-1} extract treatment respectively compared to the control (29.83±2.74%) The anti-inflammatory activities of the extract appear to differ from that of aspirin with respect to inhibition of induction of oedema by egg alburnen.

Discussion

The results of the present investigation have shown that the water extract of *Momordica balsamina* leaves

Table 2: Effect of aqueous extract of M. *balsamina* leaves on the oedema induce by egg Albumen (0.1 ml)

Treatment (mg kg^{-1})	Mean diameter of paw in mm±S.D. 0 h	1 h	2 h	3 h	4 h	5 h	24 h
Control	4.70±0.09	6.38±0.57a	7.10±0.47	6.98±0.44	6.68±0.15	6.10±0.09	5.20±0.34
	-	(35.19±13.97)	(51.13±0.82)	(48.48±8.46)	(42.20±4.73)	(29.83±2.74)	(10.63±6.76)
Extract	4.58±0.32a	5.56±0.49a	5.58±0.45b	6.38±0.29a	6.64±0.26a	5.72±0.29ac	4.80±0.48a
100 mg kg^{-1}	-	(22.13±9.71)	(27.52±8.67)	(35.51±9.66)	(48.42±15.41)	(23.16±9.58)	(25.51)
Extract	4.86±0.21a	5.98±0.16a	5.70±0.16b	5.80+0.41b	5.92±0.21b	5.52±0.15b	4.82+0.18a
200 mg kg^{-1}	-	(23.28±6.48)	(17.37±3.23)	(19.22+3.94)	(22.02±6.71)	(13.82±6.42)	(-0.75)
Extract	5.12±0.35a	5.78±0.18a	5.48±0.20b	5.32±0.08b	5.08±0.07b	4.98±0.09b	4.54±0.34a
400 mg kg^{-1}	-	(13.33±7.06)	(7.45±7.28)	(12.34)	(-0.25)	(11.07)	(11.21)
Aspir In	4.56±0.05a	7.52±0.52a	7.58±0.35ba	7.04±0.32)ab	6.52±0.16	5.88±0.12bc	4.82±0.07a
30 mg kg^{-1}	-	(64.91±11.33)	(66.26±8.17)	(54.42±7.52)	(43.00±3.69)	(28.97±3.08)	(5.72±2.29)

*mean ±S.D based on 5 observation

() figures in brackets are percentages of the increase in paw diameter. 0 h = Immediately before extract administration 24 h = 24 h after extract administration

possesses potential antinociceptive (analgesic) and anti-inflammatory activities in rats. The extract at a dose of 400 mg kg^{-1} body weight, conferred 71.3% protection on the rats. This was found to be superior to the effect of 30 mg kg^{-1} of pentazocine in the extent to which the writhings or stretching induced by acetic acid were suppressed or abolished. Acetic acid is known to trigger the production of noxious substances within the peritoneum which induces the writhing response (Bartolini *et al*., 1987). The effect of the extract against the noxious stimulus may be an indication that it depressed the production of the irritants and thereby reduction in the number of writhes in the animals. The leaves of *M. balsamina* have been shown to contain alkaloids tannins, saponins, lectins and cardiac glycosides (Akinniyi *et al*., 1986). It is possible therefore that the analgesic effects observed in this study may be attributed to the alkaloid acting alone or in combination with other constituents found in the plant extract. Alkaloid such as morphine and related compounds are known to have analgesic effects (Laurence *et al*., 1997). *Momordica balsamina* extract was also observed to significantly reduce the oedema induced by egg albumen. This is an indication of anti-inflammatory effect of the extract. The anti-inflammatory activity of the extract may be due to its contents of tannins. Tannins apart form acting as astringent are also known to inactivate enzymes (Pontrimoli and Grazi, 1969) and these may be responsible for the anti-inflammatory activity observed in this study. The anti-inflammatory activity of the extract was found to be superior to that of aspirin a standard anti-inflammatory compound that inhibits prostaglandin G/H Synthase (Laurence *et al*., 1997). This observation is an indication of the possible usefulness of the plant extract in the treatment of inflammatory conditions.

In conclusion, therefore, the results have provided evidence that the water extract of *M. balsamina* leaves posses potential analgesic and anti-inflammatory effects. Further work to isolate the active chemical principles and to elucidate the mechanism of analgesic and anti-inflammatory action of the plant extract needs to be determined.

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