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Phytochemical Screening and Antipyretic Effect of *Curcuma zedoaria* Rosc. (Zingiberaceae) Rhizome

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Authors' contributions

Author MGA designed the study, wrote the protocol. Author MSN wrote the first draft of the manuscript. Authors MGA and MSN performed the statistical analysis and managed the literature searches. Author MMAA finalized the manuscript. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: To investigate the antipyretic effect of ethanol extract of *Curcuma zedoaria* Rosc. (Zingiberaceae) rhizome in animal model.
Study Design: Extraction of plant constituents and evaluation of elevated body temperature lowering activity.
Place and Duration of Study: Department of Pharmacy, North South University, Dhaka between October 2012 and August 2013.
Methodology: We have performed phytochemical screening and evaluated antipyretic activity of ethanol extract of the rhizome of *Curcuma zedoaria* by yeast-induced pyresis method. Ethanol extract of *Curcuma zedoaria* rhizome was administered to healthy rats.
Results: The results showed that the ethanol extract of *Curcuma zedoaria* significantly reduced yeast-induced elevated body temperature in rats in a dose dependent manner and the antipyretic effect at a dose of 750 mg/kg was comparable to that of the standard antipyretic drug paracetamol (10 mg/kg). Phytochemical screening of ethanol extract showed presence of tannins, flavonoids, saponins, alkaloids, terpinoids, carbohydrates and steroids as main constituents in *Curcuma zedoaria* extract some of which may possess antipyretic activity.
Conclusion: The results justify the traditional use of the ethanol extract of *Curcuma zedoaria* in the treatment of fever.

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Keywords: Curcuma zedoaria; phytochemical screening; antipyretic.

1. INTRODUCTION

Fever or pyrexia is caused as a secondary impact of infection, tissue damage, inflammation, graft rejection, malignancy or other diseased states [1]. It is the body's natural defense to create an environment where infectious agent or damaged tissue cannot survive. Normally the infected or damaged tissue initiates the enhanced formation of pro-inflammatory mediator's (cytokines like interleukin 1β, α, β and tumor necrosis factor-α), which increase the synthesis of prostaglandin E2 (PGE2) near preoptic hypothalamus area. Therefore they trigger the hypothalamus to elevate the body temperature [2]. Most of the antipyretic drugs inhibit cyclooxygenase-2 (COX-2) expression to reduce the elevated body temperature by inhibiting PGE2 biosynthesis. Moreover, these synthetic agents irreversibly inhibit COX-2 with high selectivity but are toxic to the hepatic cells, glomeruli, cortex of brain and heart muscles, whereas natural COX-2 inhibitors have lower selectivity with fewer side effect. To combat the pro-inflammatory mediators a number of plant extracts have been investigated to modulate cyclooxygenase pathway that inhibit leukotriene and prostaglandins synthesis by inhibiting COX-1 and COX-2 pathways [3,4].

Curcuma zedoaria Rosc.(family Zingiberaceae), known as zedoaria or white turmeric is a herbaceous and rhizomatous perennial plant. Some other common names are kachur (Hindi), karchur (Sanskrit), shatkachuro (Gujarati), Meitei Yaingang (Manipuri) and shoti (Bangla) [5]. The plant is native to Bangladesh, Sri Lanka, India and Indonesia and widely cultivated in China, Japan, Brazil, Nepal and Thailand and also cultivated in China, Japan, Brazil, Nepal, Malaysia and Thailand [6]. The perennial herb has a warm-spicy, woody and camphoraceous cineolic odor and bears yellow shiny flowers, with red and green bracts. The ovate leaves possess purple-colored spots and are 1 to 2 feet long, narrowing at the base. The fruits are triangular and ovate in shape while the seeds are oval or spear shaped.

The rhizome of *C. zedoaria* has been reported to have antimicrobial [7], hepatoprotective [8], anti-inflammatory [9,10], analgesic [11], antioxidant [10,12] and cytotoxic [13] activities. The main active principles of the plant are terpenoids, specially sesquiterpenoids like furanodiene and furanodienone [11], curcumenone, curcumanolide A, curcumanolide B [14], curcumenol [15], isocurcumenol, zederone, curzerenone, curzeone, germacrone, 13-hydroxygermacrone, dehydrocurdione, zedoaronediol, ar-turmerone and beta-turmerone [16]. The rhizome is used traditionally for the treatment of menstrual disorders, dyspepsia, vomiting [17], hepatitis, inflammations [18], diarrhoea [19] and fever [20].

However, to the best of our knowledge there is no scientific report available in support of the antipyretic activity of *C. Zedoaria* rhizome. So the present study was undertaken to find out the antipyretic activity of ethanolic extract of the plant rhizome and to screen main classes of constituents.

2. MATERIALS AND METHODS

2.1 Plant Material

The plant *Carcuma zedoaria* was collected from Savar, Bangladesh during the month of January 2013 and identified by the experts of Bangladesh National Herbarium (BNH), Mirpur, Dhaka (accession number 36098). The specimen was preserved in BNH.

2.2 Preparation of Plant Extract

The rhizomes of collected plant were separated from undesirable materials. They were aerated by fan aeration to be partially dried. Then they were heated through oven to be fully dried at below 40ºC for two days. The dried rhizomes were then grinded to make them powder with the help of a suitable grinder. The powder was stored within zipper bag in refrigerator at +4ºC. About 500 g of powered material was taken in a clean, flat-bottomed glass container and soaked in 1500 mL of 80% Ethanol. The container with its contents was sealed and kept for a period of 7 days accompanying occasional shaking and stirring. The whole mixture then underwent a coarse filtration by a piece of clean cotton material. Then it was filtered through Whatman filter paper.

2.3 Phytochemical Screening

10% (w/v) solution of ethanolic extract of Carcuma zedoaria was subjected to preliminary phytochemical screening to detect the presence of various classes of constituents using the following reagents and chemicals: tannins with ferric chloride, flavonoids and terpinoids with concentrated HCl, saponins with ability to produce stable foam, alkaloids with Wagner's reagent, gums with Molisch reagent and sulphuric acid, reducing sugar by ring test and steroids by acetic anhydride and sulphuric acid. Standard procedures were followed to identify the constituents by characteristic color changes [21].

2.4 Test Animals

Young Long-Evan rats (weight: 178-210 g) were used in the study. The animals were bred and grown in animal house of Department of Pharmacy of North South University, Dhaka, Bangladesh. They were individually housed in polypropylene cages in well-ventilated rooms, under hygienic conditions.

2.5 Antipyretic Test

The antipyretic test was performed by the method developed by Chattopadhyay et al. [1]. The rats were kept at natural day night (12 hour light/12 hour dark) cycle in an air-conditioned (25±2ºC) lab of the Department of Pharmacy, North South University for 7 days and the animals with approximately constant rectal temperature were selected for the study. The animals divided in five groups of five animals each and were fasted 18 h prior to commencement of experiment but water was provided ad libitum. Fever was induced by subcutaneous injection of 20 mL/kg of 20% aqueous suspension of Brewer‟s yeast below the nape of the neck of the animals. Rectal temperature was measured using digital thermometer immediately before (-18 h) and 18 h after (0 h) Brewer's yeast injection. The control group was provided with distilled water (10 mL/kg, p.o.), positive control group was fed with standard Paracetamol suspension (10 mg/kg, p.o.) and the test groups were fed with aqueous suspension of the ethanol extract (250, 500 and 750 mg per kg of body weight, p.o.). The rectal temperature was measured at 1, 2 and 3 h after drug administration.

2.6 Statistical Analysis

The data of stool weight was expressed as mean±standard error of mean (SEM) of n=5 animals per group. Statistical analysis was carried out using one-way ANOVA followed by

Dunnet's multiple comparisons. The results obtained were compared with the control group. P values<0.05 were considered to be statistically significant.

3. RESULTS

3.1 Phytochemical Screening

Phytochemical studies showed that tannins, flavonoids, saponins, alkaloids, terpinoids, carbohydrates and steroids are present in the ethanolic extract of *Curcuma zedoaria* rhizomes (Table 1).

Table 1. Phytochemical constituents of *Curcuma zedoaria* rhizomes

Plant Extract	Tannins	Flavonoids	Saponins	Alkaloids	Terpiniods	Gums carbohydrates	Reducing sugars	Steroids
Ethanol	+++	++	+++	+++	+++	+++	+++	+++

Symbol (+++) indicates presence in high concentration, symbol (++) indicates presence in moderate concentration and symbol (+) indicates presence in trace concentration of the respective phytochemicals.

3.2 Antipyretic Activity

The ethanol extract of *Curcuma zedoaria* decreased yeast-elevated body temperature in a short span of time, when compared with control group (Table 2). The plant extract at a dose of 500 mg/kg showed significant result ($p<0.05$) at two hours and moderately significant result ($p<0.01$) at three hours of study. Higher dose of 750 mg/kg showed moderately significant ($p<0.01$) and highly significant ($p<0.001$) results at two and three hours, respectively which were comparable to the analgesic effect obtained in standard paracetamol (10 mg/kg)-treated animals.

Table 2. Antipyretic activity of ethanol extracts of *Curcuma zedoaria* rhizomes

Treatment	Dose	Temperature (ºF) at			
		0 h	1 h	2 h	3 h
Control (water)	10 mL/kg	92.00±0.44	96.18±0.44	96.38±0.56	95.70±0.66
Paracetamol	10 mg/kg	91.90±0.42	94.64±0.68	93.56±0.63**	91.98±0.67***
C zedoaria	250 mg/kg	92.00±0.44	96.94±0.41	95.14±0.42	93.26±0.43
	500 mg/kg	93.58±0.69	96.04±0.68	94.44±0.46*	92.32±0.61**
	750 mg/kg	91.80±0.55	96.00±0.38	94.24±0.44**	92.50±0.39***

*All values are expressed as mean±SEM (Standard Error of Mean), n=5. *p<0.05, **p<0.01, ***p<0.001 as compared with control group*

4. DISCUSSION

The current study investigates the antipyretic effect of ethanol extracts of *C. zedoaria* rhizomes. The most commonly used animal model is Brewer‟s yeast administered fever-inducing method. In the present study, the ethanol extracts of *C. zedoaria* rhizomes shows significant reduction of body temperature elevated by administration of Brewer`s yeast. Our preliminary results of phytochemical screening showed the presence of high concentration of terpenoids in ethanol extract. It is suggested that *C. zedoaria* exerts antipyretic effect similar to paracetamol. Paracetamol usually produce antipyretic effect through the inhibition of prostaglandin. Present study was not specifically designed to explore specific pathway involved in antipyretic activity. However, previous studies reported terpenoids` role as anti-inflammatory agents that reduce prostaglandin E2 (PGE2) and also suppress the NF-kB and iNOS [10,13-15,22]. Therefore, our results are consistent with the previous findings and suggest the effect of *C. zedoaria* in reducing prostaglandin through the inhibition of cyclooxygenase. The lowering of body temperature was predominately observed at 2 hour after administration of the extract (≥500 mg/kg). This result indicates that the extract of *C. zedoaria* was able to reduce body temperature in fever.

5. CONCLUSION

In the present study we can conclude that the ethanol extracts of *Curcuma zedoaria* have significant anti-pyretic effect, which support the traditional use of this plant. Further studies will be conducted to identify the main components of the plant responsible for the antipyretic effect.

CONSENT

Not applicable.

ETHICAL APPROVAL

Experimental protocol was approved by Institutional Ethics Committee of the Department of Pharmacy, North South University. Animals were handled in accordance with international principles guiding the use and handling of experimental animals [23].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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