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Evaluation of anti-inflammatory activity of *Aptenia cordifolia* leaves extract in wistar albino rats

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Abstract
The present study evaluated the anti-inflammatory activity of *Aptenia cordifolia* ethanolic leaves extract in wistar albino rats. The rats were divided into four groups of six animals each. Group I served as the negative control and received 10 mL/kg of distilled water orally. Group II was the positive control and received the reference drug diclofenac sodium 20mg/kg. Group III and IV received 150 mg/kg and 300mg/kg of ethanolic extracts of *A. Cordifolia* by oral route respectively. A 0.1 ml of freshly prepared egg albumin was injected into the sub plantar tissue of the right hind paw of the rats to induce inflammation. A micrometer screw gauge was used to measure the size of the rat's paw before and after administration of inflammatory agent. The ethanolic leaf extract of *A. cordifolia* showed anti-inflammatory activity against egg albumin induced oedema. *A. Cordifolia* leaf extract has ant-inflammatory properties and can therefore be used against inflammation

Keywords: *Aptenia cordifolia,* anti-inflammatory, oedema

1. Introduction
Inflammation forms a vital part of body's immune system and offers useful defense mechanisms of living tissues to injury or irritation. However, prolonged inflammations are often associated with severe lethal side effects on individual health. Over the last five decades, inflammatory diseases and associated pathophysiological conditions increased considerably due to notable rise of alterations in inflammatory responses as a result of persistent inducers [1]. Inflammation if not addressed could lead to progressive tissue damage hence threatening the life of the living organism including human beings. A number of health conditions such as rheumatoids, arthritis, periodontitis, hay fever, some types of cancers among others have been associated with chronic inflammation [2].
Currently non-steroidal anti-inflammatory drugs (NSAIDs) are the commonly used medication for inflammation and they are in most cases bought over the counter. However this drug has been found to produce adverse side effects including dermatitis, fluid retention edema as well as increasing risk for breast cancer [3]. In the right of these side effects, there is a great need for an alternative remedy for inflammation that is cost friendly and free of side effects. Over a long period time medicinal plants have been used to reduce pain and inflammation [4]. This could provide a potential source of pharmacologically active compounds that could be extracted and used as a remedy for inflammation. The present study evaluated the anti-inflammatory activity of *Aptenia cordifolia* ethanolic leaves extract in rats.
Aptenia cordifolia is an evergreen, drought-resistant and fast-growing succulent plant that belongs to the Mesembryanthemaceae family. In Rwanda like in many other countries, this plant is commonly used as a groundcover as well as an ornamental. Its propagation is by cuttings or seed.

2. Material and Method
2.1 Plant collection and extract preparation
The whole plant of *Aptenia cordifolia* was obtained from Kicukiro sector in Kicukiro district of Rwanda. The plant leaves were authenticated sliced into small pieces and extracted using 95% ethanol for two days. The extract was filtered and the filtrate allowed standing on a rotary evaporator to evaporate the ethanol. The creamy substance obtained after evaluation was collected and weighed. The percentage yield was calculated and then stored in air tight glass bottles at 4 °C for later use.

2.2 Experimental Animals
Wistar Albino rats weighing 110-220g were obtained from the department of Medical laboratory sciences in Mount Kenya University, Rwanda. Animals of both sexes were used for the study.

The animals were housed in cages under standard lab conditions (12/12 hr light and dark cycles at 25±2 °C, RH55±10%). They had free access to standard pellet diet and water *ad libitum*. The animals were acclimatized for one week prior to experiment.

2.3 Phytochemical screening
Phytochemical screening of the crude extract of the leaves of *A. cordifolia* was carried out was carried out following procedures described by [5-7].

2.4 Treatment procedure
The experimental animals were divided into four groups of six animals each. Five hours before the experiment, all the animals were fasted and denied water to ensure uniform hydration and to minimize variability in oedematous response [8]. Group I served as the negative control and received 10 mL/kg of distilled water orally. Group II was the positive control and received the reference drug diclofenac sodium 20mg/kg. Group III and IV received 150 mg/kg and 300mg/kg of ethanolic extracts of *A. Cordifolia* by oral route respectively. All the test drugs were suspended in normal saline.

2.5 Evaluation of anti-inflammatory activity of the extract
Egg albumin was used to induce inflammation in rat. A 0.1 ml of freshly prepared egg albumin 1% in normal saline was injected into the sub plantar tissue of the right hind paw of the rats. A micrometer screw gauge was used to measure the paw size of rats before and after administration of inflammatory agent following the predetermined intervals. Increase in the thickness of the right hind paws were taken as an indication of paw oedema (inflammation). Paw size was measured at 0 hour, 1 hour, 2 hour and 3 hours of egg albumin administration. The average increase in paw size of each group was determined and compared with the negative control and the positive control (standard groups).

2.6 Statistical Analysis
The experimental data collected were analyzed statistically using analysis of variance (ANOVA) followed by post hoc Tukey HSD test. Difference between the means was considered significant at P-values <0.05.

3. Results
3.1 Phytochemical screening
The phytochemical screening of the ethanolic extract of the leaves of *A. cordifolia* revealed the presence of alkaloids, flavanoids, tannins, phenols, saponins and steroids

Table 1: Results of phytochemical analyses

Phytoconstituents	Observation
Alkaloids	++
Flavanoids	+++
Tannins	++
Phenols	++
Saponins	++
Steroids	+++
Proteins	-
Coumarins	-

+++ Highly present ++ Moderately present + Lowly present - Absent

3.2 Anti-inflammatory activity
The ethanolic leaf extract of *A. cordifolia* showed anti-inflammatory activity against egg albumin induced oedema in rats. Varying dosages of the extract and diclofenac sodium (standard drug) showed significant mean differences in different time intervals compared to the control group

Table 2: Effect of *A. cordifolia* leaf extract on egg albumin induced oedema in rats (mean ± SEM) (n=6).

Treatment	Time interval in Hours			
	0 hrs	1 hour	2 hours	3 hours
Control	6.20 ± .200	6.40 ± .24	6.20 ± .20	6.00 ± .00
150 mg/kg	6.40 ± .245	5.60 ± .00	4.40 ± .24*****	4.20 ± .20*****
300 mg/kg	6.20 ± .20	4.80 ± .20*****	4.20 ± .20*****	4.00 ± .00*****
Diclofenac sodium 20 mg/kg	6.00 ± .44	4.40 ± .40*****	4.00 ± .31*****	4.00 ± .00*****

Data are expressed as mean ± S.E.M. for group of 5 animals. Asterisks indicated that the mean difference is statistically significant when compared with control. *P <0.05

4. Discussion
Inflammation is a biological response of living tissue to injury, pathogens, hypersensitivity reactions and various irritants. Inflammation also serves as a protective mechanism which results to the destruction of both the agent causing inflammation as well as the damaged tissue [9]. Inflammatory process is one of the first responses of the immune system to foreign agents including pathogens. Inflammation is triggered by chemical stimulus released by injured cells and serves to create a barrier against the spread of infection as well as enhancing recovery of damaged tissue following the clearance of pathogens [10]. The whole process of inflammation follows a well-organized cascade of fluid and cellular changes within living tissue. Chemical substances including histamine, serotonin and prostaglandin among others are the common mediators of inflammation. These mediators cause vasodilatation and increased permeability of blood vessels leading to the exudation of plasma proteins and fluids into the tissues [11].

Diclofenac exhibit anti-inflammatory activity by blocking the effect of cyclo-oxygenase (COX) enzymes that aids in the formation of prostaglandins [12]. Prostaglandins are produced at sites of injury in this case site where egg albumin was place, and cause inflammation. Inhibiting the effect of COX enzymes means fewer prostaglandins and consequently less or no inflammation.

In the present study significant inhibition of oedema was evident in all the doses after 2 and 3 hours. However, only 300mg/kg of the extract and 20mg/kg of diclofenac showed significant inhibition of oedema after one hour. The study findings show that ethanolic leaf extract of *A. cordifolia* is active against egg albumin-induced oedema. This implies that the leaf extract suppressed egg albumin induced formation of histamine, serotonin, prostaglandins and bradykinin.

5. Conclusion
It can be concluded that ethanolic extract of *A. Cordifolia* leaf has significant ant-inflammatory activity and can therefore be

used as a potential anti-inflammatory agent. A high dose such as 300mg/kg will exhibit inhibitory activity after one hour while a low dose such as 150mg/kg will show inhibitory activity after two hours of inflammation induction.

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