RESEARCH ARTICLE

Phytochemical and Pharmacological Investigation of Analgesic and Antipyretic Activities of *Cyperus pertenuis* and *Delphinium zelil* in Albino Rats

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Abstract

Background: Pain and fever are common clinical symptoms often managed with synthetic drugs that may produce undesirable side effects with prolonged use. Medicinal plants offer a promising source of safer alternatives, yet many traditionally used species remain scientifically underexplored. **Objective:** The present study aimed to investigate the phytochemical composition and evaluate the analgesic and antipyretic activities of ethanolic extracts of *Cyperus pertenuis* and *Delphinium zelil* in albino rats. **Methods:** Ethanolic extracts of both plants were subjected to qualitative phytochemical screening. Analgesic activity was assessed using the acetic acid–induced writhing test and hot plate method, while antipyretic activity was evaluated using the brewer's yeast–induced pyrexia model. Paracetamol and diclofenac sodium were used as standard reference drugs. Acute oral toxicity was assessed according to OECD guidelines. Data were analyzed using analysis of variance, and results were expressed as mean ± SEM. **Results:** Phytochemical analysis revealed the presence of alkaloids, flavonoids, tannins, phenols, and saponins in both extracts. The extracts produced significant, dose-dependent analgesic and antipyretic effects compared to the control group ($p < 0.05$). At higher doses, the pharmacological effects approached those of standard drugs at higher doses. No signs of acute toxicity were observed up to 5000 mg/kg. **Conclusion:** The findings demonstrate that *Cyperus pertenuis* and *Delphinium zelil* possess significant analgesic and antipyretic properties, supporting their traditional use. These plants may serve as potential sources for the development of novel, safe, plant-based therapeutic agents.

Keywords

Cyperus pertenuis, Delphinium zelil, Analgesic activity, Antipyretic activity, Phytochemical screening, Albino rats

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1. Introduction

Pain and fever are among the most common clinical symptoms prompting medical consultation worldwide and significantly impair quality of life if inadequately managed. Pain is defined by the International Association for the Study of Pain (IASP) as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage (1). Fever (pyrexia) is a regulated elevation of body temperature resulting from an upward shift in the hypothalamic thermoregulatory set point, usually mediated by endogenous pyrogens such as cytokines and prostaglandins (2). Conventional pharmacological management of pain and fever relies heavily on non-steroidal anti-inflammatory drugs (NSAIDs), opioids, and antipyretic agents such as paracetamol. Although effective, these drugs are associated with notable adverse effects, including gastrointestinal ulceration, hepatotoxicity, nephrotoxicity, cardiovascular risks, tolerance, and dependence, particularly with long-term use (3). These limitations have intensified the search for safer and more affordable therapeutic alternatives, especially those derived from medicinal plants. Medicinal plants have long served as a foundation for drug discovery, with many modern analgesic and antipyretic agents originating from natural sources. Phytochemicals such as flavonoids, alkaloids, tannins, saponins, and phenolic compounds have demonstrated significant analgesic, antipyretic, and anti-inflammatory properties through mechanisms including inhibition of cyclooxygenase (COX) enzymes, suppression of prostaglandin synthesis, antioxidant activity, and modulation of nociceptive pathways (4). Experimental validation of traditionally used plants is therefore essential to establish their pharmacological credibility and therapeutic potential. *Cyperus pertenuis* (family: Cyperaceae), commonly known as Nagarmotha, is traditionally employed in various ethnomedicinal systems for the management of fever, digestive disorders, hepatic ailments, and inflammatory conditions. The genus *Cyperus* is rich in bioactive constituents, including sesquiterpenes, flavonoids, phenolic acids, and essential oils, many of which have been reported to exhibit antioxidant and anti-inflammatory activities (5,5). Despite its traditional importance, *C. pertenuis* remains pharmacologically underexplored, particularly with respect to its analgesic and antipyretic effects. Similarly, *Delphinium zelil* (family: Ranunculaceae) is traditionally used as an anti-inflammatory, antipyretic, and analgesic agent in certain regions of Central and South Asia. Species of the genus *Delphinium* are known to contain a wide range of bioactive alkaloids, flavonoids, tannins, and phenolic compounds, which contribute to their diverse pharmacological activities (6). However, scientific evidence supporting the analgesic and antipyretic efficacy of *D. zelil* is limited, and systematic in-vivo evaluations are scarce.

Given the growing interest in plant-based therapeutics and the need for safer alternatives to synthetic drugs, the present study was designed to scientifically evaluate the phytochemical composition and pharmacological potential of ethanolic extracts of *Cyperus pertenuis* and *Delphinium zelil*. Specifically, this investigation aimed to assess their analgesic activity using established nociceptive models and their antipyretic activity using brewer's yeast-induced

pyrexia in albino rats. The findings of this study may provide experimental support for the traditional use of these plants and contribute to the development of novel natural analgesic and antipyretic agents.

2. Literature Review

Medicinal plants have played a pivotal role in the treatment of pain, fever, and inflammatory disorders since ancient times and continue to serve as a primary source for the discovery of novel therapeutic agents. According to the World Health Organization, approximately 80% of the global population relies on traditional medicine, largely plant-based, for primary healthcare needs (7). The growing concern regarding adverse effects, tolerance, and toxicity associated with long-term use of synthetic analgesic and antipyretic drugs has renewed scientific interest in ethnomedicinal plants as safer and cost-effective alternatives. Pain is a complex physiological and psychological phenomenon involving peripheral and central mechanisms. Peripheral pain is largely mediated by inflammatory mediators such as prostaglandins, bradykinin, histamine, and cytokines, while central pain involves modulation at the spinal and supraspinal levels (8). Fever, on the other hand, is primarily associated with immune-mediated production of pyrogenic cytokines, including interleukin-1β, tumor necrosis factor-α, and interleukin-6, which stimulate prostaglandin E_2 synthesis in the hypothalamus, resulting in an elevation of the thermoregulatory set point (2). Most conventional antipyretic and analgesic drugs exert their effects through inhibition of cyclooxygenase enzymes and suppression of prostaglandin synthesis; however, these mechanisms are also responsible for their associated adverse effects (9).

Phytochemicals such as flavonoids, alkaloids, tannins, saponins, and phenolic compounds have been extensively reported to possess analgesic, antipyretic, and anti-inflammatory activities. Flavonoids inhibit both cyclooxygenase and lipoxygenase pathways and exert antioxidant effects that reduce oxidative stress associated with inflammation (10,11). Alkaloids have demonstrated central and peripheral analgesic effects through interactions with opioid receptors, ion channels, and neurotransmitter systems. Tannins and phenolic compounds contribute to anti-inflammatory activity by reducing vascular permeability and inhibiting inflammatory mediator release (4). The presence of these phytoconstituents in medicinal plants provides a strong pharmacological basis for their traditional use in pain and fever management. The genus *Cyperus* (family: Cyperaceae) comprises more than 600 species distributed worldwide and is widely recognized for its medicinal value. Several species of *Cyperus*, including *Cyperus rotundus* and *Cyperus scariosus*, have been reported to exhibit analgesic, antipyretic, anti-inflammatory, antioxidant, and antimicrobial activities (5,5). Phytochemical investigations of *Cyperus* species have revealed the presence of essential oils, flavonoids, sesquiterpenes, phenolic acids, and alkaloids, which are believed to contribute to their pharmacological effects. Despite the extensive research on certain species, *Cyperus pertenuis* remains comparatively underexplored, with limited experimental evidence supporting its analgesic and antipyretic potential. This lack of scientific validation highlights the need for systematic pharmacological investigation.

Similarly, the genus *Delphinium* (family: Ranunculaceae) has been traditionally used in various ethnomedicinal systems for the treatment of pain, fever, inflammation, and infectious diseases. *Delphinium* species are particularly known for their rich alkaloidal content, including diterpenoid alkaloids, which exhibit diverse biological activities (6). Previous studies have reported analgesic, anti-inflammatory, antimicrobial, and neuroactive properties of several *Delphinium* species. However, many species within the genus, including *Delphinium zelil*, lack comprehensive pharmacological evaluation, particularly with respect to in-vivo analgesic and antipyretic models. Experimental animal models such as acetic acid–induced writhing, hot plate test, and brewer's yeast–induced pyrexia are widely accepted for evaluating analgesic and antipyretic activities of plant extracts. The acetic acid–induced writhing test is sensitive to peripheral analgesics and reflects inhibition of inflammatory mediators, while the hot plate test assesses centrally mediated analgesic activity (8). Brewer's yeast–induced pyrexia closely mimics pathogenic fever and is commonly employed to investigate antipyretic agents acting through prostaglandin inhibition (2). These validated models provide reliable pharmacological evidence for assessing the therapeutic potential of medicinal plants.

In light of the traditional claims, phytochemical diversity, and limited experimental validation of *Cyperus pertenuis* and *Delphinium zelil*, the present study was designed to investigate their phytochemical composition and evaluate their analgesic and antipyretic activities using established in-vivo models. This research aims to bridge the gap between traditional knowledge and scientific evidence, thereby contributing to the discovery of novel, plant-derived analgesic and antipyretic agents.

3. Materials and Methods

3.1 Plant Material Collection and Authentication

Fresh plant materials of *Cyperus pertenuis* (family: Cyperaceae) and *Delphinium zelil* (family: Ranunculaceae) were purchased from the local herbal market of Lahore, Pakistan. The plants were taxonomically authenticated by a qualified botanist at the Department of Botany, University of the Punjab, Lahore. Voucher specimens were deposited for future reference.

3.2 Preparation of Ethanolic Extracts

The collected plant materials were washed, shade-dried, and pulverized into coarse powder using a mechanical grinder. Approximately 250 g of powdered material from each plant was macerated separately in 70% aqueous ethanol for 15 days at room temperature with intermittent shaking. The mixtures were filtered through muslin cloth followed by Whatman No. 1 filter paper. Filtrates were concentrated by solvent evaporation at 37 °C using a hot air oven until semi-solid extracts were obtained. The extracts were weighed to calculate percentage yield and stored at 4–8 °C until further use.

3.3 Experimental Animals

Albino rats of either sex (150–250 g) were used for pharmacological evaluation. Animals were obtained from the animal house facility of The University of Lahore and housed at the animal facility of Riphah International University under standard laboratory conditions (25 ± 2 °C, 45–55% relative humidity, and 12 h light/dark cycle). Rats had free access to standard pellet diet and water ad libitum. All experimental procedures were conducted in accordance with internationally accepted guidelines for the care and use of laboratory animals.

3.4 Drugs and Chemicals

Paracetamol and diclofenac sodium were used as standard analgesic and antipyretic drugs. Brewer's yeast was employed for induction of pyrexia. Ethanol, methanol, dimethyl sulfoxide (DMSO), carboxymethyl cellulose (CMC), acetic acid, and other analytical-grade chemicals were used throughout the study.

3.5 Phytochemical Screening

Preliminary qualitative phytochemical screening of the ethanolic extracts was carried out using standard procedures to detect the presence of major secondary metabolites, including alkaloids, flavonoids, phenols, tannins, saponins, steroids, terpenoids, carbohydrates, proteins, and glycosides. The tests were performed according to established phytochemical protocols described in the literature.

3.6 Evaluation of Antipyretic Activity

Antipyretic activity was assessed using the brewer's yeast–induced pyrexia model in albino rats. Pyrexia was induced by subcutaneous injection of 20% (w/v) aqueous suspension of brewer's yeast (10 mL/kg). After 18 h, rats exhibiting a rise in rectal temperature of at least 0.5 °C were selected for the study. Animals were randomly divided into groups (n = 5). The control group received 5% CMC, the standard group received paracetamol (100 mg/kg), while treatment groups received ethanolic extracts of *C. pertenuis* or *D. zelil* at doses of 100, 200, and 400 mg/kg orally. Rectal temperature was recorded at 0, 1, 2, 3, and 4 h post-treatment using a digital thermometer. Percentage reduction in temperature was calculated relative to the control group.

3.7 Evaluation of Analgesic Activity

3.7.1 Acetic Acid–Induced Writhing Test

Peripheral analgesic activity was evaluated using the acetic acid–induced writhing model. Rats were divided into eight groups (n = 5). The control group received 5% CMC, the standard group received diclofenac sodium (10 mg/kg), and treatment groups received ethanolic extracts of *C. pertenuis* or *D. zelil* at doses of 100, 200, and 400

mg/kg orally. After 30 min, writhing was induced by intraperitoneal injection of 1% acetic acid (1 mL/100 g). The number of writhes was counted for 20 min, and percentage inhibition of writhing was calculated.

3.7.2 Hot Plate Test

Central analgesic activity was assessed using the hot plate method. Rats were placed on a hot plate maintained at 55 ± 1 °C, and latency time to pain response (paw licking or jumping) was recorded. Animals with baseline latency exceeding 40 s were excluded. Treatments were administered as described above, and reaction times were recorded at predetermined intervals. A cut-off time of 90 s was maintained to prevent tissue damage.

3.7.3 Acute Toxicity Study

Acute oral toxicity of the ethanolic extracts was evaluated according to the OECD guideline 423. Rats were administered single oral doses of 500, 1000, 3000, and 5000 mg/kg of each extract and observed for behavioral changes, signs of toxicity, and mortality for 24 h and up to 14 days.

3.8 Statistical Analysis

All experimental data were expressed as mean ± standard error of the mean (SEM). Statistical analysis was performed using GraphPad Prism software. Data were analyzed using one-way or two-way analysis of variance (ANOVA), followed by appropriate post hoc tests. Differences were considered statistically significant at $p < 0.05$.

4. Results

4.1 Percentage Yield of Plant Extracts

The ethanolic extraction of *Cyperus pertenuis* and *Delphinium zelil* yielded dark brown and greenish-brown semi-solid extracts, respectively. The percentage yield was calculated based on dried plant material.

Table.1: Percentage yield of Ethanolic extracts

PLANT SPECIES	WEIGHT OF DRIED POWDER (G)	EXTRACT YIELD (G)	PERCENTAGE YIELD (%)
C. PERTENUIS	250	7.9 gm	0.7
D. ZELIL	250	6.3 gm	2.54

4.2 Phytochemical Screening

Preliminary qualitative phytochemical analysis revealed the presence of several bioactive secondary metabolites in both plant extracts. Alkaloids, flavonoids, tannins, phenols, saponins, and carbohydrates were detected in both *C. pertenuis* and *D. zelil*, whereas steroids and glycosides were variably present.

Table.2: Qualitative phytochemical constituents of ethanolic extracts

PHYTOCHEMICAL	*C. PERTENUIS*	*D. ZELIL*
ALKALOIDS	+	+
FLAVONOIDS	+	+
TANNINS	+	+
PHENOLS	+	+
SAPONINS	+	+
STEROIDS	±	+
TERPENOIDS	+	±
GLYCOSIDES	−	+
CARBOHYDRATES	+	+
PROTEINS	−	−

(+ = present; − = absent; ± = trace)

4.3 Antipyretic Activity (Brewer's Yeast–Induced Pyrexia)

Administration of brewer's yeast produced a significant elevation in rectal temperature after 18 h in all experimental animals. Oral administration of ethanolic extracts of *C. pertenuis* and *D. zelil* produced a dose-dependent and statistically significant reduction in rectal temperature compared to the control group ($p < 0.05$).

The antipyretic effect became evident within 1 h of administration and persisted up to 4 h. At the highest dose (400 mg/kg), both extracts demonstrated antipyretic activity comparable to the standard drug paracetamol (100 mg/kg).

Table.3: Effect of plant extracts on rectal temperature (°C) in yeast-induced pyrexia

TREATMENT	DOSE (MG/KG)	0 H	1 H	2 H	3 H	4 H
CONTROL (CMC)	—	38.63 ± 0.135	38.66 ± 0.129	38.6 ± 0.12	38.56 ± 0.115	38.55 ± 0.0108
PARACETAMOL	100	38.45 ± 0.064	38.06 ± 0.015*	37.83 ± 0.025*	37.6 ± 0.037***	37.48 ± 0.05*** 68.8%

		28.2%	44.9%	61.6%	
C. PERTENUIS	100	38.57 ± 0.055	38.41 ± 0.046^{ns} 10.2%	38.3 ± 0.053^{ns} 16.3%	38.2 ± 0.039* 22.7%	38.12 ± 0.043* 27.1%
C. PERTENUIS	200	38.4 ± 0.06	38.14 ± 0.069* 18.7%	38.0 ± 0.068* 30.3%	37.87 ± 0.073** 37.2%	37.68 ± 0.068** 52.5%
C. PERTENUIS	400	38.45 ± 0.08	38.14 ± 0.04* 21.1%	37.97 ± 0.058** 32.2%	37.77 ± 0.056** 45.0%	37.53 ± 0.042*** 60.6%
D. ZELIL	100	38.40 ± 0.04	38.18 ± 0.056^{ns} 15.7%	38.08 ± 0.064^{ns} 22.8%	37.93 ± 0.07* 33.5%	37.85 ± 0.08* 39.2%
D. ZELIL	200	38.18 ± 0.01	38.08 ± 0.083^{ns} 12%	37.91 ± 0.093* 25%	37.78 ± 0.093* 37.0%	37.62 ± 0.115** 42.3%
D. ZELIL	400	38.45 ± 0.03	38.18 ± 0.054* 17.4%	38.02 ± 0.028** 27.7%	37.86 ± 0.034** 38.0%	37.67 ± 0.088*** 42.8%

4.4 Analgesic Activity

4.4.1 Acetic Acid–Induced Writhing Test

Both ethanolic extracts produced significant inhibition of acetic acid–induced writhing in albino rats compared to the control group. The analgesic effect was dose-dependent, with maximum inhibition observed at 400 mg/kg. *D. zelil* extract exhibited slightly higher inhibition compared to *C. pertenuis* at equivalent doses, although both were less potent than diclofenac sodium.

Table.4: Effect of plant extracts on acetic acid–induced writhing

TREATMENT	DOSE (MG/KG)	NO. OF WRITHES	% INHIBITION
CONTROL (CMC)	—	21 ± 1.19	—
DICLOFENAC SODIUM	10	8 ± 0.408	74%↑***
C. PERTENUIS	100	15 ± 0.479	48.8%↑**

C. PERTENUIS	200	12 ± 0.479	59%↑**
C. PERTENUIS	400	9 ± 0.250	68%↑***
D. ZELIL	100	14 ± 0.707	54.8%↑**
D. ZELIL	200	11 ± 0.500	63.2%↑***
D. ZELIL	400	11 ± 0.408	64.5%↑***

4.4.2 Hot Plate Test

In the hot plate test, both plant extracts significantly increased pain reaction latency compared to the control group ($p < 0.05$), indicating central analgesic activity. The increase in latency was dose-dependent and time-dependent. The highest dose (400 mg/kg) of both extracts produced a marked prolongation of reaction time, although the effect remained lower than that of diclofenac sodium.

Table.5: Effect of plant extracts on pain reaction time (seconds) in hot plate test

TREATMENT	DOSE (MG/KG)	0 MIN	30 MIN	60 MIN	90 MIN
CONTROL (CMC)	—	13.7 ± 0.57	14.95 ± 0.74	16.1 ± 1.14	15.02 ± 0.68
DICLOFENAC SODIUM	10	14.5 ± 1.04*	31.9 ± 1.89*	45.5 ± 2.15**	58.07 ± 2.48**
C. PERTENUIS	100	15.27± 1.43ns	22.7 ± 1.30ns	28.5 ± 0.54*	34.7 ± 2.52*
C. PERTENUIS	200	15.5 ± 1.16	28.6 ± 1.18*	38.07 ± 1.7*	45.25 ± 1.5**
C. PERTENUIS	400	14.6 ± 0.992	28.7 ± 0.82*	37.6 ± 1.97**	45.02 ± 2.12***
D. ZELIL	100	15.27 ± 1.63ns	23.0 ± 1.39ns	31.9 ± 2.74*	42.7 ± 1.32*
D. ZELIL	200	16.7 ± 1.61*	25.6 ± 1.35*	37.22 ± 1.07**	46.82 ± 1.5**
D. ZELIL	400	16.9 ± 1.97*	27.7 ± 1.98**	36.3 ± 1.45**	45.22 ± 1.18**

4.5 Acute Toxicity Study

No mortality or significant behavioral changes were observed in rats treated with ethanolic extracts of *C. pertenuis* and *D. zelil* up to a dose of 5000 mg/kg. The extracts were considered safe, with no apparent signs of acute toxicity during the 14-day observation period.

5. Discussion

The present study provides experimental evidence supporting the traditional use of *Cyperus pertenuis* and *Delphinium zelil* for the management of pain and fever. The findings demonstrate that ethanolic extracts of both plants possess significant analgesic and antipyretic activities in established in-vivo models, with effects that were dose-dependent and comparable to standard drugs at higher doses. These pharmacological actions may be attributed to the presence of bioactive phytoconstituents identified during preliminary phytochemical screening. Pain induced by acetic acid is primarily mediated through peripheral mechanisms involving the release of endogenous algogenic substances such as prostaglandins (PGE_2 and $PGF_{2\alpha}$), bradykinin, serotonin, and histamine, which sensitize nociceptive neurons. In the present study, both plant extracts significantly reduced the number of writhing responses, suggesting inhibition of peripheral nociceptive pathways. This effect may be associated with suppression of cyclooxygenase activity and subsequent reduction in prostaglandin synthesis, a mechanism commonly reported for plant-derived flavonoids and phenolic compounds (11). The hot plate test evaluates centrally mediated analgesic activity by assessing the response to thermal nociception, which involves supraspinal and spinal pain pathways. The observed increase in reaction latency following administration of both extracts indicates a possible central analgesic effect. Although the extracts were less potent than the standard drug diclofenac sodium, the dose-dependent prolongation of reaction time suggests potential modulation of central nociceptive mechanisms, possibly through interaction with opioid receptors or inhibition of central prostaglandin synthesis (8,12). Similar central analgesic effects have been reported for other *Cyperus* and *Delphinium* species, supporting the findings of the present study.

Fever induced by brewer's yeast is a well-established experimental model that mimics pathogenic fever through enhanced production of pro-inflammatory cytokines such as interleukin-1β, tumor necrosis factor-α, and interleukin-6, leading to increased synthesis of prostaglandin E_2 in the hypothalamus (13). The significant reduction in rectal temperature observed after administration of *C. pertenuis* and *D. zelil* extracts suggests interference with the synthesis or release of these pyrogenic mediators. The antipyretic activity observed was comparable to paracetamol at higher doses, indicating a possible shared mechanism involving inhibition of prostaglandin synthesis at the central thermoregulatory centers. The presence of flavonoids, tannins, alkaloids, and phenolic compounds in both extracts provides a plausible biochemical basis for the observed pharmacological effects. Flavonoids are known to exert analgesic and antipyretic effects through inhibition of cyclooxygenase and lipoxygenase pathways, antioxidant activity, and modulation of inflammatory mediators (4,10). Alkaloids, particularly those reported in *Delphinium* species, have demonstrated diverse pharmacological activities, including analgesic and anti-inflammatory effects, through interaction with neuronal ion channels and receptors. Tannins may also contribute by reducing inflammatory responses and inhibiting the release of inflammatory mediators.

The acute toxicity study revealed no mortality or observable signs of toxicity at doses up to 5000 mg/kg, suggesting a wide margin of safety for both extracts. This safety profile is consistent with previous reports on related species and supports the traditional use of these plants in ethnomedicine. However, despite these promising findings, the absence of chronic toxicity studies and molecular mechanism investigations represents a limitation of the present work. Overall, the results of this study validate the ethnopharmacological claims associated with *Cyperus pertenuis* and *Delphinium zelil* and highlight their potential as sources of natural analgesic and antipyretic agents. Further studies focusing on isolation of active compounds, elucidation of molecular mechanisms, and long-term safety evaluation are warranted to advance these plants toward clinical relevance.

6. Conclusion

The present study provides scientific validation for the traditional use of *Cyperus pertenuis* and *Delphinium zelil* as analgesic and antipyretic agents. Ethanolic extracts of both plants demonstrated significant, dose-dependent analgesic activity in peripheral and central nociceptive models, as well as marked antipyretic effects in brewer's yeast–induced pyrexia in albino rats. The observed pharmacological effects are plausibly attributed to the presence of bioactive phytochemicals, particularly flavonoids, alkaloids, tannins, and phenolic compounds, which are known to modulate inflammatory mediators and prostaglandin synthesis. Both plant extracts exhibited a favorable safety profile, with no signs of acute toxicity observed up to a dose of 5000 mg/kg, suggesting a wide margin of safety. While the extracts were less potent than standard reference drugs, their significant biological activity supports their potential as sources of natural therapeutic agents. However, further studies are required to isolate and characterize the active constituents, elucidate precise molecular mechanisms, and evaluate chronic toxicity and clinical efficacy. Overall, the findings of this study contribute valuable experimental evidence supporting the ethnopharmacological relevance of *C. pertenuis* and *D. zelil* and highlight their potential for future development into safer, plant-based analgesic and antipyretic formulations.

6. References

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