

Anti-pyretic Potential of Dichloromethanolic Root Extract of *Clutia abyssinica* in Wistar Albino Rats

Koech SC*, Sindani AV, Maoga JB, Ouko RO, Njagi NM and Ngugi MP

Department of Biochemistry and Biotechnology, School of Pure and Applied Sciences, Kenyatta University, Nairobi, Kenya

Abstract

Fever is a symptom that is associated with pathological processes in animal body. It is mostly presented in a number of infections and diseases. Although, fever is utilized by the immune system as a means of defense against infections and diseases, it lowers the quality of life. Since fever brings discomfort to the victims it requires medication. Synthetic drugs that are used to manage fever are inaccessible and are associated with adverse effects. Herbal medicines are deemed to be safe, have good efficacy and are assumed to have fewer side effects. *C. abyssinica* has been used traditionally by Kallenjin community to manage fever among other ailments. However, ethnomedicinal use of the *C. abyssinica* lacks scientific validation. The study was designed to determine the antipyretic potential of dichloromethane root extracts of *C. abyssinica* on turpentine-induced pyrexia in Wistar albino rat. Thirty Wistar albino rats aged 8-9 weeks and weighing 120-140 g were grouped into normal group, positive control, negative control and three experimental groups. The laboratory animals were administered with the dichloromethane root extract at 50, 100 and 150 mg/kg body weight. The dichloromethane root extract reduced the elevated rectal temperature between 0.68 and 3.34%, while the reference drug reduced between 3.32 and 4.96%. Qualitative phytochemical screening of the root extract showed the presences of various phytochemicals compounds associated with antipyretic activities. The present study demonstrated antipyretic potential of *C. abyssinica* in Wistar albino rats and thus the traditional use of the *C. abyssinica* was scientifically confirmed.

Keywords: *C. abyssinica*; Fever; Antipyretic; OVLT; Albino rats

Introduction

Fever means the body temperature is above normal and fever is a symptom, not a disease. It is a mechanism used by immune system to fight or defend against infections. Fever turns on the body's immune system and helps fight infections [1]. Fever or pyrexia [2] is a common clinical sign that is characterized by raise in body temperature beyond the normal range of (36.5°C -37.5°C) brought about by raise in the body temperature regulatory set point [3]. Regulation of temperature is in the hypothalamus. Fever is triggered by substances called 'pyrogen' and usually induces the synthesis of prostaglandin E₂ (PGE₂) [4] which are major mediators of fever. Febrile response or fever involves innate immune system activation via Toll-like receptor 4 (TLR-4) leading to production of pyrogenic cytokines such as; (IL)-1 β , IL-6, and tumor necrosis factor (TNF- α). These pyrogenic cytokines act on an area of the brain known as the Organum vasculum of the laminae terminalis (OVLT) and eventually leading to the release of PGE₂ via activation of cyclo-oxygenase 2 enzyme (COX-2) [5]. Prostaglandin E₂ acts on the hypothalamus to generate systemic response to the rest of the body, causing heat- creating effects to match the new temperature. The hypothalamus works like a thermostat in many situations [4]. Fever is associated with sickness behavior, such as depression, anorexia, sleepiness, lethargy, inability to concentrate and hyperalgesia [6].

A number of different microorganisms and other substances can cause fever and are collectively termed as pyrogens. Pyrogens are classified into either exogenous or endogenous pyrogens [7]. Products released by bacterial cell membranes such as lipopolysaccharide, toxins and breakdown of protein products in an organism body can cause the set point of the hypothalamic thermostat to increase [8]. In essence, endogenous pyrogens are cytokines, molecules associated with innate immune system. Phagocytic cells produce this molecules that causes increase in thermoregulatory set-point and this includes; interleukin 1 α and interleukin 1 β [9].

To manage fever, nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin are prescribed [10]. Antipyretic drugs such as aspirin, exhibit their antipyretic activity by inhibiting cyclo-oxygenase enzyme (COX). Inhibition of cyclooxygenase enzyme results in blockage of synthesis of prostaglandins consequently the levels of PGE₂ in the hypothalamic region is also reduced [11]. NSAIDs also act by suppressing the production of pyrogenic cytokines such as TNF- α and IL- β [12]. However, this synthetic drugs manifest a lot of side effects after long term use for example gastric irritation, ulceration, prolonged bleeding, renal failure, interstitial corrosion, and pruritis [13].

Though medicinal plants from immemorial time have been used as a source of antipyretic agent to manage fever, emergence of synthetic drugs resulted in neglect of their use. However, due to its availability, low cost and fewer side effects herbal medicine is gaining its position [14]. Herbal medicines from medicinal plants have been utilized by societies as the principal source of curing a number of diseases [15]. Therefore, medicinal plants are assuming important role in their wellbeing [16]. *C. abyssinica* has been used traditionally by the Kallenjin community to treat several ailments such as; malaria, colds, fever, skin diseases, chest problems, cancer and infertility in humans [17].

***Corresponding author:** Koech Samson Cheruiyot, Department of Biochemistry and Biotechnology, Kenyatta University, PO Box 43844-00100, Nairobi, Kenya, Tel: +254728002111; E-mail: koechsam22@gmail.com

Received December 27, 2016; **Accepted** December 30, 2016; **Published** January 06, 2017

Citation: Koech SC, Sindani AV, Maoga JB, Ouko RO, Njagi NM, et al. (2017) Anti-pyretic Potential of Dichloromethanolic Root Extract of *Clutia abyssinica* in Wistar Albino Rats. Med Aromat Plants (Los Angel) 6: 281. doi: [10.4172/2167-0412.1000281](https://doi.org/10.4172/2167-0412.1000281)

Copyright: © 2017 Koech SC, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Though there are some ethnobotanical studies that have been conducted on *C. abyssinica*, no study has been carried out on its antipyretic potential. Therefore, this study aimed at providing information on antipyretic activity of *C. Abyssinica* as a potential candidate in development of antipyretic drug from plant based origin.

Materials and Methods

Collection and preparation of plant materials

Fresh roots of *C. abyssinica* were collected from Kaptebee village, Turbo sub-county in Uasin Gishu county Kenya with the help of local herbalist under accepted bio-conservation methods from its natural habitat. This process was conducted during the months of January-March, a season in which the local herbalist believed that the medicinal plant had its maximum medicinal activity. A sample of fresh twigs with leaves was presented to a taxonomist for botanical authentication and a sample voucher was deposited at the National Museum of Kenya herbarium with the voucher number (NMK/BOT/CTX/1/2). Sample roots were then cleaned with tap water to remove any dirt and chopped into smaller pieces. The root samples of *C. abyssinica* were completely air dried under shade for two weeks. The samples were then packed into burlap sacks and transported to Kenyatta University Biochemistry laboratory. The samples were then pulverized into fine powder using laboratory electrical mill.

Extraction

A 400 g weight of powdered root sample was soaked in 1.3 litres of DCM with regular agitation at an interval of 1 hour to uniformly mix the sample within the first 10 hours and left to stand for 48 hours. Filtration was performed using Whatman's filter paper No. 1. Concentration of the filtrate was performed using rotary evaporator at a temperature of 41°C under reduced pressure.

Experimental Design

Laboratory animals

Only male Wistar albino rats aged between 8-9 weeks, weighing between 120-140 g were utilized for screening antipyretic activity of the plant extract because there are not affected by hormonal fluctuations during experiment as compared to female sex which are believed to be affected hormonal fluctuations and therefore may have an effect on the results. All the experimental animals were housed in animal house at Kenyatta University in standard laboratory cages. The experimental animals were kept at room temperature for 12 hours darkness followed by 12 hours light cycles throughout the entire experimental period. The animals were fed on rodent pellet diet and water *ad libitum*. In this study ethical guidelines and procedures were followed while handling the laboratory animals [18].

Evaluation of antipyretic effect

Male Wistar albino rats were grouped into 6 groups of five

rats each. Prior to fever induction, rectal temperature of all the experimental animals were measured using digital thermometer and recorded. All the experimental animals were fasted for 12 hours during the entire experimental period, but were allowed access to water *ad libitum*. Steam distilled turpentine solution was used to induce fever and it was injected intraperitoneally at a dose of 20 ml/kg according to body weight and the animal left for one hour [19]. A raise in rectal temperature of Wistar albino rats by 0.8°C after one hour was termed pyretic and proceeded to be used in the assay.

One hour after fever induction, pyretic animals in groups IV-VI were administered intraperitoneally with the three experimental doses of 50, 100 and 150 mg/kg body weight respectively. Pyretic animals in group III (Positive control) were administered with aspirin (100 mg/kg body weight). Pyretic animals in group II (negative control) were administered with 10% DMSO only. Experimental animals in group I (normal control) were not induced with fever but administered 10% DMSO only [20]. This design is summarized in Table 1.

Plant extract doses were prepared on the same day of experiment. All the treatments were administered intraperitoneally. The rectal temperatures of rats were measured by inserting a well lubricated digital thermometer about 3 cm into the anus of the rats. The mean body temperature of Wistar albino rats was recorded at 20 minutes intervals over the 1 hour before turpentine injection and was recorded as the baseline/initial temperature. Rectal temperature was measured and recorded at an interval of one hour continuously for four hours after treatments. Percentage inhibition anal temperature was calculated by formula described by Ref. [20].

$$\% \text{Rectal temperature inhibition} = \frac{B - C_n}{B} \times 100$$

Where, B: Rectal temperature at 1 hour after turpentine injection; C_n : Rectal temperature after dose administration.

Qualitative phytochemical screening

The DCM root extract of *C. abyssinica* was subjected to qualitative phytochemical screening to determine the presence/absence of different active secondary metabolites constituents following the methodology described by Ref. [21]. The phytochemicals tested included flavonoids, phenolics, saponins, alkaloids, cardiac glycosides, steroids and terpenoids.

Data management and statistical analysis

Raw data on anal temperature was measured and tabulated on a broad sheet using Microsoft excel program. Data on rectal temperature was then exported to statistical software (Minitab version 17.0) for analysis. Data was subjected to descriptive statistics and results were expressed as Mean \pm Standard Error of the Mean (SEM). Results among the groups was analysed for statistical significance using one way ANOVA followed Tukey's post hoc test for pairwise comparison

Group	Treatment
I (Normal control)	DMSO (10%)
II (Negative control)	Turpentine (20%)
III (Positive control)	Turpentine (20%)+Aspirin (100 mg/kg bw)
IV (Experimental group A)	Turpentine (20%)+ <i>C. abyssinica</i> (50 mg/kg bw)
V (Experimental group B)	Turpentine (20%)+ <i>C. abyssinica</i> (100 mg/kg bw)
VI (Experimental group C)	Turpentine (20%)+ <i>C. abyssinica</i> (150 mg/kg bw)

Table 1: Treatment protocol for antipyretic activity of DCM root extract of *C. abyssinica* in wistar albino rats.

DMSO=10%

and separation of means. Results were presented in tables and graphs. A value of $P \leq 0.05$ was considered significant.

Results

Antipyretic activity of DCM root extract of *C. Abyssinica*

The DCM root extract of *C. abyssinica* showed antipyretic effects against turpentine-Induced pyrexia in rats, which was indicated by reduction in rectal temperature (Table 2; Figure 1). In the first hour after treatment with the experimental doses, all the three doses (50, 100 and 150 mg/kg body weight), lowered the elevated anal temperature by 0.81%, 0.68% and 1.14% respectively (Table 2; Figure 1). On the other hand, aspirin lowered the anal temperature significantly by 3.32%, indicating a stronger antipyretic activity than the all the three experimental doses ($P < 0.05$; Table 2; Figure 1). However, the antipyretic effects of all the three doses of the DCM root extract of *C. abyssinica* were not significantly different ($P > 0.05$; Table 2).

In the 2nd hour, experimental animals administered with DCM root extract of *C. abyssinica* at 50, 100 and 150 mg/kg body weight, reduced the anal temperature by 2.54%, 1.84% and 2.48% respectively. The reference drug, at this hour, reduced rectal temperature by 3.53% (Table 2; Figure 1). At this hour, a dose of 50 mg/kg body weight demonstrated the highest fever reducing activity. Even though the three experimental doses of *C. abyssinica* and the reference drug reduced the rectal temperature at different percentages, their antipyretic effects were not significantly different ($P > 0.05$; Table 2; Figure 1).

In the third hour, the DCM root extract of *C. abyssinica*, at the three doses exhibited antipyretic effects by reducing the elevated anal temperature by 2.38%, 2.88% and 3.34% respectively in a dose dependent manner. Reference drug (aspirin) reduced elevated rectal temperature by 4.56% (Table 2; Figure 1). The antipyretic effects of 150 mg/kg body weight and 100 mg/kg body weight were comparable to the reference drug (aspirin) ($P > 0.5$; Table 2).

At the end of four hours of the test period, the DCM root extract of *C. abyssinica* at all three dose levels, reduced the rectal temperature by

2.44%, 2.88% and 3.21% respectively in a dose dependent manner. The reference drug reduced rectal temperature by 4.96% (Table 2; Figure 1). Administration of extract to the experimental groups at all the three dose levels (50, 100 and 150 mg/kg body weight), exhibited strong antipyretic activity but showed no significant difference ($P > 0.5$; Table 2; Figure 1). The antipyretic effects of 100 mg/kg body weight and 150 mg/kg body weight were comparable to the reference drug (aspirin) ($P > 0.5$; Table 2; Figure 1).

Qualitative phytochemical screening

The DCM root extract of *C. abyssinica* upon phytochemicals test revealed the presence of the following compounds; terpenoids, alkaloids, flavonoids, steroids, cardiac glycosides and saponins. This phytochemical compounds have been associated with antipyretic activities (Table 3).

Discussion

The study was designed to evaluate the antipyretic activity of DCM root extract on turpentine-Induced pyrexia in male Wistar albino rats. Fever can be induced in laboratory animals using several agents collectively termed as pyrogens such as lipopolysaccharides (LPS), E-coli, amphetamines, sulphur, brewer's yeast and turpentine. These agents are considered exogenous pyrogens [16,22]. Turpentine is a clear flammable liquid with pungent odour and bitter taste, refined from resin pine. It is a mixture of organic compounds especially terpenes. Subcutaneous administration of turpentine is a well established model for sterile inflammation. Turpentine causes tissue damage and induces acute phase response as well as fever [23]. According to Soszynski [24] rats respond with acute fever to intramuscular injection of turpentine reaching its peak value in 9th hour and 11th hour. Turpentine injection into experimental animals induces a persistently high fever pattern (Kuochung et al.). According to Ref. [25] turpentine causes local inflammation and robust fever when administered into laboratory animals.

The DCM root extract of *C. abyssinica*, in this study demonstrated

Group	Treatment	% change in anal temperature in (°C) after dose administration				
		0 hr	1 hr	2 hr	3 hr	4 hr
Normal Control	10% DMSO	100.00 ± 0.00	99.79 ± 0.16 ^{bc}	99.79 ± 0.16 ^{bc}	99.94 ± 0.12 ^c	99.95 ± 0.31 ^c
		(0.00)	(0.21)	(0.21)	(0.06)	(0.05)
Negative Control	Turpentine	100.00 ± 0.00	101.08 ± 0.51 ^c	101.39 ± 0.5 ^c	100.82 ± 0.2 ^c	100.61 ± 0.4 ^c
		(0.00)	(-1.08)	(-1.39)	(-0.82)	(-0.61)
Positive Control	Turpentine+Aspirin (100 mg/kg bw)	100.00 ± 0.00	96.68 ± 0.19 ^a	96.47 ± 0.12 ^a	95.44 ± 0.29 ^a	95.04 ± 0.23 ^a
		(0.00)	(3.32)	(3.53)	(4.56)	(4.96)
Experimental group A	Turpentine+C. <i>abyssinica</i> (50 mg/kg bw)	100.00 ± 0.00	99.19 ± 0.56 ^b	97.46 ± 0.48 ^a	97.62 ± 0.53 ^b	97.56 ± 0.46 ^b
		(0.00)	(0.81)	(2.54)	(2.38)	(2.44)
Experimental group B	Turpentine+C. <i>abyssinica</i> (100 mg/kg bw)	100.00 ± 0.00	99.32 ± 0.54 ^b	98.17 ± 0.68 ^{ab}	97.12 ± 0.80 ^{ab}	97.12 ± 0.79 ^{ab}
		(0.00)	(0.68)	(1.83)	(2.88)	(2.88)
Experimental group C	Turpentine+C. <i>abyssinica</i> (150 mg/kg bw)	100.00 ± 0.00	98.86 ± 0.16 ^b	97.52 ± 0.34 ^a	96.64 ± 0.33 ^{ab}	96.79 ± 0.45 ^{ab}
		(0.00)	(1.14)	(2.48)	(3.34)	(3.21)

Table 2: Antipyretic activities of DCM root extracts of *C. abyssinica* on Turpentine-Induced pyrexia in Wistar albino rats.

Values are expressed as Mean ± SEM for five animals per group. Values with the same superscript letter are not significant different (one way ANOVA followed by Tukey's test) ($p > 0.05$). Percentage reduction in rectal temperature is within parenthesis.

antipyretic activities against turpentine-induced pyrexia in Wistar albino rats (Table 2; Figure 1). Findings from this study were relatable to other earlier research studies on evaluation of antipyretic effects of herbal extracts of herbal plants using animal models. Similar study carried out by Ref [26] showed that the methanolic stem extracts of *Harrisonia abyssinica* and *Ladolphia buchananii* staph possess antipyretic activities against turpentine-induced pyrexia in Wistar albino rats. Likewise, a study carried out by Ref [27] on antipyretic properties methanolic leaf extracts of *Kigelia africana* (Lam) and *Acacia hockii* de wild showed significant antipyretic activities in Wistar albino rats.

To relieve fever nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin are prescribed [28]. Antipyretic drugs such as aspirin, exhibit their antipyretic activity by inhibiting cyclooxygenase enzyme (COX). Inhibition of cyclooxygenase enzyme results in blockage of synthesis of prostaglandins consequently the levels of PGE₂ in the hypothalamic region is also reduced [11]. The extract lowered elevated temperature by inhibiting cyclooxygenase enzyme, a key enzyme necessary for synthesis of prostaglandins, thereby reducing fever. Moreover, the extract may have reduced the concentration of PGE₂ in the hypothalamus through its action on cyclooxygenase enzyme or by enhancing of body's own antipyretic substances like vasopressin, IL 10 and arginine [28]. However, other mechanism for blocking fever cannot be ignored.

The dose range of (50, 100 and 150 mg/kg body weight) applied in bioscreening of antipyretic activities of DCM root extract in the study were comparable to dose ranges used by Ref. [29] while evaluating the antipyretic, anti-inflammatory and analgesic activity of methanolic leaf extract of *Acacia hydasypica* (R) parker in laboratory animals. Similarly, Ref. [30] used these doses while evaluating antipyretic activity of methanolic leaf extract of *Kigelia africana* (lam) benth and stem bark extract of *Acacia hockii* de wild in animal models.

The DCM root extract of *C. abyssinica*, lowered the elevated rectal temperature more in the fourth hour than (in the third hour, the second and the first hour) (Table 2; Figure 1). This might be attributed to the fact that most of the bioactive compounds may have not been completely absorbed across the peritoneum cavity while in the third and fourth hours most of the bioactive compounds may have been absorbed across the peritoneum cavity thereby causing higher antipyretic activities. Lower percentage inhibition in first and the second hours could also be attributed to the fact that the drug needed time to be biotransformed into an antipyretic agent. Another factor is that at certain dose ranges, the active antipyretic phytochemicals compounds in the extract were not sufficient enough to lower the rectal temperature. However, the plant extract at 50 mg/kg body weight lowered the rectal temperature in the second hour, then reducing antipyretic activity in the third and fourth hours respectively (Table 2; Figure 1). This scenario could be ascribed to the fact that most of the bioactive compounds might have been quickly metabolized and excreted because of the small concentrations of phytochemicals compounds in the extract.

In the fourth and the third hours, the DCM root extract of *C. abyssinica*, showed a dose dependent response in reducing the elevated rectal temperature in turpentine-induced pyrexia in Wistar albino rats (Table 2; Figure 1). The dose dependent response observed in this study are in agreement with studies by Ref [31], who observed a similar trend while examining antipyretic activities of methanolic bark extract of *T.*

Phytochemicals	DCM root extract of <i>C. abyssinica</i>
Alkaloids	+
Flavonoids	+
Steroids	+
Saponins	+
Cardiac glycosides	+
Phenolics	-
Terpenoids	+

Table 3: Phytochemical composition of DCM root extract of *C. abyssinica*. Present phytochemicals denoted by (+), absent phytochemicals denoted by (-)

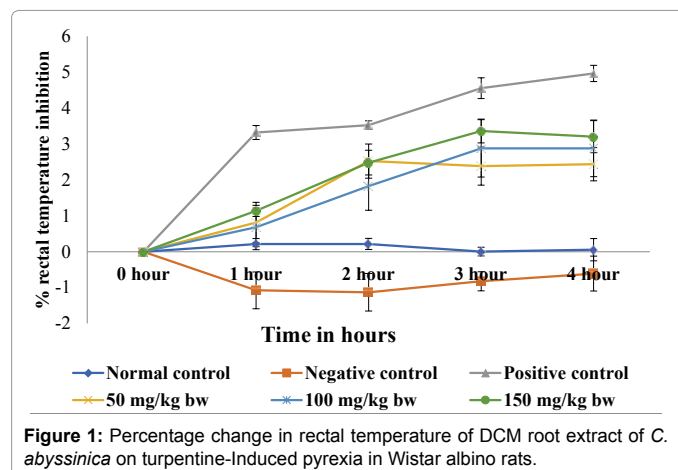


Figure 1: Percentage change in rectal temperature of DCM root extract of *C. abyssinica* on turpentine-Induced pyrexia in Wistar albino rats.

brownii in rats. Likewise, [26] Ref observed similar dose dependent response while evaluating the antipyretic properties of methanolic stem bark extracts of *H. abyssinica* oliv and *L. buchananii* staph against turpentine-induced pyrexia in Wistar albino rats. Within the first and second hours, the extract demonstrated a non-dose dependence antipyretic activity. This phenomenon can be explained in terms of certain dose limits when excited the activity of that particular drug is reduced or is rendered inactive.

The presences of active phytochemical compounds in the DCM root extract of *C. abyssinica* might have contributed to the antipyretic activity. Flavonoids have been found to inhibit prostaglandin E synthase production and its transcription, resulting in blockage of prostaglandin synthesis [32]. Flavonoids such as baicalin have been shown to exert antipyretic activity by inhibiting TNF- α [33].

Conclusion

The DCM root extract reduced the elevated temperature when compared to the aspirin (reference drug). This signifies that the plant is endowed with potent antipyretic properties and it might be useful in obtaining therapeutic agents capable of relieving fever. The study therefore scientifically confirms the traditional use of the medicinal plant in management of pyrexia.

Acknowledgements

The authors acknowledge the technical support provided by James Adino, Daniel Gitomga and James Ngujiri.

References

- Blatteis CM (2007) The onset of fever: new insights into its mechanism. *Progress in Brain Research* 162: 3-14.
- Alexrod YK, Diringner MN (2008) Temperature management in acute neurologic disorders. *Neurologic Clinics* 26: 585-603.

3. Karakitsos D, Karabinis A (2008) Hyperthermia therapy after traumatic brain injury in children. *New England Journal of medicine* 359: 1179-1182.
4. Anochie M, Philips P (2013) Mechanism of fever in humans. *Apex Journal International* 2: 37-43.
5. Young P, Saxena M (2014) Fever management in intensive care patients with infections: *Intensive Care* 18: 206-213.
6. Kelly KW, Bluth RM, Dantzer R, Zhou JH, Shen WH, et al. (2003) Cytokine induced sickness behaviour. *Brain Behaviour and Immunology* 1: 2-8.
7. Shalini MD, Dona SZ (2006) Pathophysiology and Management of Fever. *Journal of Supportive Oncology* 4: 9-16.
8. Guyton AC, Hall JE (2000) *Textbook of medical physiology*. 10th edn. Saunders, Philadelphia, pp: 822-823.
9. Walter FB (2003) *Medical Physiology: A Cellular and Molecular Approach*. Elsevier. Saunders limited. Philadelphia, p: 1300.
10. Boursinos LA, Karachalios T, Poultsides L, Malizos M (2009) Do steroids, conventional non-steroidal anti-inflammatory drugs and selective Cox-2 inhibitors adversely affect fracture healing. *Journal of Musculoskeletal Neuronal Interact* 9: 44-52.
11. Paya DG, Katzung BG (1995) Non-steroidal anti-inflammatory drugs; nonopoid analgesics; drugs used in gout. *Basic and Clinical Pharmacology* 6: 536-559.
12. Aronoff DM, Neilson EG (2000) Antipyretics: Mechanism of action and clinical use in fever suppression. *American Journal of Medicine* 111: 304-315.
13. Robotin MC, Penman AG (2006) Integrating complementary therapies into mainstream cancer care: which way forward. *Medical Journal of Australia* 185: 377-379.
14. Sharma US, Umesh KS, Abhishek S, Niranjana S, Puspak JS (2010) Screening of Terminalia bellirica Fruits Extracts for its Analgesic and Antipyretic Activities. *Jordan Journal of Biological Sciences* 3: 45-53.
15. Shinwari ZK (2010) Medicinal plants research in Pakistan. *Journal of Medicinal Plants Research* 4: 161-176.
16. Vasundra DP, Divya PS (2013) Antipyretic Activity of Ethanol and Aqueous Extract of Root of Asparagus racemosus in Yeast Induced Pyrexia. *Asian Journal of Pharmaceutical Clinical Research* 6: 190-119.
17. Jeruto P, Charles M, Lukhoba C, George O (2011) Phytochemical constituents of some medicinal plants used by the Nandis of South Nandi district, Kenya. *Journal of Animal and Plant Sciences* 9: 1201-1210.
18. Lapah PT, Noa PA, Ogonna OJ (2014) Anti-Pyretic and Analgesic Potentials of Aqueous Extract of Phragmanthera capitata S. Balle in Albino Rats. *American Journal of Pharmacy and Pharmaceutical Sciences* 1: 37-43.
19. Kuochung T, Haruko F, Yasuo Y, Yuzo T (2006) Effects of turpentine induced fever during the enamel formation of rat incisor. *Archives of oral biology* 51: 464-470.
20. Maria F, Jeffrey BN, Natarajan P, Mehalingam P (2014) Pharmacological screening of leaf extracts of ethnomedicinal plant Vitex altissima for its traditional claims. *Asian Journal of Pharmaceutical and Clinical References* 7: 22-28.
21. Trease GE, Evans MC (1983) *Text book of Pharmacognosy*. 12th edn. Balliere, Tindall: London, pp: 343-383.
22. Petrova L, Nikolova M, Nikolov R, Stefanova D (1978) Dipyron and acetylsalicylic acid comparative pharmacological research. Antipyretic, anti-inflammatory and analgesic action. In: Ovtcharov R, Pola W (eds.), *Proceedings Dipyron*. Moscow Symposium, Schattauer-Verlag, Stuttgart, New York, USA, pp: 99-107.
23. Wieslaw K, Mathew JK, Dariusz S, Carole C, Karin R, et al. (1998) IL-6 and IL-1 β in fever. Studies using cytokine-deficient (knockout) mice. *Annals of the New York Academy of Sciences* 856: 33-47.
24. Chelminiak S (2000) Blockade of nitric oxide formation enhances thermal and behavioral responses in rats during turpentine abscess. *Neuroimmunomodulation* 8: 188-196.
25. Gourine AV, Rudolph K, Korsak AS, Kubatko J, Tesfaigzi J, et al. (2001) Role of capsaicin-sensitive afferents in fever and cytokine responses during systemic and local inflammation in rats. *Neuroimmunomodulation* 9: 13-22.
26. Nthiga PM, Kamau JK, Safari VZ, Mwonjoria JK, Mburu DN, et al. (2016) Antipyretic Potential of Methanolic Stem Bark Extracts of Harrisonia abyssinica Oliv and Landolphia buchananii (Hallier F.) Stapf in Wistar Rats. *Journal of Applied Pharmacy* 8: 227-233.
27. Kamau JK, Nthiga PM, Safari VC, Njagi SM, Mwonjoria JK, et al. (2016) Antipyretic properties of methanol stem bark extracts of Acacia hockii de wild and Kigelia africana (Lam) benth in Wistar rats. *Journal of Pharmacognosy and Natural products* 2: 118-124.
28. Okokon JE, Nwafor P (2010) Antiinflammatory, analgesic and antipyretic activities of ethanol root extract of Croton zambesicus. *Journal of Pharmaceutical Science* 23: 385-392.
29. Tayyaba A, Muhamed RK, Suhail R, Shafi U, Bushra M (2015) Antipyretic, anti-inflammatory and analgesic of Acacia hydaspicar parker and its phytochemicals analysis. *Complementary and alternative medicine* 15: 136-147.
30. Kamau JK, Nthiga PM, Safari VC, Njagi SM, Mwonjoria JK, et al. (2016) Anti-inflammatory activity of methanolic leaf extract of Kigelia africana (Lam) benth and Acacia hockii de wild in mice. *Journal of Developing drugs* 5: 158-166.
31. Mbiri JW, Sichangi K, Kisangau P, Wilton M, Ngugi MP (2016) Anti-pyretic properties of methanolic bark extracts of Terminalia brownii in Wistar albino rats. *Journal of Pharmacognosy and Natural Products* 2: 121-126.
32. Hamalainen M, Nieminen R, Asmawi MZ, Vuorela P, Vapaatalo H, et al. (2011) Effects of flavonoids on prostaglandin E2 production. *Planta Medicina* 77: 1504-1511.
33. Adesokan AA, Yakubu MT, Owoyele BV, Akanji MA, Soladoye AO, et al. (2008) Effect of administration of aqueous and ethanol extracts of Enantia chlorantha stem bark on brewer's yeast induced pyrexia in rats. *African Journal of Biochemistry* 2: 165-169.

Citation: Koech SC, Sindani AV, Maoga JB, Ouko RO, Njagi NM, et al. (2017) Anti-pyretic Potential of Dichloromethanolic Root Extract of *Clusia abyssinica* in Wistar Albino Rats. *Med Aromat Plants (Los Angel)* 6: 281. doi: [10.4172/2167-0412.1000281](https://doi.org/10.4172/2167-0412.1000281)

OMICS International: Open Access Publication Benefits & Features

Unique features:

- Increased global visibility of articles through worldwide distribution and indexing
- Showcasing recent research output in a timely and updated manner
- Special issues on the current trends of scientific research

Special features:

- 700+ Open Access Journals
- 50,000+ Editorial team
- Rapid review process
- Quality and quick editorial, review and publication processing
- Indexing at major indexing services
- Sharing Option: Social Networking Enabled
- Authors, Reviewers and Editors rewarded with online Scientific Credits
- Better discount for your subsequent articles

Submit your manuscript at: <http://www.omicsonline.org/submission>