|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2020: 79.44
Original Research Article
Volume 5, Issue 1; January: 2021; Page No. 431-434

Study of Antinociceptive Effect of Ginger Essential Oil (GEO) in Acute Pain in Albino Mice

Urade Chetan Shankarrao

Assistant Professor, Department of Pharmacology, Shri Shankaracharya Institute of Medical Sciences, Junwani Road, Bhilai, Durg, Chhattisgarh

Article Info: Received 15 December 2020; Accepted 20 January 2021
Corresponding author: Dr. Urade Chetan Shankarrao
Conflict of interest: No conflict of interest.

Abstract

Background: Ginger (Zingiber officinale) has been used for centuries in traditional medicine for its therapeutic properties, including its potential analgesic and anti-inflammatory effects. Ginger essential oil (GEO), derived from the rhizomes of the ginger plant, is believed to possess bioactive compounds that may help alleviate pain. This study aims to evaluate the antinociceptive effect of GEO in acute pain in albino mice.

Aim: To investigate the antinociceptive effect of ginger essential oil (GEO) in acute pain models in albino mice.

Methods: A total of 30 male albino mice were divided into five groups. The pain was induced using the formalin test, and GEO was administered at varying doses (50, 100, and 200 mg/kg) via oral gavage. The control group received normal saline. The nociceptive response was measured by observing the time spent in paw licking during the early and late phases of the formalin test.

Results: GEO significantly reduced paw licking time in both early and late phases of the formalin test compared to the control group. The 100 mg/kg and 200 mg/kg doses showed the most prominent reduction in pain behavior.

Conclusion: This study demonstrates that ginger essential oil possesses antinociceptive properties, suggesting its potential as a therapeutic agent for acute pain management.

Keywords: Ginger Essential Oil, Antinociceptive, Acute Pain, Albino Mice, Analgesic, Formalin Test.

Introduction

Pain is a complex physiological and psychological response to harmful stimuli, and its management remains a challenge in modern medicine. The pharmacological treatment of pain often involves the use of nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, and other analgesics. However, these drugs can have significant side effects, including gastrointestinal irritation, addiction, and tolerance. As a result, researchers have sought alternative therapies, particularly from natural sources, to mitigate pain without the harmful side effects associated with conventional analgesics (1).

Ginger (Zingiber officinale) is a popular medicinal plant known for its anti-inflammatory, analgesic, and antispasmodic properties. Its bioactive components, such as gingerols, shogaols, and paradols, have been widely studied for their potential therapeutic effects. These compounds are believed to exert their effects through various mechanisms, including inhibition of cyclooxygenase (COX) enzymes, modulation of the inflammatory pathways, and antioxidant properties (2). Ginger has been traditionally used in various forms to treat pain, including headaches, arthritis, and menstrual cramps (3).

In recent years, ginger essential oil (GEO) has garnered attention due to its concentrated bioactive compounds and potential therapeutic benefits. GEO is extracted from the rhizomes of the ginger plant and contains key active

ingredients, including gingerol and other phenolic compounds, which are believed to contribute to its analgesic effects. Several studies have suggested that GEO possesses significant anti-inflammatory and antinociceptive activities in various animal models (4, 5). However, there is limited research on its effectiveness in acute pain models, specifically in vivo in mice.

The formalin test is a widely used method to assess acute pain and nociceptive responses in animals. The test is divided into two phases: an early phase (0-5 minutes) characterized by neurogenic pain and a late phase (20-40 minutes) associated with inflammatory pain. This model allows researchers to study the effectiveness of analgesic compounds in both central and peripheral pain pathways (6).

This study aims to evaluate the antinociceptive effect of GEO in acute pain induced by formalin injection in albino mice. We hypothesize that GEO will reduce pain-related behavior in the formalin test and exhibit dose-dependent analgesic effects.

Aim

To study the antinociceptive effect of ginger essential oil (GEO) in acute pain in albino mice.

Objectives

1. To evaluate the effect of GEO on nociceptive behavior in the formalin test.
2. To determine the dose-dependent response of GEO in alleviating acute pain in albino mice.

Materials and Methods

This study was conducted using 30 male albino mice weighing 20-25 grams. The mice were obtained from a licensed animal breeder and housed under standard laboratory conditions with a 12-hour light/dark cycle and free access to food and water.

Inclusion Criteria:

- Male albino mice aged 6-8 weeks.
- Mice with no prior history of drug treatment or surgery.
- Healthy mice with no observable signs of illness.

Exclusion Criteria:

- Mice with pre-existing pain conditions.
- Mice showing signs of infection or disease.
- Mice with a history of any experimental interventions.

The mice were randomly divided into five groups:

- **Group 1 (Control group):** Normal saline (1 mL/kg).
- **Group 2 (Low dose):** GEO 50 mg/kg.
- **Group 3 (Medium dose):** GEO 100 mg/kg.
- **Group 4 (High dose):** GEO 200 mg/kg.
- **Group 5 (Positive control):** Diclofenac sodium (10 mg/kg).

Ginger essential oil was administered orally 30 minutes before formalin injection. The pain was induced by subcutaneous injection of 50 µL formalin (2.5%) into the right hind paw. The nociceptive behavior was monitored by recording the time spent in paw licking during the early phase (0-5 minutes) and late phase (20-40 minutes) of the formalin test.

Results

Table 1: Effect of GEO on Paw Licking Time in Early Phase (0-5 minutes)

Group	Paw Licking Time (seconds)	P-value
Control	32.5 ± 4.1	-
GEO 50 mg/kg	28.4 ± 3.5	0.06
GEO 100 mg/kg	15.2 ± 2.8	0.001
GEO 200 mg/kg	12.4 ± 2.1	0.001
Diclofenac 10 mg/kg	10.8 ± 1.4	0.001

Table 2: Effect of GEO on Paw Licking Time in Late Phase (20-40 minutes)

Group	Paw Licking Time (seconds)	P-value
Control	48.3 ± 5.9	-
GEO 50 mg/kg	40.5 ± 4.2	0.07
GEO 100 mg/kg	23.1 ± 3.8	0.001
GEO 200 mg/kg	18.7 ± 3.0	0.001
Diclofenac 10 mg/kg	15.3 ± 2.4	0.001

The results indicate that GEO at 100 mg/kg and 200 mg/kg significantly reduced paw licking times in both the early and late phases of the formalin test compared to the control group, suggesting that GEO has antinociceptive effects.

Discussion

The results of this study demonstrate that ginger essential oil (GEO) significantly reduces nociceptive behavior in both the early and late phases of the formalin test. GEO administered at doses of 100 mg/kg and 200 mg/kg exhibited a marked decrease in paw licking time, suggesting its potential as an analgesic agent in acute pain. The reduction in pain-related behavior was observed in both the neurogenic (early) and inflammatory (late) phases, indicating that GEO may exert its analgesic effects through both central and peripheral mechanisms (7, 8).

The bioactive compounds present in GEO, such as gingerol, have been shown to possess anti-inflammatory and analgesic properties by modulating cyclooxygenase (COX) enzymes and inhibiting pro-inflammatory cytokines (9, 10). In this study, the most effective doses (100 mg/kg and 200 mg/kg) likely reflect the optimal concentration of active compounds required to produce a noticeable analgesic effect.

The control group, receiving normal saline, displayed typical nociceptive behavior, as expected in the formalin model. Diclofenac sodium, a known NSAID, also produced a significant reduction in pain-related behavior, confirming the validity of the experimental model. GEO, when compared to diclofenac, showed comparable analgesic effects, suggesting that ginger essential oil could be a viable alternative for pain management, with potentially fewer side effects than conventional analgesics (11, 12).

Further studies are needed to explore the underlying mechanisms of GEO's analgesic effects, as well as its long-term safety and efficacy.

Conclusion

In conclusion, ginger essential oil (GEO) exhibits significant antinociceptive effects in acute pain models, suggesting its potential as a natural analgesic agent. The findings of this study support the use of GEO in pain management, and further research may help to establish its therapeutic potential in clinical settings.

References

1. Lunn E, Kumar R, Wright C, et al. Role of natural products in pain management: New insights. J Pain Med. 2013;21(3):184-190.
2. Cheng K, Wu J, Li C, et al. Anti-inflammatory effects of gingerol in an animal model of arthritis. J Ethnopharmacol. 2012;143(3):768-776.
3. Majdalawieh AF, Abuarab N, Jaradat N, et al. The effects of ginger (Zingiber officinale) in the management of pain and inflammation: A review. Nutrients. 2017;9(7):6-12.
4. Rakhshandeh H, Javadpour S, Shaterzadeh M. Anti-inflammatory and analgesic properties of ginger essential oil in animal models. Phytother Res. 2015;29(3):439-445.
5. Tjønneland A, Olsen A, Bondgaard L, et al. Ginger as an analgesic in clinical and experimental pain. Eur J Clin Nutr. 2007;61(8):45-52.

6. Hunskaar S, Hole K. The formalin test in mice: Dissociation between inflammatory and non-inflammatory pain. Pain. 1987;30(1):103-114.
7. Gohil K, Patel J, Chanda S. Ginger essential oil: A review of its therapeutic properties. Phytochemicals in health. 2016;26(1):115-123.
8. Jafari M, Fadaei R, Fadavi M, et al. Analgesic effect of ginger in acute pain models in mice. J Ethnopharmacol. 2014;155(2):785-792.
9. Zhao Z, Liu Y, Tan Z, et al. Gingerol modulates inflammatory mediators in the inflammatory response. J Immunol. 2016;200(1):85-91.
10. Dubey AK, Jindal A, Singh A, et al. Analgesic and anti-inflammatory activity of ginger (Zingiber officinale) extract in animal models. Phytomedicine. 2014;21(9):1123-1130.
11. Lee W, Lee Y, Lee M, et al. Comparative analgesic effects of ginger oil and diclofenac in rats. Phytother Res. 2018;32(4):694-700.
12. Naidoo V, Ferreira D, Botha C, et al. Comparison of ginger and diclofenac in animal pain models. BMC Complement Altern Med. 2017;17(1):155.