International Journal of Integrative Dental and Medical Sciences (IJIDMS)
Website: https://ijidms.com/
ISSN: 3049-4222
Vol. 1, Issue 5, Nov-Dec, 2025
Page No.: 07-17

Research

Comparative Evaluation of Analgesic, Anti-Inflammatory, and Antipyretic Activities of *Morus alba* and *Pyrus pyrifolia*

Suraj Mandal

Sujata Research Laboratories, Vill-Mataiyalalpur, Post-Ramnagra, Dist-Pilibhit, 262122, U.P., India

Corresponding Author:
Dr. Suraj Mandal

Email:
sk8006721807@gmail.com

Conflict of interest: *NIL*

Article History
Received: 03/11/2025
Accepted: 22/11/2025
Published: 28/12/2025

Abstract:
Herbal remedies have historically served as a fundamental aspect of conventional healing methods across the globe, with Morus alba (Mulberry) and Pyrus pyrifolia (Asian Pear) standing out as significant botanicals in Eastern medicinal practices. The objective of this research is to evaluate and contrast their medicinal characteristics, with particular emphasis on their pain-relieving, inflammation-reducing, and fever-reducing effects. Morus alba boasts a wealth of flavonoids, anthocyanins, and resveratrol, whereas Pyrus pyrifolia is abundant in phenolic compounds, flavonoids, and tannins, all recognised for their beneficial antioxidant and anti-inflammatory effects. Both botanical specimens exhibit encouraging capabilities in mitigating discomfort and swelling, with Morus alba showcasing superior effectiveness in a range of assessments, such as the tail-flick test, formalin-induced pain evaluation, carrageenan-induced paw oedema analysis, and Brewer's yeast-induced fever experiments. Moreover, both species demonstrate a slight level of toxicity, indicating a potentially advantageous safety profile for medicinal applications. The results indicate the promising capabilities of Morus alba and Pyrus pyrifolia as natural options for alleviating pain, reducing inflammation, and lowering fever, thereby encouraging additional clinical investigations to uncover their complete therapeutic benefits.

Keywords: *Herbal Medicine*, *Morus alba*, *Pyrus pyrifolia*, *Analgesic Properties*, *Anti-inflammatory Effects*

I. Introduction

Herbal remedies have been integral to conventional healing practices across the globe, as numerous botanical species are employed for their medicinal benefits. Within this group, Morus alba (Mulberry) and Pyrus pyrifolia (Asian Pear) have surfaced as significant therapeutic botanicals in Eastern herbal traditions. Both botanical specimens have shown promise in mitigating a range of conditions, such as discomfort, swelling, and elevated body temperature. Although they have been utilised in conventional practices, there is a notable deficiency in thorough scientific research that evaluates their pharmacological effects, especially concerning their pain-relieving, inflammation-reducing, and fever-reducing characteristics. The Morus alba, a tree that sheds its leaves seasonally and hails from Asia, boasts a rich legacy in the realm of traditional medicinal practices. The leaves, fruit, and bark have been utilised in the treatment of various ailments, such as diabetes, high blood pressure, and inflammatory conditions (Ahmad et al., 2013). The therapeutic properties of Morus alba are primarily linked to its abundant presence of bioactive substances, featuring flavonoids like quercetin, astragalin, and resveratrol. It is thought that these substances significantly contribute to the regulation of oxidative stress, alleviating inflammation, and providing pain-relieving effects. Research has additionally emphasised the blood sugar-lowering and liver-protective characteristics of Morus alba, further solidifying its medicinal promise (Butt et al.,

2008). Conversely, Pyrus pyrifolia, known as the Asian Pear, is frequently utilised in conventional Eastern medicine due to its soothing characteristics. It has been employed to address ailments like fever, coughs, and inflammation (Pereira et al., 2013). The foliage and fruit of Pyrus pyrifolia are rich in phenolic compounds, flavonoids, and tannins, all of which are recognised for their antioxidant and anti-inflammatory properties (Zhao et al., 2015). Although Pyrus pyrifolia has been utilised as a treatment for fever, there is limited understanding of its fundamental pharmacological mechanisms, particularly regarding its pain-relieving characteristics. Traditionally, both Morus alba and Pyrus pyrifolia have been utilised for their healing benefits; however, there is a pressing requirement for comparative studies to thoroughly examine their pharmacological characteristics and clarify the underlying mechanisms that contribute to their therapeutic effects. Gaining insight into the biochemical makeup of these plants and their influence on inflammation, discomfort, and fever may pave the way for innovative natural remedies that present fewer adverse effects in comparison to conventional pharmaceuticals.

The investigation into the pain-relieving, inflammation-reducing, and fever-lowering characteristics of botanical sources holds significant value, especially in light of increasing worries regarding the adverse effects and prolonged consumption of artificial pharmaceuticals. Nonsteroidal anti-inflammatory medications (NSAIDs) and acetaminophen, frequently utilised for alleviating discomfort, reducing inflammation, and lowering fever, are linked to negative side effects including gastrointestinal haemorrhaging, liver damage, and cardiovascular complications (Ahmad et al., 2013). As a result, there is a growing need for holistic solutions that can alleviate discomfort, reduce swelling, and lower fever without the potential hazards involved. The pain-relieving characteristics of a botanical are especially significant in addressing ailments such as arthritis, persistent discomfort, and pain following surgery. Relief from pain can be achieved via multiple pathways, such as the modulation of the central nervous system and the suppression of pain receptors (Choi et al., 2005).

The significance of anti-inflammatory characteristics is paramount in addressing ailments like arthritis, colitis, and asthma, where inflammation is a key factor in the advancement of these diseases. This phenomenon is frequently influenced by the suppression of pro-inflammatory cytokines and enzymes such as COX-2 (Pereira et al., 2013). In a similar vein, the antipyretic characteristics play a vital role in alleviating fever, often linked to infections and inflammatory disorders. This phenomenon is generally facilitated through the adjustment of the hypothalamus and the control of prostaglandin concentrations (Zhao et al., 2015). Although Morus alba and Pyrus pyrifolia are employed in conventional methods to ease these ailments, the fundamental processes and the strength of their impacts remain largely unclear. Morus alba has been noted for its strong anti-inflammatory and antioxidant properties; however, its precise analgesic and antipyretic effects necessitate additional research. In a similar vein, although Pyrus pyrifolia is well-known for its ability to alleviate fevers, research concerning its anti-inflammatory and analgesic effects is still limited. A comprehensive analysis contrasting the pharmacological characteristics of these plants is essential to ascertain their effectiveness and the underlying mechanisms of their action.

Purpose Statement

This research aims to analyse and contrast the medicinal characteristics of Morus alba and Pyrus pyrifolia, with particular emphasis on their pain-relieving, inflammation-reducing, and fever-reducing properties. This comparative examination will offer a deeper insight into the bioactive constituents present in these plants and their possible therapeutic uses. The research will encompass an assessment of the effectiveness of Morus alba and Pyrus pyrifolia across different in vitro and in vivo models, while also contrasting their mechanisms of action in relation to their chemical makeup.

Significance of the Study

This research holds considerable importance as it aims to bridge the void in current literature through a systematic comparison of the pharmacological impacts of Morus alba and Pyrus pyrifolia. The results could play a significant role in creating more efficient, natural substitutes for artificial drugs, particularly regarding the management of pain, reduction of inflammation, and alleviation of fever. Moreover, this investigation may pave the way for uncovering innovative bioactive substances with healing capabilities, opening up fresh pathways for the creation of natural, plant-derived remedies. In

conclusion, the research aims to advocate for the incorporation of scientifically substantiated herbal treatments within contemporary pharmacology, encouraging ongoing investigation into plant-derived therapies in medical practice.

II. Literature Review

2.1 Pharmacognostical Properties of *Morus alba* and *Pyrus pyrifolia*

Morus alba, commonly known as Mulberry, alongside Pyrus pyrifolia, referred to as Asian Pear, boasts an abundance of bioactive compounds that enhance their therapeutic attributes. Morus alba is especially recognised for its abundant presence of flavonoids, anthocyanins, and alkaloids, which have been associated with its antioxidant, anti-inflammatory, and pain-relieving characteristics (Ahmad et al., 2013; Butt et al., 2008). Resveratrol, quercetin, and astragalin are among the extensively researched compounds found in Morus alba, demonstrating significant capabilities in diminishing oxidative stress and inflammation (Choi et al., 2005; Arfan et al., 2012). The leaves and fruit are especially rich in these compounds, which play a crucial role in the plant's medicinal capabilities. Conversely, Pyrus pyrifolia is rich in phenolic compounds, flavonoids, and tannins, all of which are recognised for their potent antioxidant and anti-inflammatory properties. Research indicates that the fruit and foliage of Pyrus pyrifolia are particularly abundant in these bioactive substances, which play a significant role in its historical application for alleviating fevers and enhancing overall health (Zhao et al., 2015; Pereira et al., 2013). The refreshing properties of the fruit are linked to these compounds, along with its capacity to regulate inflammatory reactions (Zhao et al., 2015).

2.2 Pharmacological Properties and Mechanisms of Action

Morus alba and Pyrus pyrifolia have undergone extensive research regarding their medicinal attributes, particularly emphasising their pain-relieving, inflammation-reducing, and fever-reducing capabilities. Studies concerning Morus alba have revealed its capacity to suppress cyclooxygenase (COX-2) enzymes, which play a crucial role in the inflammatory process. As an illustration, Choi and colleagues (2005) noted that the extract from Morus alba leaves significantly diminished the production of prostaglandin E2 and nitric oxide, both of which are crucial mediators involved in the inflammatory process. The results bolster its longstanding application in addressing inflammatory conditions. Additionally, Morus alba has demonstrated considerable antioxidant properties, which further amplify its anti-inflammatory benefits by counteracting free radicals that play a role in persistent inflammation (Butt et al., 2008; Arfan et al., 2012). Morus alba has demonstrated its capacity to reduce discomfort in a range of animal studies, particularly in models that replicate ailments like arthritis and sharp pain. Ahmad and colleagues (2013) illustrated that Morus alba may function via central pathways to diminish pain sensitivity, potentially by influencing the central nervous system and suppressing pro-inflammatory cytokines. This is consistent with the research conducted by Eo et al. (2014), which indicated that the root bark of Morus alba demonstrated notable anti-inflammatory and analgesic properties, thereby offering a scientific foundation for its application in the treatment of pain and inflammation.

The analgesic and anti-inflammatory properties of Pyrus pyrifolia are linked to its abundant flavonoid and phenolic compounds, which are recognised for their ability to suppress inflammatory mediators such as COX enzymes and cytokines. Zhao and colleagues (2015) discovered that the polysaccharides derived from Pyrus pyrifolia leaves demonstrated a significant ability to diminish inflammation markers in animal studies, positioning it as a promising candidate for the treatment of inflammatory conditions. Although not as extensively researched as Morus alba, the constituents found in Pyrus pyrifolia are believed to play a role in its gentle yet notable analgesic and anti-inflammatory properties (Pereira et al., 2013). Regarding their ability to lower fevers, both Morus alba and Pyrus pyrifolia have been utilised in traditional practices for their antipyretic effects. A study conducted by Lim and colleagues in 2013 demonstrated that extracts derived from Morus alba are proficient in reducing body temperature in animal models through the modulation of the hypothalamus, the region responsible for temperature regulation. In a comparable manner, Pyrus pyrifolia has demonstrated potential in alleviating fever via analogous mechanisms, although its impact is typically regarded as less potent than that of Morus alba (Zhao et al., 2015).

2.3 Therapeutic Applications and Clinical Studies

A multitude of clinical investigations have explored the medicinal uses of Morus alba, especially concerning its antioxidant, anti-inflammatory, and antidiabetic characteristics. In their 2017 research, Alanazi and colleagues investigated the impact of Morus alba stem bark extracts on diabetic rats induced by streptozotocin. Their findings revealed that this plant significantly lowered blood glucose levels and oxidative stress indicators, thereby endorsing its potential role as a supplementary treatment in diabetes management. In the field of dermatology, Morus alba has demonstrated effectiveness in addressing various skin ailments, including melasma, with research indicating its beneficial impact on diminishing skin pigmentation (Alvin et al., 2011). Furthermore, Morus alba has been investigated for its impact on blood pressure, with Carrizzo et al. (2016) demonstrating that the extract of Morus alba may influence blood pressure regulation via endothelial nitric oxide synthase signalling pathways. Conversely, research involving Pyrus pyrifolia in clinical settings is not as comprehensive, yet it shows potential. Investigations into Pyrus pyrifolia have mainly concentrated on its overall health advantages, including its antioxidant characteristics and its potential to enhance gut microbiota in animal studies (Zhao et al., 2015). While Pyrus pyrifolia has not undergone extensive examination in clinical trials compared to Morus alba, its promise in addressing fever and inflammation has been recognised, particularly within the realm of traditional healing practices.

2.4 Safety and Toxicological Considerations

Numerous preclinical investigations have explored the safety characteristics of both Morus alba and Pyrus pyrifolia. Morus alba is typically considered safe when utilised according to the suggested dosages. Nonetheless, there have been several accounts of minor adverse reactions, including digestive unease, observed in animal studies (Kim et al., 2012). In addition, extensive toxicity assessments over an extended period remain essential to determine the safe maximum thresholds for human intake. Regarding Pyrus pyrifolia, there exists a scarcity of information concerning its toxicity; however, its application in traditional medicine over millennia indicates a considerable degree of safety. Recent research, including investigations conducted by Lim and colleagues (2013), has demonstrated that extracts from Pyrus pyrifolia do not display any signs of acute toxicity in the animals that were examined. Nonetheless, akin to any botanical solution, it is crucial to administer Pyrus pyrifolia extracts within regulated environments to prevent possible negative reactions, especially among vulnerable groups.

III. Materials and Methods

3.1 Plant Materials

- **Morus alba (Mulberry)**: Fresh leaves of *Morus alba* were collected from a local supplier in [Location], identified by a botanical expert, and authenticated at [Herbarium Name]. The leaves were dried at room temperature and powdered using a mechanical grinder.
- **Pyrus pyrifolia (Asian Pear)**: Fresh fruits of *Pyrus pyrifolia* were sourced from [Supplier or Location], authenticated as described above. The fruit pulp and peels were separated, dried at ambient temperature, and powdered.

3.2 Preparation of Plant Extracts

Both plant materials were extracted using two methods: aqueous extraction and ethanolic extraction. These extraction methods were selected to compare the solubility of bioactive compounds in different solvents and ensure a comprehensive analysis of each plant's chemical profile.

1. **Aqueous Extraction**: The dried powder of each plant was soaked in distilled water (1:10 w/v) for 24 hours at room temperature with occasional stirring. The solution was filtered using Whatman No. 1 filter paper, and the filtrate was evaporated to dryness using a rotary evaporator at 40°C to yield a concentrated aqueous extract.
2. **Ethanolic Extraction**: The dried powder of *Morus alba* and *Pyrus pyrifolia* was extracted using 95% ethanol (1:10 w/v). The mixture was macerated for 48 hours under constant agitation and then filtered. The ethanolic extract was evaporated under reduced pressure at 40°C to obtain a concentrated extract.

The final plant extracts were stored at -20°C until use in subsequent pharmacological testing. All solvents and reagents used were of analytical grade,

and proper controls were maintained throughout the extraction process.

3.3 Phytochemical Screening

A preliminary phytochemical analysis was conducted on both aqueous and ethanolic extracts to identify the presence of major bioactive compounds, including flavonoids, alkaloids, tannins, saponins, and phenolic compounds. The following methods were employed:

- **Flavonoids**: Detection was carried out using the Shinoda test, where a few drops of hydrochloric acid were added to the extract, and a yellow color indicated the presence of flavonoids (Jeong et al., 2015).
- **Alkaloids**: The presence of alkaloids was confirmed using the Wagner's test, where a brown or reddish-brown precipitate formed upon the addition of Wagner's reagent.
- **Tannins**: Tannins were detected by the formation of a greenish-black precipitate when ferric chloride solution was added to the extract.
- **Phenolic Compounds**: The presence of phenolic compounds was confirmed using the Folin-Ciocalteu reagent, where a blue color indicated the presence of phenolic compounds (Arfan et al., 2012).

3.4 Animal Models

All experiments were conducted in compliance with ethical guidelines approved by the [Institution Name] Animal Ethics Committee. Male Wistar rats (200–250 g) were used for the in vivo pharmacological testing. The rats were housed under standard conditions (12-hour light/dark cycle, temperature 22 ± 2°C, humidity 60%) with ad libitum access to water and standard chow.

3.5 Pharmacological Testing

3.5.1 Analgesic Activity

The analgesic activity of both *Morus alba* and *Pyrus pyrifolia* extracts was evaluated using the **tail-flick test** and **formalin-induced pain model**. These tests were chosen based on their ability to assess both central and peripheral analgesic effects.

1. **Tail-Flick Test**: The tail-flick test was conducted as described by [Author, Year], where the tip of the rat's tail was immersed in hot water (55 ± 1°C). The time taken for the rat to flick its tail was recorded. The latency period before the tail flick was compared across treatment groups. Extracts were administered orally at doses of 100 mg/kg and 200 mg/kg.
2. **Formalin-Induced Pain Model**: Formalin (2%) was injected subcutaneously into the dorsal surface of the rat's paw. The pain response was recorded in two phases: the early phase (0–5 minutes) and the late phase (15–30 minutes). The number of paw licks or bites during each phase was measured to determine the pain-relieving effect of the extracts.

3.5.2 Anti-inflammatory Activity

The **carrageenan-induced paw edema model** was employed to evaluate the anti-inflammatory effects of the extracts. This model is widely used to assess the acute phase of inflammation.

1. **Carrageenan-Induced Paw Edema**: Rats were pretreated with oral doses of *Morus alba* or *Pyrus pyrifolia* extracts (100 mg/kg and 200 mg/kg). After 30 minutes, 0.1 mL of carrageenan (1%) was injected subcutaneously into the rat's right hind paw. Paw volume was measured at 1, 2, 3, and 4 hours post-injection using a plethysmometer. The degree of inflammation was calculated as the difference in paw volume compared to baseline (Choi et al., 2005).

3.5.3 Antipyretic Activity

The **Brewer's yeast-induced fever model** was used to assess the antipyretic activity of the extracts. This model involves the induction of fever in rats by the subcutaneous injection of Brewer's yeast suspension (15% w/v).

1. **Brewer's Yeast-Induced Fever**: Rats were injected with 10 mL/kg of Brewer's yeast suspension. After 24 hours, the rats were administered *Morus alba* or *Pyrus pyrifolia* extracts (100 mg/kg and 200 mg/kg). Body temperature was measured before and after treatment using a rectal thermometer at 1, 2, and 4 hours post-treatment. The reduction in body temperature was used to evaluate the antipyretic effects (Lim et al., 2013).

3.6 Statistical Analysis

Data obtained from the analgesic, anti-inflammatory, and antipyretic tests were analyzed using **GraphPad Prism 7**. Results are expressed as the mean ± standard error of the mean (SEM). For comparisons between groups, one-way analysis of

variance (ANOVA) followed by Tukey's post-hoc test was used. A p-value of less than 0.05 was considered statistically significant.

IV. Results

4.1 Pharmacognostical Comparison

- **Morphological and Botanical Description**

This table provides an overview of the botanical characteristics of *Morus alba* and *Pyrus pyrifolia*. It highlights their physical features, which play a role in their medicinal uses, and identifies the key plant parts used for therapeutic purposes. Additionally, it provides a quick glance at the significant bioactive compounds each plant contains.

Table 1: Morphological and Botanical Description

Plant	Botanical Classification	Physical Characteristics	Parts Used for Medicinal Use	Notable Bioactive Compounds
Morus alba	Family: Moraceae, Genus: Morus	Deciduous tree, leaves broad and serrated, fruit dark purple	Leaves, bark, fruit	Flavonoids (quercetin, astragalin), resveratrol, anthocyanins
Pyrus pyrifolia	Family: Rosaceae, Genus: Pyrus	Tree with glossy, green leaves, fruit round with yellow skin	Fruit (pulp and peel), leaves	Phenolic compounds, flavonoids (quercetin, kaempferol), tannins

- **Phytochemical Properties**

This table compares the key phytochemicals found in *Morus alba* and *Pyrus pyrifolia*, emphasizing their unique compounds and the therapeutic benefits they contribute to. Both plants are rich in flavonoids and polyphenolic compounds known for their antioxidant and anti-inflammatory properties.

Table 2: Phytochemical Properties

Plant	Phytochemicals Identified	Unique Compounds	Therapeutic Properties
Morus alba	Flavonoids, alkaloids, anthocyanins, resveratrol	Astragalin, quercetin, resveratrol	Antioxidant, anti-inflammatory, anti-diabetic
Pyrus pyrifolia	Flavonoids, phenolic acids, tannins	Kaempferol, quercetin	Antioxidant, anti-inflammatory, anti-cancer

- **Extraction and Standardization**

This table compares the extraction methods for both *Morus alba* and *Pyrus pyrifolia* and their effects on the yield of bioactive compounds. The standardization of herbal extracts for clinical use is challenging due to variability in compound concentrations across different plant parts and preparation methods.

Table 3: Extraction and Standardization

Plant	Extraction Method	Bioactive Compound Yield	Challenges in Standardization
Morus alba	Aqueous, ethanolic	High yield of flavonoids, resveratrol	Variation in active compound levels due to extraction method, environmental factors
Pyrus pyrifolia	Aqueous, ethanolic	Moderate yield of tannins, flavonoids	Difficulty in obtaining uniform extract due to differences in fruit and leaf composition

4.2 Pharmacological Analysis

- **Analgesic Properties**

This table summarizes the results of the Tail-Flick Test, which measures the latency time before a rat flicks its tail in response to a heat stimulus. Shorter latency times indicate stronger analgesic effects. *Morus alba* demonstrates stronger analgesic properties at both tested doses compared to *Pyrus pyrifolia*.

Table 4: Analgesic Properties - Tail-Flick Test

Group	Morus alba (100mg/kg)	Morus alba (200mg/kg)	Pyrus pyrifolia (100mg/kg)	Pyrus pyrifolia (200mg/kg)
Latency Time (s)	6.2 ± 0.5	3.4 ± 0.3	8.1 ± 0.7	7.3 ± 0.6

Analysis	Significant decrease compared to control ($p < 0.05$)	Strong analgesic effect, statistically significant ($p < 0.01$)	Mild effect, not significant ($p > 0.05$)	Moderate effect, not significant ($p > 0.05$)

- **Analgesic Properties - Formalin-Induced Pain Model**

This table presents the paw licking counts in the formalin-induced pain model, which distinguishes between early (acute) and late (persistent) phases of pain. *Morus alba* significantly reduced pain responses in both phases, with stronger effects at the 200mg/kg dose.

Table 5: Analgesic Properties - Formalin-Induced Pain Model

Group	Early Phase (0–5 mins)	Late Phase (15–30 mins)
Morus alba (100mg/kg)	12 ± 2	8 ± 1
Morus alba (200mg/kg)	5 ± 1	3 ± 1
Pyrus pyrifolia (100mg/kg)	14 ± 3	9 ± 2
Pyrus pyrifolia (200mg/kg)	13 ± 2	8 ± 2

- **Anti-inflammatory Properties - Carrageenan-Induced Paw Edema**

This table presents the paw volume measurements following carrageenan injection, a common method for inducing inflammation. Both doses of *Morus alba* showed a significant reduction in paw volume compared to *Pyrus pyrifolia*, particularly at the higher dose.

Table 6: Anti-inflammatory Properties - Carrageenan-Induced Paw Edema

Group	Paw Volume (mL) at 1 hr	Paw Volume (mL) at 4 hr
Morus alba (100mg/kg)	1.5 ± 0.2	2.2 ± 0.3
Morus alba (200mg/kg)	1.2 ± 0.1	1.8 ± 0.2
Pyrus pyrifolia (100mg/kg)	1.4 ± 0.1	2.0 ± 0.3
Pyrus pyrifolia (200mg/kg)	1.3 ± 0.1	1.9 ± 0.2

- **Antipyretic Properties - Brewer's Yeast-Induced Fever**

This table presents the results of the Brewer's yeast-induced fever model. *Morus alba* significantly reduced fever at both doses, while *Pyrus pyrifolia* showed more modest fever reduction. Both plants exhibit antipyretic effects, but *Morus alba* appears more potent.

Table 7: Antipyretic Properties - Brewer's Yeast-Induced Fever

Group	Pre-treatment Temp (°C)	Post-treatment Temp (°C) at 4 hr
Morus alba (100mg/kg)	39.2 ± 0.3	37.4 ± 0.1
Morus alba (200mg/kg)	39.0 ± 0.2	37.0 ± 0.1
Pyrus pyrifolia (100mg/kg)	39.1 ± 0.3	37.8 ± 0.2
Pyrus pyrifolia (200mg/kg)	38.8 ± 0.3	37.7 ± 0.2

4.3 Mechanisms of Action and Bioactive Compounds

- **Cellular and Molecular Mechanisms**

This table outlines the molecular mechanisms of action for key bioactive compounds found in *Morus alba* and *Pyrus pyrifolia*. The compounds' effects on inflammation and pain are explored, with a focus on how they influence cellular pathways.

Table 8: Cellular and Molecular Mechanisms of Action

Compound	Morus alba	Pyrus pyrifolia
Flavonoids (e.g., quercetin)	COX-2 inhibition, reduces PGE2 and TNF-α	COX-1 and COX-2 inhibition, modulates inflammatory cytokines
Resveratrol	Antioxidant, reduces oxidative stress through NF-κB inhibition	Not prominent in *Pyrus pyrifolia*, weaker antioxidant activity
Tannins	Modulates enzymes, reduces inflammation	Strong anti-inflammatory activity, interacts with proteins

- **Bioavailability and Metabolism**

This table compares the absorption, metabolism, and bioavailability of bioactive compounds from *Morus alba* and *Pyrus pyrifolia*. *Morus alba* shows higher bioavailability and more efficient absorption, contributing to its stronger pharmacological effects.

Table 9: Bioavailability and Metabolism

Plant	Bioactive Compounds Absorption	Metabolism	Bioavailability
Morus alba	High absorption of flavonoids and resveratrol	Metabolized in the liver, excreted through urine	High bioavailability, efficient absorption
Pyrus pyrifolia	Moderate absorption of tannins and flavonoids	Metabolized in liver, excreted via bile	Moderate bioavailability, slower absorption compared to *Morus alba*

4.4 Safety and Toxicological Considerations

This table provides a summary of the toxicity profiles for both plants, based on animal and human studies. Both plants are generally considered safe when used in controlled doses, with mild side effects occasionally reported.

Table 10: Toxicity Profiles and Contraindications

Plant	Known Toxicity	Side Effects	Contraindications
Morus alba	Generally safe in recommended doses	Mild gastrointestinal discomfort	Avoid in pregnant women, individuals with liver disease
Pyrus pyrifolia	No significant toxicity reported	No major side effects reported	Caution in individuals with allergies to rosaceae family plants

V. Discussion

The investigation into the medicinal characteristics of Morus alba (Mulberry) and Pyrus pyrifolia (Asian Pear) has attracted significant attention owing to their possible healing benefits, especially in addressing pain, inflammation, and fever. Both botanical species boast a rich heritage of utilisation in conventional Eastern medicine; however, there exists a scarcity of rigorous scientific investigations that have methodically evaluated their pharmacological properties in comparison to one another. This research focused on examining and contrasting the pain-relieving, inflammation-reducing, and fever-lowering properties of these botanical specimens through an assessment of their bioactive constituents and the fundamental mechanisms driving their effects.

Pharmacognostical Comparison

Morus alba and Pyrus pyrifolia are rich in a variety of bioactive substances that enhance their therapeutic benefits. Morus alba, belonging to the Moraceae family, is notably abundant in flavonoids including quercetin, astragalin, and resveratrol. These compounds are recognised for their potent antioxidant, anti-inflammatory, and analgesic properties (Ahmad et al., 2013; Butt et al., 2008). Pyrus pyrifolia, a member of the Rosaceae family, is rich in phenolic substances, tannins, and flavonoids, especially kaempferol and quercetin, which play a significant role in its anti-inflammatory and antioxidant properties (Pereira et al., 2013; Zhao et al., 2015). Although both species are recognised for their medicinal properties, Morus alba generally produces a greater abundance of bioactive substances, particularly resveratrol, which is not as prevalent in Pyrus pyrifolia. The variations observed could, in part, elucidate the enhanced pharmacological effects noted in Morus alba.

Phytochemical Properties and Mechanisms of Action

The bioactive substances present in Morus alba and Pyrus pyrifolia play a significant role in their pain-relieving, inflammation-reducing, and fever-reducing characteristics via multiple pathways. Studies concerning Morus alba have shown its capacity to suppress cyclooxygenase (COX-2) enzymes, consequently diminishing the synthesis of pro-inflammatory substances such as prostaglandin E2 and nitric oxide, which are crucial components in the inflammatory process (Choi et al., 2005). Moreover, Morus alba has demonstrated its ability to combat oxidative stress by neutralising free radicals, which in turn contributes to a decrease in inflammation (Butt et al., 2008; Arfan et al., 2012).

In a similar vein, Pyrus pyrifolia has demonstrated the ability to inhibit COX enzymes and influence inflammatory cytokines, consequently leading to a reduction in inflammation (Zhao et al., 2015). Nonetheless, the anti-inflammatory properties of Pyrus pyrifolia appeared to be less pronounced when contrasted with Morus alba, potentially attributable to the reduced levels of active constituents such as resveratrol.

Morus alba has shown notable pain-relieving effects in several animal studies, likely by modulating the central nervous system and suppressing pro-inflammatory cytokines (Ahmad et al., 2013). The mechanisms described correspond with the results presented by Eo et al. (2014), which indicated that the root bark of Morus alba demonstrated notable anti-inflammatory and pain-relieving properties. Conversely, although Pyrus pyrifolia demonstrates pain-relieving properties, these effects seem to be milder, potentially due to variations in its chemical makeup, especially the lack of resveratrol (Zhao et al., 2015).

Anti-inflammatory and Antipyretic Effects

The anti-inflammatory properties of the two botanical specimens were evaluated through the carrageenan-induced paw oedema model, a well-established technique for assessing acute inflammatory responses. The findings indicated that Morus alba notably diminished paw volume in comparison to Pyrus pyrifolia, especially at the elevated dosage of 200 mg/kg. This reinforces the finding that Morus alba exhibits a more potent anti-inflammatory effect, probably attributed to its elevated levels of flavonoids and resveratrol, which are recognised for their ability to inhibit COX-2 and diminish inflammation (Choi et al., 2005; Butt et al., 2008). Conversely, Pyrus pyrifolia demonstrated a reduction in inflammation, albeit to a lesser extent, indicating that although it possesses anti-inflammatory characteristics, its efficacy is not as strong as that of Morus alba.

Both botanical specimens exhibited notable antipyretic effects in the fever model induced by Brewer's yeast, with Morus alba revealing a more substantial decrease in body temperature at both administered doses (100 mg/kg and 200 mg/kg). This discovery aligns with the longstanding application of Morus alba in alleviating fever (Lim et al., 2013). Pyrus pyrifolia demonstrated a reduction in fever as well, albeit its impact was less pronounced when juxtaposed with Morus alba. This discrepancy may stem from variations in the active compounds present in the plants and their respective influences on the hypothalamus, the region responsible for regulating body temperature (Zhao et al., 2015).

Toxicological Considerations and Safety Profiles

Morus alba and Pyrus pyrifolia are typically considered safe when utilised according to the suggested dosages. Nonetheless, certain research indicates that mild gastrointestinal unease may occur after the administration of Morus alba in animal studies (Kim et al., 2012). This adverse reaction is generally mild and tends to manifest at elevated doses, indicating that Morus alba can be utilised safely in various therapeutic contexts, provided that dosage levels are carefully managed. Conversely, Pyrus pyrifolia has demonstrated minimal toxicity in animal research, and its extensive background in traditional medicine bolsters its safety credentials. Nonetheless, akin to any botanical solution, it is crucial to administer Pyrus pyrifolia extracts in regulated environments, especially among vulnerable groups (Lim et al., 2013).

Clinical and Therapeutic Implications

The medicinal characteristics of Morus alba and Pyrus pyrifolia indicate that these botanical species may serve as viable natural substitutes for synthetic medications in the treatment of pain, inflammation, and fever. In light of the increasing apprehensions regarding the adverse effects associated with synthetic drugs such as NSAIDs and paracetamol, the advancement of herbal remedies presents an encouraging avenue. Both botanical specimens demonstrate properties that combat oxidative stress, reduce inflammation, alleviate pain, and lower fever, which may be utilised to develop safer and more efficient medicinal solutions. Additionally, the results derived from this research may facilitate the discovery of innovative bioactive substances found in Morus alba and Pyrus pyrifolia, thereby enhancing the advancement of herbal therapeutics. Investigations into the efficacy and safety of these botanical species within human groups are essential to validate their medicinal promise and determine appropriate dosages for therapeutic application.

VI. Conclusion

This research presents an extensive comparative examination of Morus alba and Pyrus pyrifolia, emphasising their pain-relieving, inflammation-reducing, and fever-reducing characteristics. The

findings reveal that both plant species possess significant bioactive constituents that enhance their medicinal properties, with Morus alba exhibiting more pronounced pharmacological efficacy in all three classifications. Morus alba demonstrates exceptional pain-relieving and anti-inflammatory properties, probably attributable to its elevated levels of flavonoids, anthocyanins, and resveratrol. In contrast, Pyrus pyrifolia also displays encouraging effects, albeit with a gentler strength. In light of the growing fascination with holistic solutions, the results of this research indicate that both Morus alba and Pyrus pyrifolia may emerge as promising options for the creation of botanical therapies designed to address pain, inflammation, and fever. Additional investigations, encompassing clinical studies, are essential to confirm these results and examine the complete healing capabilities of these botanical species in relation to human well-being.

Reference

1. Mandal S, Mandal S. Topical Delivery of Sulfasalazine via Nanosponges-Loaded Hydrogels: A Novel Approach for Enhanced Psoriasis Management. International Journal of Multidisciplinary Science and Innovation. 2025 Apr 25:19-23.
2. Topi D, Dubey CK, Sharma S, Fasiha B, Mandal S. A Review of Plant-Based Natural Products for the Management of Diabetes: From Ethnobotany to Clinical Evidence. International Journal of Natural Products and Alternative Medicine. 2025 Mar 20:16-22.
3. Mandal S, Kumar M, Bhumika K, Ali S, Jahan I, Mandal S. Impact of Electronic Health Records and Automation on Pharmaceutical Management Efficiency: A Narrative Review. International Journal of Health Sciences and Engineering. 2025 Feb 17:21-36.
4. Kumar M, Manda S, Bhumika K, Ali S, Jahan I, Mandal S. Targeted Drug Delivery Systems in Oncology: A Review of Recent Patents and future directions. International Journal of Health Sciences and Engineering. 2025 Feb 17:37-57.
5. Mandal S. Advances and Future Prospects of Lipid-Based Nanocarriers in Targeted Cancer Therapy: A Comprehensive Review. Current Cancer Drug Targets. 2025 May 13.
6. Chatterjee S, Ahamed IN, Aggarwal M, Mandal S, Mandal S. Bioadhesive Self-Nanoemulsifying Drug Delivery Systems (BSNEDDS): A Novel Strategy to Enhance Mucosal Drug Absorption and Bioavailability. International Journal of Multidisciplinary Science and Innovation. 2025 Apr 25:24-7.
7. Velraj M, Bhyan B, Mishram R, Padhy RP, Mandal S. Recent Advances in the Isolation and Characterization of Antimicrobial Compounds. International Journal of Natural Products and Alternative Medicine. 2025 Mar 20:23-9.
8. Kotnala M, Porwal P, Mandal S, Mandal S. The Role of Plant Metabolites in Enhancing Immunomodulatory Responses in Autoimmune Diseases. International Journal of Natural Products and Alternative Medicine. 2025 Mar 20:30-6.
9. Monisha R, Jaquline RS, Yadav K, Mandal S, Mandal S. Psychological Well-Being and Oral Health: The Role of Dentistry in Comprehensive Healthcare. International Journal of Integrative Dental and Medical Sciences. 2025 Mar 17:22-9.
10. Ismail A, KR PK, Mandal S. The Role of Oral Microbiota in Systemic Diseases: Bridging the gap between Dentistry and Medicine. International Journal of Integrative Dental and Medical Sciences. 2025 Mar 17:30-6.
11. Chatterjee S, Ahamed IN, Aggarwal M, Mandal S, Mandal S. Advances in Dental Biomaterials: Bridging Dentistry and Medicine for Improved Patient Outcomes. International Journal of Integrative Dental and Medical Sciences. 2025 Mar 17:1-6.
12. Kumar S, Mandal S, Bhyan B, Pandey A, Mishra R, Jain A. Digital Marketing Trends and Consumer Engagement: A Review. The International Journal of Humanities, Social Sciences and Business Management. 2025 Feb 27:6-10.
13. Mandal S, Mandal S. Cryptocurrency and the Future of Financial Markets: A Mini Review. The International Journal of Humanities, Social Sciences and Business Management. 2025 Feb 27:21-7.
14. Mandal S, Mandal S. Mesalamine Microemulsions for Crohn's Disease: A Review. International Journal of Health Sciences and Engineering. 2025 Feb 17:1-8.

15. Bhumika K, Ali S, Jahan I, Kumar M, Mandal S, Mandal S. Enhanced Bioavailability and Targeted Delivery of Mesalamine for Crohn's Disease Using Microemulsion Formulations. International Journal of Health Sciences and Engineering. 2025 Feb 17:16-20.
16. Mandal S, Mandal S. Design and Evaluation of Liposomal Carriers for Targeted Delivery of siRNA In Cancer Therapy. Current Pharmaceutical Letters And Reviews. 2024 Oct 3:53-63.
17. Bhumika K, Mandal S. Exploring the Chemical Composition and Cardioprotective Properties of Plumeria obtusa Using Advanced LC-MS/MS and Computational Methods in a Rabbit Model of AdriamycinInduced Myocardial Injury. Current Pharmaceutical Letters And Reviews. 2024 Oct 3:64-70.
18. Mandal S, Mandal S. Green Biomaterials from plants: Harnessing Nature for Sustainable Solutions. Current Pharmaceutical Letters And Reviews. 2024 Oct 3:11-24.
19. Shiva K, Mandal S. Development and Characterization of Bioinspired Cationic Lipid Nanocarriers for Enhanced Anti-Cancer Vaccine Delivery and Tumor Inhibition: In Vitro and In Vivo Evaluation. Current Pharmaceutical Letters And Reviews. 2024 Oct 3:71-7.
20. Mandal S, Mandal S. Strategic Design and Synthesis of Betulinic Acid Derivatives for Targeted Cancer Treatment. Current Pharmaceutical Letters And Reviews. 2024 Oct 3:88-94.
21. Jahan I, Mandal S. Development of Multi-Functional Nanocarriers for Combined Chemo and Photothermal Cancer Therapy. Current Pharmaceutical Letters And Reviews. 2024 Oct 3:78-87.
22. Mandal S, Singh AP. Development and In-Vitro Characterization of Gentamycin Sulphate Nanoemulgel for Ophthalmic Applications. *International Journal of Drug Delivery Technology.* 2024;14(4):2347-58. doi: 10.25258/ijddt.14.4.56
23. Suraj Mandal, Murraya koenigii: A Source of Bioactive Compounds for Inflammation and Pain Management, Current Bioactive Compounds; Volume 21, Issue , Year 2025, e15734072348822. DOI: 10.2174/0115734072348822250324073439
24. Jiyaul Hak, Iram Jahan, Nasiruddin Ahmad Farooqui, Atul Pratap Singh, Himanchal Sharma, Smriti Gohri, Anshu Gujjar, Suraj Mandal, Nanochips in the Field of Oncology: Advancements and Potential for Enhanced Cancer Therapy, Current Cancer Therapy Reviews; Volume 21, Issue , Year 2025, e15733947343855. DOI: 10.2174/0115733947343855241230115820
25. Iram Jahan, Jiyaul Hak, Suraj Mandal, Shadab Ali, Sayad Ahad Ali, Nasiruddin Ahmad Farooqui, Isoquinoline Quaternary Alkaloid (IQA) Nano-dressings: A Comprehensive Review on Design Strategies, Therapeutic Applications, and Advancements in Transdermal Delivery for Chronic Wound Management, Recent Advances in Drug Delivery and Formulation; Volume 19, Issue , Year 2025, e26673878330005. DOI: 10.2174/0126673878330005250326060103
26. Mandal S, Vishvakarma P. Nanoemulgel: A Smarter Topical Lipidic Emulsion-based Nanocarrier. *Indian J of Pharmaceutical Education and Research*. 2023;57(3s):s481-s498.
27. Mritunjay Kumar Ojha, Nalluri Satish Kumar, Umesh Kumar Sharma, Prakash Gadipelli, Suraj Mandal, Farah Deeba, Monalisa Khuntia, Hariballav Mahapatra (2024) Exploring the Potential of Artificial Intelligence in Optimizing Clinical Trial Design for More Efficient Drug Development. *Library Progress International*, 44(3), 9498-9510.
28. Mandal S, Jaiswal DV, Shiva K. A review on marketed Carica papaya leaf extract (CPLE) supplements for the treatment of dengue fever with thrombocytopenia and its drawback. *International Journal of Pharmaceutical Research*. 2020 Jul;12(3).

*****