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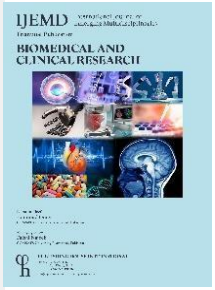

Evaluation of the Antipyretic Effects of Methanolic Leaf Extract of Chromolaena odorata in Albino Rats

Oko, J. O.[1,2]*, Akafyi, D. E.[1], Umar, M.[1], Buhari, R. D.[4], Oyelakin, O. K.[3], Ojeleye, F. S.[1], Zubair, H.[1], Yusuf, S. I.[1], Jakheng, S. P.E.[1], Albert, K. A.[1]

1.Department of Science Laboratory Technology, Nigerian Institute of Leather and Science Technology, Zaria

2.Department of Pharmaceutics and Pharmaceutical Microbiology, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria

3.Department of Leather Technology, Nigerian Institute of Leather and Science Technology, Zaria

4.Water Resources and Environmental Management, National Water Resources Institute, Mando, Kaduna State

Abstract

This study evaluates the antipyretic activity of methanolic leaf extract of *Chromolaena odorata* in albino rats. Pyrexia, commonly known as fever, is the medical term for an elevated body temperature. It occurs when the body's temperature rises above the normal range, typically over 38°C (100.4°F), as a response to infection, inflammation, or other stimuli. The experimental setup included five groups of albino rats, with two control groups receiving either normal saline (negative control) or acetaminophen (positive control), and the test groups receiving 200 mg/kg and 400 mg/kg of the leaf extract. Fever (pyrexia) was induced using 0.01 mL/kg of *Escherichia coli* suspension injected into the rats, after which varying doses of the methanolic leaf extract were administered. The results demonstrated a significant reduction in rectal temperature in the rats treated with the extract, showing a dose-dependent response. The highest antipyretic activity was observed in the group administered 400 mg/kg, where the rectal temperature decreased by 2.5°C within two hours of treatment. This effect was comparable to, and in some cases, exceeded that of acetaminophen, suggesting that the methanolic extract of *Chromolaena odorata* possesses significant antipyretic properties. The observed antipyretic effect may be attributed to the bioactive constituents of the plant, including flavonoids, terpenoids, and anthraquinones. Further research is recommended to isolate and characterize the active compounds responsible for the observed pharmacological activity.

Keywords: *Chromolaena odorata*, Antipyretic, Methanolic extract, Albino rats, *Escherichia coli*, Rectal temperature.

Email Addresses: odeyadebe@yahoo.com (Oko), dakafyippp@gmail.com (Akafyi) , mustamina19@nilest.edu.ng (Umar) , crytals52002@yahoo.co.uk (Buhari) , oyelakinopeyemik@gmail.com (Oyelakin) , sbonire@gmail.com (Ojeleye) , zubairuhalima968@gmail.com (Zubair) , ishola.sulyman@gmail.com (Yusuf) , shangs4real@gmail.com (Jakheng) , kigbualbert2@gmail.com (Albert)

INTRODUCTION

Fever, also known as pyrexia and febrile response [4], is defined as having a temperature above the normal range due to an increase in the body's temperature set-point [9],[12]. There is not a single agreed-upon upper limit for normal temperature with sources using values between 37.5 and 38.3°C (99.5 and 100.9°F) [10]. The increase in set-point triggers increased muscle contraction and cause a feeling of cold [18]. This results in greater heat production and efforts to conserve heat. When the set-point temperature returns to normal, a person feels hot, becomes flushed, and may begin to sweat [17]. Rarely a fever may trigger a febrile seizure. This is more common in young children. Fevers do not typically go higher than 41 to 42°C [8].

A fever can be caused by many medical conditions ranging from non-serious to potentially serious. This includes viral, bacterial and parasitic infections such as the common cold, urinary tract infections, meningitis, malaria and appendicitis among others [3]. Non-infectious causes include vasculitis, deep vein thrombosis, side effects of medication, and cancer among others (Rayamajhi).

Normal body temperature varies depending on many factors, including age, sex, time of day, ambient temperature, activity level, and more. A raised temperature is not always a fever, for example, the temperature of a healthy person rises when he or she exercises, but this is not considered a fever, as the set-point is normal. On the other hand, a "normal" temperature may be a fever, if it is unusually high for that person. For example, medically frail elderly people have a decreased ability to generate body heat, so a "normal" temperature of 37.5°C may represent a clinically significant fever [16].

Medicinal plants have been used for centuries as remedies for human diseases because they contain chemical components of therapeutic value. According to the World Health Organization (WHO), more than 80% of the world's population relies on traditional medicines for their primary healthcare needs [14].

Chromolaena odorata is a perennial semi wood, shrub. In traditional medicine, a decoction of leaf is used as a cough remedy and as an ingredient with lemon grass and guava leaves for the treatment of malaria. Other medicinal uses include antidiarrheal, astringent, antiplasmodic, antihypertensive, anti-inflammatory and diuretic [11]. A decoction of flowers is used as a tonic, antipyretic and heart tonic [3]. A study was done using another species of *Chromoleana* and it was found to possess anti-protozoan activity [19].

The secondary metabolites of plants like other xenobiotics are usually detoxified in the liver. The use of natural therapy for relieving pyrexia is the next target in the advancement of human medicine. This is because of less toxicity and adverse effects of plant extracts used for the treatment of various ailments [5]. Thus, the present study was undertaken to evaluate the antipyretic activity of methanolic leaf extract of C*hromolaena odorata* in albino rats.

MATERIALS AND METHODS

Sample Collection and Preparation of Extract

Fresh plant leaves of *Chromolaena odorata* were collected from Abuja and were taxonomically identified at the Herbarium section of the Biological Science Department, Ahmadu Bello University, Zaria. The leaves were thoroughly washed with running water and dried under shade for 4-6 days as described by [15]. The dried plant was crushed into powder was stored in a sealed sterile reagent bottle for further use. The plant extract was prepared by the method of [2] with minor modifications. The extraction of the leaves of *Chromolaena odorata* was done using methanol. A mass of 50 grams of

dried powder was weighed using a weighing balance (Mettle 166(R)) and was extracted by 200 mL of solvent by using a Soxhlet extractor for 72 hours at a temperature not exceeding the boiling point of the methanol until the content evaporated completely as adopted by [13]. The extract was collected and weighed in varying concentrations and kept in an air-tight container at 4°C.

Animal Selection and Ethical Approval

Adult healthy male and female albino rats weighing 60-150 grams were obtained from the Department of Pharmacology, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria. All the animals were housed in a standard animal room (cages) under standard laboratory conditions, 21-22°C, light (12 hours light/dark cycled humidity (50 $\pm$ 10%)). The animals were provided with a standard pellet diet and water. They were acclimatized (getting used to the environment) for 7 days before experiments. The experiments were performed according to the guiding principle in the use of animals in toxicology and approved by the institutional animal ethics committee, Ahmadu Bello University, Zaria.

Preparation of *Escherichia coli* Suspension

The pure and identified culture of *Escherichia coli* was obtained on McConkey agar from the microbiology laboratory, Nigerian Institute of Leather and Science Technology (NILEST) Zaria and incubated for 24 hours at 35°C. A colony of the organism was picked and washed in normal saline spread on an agar plate for re-culture (sub-culture) and incubated for 24 hours. Several washing and sub-culturing of the organism reduces its virulence. The final inoculum was maintained as pure culture in nutrient broth and adjusted to the 0.5 McFarland scale from which a tenfold dilution of the suspended broth culture was prepared with normal saline and a total number of cells in the dilution was determined.

Experimental Design

The antipyretic activity of the methanolic leaf extract of *Chromolaena odorata* was screened using *Escherichia coli*-induced pyrexia method. Albino rats of both sexes weighing 60-150 grams were selected and divided into five (5) groups having 5 animals each. They were maintained at a constant body temperature of 24-25°C for 24 hours. Pyrexia was produced in albino rats by injecting *Escherichia coli* suspension in the marginal ear vein of the albino rats at a concentration of 0.01 mL/kg body weight [6]. Rectal temperature was recorded before and after injection of the inducing agent and at regular intervals during the period of the experiment. Pyrexia was examined 2 hours after injection of *Escherichia coli* suspension before treatment. Groups I and IV were not induced with the *Escherichia coli* and not treated with the extract but group I was treated with normal saline.

Treatment of Animal with Plant Extract

The extract of *Chromolaena odorata* was suspended in normal saline and administered orally. Group I received 2 mL/kg of normal saline. Group II received 150 mg/kg of paracetamol. This served as a positive control. Group III and IV received 200 mg/kg and 400 mg/kg respectively of methanolic extract of *Chromolaena odorata* and group V animals were not induced and therefore were not treated. Rectal temperature was noted at 30-minute intervals up to 180 minutes.

RESULTS AND DISCUSSIONS

The results of the Escherichia *coli*-induced pyrexia in rats is presented in Table 1. The injection of *Escherichia coli* suspension elevated the rectal temperature after 2 hours of administration. Treatment

with paracetamol at a dose of 150 mg/kg and extract of *Chromolaena odorata* at a dose of 200 and 400 mg/kg decreased the rectal temperature of the rats in a dose-dependent manner (Table 2). It was found that the extract at a dose of 200 and 400 mg/kg caused a significant lowering of rectal temperature at 3 hours following its administration. It was revealed that the extract showed dose-dependent antipyretic activity. There was a significant difference ($p < 0.05$) in the reduction of rectal temperature between the doses of extract and the positive control, paracetamol.

The antipyretic effect of methanolic leaf extracts was dose-dependent being that the reduction at the higher dose level was visible than at the lower dose level. The reduction in *Escherichia coli*-induced pyrexia was also found to be increasingly progressive with time (Fig. 1). The antipyretic effect of the extracts agreed with the report of [7] in which the extracts could be acting centrally on the temperature regulation centre in the brain or peripherally through inhibiting the synthesis of prostaglandin. The effects produced by the extracts at the doses tested showed a higher antipyretic effect than the positive control. This is in disagreement with the findings of [7] where the standard showed superiority in reducing *Escherichia coli*-induced pyrexia in laboratory animals. The result of this current study differs from that of [1] who recorded no significant antipyretic effect with the plant studied. The differences in the activity of the extracts compared to paracetamol may be due to the high quantities of bioactive constituents like flavonoids, anthraquinones and terpenoids in the methanol extract as earlier reported by [20].

Table 1: Induction of pyrexia in albino rats

Animals' groups	**RTo(°C)**	**RT_2(°C)**
Group I	37.7	-
Group II	37.6	39.8
Group III	37.7	39.2
Group IV	37.8	39.3
Group V	-	-

RT_o = Initial Rectal Temperature.
RT_2 = Rectal Temperature after 2 H of inducti

Table 2: Rate Activity of Antipyretic Effect of *Chromolaena odorata* of Methanolic Leaf Extract

						Rectal temperature (°C) after treatment with extract					
Animal group	Test items	Dose (mg/kg)	Body weight (g)	RT_o(°C)	RT_2(°C)	30 minutes	60 minutes	90 minutes	120 minutes	150 minutes	180 minutes
Group I	Normal saline	2 ml	90.0	37.7	-	37.8	38.5	37.6	36.8	37.8	37.9
Group II	Paracetamol	150	107.2	37.58	39.76	37.24	37.92	37.32	37.02	37.22	37.22
Group III	*Chromolaena odorata*	200	85	37.72	39.2	38.26	38.24	38.0	37.24	37.1	38.26
Group IV	*Chromolaena odorata*	400	121.8	37.78	39.26	38.78	38.62	37.86	37.76	37.94	37.7
Group V	-	-	119.6	-	-	37.82	39.38	38.68	37.64	37.84	38.84

RT_o = Initial Rectal Temperature. RT_2 = Rectal Temperature after 2 H of induction

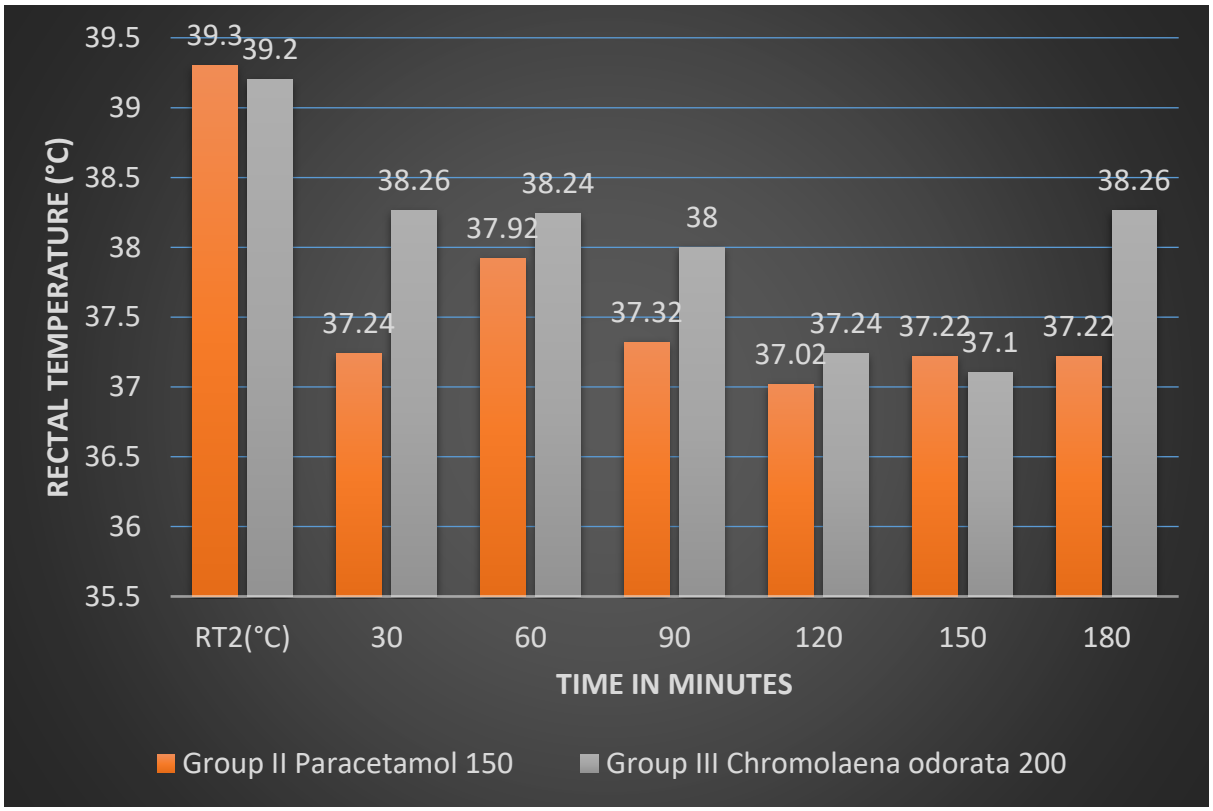

Fig. 1: Antipyretic Effect of *Chromolaena odorata* of Methanolic Leaf Extract

CONCLUSION

The results of this study showed that the methanolic extract of *Chromolaena odorata* exhibited antipyretic activity. The presence of some bioactive phytochemical constituents in the leaves may be responsible for the observed effect. However, further studies are necessary to isolate and characterize the active principles of *Chromolaena odorata* leaf responsible for the antipyretic properties.

Conflict of interest

The authors declared that no conflict of interest exists.

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