
A Comprehensive Review of Ethnopharmacological Strategies in Post-C-Section Lumbar Pain Management

K Mythili¹, Dr. S. Prabakar², L.Swetha³, AP Saranya⁴, G.Rajeshwari⁵

¹²³⁴⁵Sona College of Technology, India

¹mythili.bme@sonatech.ac.in, ²prabakar.bme@sonatech.ac.in,

³swethalakshmanan160@gmail.com, ⁴saranyaap1334@gmail.com,

⁵gceema9@gmail.com

Abstract.

Most women experience painful lower back pain that is caused by conditions like menstrual cramps, endometriosis, bad posture, ovarian cysts, menopause, and especially after a C-section, where there can be chronic pain after giving birth. In this paper, we focus specifically on women who experience Lower Back Pain (LBP) from a Cesarean Section (C-section), which can be chronic. Causes of such chronic pain involve anesthesia given at the time of procedure, higher BMI, wrong posture, endocrine imbalance, excessive lifting, and extended lactation. Mainstream treatments in the form of exercises, hot or cold, and medication also often have a risk of adverse effects like dizziness and nausea. These are successfully treated using ethnopharmacological remedies with high anti-inflammatory and antioxidant activities. Numerous herbal derivatives have been used traditionally for their pharmacological effects, providing a pharmaceutical-free way of pain management. Their mechanism of action is consistent with the Gate Control Theory of Pain, acting as natural analgesics that modify inflammatory pain by blocking the NF- κ B pathway. This blockade prevents pro-inflammatory cytokines and enzymes from being formed and prevents local inflammation and pain transmission. By stimulating larger nerve fibers, these remedies facilitate the closure of the pain gate, thus alleviating discomfort. With few side effects and high ethnopharmacological efficacy, these herbal remedies are an ideal alternative to the treatment of LBP in women after C-section delivery. This review seeks to summarize and discuss the role of various ethnopharmacological remedies in the management of lower back pain, particularly in women after C-section delivery.

Keywords : Cesarean section, Ethnopharmacological interventions, Gate Control Theory, Lower back pain, Pain management

1. INTRODUCTION

Lower back pain (LBP) is becoming a common problem among women because of causes such as menstrual cramps, endometriosis, poor posture, ovarian cysts, menopause, and hormonal imbalance. In this chapter, the post-Caesarean section (C-section) pain is discussed, and how appropriate pain management and postoperative care are essential during this critical phase of motherhood is highlighted. A flowchart illustrates the treatment plan developed by researchers to manage pain in female patients undergoing a Csection.

A. Findings from Literature Insights

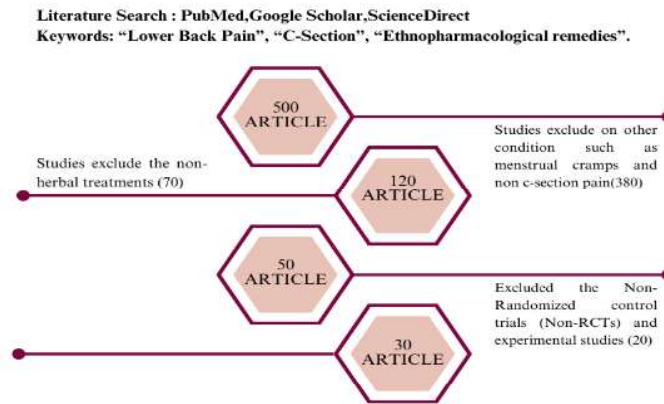


Figure 1: Flowchart on searching and selection of articles.

We conducted a comprehensive search across research databases, including PubMed, ScienceDirect, and Google Scholar, to gather multidisciplinary materials such as research articles, patents, theses, and books ([see Figure 1](#)). Initially, 300-400 articles were identified, but those that did not focus on conditions like C-section or natural remedies were excluded from our selection. This refinement process led to the identification of 50 relevant articles. Of these, an additional 20 articles were excluded based on their use of non-randomized controlled trials (RCTs) or experimental studies. Consequently, 30 articles with strong evidence on herbal medicine's role in pain management were retained for analysis.

B. Etiology of Pain

There are several factors involved in LBP in women after C-section, as shown in [Figure 2](#). Spinal anesthesia reduces lumbar lordosis and disrupts transmission of nociception, leading to chronic pain in nearly 80% of patients^[1,2,3]. Increased BMI puts excessive stress on the lower back, leading to posture and mobility impairment and also chronic inflammation^[1,3]. Poor posture, especially during breastfeeding and baby care, overstrains lumbar muscles and increases pain^[1,3,4]. Hormonal fluctuations, such as increases in relaxin levels, loosen the pelvic ligaments and result in pain and instability^[1,4]. Ascending and lifting heavy babies also contribute to lumbar strain, extend recovery time, and establish chronic LBP as a result.



Figure 2: Etiology of pain

C. Conventional Pain Management Therapy

Analgesic pharmacological treatment includes use of Over-the-Counter (OTC) medications and medication treatments, such as Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) Ibuprofen and Naproxen, analgesics Acetaminophen (Tylenol), opioid analgesics Oxycodone and Hydrocodone, muscle relaxants Cyclobenzaprine and Methocarbamol, anticonvulsants Gabapentin and Pregabalin, topical analgesics Lidocaine patches and Capsaicin cream, and corticosteroids Prednisone, which are short-term medications but cause gastrointestinal disorders and liver injuries^[1]. Physical therapy consists of exercise ordered by a therapist to enhance mobility

and reduce pain but potentially leading to muscle soreness, pain, and discomfort [4]. Heat and cold applications are a very common pain management technique, where heat in the form of a heating pad or warm compress is applied to relax spasms of the muscles and relieve pain, and cold is used to reduce inflammation, but repeated or inappropriate use can cause skin irritation, burns, pain, or frostbite[4]. Exercise, such as light activity involving walking and stretching, makes muscles stronger and more flexible but causes soreness and strain in muscles, especially when done incorrectly or excessively [4]. Massage therapy, such as Swedish and deep tissue massage, relaxes muscles and enhances circulation but at times causes temporary pain and bruising [4]. Transcutaneous Electrical Nerve Stimulation (TENS) is the process of using electrical stimulation to minimize pain, but it has short-term relief and sometimes causes skin irritation [4]. Techniques of relaxation like meditation and yoga are used in minimizing stress and pain with less side effects and are thus an effective and safe approach to pain management [4].

2. ETHNOPHARMACOLOGICAL REMEDIES FOR LOW BACK PAIN AFTER CESAREAN SECTION

Ethnopharmacology is the science of medicinal plants and their traditional uses in healing. Natural remedies have been used by many cultures for centuries to manage pain. These herbal remedies have bioactive compounds that are responsible for pain management and inflammation reduction as indicated in [Figure 3](#) and [Figure 4](#).

St. John's Wort: *Hypericum perforatum* is a well-known medicinal herb known for its use for centuries, native to Europe and Asia [5,16]. Some of the active principles in the genus include hyperforin, hypericin, and flavonoids, attributing its promising pharmacologic action. Used in herbal medicine, this herb finds a wide application in tea, extracts, and capsules [5,16,17].78

Ginger: *Zingiber officinale* is a Southeast Asian native plant that has become one of the most popularly used spices and medicinal herbaceous plants globally [5,12,15]. It includes bioactive substances such as gingerols and shogaols, fresh and dried ginger. Ginger has been used both as traditional medicine and in food and culinary preparations and supplements made in capsule form, teas, and extracts [5,12,15]

Turmeric: *Curcuma longa*, hailing from the Indian subcontinent and Southeastern Asia, is a golden-yellow condiment extensively employed in cooking, Ayurveda, and traditional Chinese medicine [5,11,12,13]. The chief bioactive compound of turmeric known as curcumin has potent anti-inflammatory and antioxidant properties, which helps significantly with the treatment of pain, especially in that related to arthritis and joint pains [5,11,12,13].

Nuts And Seeds: Nuts and seeds like walnuts, flaxseeds, and chia seeds are some of the finest plant-based sources of omega-3 fatty acids [5,14,27]. They contain alpha-linolenic acid (ALA), while its marine sources provide eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Foods rich in omega-3 fats are popular in daily diets, while concentrated sources are widely used in supplements [5,14,27].

Capsaicin: Chili peppers, originally domesticated on American continents, are of the genus *Capsicum annum*. Dishes and medicine employ this as a source of significant compounds like capsaicin and dihydrocapsaicin found in concentrated form in the seeds and inner membranes of the pepper [5,19,20]. Capsaicin is utilized in cooking, topical creams, and patches for therapeutic purposes [5,18,19,20].

Thunder God Vine: This herb, also referred to in the West as Thunder God Vine, is native to East Asia and has been used in traditional Chinese medicine for many centuries [5,22]. The plant has two primary compounds of interest-triptolide and celastrol, which are possibly the cause of its healing properties. Because of the strength of the vinegar, it is largely found in regulated herbal preparations and must be administered with care due to its toxic potential [5,22]

Butterbur: Native to Asia and Europe, *Petasites hybridus* is a perennial plant that has been traditionally applied in the management of disorders like migraine and muscle cramp [5,21]. The bioactives, petasin and isopetasin, of the herb are present mainly in the root and leaves [5,21]. Butterbur extracts need purification to eliminate pyrrolizidine alkaloids which could be harmful in raw form.

Feverfew: A native of Europe and the Balkan countries, *Tanacetum parthenium* has for centuries been widely known in herbal medicine [5,25]. Parthenolide, a major bioactive present in the leaves and flowers, is responsible for feverfew's traditionally recognized properties [5,25]. It is consumed in powdered, tinctured, or encapsulated forms and is widely respected in herbal therapy [5,25].

Willow Bark: *Salix alba*, indigenous to Europe, Asia, and North America, has been used in traditional medicine since antiquity [5,26]. Salicin, flavonoids, and polyphenols are among the most important components of bark [5,26]. Willow bark is processed into extracts, teas, and capsules in a natural approach for the treatment of pain.

Moringa Oleifera: *Moringa oleifera*, also known as the "Wonder Tree," originates from the Indian subcontinent [6,7,8,9,10]. This tree has numerous health benefits and consists of flavonoids, phenolic acids, and glucosinolates present in its leaves, seeds, and pods. Moringa is taken as powder, extract, or in the form of tea and is frequently combined with phytomedicine and nutritional supplements [6,7,8,9,10].



Figure 3: Ethnopharmacological Remedies in Pain Management



Figure 4: Bioactive Compounds of Ethnopharmacological Remedies in Pain Management

3. PAIN MANAGEMENT IN GATE CONTROL THEORY WITH ETHNOPHARMACOLOGICAL REMEDIES

Low back pain, particularly post-C-section, starts when nociceptors in the tissues detect injury and transmit pain messages via A-delta and C fibers to the spinal cord [28,29,30]. The message arrives at the dorsal horn, where the Gate Control Theory of Pain decides whether to transmit the pain to the brain. When inflammation develops, pro-inflammatory mediators like prostaglandins, cytokines, and tumor necrosis factor-alpha (TNF- α) stimulate the nuclear factor kappa-light-chain-enhancer of activated B cells (NF- κ B) pathway, enhancing the inflammation and keeping the gate of pain "open" [10,28,29,30]. This makes more than usual pain signals travel to the brain, amplifying pain perception and causing it spreading to nearby tissues [10,28,29,30]. Ethnopharmacological interventions, rich in anti-inflammatory and antioxidant action, control both pain transmission and the NF- κ B pathway [10][26]. These treatments contain bioactive compounds such as curcumin (turmeric) [5,11,12,13], gingerols (ginger) [5,12,15], and flavonoids (*Moringa oleifera*) [6,7,8,9,10], etc., which have robust analgesic and anti-inflammatory effects. These compounds act on sensory nerve fibers and modify the gate control system by stimulating large-diameter A-beta fibers, which could "close the gate" and diminish pain perception [10,26]. In addition, they inhibit NF- κ B activation and ensuing inflammatory cytokine expression and thereby reduce inflammation. Since inflammation and oxidative stress increase pain sensitivity, the inhibition of the NF- κ B pathway retards the excessive generation of inflammatory mediators such that pain is localized and does not spread to other areas of the body [10,26,28,29,30]. Thus, not only do these remedies possess anti-inflammatory activity, but the bioactive molecules present in them also induce the secretion of endorphins, which enhance the body's intrinsic pain control mechanism. This coordinated activity leads to efficient as well as localized pain relief along with preventing chronic pain development. The site-specific and long-term release of these bioactive compounds from ethnopharmacological

treatments triggers extended pain, along with inhibiting inflammatory pathways like NF- κ B, preventing excessive pain signaling, and restricting pain amplification through the nervous system.

4. VERSATILE APPLICATIONS OF ETHNOPHARMACOLOGICAL REMEDIES IN PAIN MANAGEMENT

Ethnopharmacological drugs have been used extensively in analgesic treatment, and recent technology has enhanced their activity through improved extraction, formulation, and drug delivery. *Salix tetrasperma* (willow plant) is phytochemically extracted and salicin derivative profiled, resulting in oral formulations like capsules, teas, and tinctures for systemic pain relief and topical formulations like ointments and creams for relief from local musculoskeletal pain [5,26]. St. John's Wort (*Hypericum perforatum*) is formulated into nanotechnology drug delivery systems like solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) to improve neuroprotection and bioavailability, while LC-MS/MS and liquid chromatography are applied in flavonoid and phenolic acid profiling [5,16,17]. *Moringa oleifera* has been studied by in vitro and in vivo research, drug development and nutraceuticals, and food functionalism with follow-up oral products like capsules, powders, teas, and food functional foods for systemic inflammation and antioxidant effects and topical creams and ointments for local inflammation and pain [6,7,8,9,10]. *Curcuma longa* or turmeric and its bioactive compound curcumin are investigated by clinical trials, molecular targeting of inflammatory processes, and pharmacological studies to develop oral formulations such as powders, tablets, capsules, and topical formulations such as gels, patches, and ointments for inflammatory pain disorders [5,11,12,13]. Such developments in herbal medicines also maximize ethnopharmacological strategies to alleviate pain to achieve the maximum bioavailability and therapeutic activity.

5. CONCLUSION

In conclusion, this review puts into perspective the potential therapeutic applications of ethnopharmacological medicines for treating post-C-section lower back pain (LBP) through accessing bioactive molecules that act to modulate inflammatory mechanisms, notably NF- κ B, and supplement the Gate Control Theory of Pain for effective analgesia. Other than pain alleviation in the postpartum setting, these medications exhibit multi-faceted application in pain management, including systemic relief through oral delivery, localized use through topical delivery, and bioavailability enhancement through the use of nanotechnology-based drug delivery systems. With the integration of the ancient traditional herbal medicine with modern pharmacological technology, ethnopharmacology offers an eco-friendly, non-invasive, and effective remedy for treating diseases of chronic pain with lesser side effects than in conventional therapy.

7. REFERENCE

1. Sahaya Packia Shanthi M, N. Gayathiri, Jissy Paul E, Prevalence of back-pain following caesarean section under spinal anesthesia” Published on 4 August 2023.
2. Hizir Kazdal, Ayhan Kanat, Bulent Ozdemir, Vacide Ozdemir, Ali Riza Guverci, “Does-the anesthesia technique of cesarean section cause persistent low back pain after delivery? A retrospective analysis” Published on 5 October 2022.
3. Mukhopadhyay A, Bhattacharyya A, Chanda S, Syamal A.K. “Spinal anesthesia during cesarean section and persisting low back pain: a cross sectional study in West Bengal, India”, Published on 25 November 2019.
4. Nusrat Rasheed, Muhammed Hassaan Khan, Naseem Rashee. “Comparison of Incidence of Low Back Pain in Women with Normal Vaginal Delivery and Cesarean Section”. Published on 29 December 2017.

5. Behdad Jahromi 1, Iulia Pirvulescu 1, Kenneth D. Candido 1,2,3 and Nebojsa Nick Knezevic. "Herbal Medicine for Pain Management: Efficacy and Drug Interactions".Published on 11 February 2021.
6. Zahidul Islam, S. M. Rashadul Islam, Faruk Hossen, Kazi Mahtab-ul-Islam, Md. Rakibul Hasan, and Rezaul Karim, "Moringa oleifera is a Prominent Source of Nutrients with Potential Health Benefits".Published on 11 August 2021.
7. Navnidhi Chhikara, Amolakdeep Kaur, Sandeep Mann, "Bioactive compounds, associated health benefits and safety considerations of Moringa oleifera L.: an updated review".Published on 16 May 2020.
8. Dewa Gde Rismanandha Adiwira, Made Niko Winay, Ni Luh Nopi Andayani, "The effect of moringa oleifera leaf as an anti-inflammatory: a literature review", 22 November 2023.
9. Abideen Adeyinka Adekanmi, Sherifdeen Adeniyi Adekanmi, Opeyemi shafiu Adekanmi, "Qualitative and Quantitative Phytochemical Constituents of Moringa Leaf".Published on 5 May 2020.
10. Marcela Vergara-Jimenez, Manal Mused Almatrafi and Maria Luz Fernandez, "Bioactive Components in Moringa Oleifera Leaves Protect against Chronic Disease". Published on 16 November 2017.
11. Adeeb Shehzad, Gauhar Rehman, Young Sup Lee, "Curcumin in Inflammatory Diseases".Published on 22 December 2012.
12. Gamal Ramadan, Mohammed Ali Al-Kahtani, Wael Mohamed El-Sayed, "Anti-inflammatory and Anti-oxidant Properties of Curcuma longa (Turmeric) Versus Zingiber officinale (Ginger) Rhizomes in Rat Adjuvant-Induced Arthritis" Published on August 2011.
13. Louay Labban, "Medicinal and pharmacological properties of Turmeric (Curcuma longa)" published on 04 April 2014.
14. Santiago R Unda, Emilce A Villegas, María Eugenia Toledo, Gabriela Asis Onell, Carlos H Laino, "Beneficial effects of fish oil enriched in omega-3 fatty acids on the development and maintenance of neuropathic pain".Published on 26 December 2019.
15. Parvin Rahnama1, Ali Montazeri, Hassan Fallah Huseini, Saeed Kianbakht, Mohsen Naseri, "Effect of Zingiber officinale R. rhizomes (ginger) on pain relief in primary dysmenorrhea: a placebo randomized trial" Published on 2012.
16. Paweł Rychlewski, Elham Kamgar, Sylwia Mildner-Szkudlarz, Przemysław Łukasz Kowalczewski, Joanna Zembruska, "Determination of the contents of bioactive compounds in St. John's wort (Hypericum perforatum): Comparison of commercial and wild samples" Published on 25 May 2023.
17. Monica Vazzana, Ana S. Macedo, Antonello Santini, Caterina Faggiol, Eliana B. Souto, "Novel Neuroprotective Formulations Based on St. John's Wort Extract" Published on 10 April 2014.
18. Shaherin Basith, Minghua Cui, Sunhye Hong and Sun Choi, "Harnessing the Therapeutic Potential of Capsaicin and Its Analogues in Pain and Other Diseases" Published on 23 July 2016.
19. Simona Mirel1, Liora Colobățiu1, Mihaela Mirel2, Sorina Pop, "Topical patches as treatments for the management of patient musculoskeletal and neuropathic pain" Published on 01 February 2017.
20. Sunita Babbar, Jean-Francois Marier, Mohamad-Samer Mouksassi, Martin Beliveau, Geertrui F. Vanhove, Sanjay Chanda, Keith Bley, "Pharmacokinetic Analysis of Capsaicin After Topical Administration of a High-Concentration Capsaicin Patch to Patients With Peripheral Neuropathic Pain" Published on 5 April 2009.
21. Mary Giles, PharmD Catherine Ulbricht, PharmD Karta Purkh Singh Khalsa, CDN, RH Catherine DeFranco Kirkwood, MPH, CCCJS-MAC Christine Park, PharmD Ethan Basch, MD, "Butterbur: An Evidence-Based Systematic Review by the Natural Standard Research Collaboration".Published on 20 July 2014.

22. Longhe Yang, Yanting Li , Jie Ren , Chenggang Zhu , Jin Fu , Donghai Lin ,Yan Qiu, “Celastrol Attenuates Inflammatory and Neuropathic Pain Mediated by Cannabinoid Receptor Type 2” Published on 6 August 2014.
23. Henik Tri Rahayu, Ning Sri Rahayu,Sunardi Sunardi, “The Effectiveness of Red Ginger Compress Therapy (*Zingiber officinale* rosc. var. rubrum) on Elders with Joint Pain” Published on 2017.
24. R.Surl , K. Martin , F. Liebel , P. Lyte , S. Shapiro1,M. Southall, “Anti-Inflammatory Activity of Parthenolide-Depleted Feverfew (*Tanacetum parthenium*)” Published on 30 December 2008.
25. Rengin Baydar, Ayşe Esra Karadağ, Sevde Nur Biltekin, Etil Güzelmeriç, Fatih Demirci4, “In vitro anti-inflammatory activities of *Tanacetum parthenium* L. extract and its major metabolite parthenolide “. Published on 25 September 2023.
26. Pei-Qian WuYing LiYu-Hao RenJun-Su ZhouQun-Fang LiuYan WuJin-Hai YuBin Zhou*Jian-Min Yue. “Anti-Inflammatory Salicin Derivatives from the Barks of *Salix tetrasperma*” .Published on 11 April, 2024.
27. Dean M. Cordingley 1,2 and Stephen M. Cornish, “Omega-3 Fatty Acids for the Management of Osteoarthritis: A Narrative Review”.Published on 16 August 2022.
28. Ronald Melzack, “Gate control theory: On the evolution of pain concepts”. Published on 5 May 2011.
29. Massieh Moayedí and Karen D. Davis, “ Theories of pain: from specificity to gate control” .Published on 1 October 2012.
30. Francisco Javier Ropero Peláez1 and Shirley Taniguchi, “The Gate Theory of Pain Revisited: Modeling Different Pain Conditions with a Parsimonious Neurocomputational Model”. Published on 19 August 2015.

Biographies



Ms. K. Mythili received the bachelor's degree in Biomedical Engineering from Dr. N.G.P Institute of Technology, Coimbatore in 2016, the master's degree in Biomedical Engineering from SRM Institute of Science and Technology, Kattankulathur in 2018, and Pursing the philosophy of doctorate degree in Biomedical Engineering from Anna University since 2022, respectively. She is currently working as an Assistant Professor at the Department of Biomedical Engineering, Sona College of Technology, Salem, Tamil Nadu. Her research areas include Biomaterials, Regenerative Medicine and Tissue Engineering.