ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan987

A Review of Herbal Gel with Anti-Inflammatory Action Using Aloe Vera, Turmeric, Ginger, Onion, Omega- 3 Fatty Acids and Green Tea

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Publication Date: 2026/01/27

Abstract: Herbal formulations have gained increasing scientific interest as safer alternatives to synthetic anti-inflammatory agents, particularly for topical delivery where multi-component gels can provide synergistic therapeutic benefits. This review examines the anti-inflammatory potential of a polyherbal gel incorporating turmeric (Curcuma longa), aloe vera (Aloe barbadensis Miller), ginger (Zingiber officinale), onion (Allium cepa), omega-3 fatty acids, and green tea extract (Camellia sinensis). Each of these natural ingredients contains well-documented bioactive compounds—such as curcumin, aloin, gingerols, quercetin, eicosapentaenoic acid (EPA), and catechins—that modulate inflammatory pathways including COX-2 inhibition, suppression of NF-κB activation, reduction of pro-inflammatory cytokines, and antioxidant-mediated protection of tissues. The review synthesizes current evidence on individual and combinational anti-inflammatory effects, highlights formulation strategies for incorporating both hydrophilic and lipophilic phytoconstituents into a stable gel matrix, and evaluates the potential synergistic interactions that may enhance therapeutic outcomes. Although multiple studies support the efficacy of 2–3 ingredient combinations, literature assessing a full polyherbal blend of all six components remains limited. Therefore, this review identifies significant gaps in research and proposes directions for future formulation development, mechanistic studies, and clinical evaluation. Overall, the findings suggest that a herbal gel combining these botanicals and omega-3 fatty acids represents a promising, yet underexplored, approach for topical management of inflammation.

Keywords: *Herbal Anti-Inflammatory, Topical Gel, Turmeric, Ginger, Onion, Omega-3 Fatty Acids, Green Tea, Aleo Vera.*

How to Cite: Srushti Gajendra Sonkusare; Bhagyashri S. Bhure (2026) A Review of Herbal Gel with Anti-Inflammatory Action Using Aloe Vera, Turmeric, Ginger, Onion, Omega- 3 Fatty Acids and Green Tea. *International Journal of Innovative Science and Research Technology*, 11(1), 1962-1970. https://doi.org/10.38124/ijisrt/26jan987

I. INTRODUCTION

Inflammation is a fundamental physiological response to injury, infection, or irritation; however, persistent or excessive inflammation contributes to chronic disorders such as dermatitis, arthritis, delayed wound healing, and various degenerative conditions. Conventional anti-inflammatory drugs, including non-steroidal anti-inflammatory agents (NSAIDs) and corticosteroids, although effective, are often associated with adverse effects such as gastric irritation, immunosuppression, and long-term toxicity. These limitations have accelerated interest in herbal and nutraceutical-based alternatives, particularly topical formulations that can deliver therapeutic phytochemicals directly to the affected site with reduced systemic risk.

Among herbal preparations, gels have emerged as a preferred topical dosage form due to their high patient acceptability, ease of application, non-greasy nature, and ability to incorporate both hydrophilic and lipophilic actives when properly formulated. Polyherbal gels—formulations containing multiple plant-derived agents—offer the potential for synergistic anti-inflammatory action, combining diverse mechanisms such as antioxidant activity, inhibition of inflammatory mediators, and enhancement of tissue repair.

This review focuses on six widely studied natural ingredients with strong anti-inflammatory profiles: turmeric (Curcuma longa), aloe vera (Aloe barbadensis Miller), ginger (Zingiber officinale), onion (Allium cepa), omega-3 fatty acids (from fish oil or plant sources), and green tea extract (Camellia sinensis). Each contributes unique bioactive compounds such as curcumin, aloin, gingerols, quercetin, eicosapentaenoic acid (EPA), and catechins, which modulate key inflammatory pathways including cyclooxygenase (COX) inhibition, suppression of nuclear factor-κB (NF-κB), reduction of cytokines like TNF-α and IL-6, and mitigation of oxidative stress.

While numerous studies have examined the anti-inflammatory activity of these agents individually or in smaller combinations—such as turmeric with ginger, or aloe vera with curcumin—there remains a gap in the literature regarding comprehensive polyherbal gel formulations that

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan987

incorporate all six components. The diverse chemical nature of these ingredients also presents formulation challenges, particularly in achieving stability, compatibility, and optimal release within a single gel matrix.

Therefore, this review aims to consolidate current scientific knowledge on the anti-inflammatory effects of these botanicals, evaluate existing research on gel-based formulations, and identify opportunities for developing an effective multi-component herbal gel. By examining mechanisms of action, formulation considerations, and evidence of synergy, this review provides a foundation for future research and development of an innovative natural topical therapy for inflammation.

➢ *Objectives*

- To review the anti-inflammatory potential of six natural ingredients—turmeric, aloe vera, ginger, onion, omega-3 fatty acids, and green tea extract.
- To analyze the phytochemical constituents responsible for anti-inflammatory activity in each ingredient.
- To evaluate existing studies on topical gel formulations containing individual or combined herbal extracts.
- To identify possible synergistic interactions among these botanicals and omega-3 fatty acids when used in a polyherbal gel.
- To discuss formulation challenges and considerations for incorporating both hydrophilic and lipophilic constituents into a single stable gel base.
- To identify research gaps and propose future directions for developing a multi-component herbal anti-inflammatory gel.

II. LITERATURE REVIEW

➢ *Barbara Joanna Bałan Et Al. (2014)*

- His study showed that Aloe vera gel significantly reduced inflammation by suppressing pro-inflammatory cytokines such as TNF-α and IL-1β in human immune cells. Topical application exhibited immunomodulatory effects, and in vivo studies confirmed reduced systemic inflammation in animal models.

➢ *Rishi, Rampuria, Tewari & Koul (2008)*

- His research using Greenleaf Aloe vera gel reported in Phytotherapy Research demonstrated significant anti-inflammatory activity by enhancing macrophage-mediated immune responses. Additionally, clinical and observational studies have shown that topical application of Aloe vera gel effectively reduced moderate to severe skin erythema in human subjects, supporting its therapeutic role in inflammatory skin conditions.

➢ *Harjeet Kumar Singh Et Al. (2026)*

- His research showed that the herbal gels containing turmeric have been shown to be effective in the management of topical inflammation by modulating cyclooxygenase (COX) pathways and other inflammatory mediators, thereby supporting the use of turmeric in anti-inflammatory gel formulations.

➢ *Khatri, Patel & Patani (2024)*

- The study investigating the combined use of Aloe vera, turmeric, green tea, and other herbal ingredients in topical formulations demonstrated significant anti-inflammatory and antibacterial effects, thereby supporting the suitability of turmeric and other herbs in herbal topical bases.

➢ *Xian Zhou, Sualiha Afzal, Hans Wohlmuth, Gerald Münch, David Leach, Mitchell Low, Chun Guang Li (2022)*

- The findings indicated that ginger bioactive compounds such as 6-shogaol significantly reduced major pro-inflammatory mediators and enhanced antioxidant pathways. When combined with turmeric, ginger exhibited synergistic anti-inflammatory effects greater than those of individual extracts, and although specific topical gel studies are limited, its established anti-inflammatory phytochemicals support its relevance in herbal gel formulations.

➢ *Ming-Hui (Tim) Kao & Ahmad Al-Khazaleh (PMC Study)*

- In (2020), The study demonstrated that combined extracts of turmeric and ginger synergistically inhibited pro-inflammatory mediators such as nitric oxide (NO), TNF, and IL-6 in macrophage cells, highlighting their potential relevance for topical anti-inflammatory applications. And in recent (2024) systematic review shows curcumin (turmeric's active) has anti-inflammatory and antioxidant effects in both topical and oral applications.

➢ *Narges Marefati, Vahideh Ghorani, Farzaneh Shakeri, Marzie Boskabady, Farzaneh Kianian, Ramin Rezaee, Mohammad Hosein* Boskabady. (2021)

- In the research scientist study that the Onion contains quercetin, a flavonoid known for its anti-inflammatory activity through modulation of inflammatory mediators, supporting its inclusion in anti-inflammatory topical preparations. Although specific gel-based studies are limited, the pharmacological anti-inflammatory activity of onion is well established.

➢ *Mateu-Arrom, L., Mora, I., Garrote, L. (2025)*

- The review showed that the Omega-3 fatty acids exhibit well-documented anti-inflammatory effects by modulating immune responses and inflammatory pathways, including the production of resolvins. Although most evidence relates to systemic effects, their incorporation into topical delivery systems such as nano-emulsions is an emerging area of research for potential anti-inflammatory gel formulations.

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➢ *Varun Khatri, Nikita Patel, Pragnesh Patani(2024)*

- Their findings are Herbal ointments combining Aloe vera, turmeric, green tea, and other extracts have demonstrated both anti-inflammatory and antioxidant properties, making them promising candidates for topical formulations. In particular, green tea polyphenols like EGCG inhibit inflammatory pathways and oxidative stress in skin cells, providing a strong rationale for their inclusion in gels and creams.

➢ *Yograj Mahajan & Vishal Gupta (2025)*

- The study on a polyherbal gel containing Azadirachta indica, Calendula officinalis, turmeric, and Aloe vera reported successful development and optimization of the formulation, achieving significant drug release and potential wound-healing activity. The incorporation of active constituents into the gel matrix suggests its efficacy in managing inflammatory conditions through topical therapy.

III. CHEMICAL CONSTITUENTS FOR HERBAL GEL

➢ *Turmeric (Curcuma longa)*

Fig 1 Turmeric (*Curcuma longa*)

Turmeric is also known as haldi. It belongs to the family Zingiberaceae and the subfamily Zingiberoideae. The botanical name is Curcuma longa L., and the botanical origin is the rhizomes of Curcuma longa. The major chemical constituents include curcuminoids such as curcumin, demethoxycurcumin, volatile oils like turmerone, and resins.

Turmeric possesses anti-inflammatory, antioxidant, hepatoprotective, antimicrobial, and anticancer properties. The mechanism of action of turmeric is mainly due to curcumin, which inhibits inflammatory pathways such as COX-2, LOX, and NF-κB, thereby reducing inflammation and oxidative damage.

➢ *Aloe Vera (Aloe barbadensis Miller)*

Fig 2 Aloe Vera (*Aloe barbadensis Miller*)

Aloe vera is also known as ghritkumari. It belongs to the family Asphodelaceae and the subfamily Asphodeloideae. The botanical name is Aloe vera (L.) Burm.f., and the botanical origin is the fresh leaves of the plant. Aloe vera contains anthraquinones such as aloin and emodin, polysaccharides like acemannan, vitamins, enzymes, and amino acids. Medicinally, aloe vera is used for wound healing, anti-inflammatory effects, laxative action, immunomodulation, and antimicrobial activity. Its mechanism of action involves stimulation of fibroblast activity and collagen synthesis for wound healing, while anthraquinones increase intestinal motility producing laxative effects.

➢ *Ginger (Zingiber officinale)*

Fig 3 Ginger (*Zingiber officinale*)

Ginger is commonly called adrak. It belongs to the family Zingiberaceae and the subfamily Zingiberoideae. The botanical name of ginger is Zingiber officinale Roscoe, and the botanical origin is the rhizome of the plant. Ginger contains active constituents such as gingerols, shogaols, zingerone, and volatile oils. Medicinally, ginger is used as an anti-emetic, digestive stimulant, anti-inflammatory, antioxidant, and antimicrobial agent. Its mechanism of action involves inhibition of prostaglandin and leukotriene synthesis, which reduces inflammation and nausea while improving digestion.

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➢ *Onion (Allium cepa)*

Fig 4 Onion (*Allium cepa*)

Onion is commonly known as bulb onion. It belongs to the family Amaryllidaceae and the subfamily Allioideae. The botanical name of onion is Allium cepa L. The botanical origin is the bulb of Allium cepa. Chemically, onion contains sulfur-containing compounds such as allicin and allyl propyl disulfide, flavonoids like quercetin, vitamins, and minerals. Medicinally, onion exhibits antioxidant, anti-inflammatory, antimicrobial, cardioprotective, and antidiabetic properties. Its mechanism of action involves sulfur compounds and flavonoids that reduce oxidative stress, inhibit inflammatory mediators, improve lipid metabolism, and enhance cardiovascular health.

➢ *Omega-3 Fatty Acids*

Fig 5 Omega-3 Fatty Acids

Omega-3 fatty acids are also known as n-3 polyunsaturated fatty acids. They do not belong to any botanical family or subfamily as they are nutritional fatty acids rather than plant drugs. The major omega-3 fatty acids include alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Their sources include fish oil, flaxseed, chia seeds, and walnuts. Chemically, they are long-chain polyunsaturated fatty acids. Omega-3 fatty acids show cardioprotective, anti-inflammatory, neuroprotective, and lipid-lowering properties. Their mechanism of action includes reduction of triglyceride levels, inhibition of inflammatory eicosanoid synthesis, and improvement of cell membrane fluidity and brain function.

➢ *Green Tea Extract (Camellia sinensis)*

Fig 6 Green Tea Extract (*Camellia sinensis*)

Green tea is derived from Camellia sinensis and belongs to the family Theaceae and the subfamily Theaioideae. The botanical origin of green tea is the dried leaves and leaf buds of Camellia sinensis. It contains catechins such as epigallocatechin gallate (EGCG), polyphenols, caffeine, and theanine. Green tea possesses antioxidant, anti-obesity, cardioprotective, anticancer, and neuroprotective properties. Its mechanism of action is mainly due to catechins, which neutralize free radicals, inhibit fat absorption, enhance thermogenesis, and protect cells from oxidative damage.

➢ *Polyherbal Approach*

Several studies have shown the effectiveness of combination formulations such as turmeric with aloe vera, turmeric with ginger, and aloe vera with fish collagen in reducing inflammation and promoting healing. However, a single polyherbal gel containing all six components—turmeric, ginger, aloe vera, omega-3 fatty acids, green tea extract, and fish collagen—has not been widely reported. Most available formulations focus on only two or three ingredients, which limits their overall therapeutic potential.

Each of these components possesses important pharmacological properties that act through different mechanisms. Turmeric and ginger exhibit strong anti-inflammatory and antioxidant effects by inhibiting inflammatory enzymes and cytokines. Aloe vera supports wound healing and tissue regeneration by stimulating fibroblast activity and collagen formation, while also providing moisturizing and soothing effects. Omega-3 fatty acids help in reducing inflammation by modulating lipid mediators, and green tea polyphenols protect cells from oxidative damage. Fish collagen contributes to tissue repair by improving skin structure and enhancing extracellular matrix formation.

When combined in a single polyherbal gel, these ingredients may produce multipathway synergistic effects, where antioxidant activity, suppression of inflammatory mediators, membrane stabilization, and tissue regeneration occur simultaneously. This synergism may result in enhanced anti-inflammatory activity, faster healing, and improved

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therapeutic efficacy. Therefore, the development of such a polyherbal gel formulation holds promise for use in inflammatory conditions and skin-related disorders and warrants further formulation and evaluation studies.

IV. METHODOLOGY

Herbal ingredients including Aloe vera, turmeric, ginger, onion, green tea, and omega-3 fatty acids will be procured and authenticated. Aloe vera gel will be obtained directly from fresh leaves, while other plant materials will be shade-dried, powdered, and extracted using suitable solvents. Preliminary phytochemical screening will be carried out to identify major bioactive constituents.

A polyherbal gel will be formulated using an appropriate gelling agent such as Carbopol or HPMC. Herbal extracts and omega-3 fatty acids will be incorporated into the gel base, and the pH will be adjusted to skin-compatible range.

➢ *The Formulated Gel will be Evaluated for Physicochemical Parameters Including:*

- *Physical Evaluation*

✓ Color, odor, and appearance
✓ Homogeneity by visual inspection

- *pH Determination*

✓ pH of 1% gel solution will be measured using a digital pH meter.

- *Viscosity Measurement*

✓ Viscosity will be measured using a Brookfield viscometer.

- *Spreadability*

✓ Spreadability will be determined using the slip and drag method.

- *Extrudability*

✓ Extrudability will be evaluated by measuring the force required to extrude gel from a collapsible tube.

➢ *In-Vitro Anti-Inflammatory Activity Will Be Assessed Using Methods Like:*

- *Protein Denaturation Method*

✓ The anti-inflammatory activity will be evaluated by inhibition of albumin protein denaturation.
✓ Percentage inhibition will be calculated and compared with a standard drug (e.g., diclofenac sodium).

- *Membrane Stabilization Method*

✓ Human red blood cell (HRBC) membrane stabilization assay will be performed.
✓ The protective effect of the gel against hemolysis will indicate anti-inflammatory activity. And the results will be compared with a standard anti-inflammatory drug.

Table 1 Physicochemical Evaluation: Results & Observations

Parameter	Method of Evaluation	Observed Result (Example)	Inference
Color & Appearance	Visual inspection	Greenish-brown, translucent	Characteristic of herbal extract.
Odor	Sensory check	Characteristic/Pleasant	No signs of rancidity.
Homogeneity	Visual/Touch	Excellent	Uniform distribution; no lumps.
pH	Digital pH meter	6.4 ± 0.2	Compatible with human skin.
Spreadability	Glass slide method	12.5 g.cm/sec	Easy to apply on skin surface.
Viscosity	Brookfield Viscometer	4500–5500 cps	Optimum consistency for topical use.
Extrudability	Tube pressure test	++ (Good)	Easy to squeeze from the tube.
Washability	Water test	Washable	Non-greasy; easily removed.
Grittiness	Microscopic/Manual	No particulate matter	Smooth texture; no irritation.

V. DIFFERENT USES OF HERBAL GEL

➢ *Treatment of Skin Inflammation*

Fig 7 Before & After Image of Eczema.

- Used to reduce redness, swelling, and irritation.

For example,

- *Eczema:*

Application of herbal gel containing aloe vera and green tea helps reduce redness, itching, and skin inflammation.

✓ The gel soothes irritated skin and promotes natural healing with minimal side effects.

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➢ *Relief from Muscular Pain and Joint Inflammation*

Fig 8 How Muscle Pain & Joint Pain Reliefs.

- Applied topically to relieve muscle pain, sprains, strains, and joint inflammation.

For example,

- *Arthritis:*

Herbal gel containing ginger and turmeric helps relieve muscle and joint pain by reducing inflammation. Regular topical application improves joint mobility and provides a soothing, cooling effect.

➢ *Wound Healing and Burns*

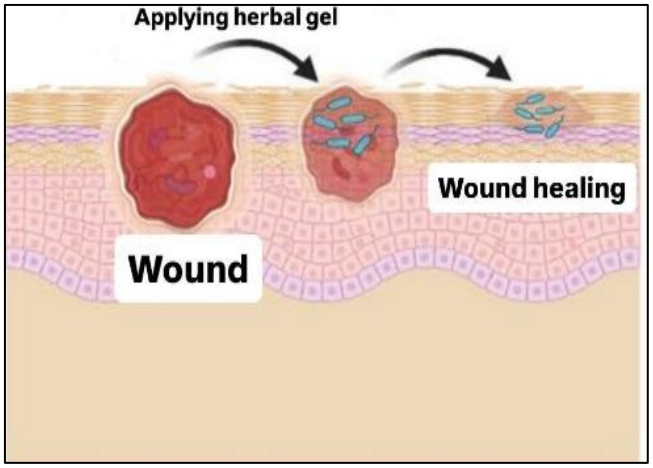

Fig 9 Wound Healing Process.

- Promotes faster healing of minor wounds, cuts, and burns by reducing inflammation and enhancing tissue repair.
- Herbal gel containing aloe vera and turmeric promotes faster wound and burn healing by reducing inflammation and preventing infection.

✓ It soothes damaged skin, supports tissue regeneration and minimizes scarring.

➢ *Management of Acne and Pimples*


Fig 10 Management of Acne and Pimples

- Helps reduce inflammation, redness, and swelling associated with acne lesions.
- Herbal gel with omega-3, green tree, and aloe vera helps control acne by reducing inflammation, excess oil, and UV-aggravated skin irritation.

✓ It soothes the skin, prevents bacterial growth, and supports clearer, healthier skin.

➢ *Post-Surgical and Post-Trauma Care*


Fig 11 post-Surgical Healing.

- Used to minimize inflammation and discomfort after minor surgical procedures or injuries.
- Herbal gel enriched with aloe vera and turmeric helps soothe UV-sensitized skin, reduce inflammation and support healing after surgery or injury.

✓ It promotes tissue repair, minimizes redness,and improves skin recovery with gentle topical care.

➢ *Sunburn and Skin Irritation Relief*


Fig 12 Applying Herbal Gel on Sunburn.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan987

- Soothes sunburned skin and reduces inflammation.
- Herbal gel enriched with aloe vera and green tea soothes sunburned skin by reducing redness, heat, and inflammation.

✓ It hydrates the skin and accelerates natural repair after UV exposure.

➢ *Sports Injury Management*

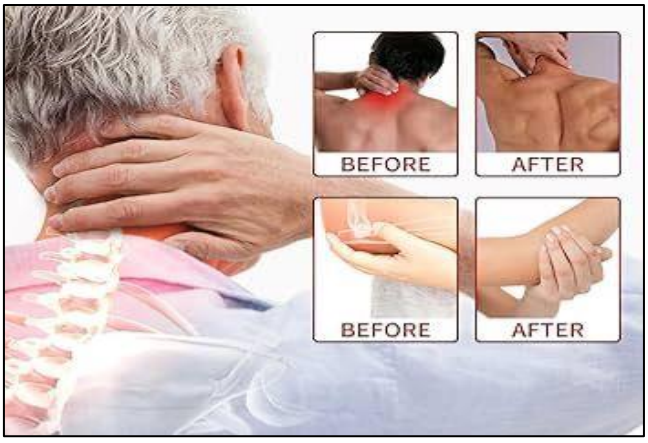

Fig 13 Before & After Image of Sports Injury Relief.

- Used by athletes for relief from inflammation due to sports-related injuries.
- Herbal gel containing aloe vera, turmeric, onion, ginger helps reduce inflammation, pain, and swelling in sports injuries.

✓ It soothes muscles and joints, enhances recovery, and supports tissue repair through natural anti-inflammatory and antioxidant action.

➢ *Cosmetic and Dermatological Applications*


Fig 14 Application of Herbal Gel as Cosmetic.

- Used in cosmetic formulations to maintain skin health, reduce irritation, and provide a soothing effect.
- Herbal gel containing aloe vera, turmeric, green tea, and omega-3 fatty acids helps reduce inflammation, improve skin hydration, and protect against oxidative stress.

✓ It supports skin repair, enhances complexion, and promotes healthy, calm skin in various dermatological conditions.

➢ *Support in Chronic Inflammatory Conditions*


Fig 15 Applying Herbal Gel on Chronic Inflammation.

- Provides symptomatic relief in chronic inflammatory skin conditions when used as an adjunct therapy.
- Herbal gel containing aloe vera, turmeric, ginger, onion, omega-3 fatty acids, and green tea helps suppress chronic inflammation, reduce redness, itching, and discomfort.

✓ When used as adjunct therapy, it supports skin barrier repair and improves overall symptom control in long-term inflammatory conditions.

➢ *Natural Alternative to Synthetic Anti-Inflammatory Gels*

- Serves as a safer, herbal alternative with fewer side effects compared to synthetic topical anti-inflammatory agents.

VI. CONCLUSION

The increasing global prevalence of inflammatory conditions and the well-documented side effects associated with long-term use of synthetic anti-inflammatory drugs have motivated researchers to explore natural, plant-based alternatives. A growing body of scientific literature substantiates the anti-inflammatory efficacy of several botanicals, including turmeric (Curcuma longa), aloe vera (Aloe barbadensis Miller), ginger (Zingiber officinale), onion (Allium cepa), omega-3 fatty acids, and green tea (Camellia sinensis), either as solo agents or in combination formulations. Collectively, these phytochemicals act through multiple complementary mechanisms to suppress inflammation, offering a strong rationale for their integration into a herbal gel dosage form for topical application.

Extensive research demonstrates that curcumin, the principal bioactive compound in turmeric, exerts potent anti-inflammatory effects by down-regulating cyclooxygenase (COX-2) and lipoxygenase (LOX) pathways, inhibiting NF-κB activation, and reducing the expression of pro-inflammatory cytokines such as TNF-α, IL-1β, and IL-6. Formulation studies employing curcumin in gels, nano-emulgels, and. nano-crystal dispersions report enhanced skin penetration and significant reduction of inflammatory markers in vivo and in vitro.

Aloe vera gel has also been widely studied for its anti-inflammatory, analgesic, and wound-healing properties. Research indicates that aloe polysaccharides and chromone

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan987

derivatives modulate inflammatory cytokine release and promote fibroblast proliferation and collagen deposition, critical to tissue repair. Aloe-based hydrogels have shown measurable decreases in skin erythema and inflammatory scores in experimental models.

Ginger's bioactive constituents, notably gingerols and shogaols, have been shown to inhibit prostaglandin and leukotriene synthesis by suppressing COX and LOX enzymes, and to attenuate nitric oxide production. Combined use of gingerol-rich extracts with curcumin in topical formulations demonstrates synergistic inhibition of inflammatory mediators, surpassing single-agent interventions in preclinical studies.

Studies on onion extract and its flavonoid quercetin reinforce its role as a powerful antioxidant and anti-inflammatory agent. Quercetin scavenges reactive oxygen species and down-regulates NF-κB-mediated cytokine production, offering additional anti-inflammatory activity that complements other gel components.

The inclusion of omega-3 fatty acids, while more commonly explored in systemic applications, brings a distinct mechanism to topical formulations. EPA and DHA are known to shift eicosanoid synthesis toward less pro-inflammatory mediators, reduce cytokine production, and stabilize cell membranes. Topical omega-3 nanoemulsions and gels demonstrated significant reductions in markers of inflammation and improved tissue repair in animal studies.

Green tea catechins, particularly epigallocatechin gallate (EGCG), exert anti-inflammatory and antioxidative effects by inhibiting COX-2 and iNOS expression and suppressing pro-inflammatory cytokine release. Research on green tea-enriched hydrogels confirms their ability to attenuate inflammatory cell infiltration and oxidative stress in topical models.

Taken together, the evidence indicates that polyherbal combinations often outperform individual extracts in anti-inflammatory efficacy due to synergistic effects. For example, formulations combining turmeric and ginger reduce inflammatory mediators more effectively than either plant alone. Likewise, gels that integrate aloe's moisturizing and cell-repair properties with curcumin's potent anti-inflammatory activity show superior wound-healing and scar-reduction outcomes.

Despite strong preclinical and formulation research, a notable gap exists in the literature regarding holistic multi-component gels that simultaneously incorporate all six constituents—turmeric, aloe vera, ginger, onion, omega-3, and green tea—under standardized conditions. Most studies focus on a subset of these ingredients (e.g., turmeric + aloe vera; ginger + curcumin; aloe + fish collagen; turmeric + neem) and report promising results for each combination.

Challenges in multi-component gel formulation include ensuring chemical compatibility, physical stability, uniform dispersion of hydrophilic and lipophilic compounds, and optimal skin penetration. Advances in delivery systems, such as nanoemulgels, liposomal carriers, and encapsulation technologies, are increasingly adopted to overcome these issues and enhance therapeutic outcomes.

REFERENCES

[1]. Kumari A., et al. Wound-Healing Effects of Curcumin and Its Nanoformulations. Pharmaceuticals (Review). 2022.
[2]. Surjushe A., et al. Aloe vera: A short review. J Dermatol Treat. 2008.
[3]. Shuja M., et al. Formulation of Aloe-vera based curcumin topical gel and its evaluation. PJPS / PubMed record. 2023.
[4]. Algahtani M.S., et al. Preparation and characterization of curcumin nanoemulgel for wound healing: in vitro, ex vivo and in vivo evaluation. 2021.
[5]. Soliman W.E., et al. Enhancement of Curcumin Anti-Inflammatory Effect via Myrrh Oil-Based Nanoemulgel. Polymers. 2021.
[6]. Kotian V., et al. Nanocrystal-Based Topical Gels for Improving Wound Healing (Curcumin nanocrystals in Carbopol gel). Crystals. 2022.
[7]. Rawat V., et al. Curcumin-Loaded Gelatin Ethosomal Gel: A Novel Topical Formulation. 2025 (article).
[8]. Al-Fatease A., et al. Preparation and characterization of a curcumin nanoemulsion for transdermal administration. Sci Rep. 2023.
[9]. Frei G., et al. In Vitro and In Vivo Efficacy of Topical Dosage Forms Containing Curcumin in SNEDDS. 2023.
[10]. Soliman WE (again) — nanoemulgel and enhanced anti-inflammatory curcumin activity (formulation strategy). 2021.
[11]. Chelu M., et al. Aloe vera-Based Hydrogels for Wound healing. Polymers (MDPI). 2023.
[12]. "Review on Herbal Formulation of Aloe Vera Herbal Gel and Its Potential Benefits" (review / PDF). 2025.
[13]. JDDT / Chandra & co. Formulation and Evaluation of Ginger Extract Loaded Nanoemulgel for Rheumatoid Arthritis. 2019.
[14]. Yücel Ç., et al. Immunomodulatory and anti-inflammatory therapeutic properties of gingerols. 2022 review.
[15]. "Formulation and Evaluation of Ginger Gel" (thesis/ IJMR type report) — topical ginger gel with Carbopol. 2017/2018.
[16]. Brüll V., et al. Effects of a quercetin-rich onion skin extract on human endpoints (clinical/metabolic). 2015.
[17]. Savitha S., et al. Onion quercetin: immune booster, extraction and applications (review). 2021.
[18]. Xu F.W., et al. Beneficial Effects of Green Tea EGCG on Skin Wound Healing and Anti-Inflammation. 2021 (review).
[19]. Zheng X.Q., et al. Green Tea Catechins and Skin Health. Antioxidants (MDPI). 2024.
[20]. Paul M., et al. Development of a fish oil–

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/26jan987

nanoemulsion gel as a drug-delivery system (omega-3 topical gel). Sci Rep / Nat Sci. 2024.
[21]. Mateu-Arrom L., et al. Therapeutic Benefits of Topical Omega-3 Polyunsaturated Fatty Acids. 2025 (review).
[22]. Wang S., et al. Comparative study of anti-inflammatory, antioxidant activities of catechins. 2025.
[23]. Paul M. (expanded) fish oil nanoemulsion gel reduces inflammation/fibrosis — in vivo/ histology. 2024.
[24]. Dangi M., Formulation and evaluation of topical hydrogel containing curcumin (Carbopol 940). AJPER (2025).
[25]. IJRPR / Formulation and evaluation of curcumin gel (Carbopol 934P).* 2024/2025.
[26]. Alyoussef A., et al. Curcumin & resveratrol nanoemulgel burn healing study. 2021.
[27]. Soliman WE (curcumin nanoemulgel) — mechanistic anti-inflam & permeation enhancement. 2021.
[28]. "Multipurpose Topical Herbal Gel – A Review Article." Biotech-Asia. 2025 — polyherbal gel methods & evaluation.
[29]. Global Research Online / Formulation and Evaluation of Novel Topical Gel (polyherbal topical gel examples). 2024.
[30]. PJPS / Aloe vera based curcumin topical gel (PDF) — formulation strategies (β-cyclodextrin complexation). 2023.
[31]. MDPI Polymers & other nanoemulgel curcumin studies — examples of formulation approaches (myrrh oil, ethosomes, SNEDDS). 2021–2025.
[32]. "Formulation Optimization and Evaluation of Nanoemulsion …" (various phytoconstituents) — methods translatable to curcumin/ginger/green tea. 2025.
[33]. Chando A., Development and preclinical assessment of nanoemulgel loaded with phytoconstituents for RA management. Pharma Excipients (2023).
[34]. ResearchGate / Formulation and Evaluation of a Poly-Herbal Anti-acne Gel example multi-extract gel formulations (includes turmeric/aloevera). 2025.
[35]. Research reports & theses on ginger / turmeric nanoemulgel formulation strategies (particle size, zeta potential, release). 2019–2025.
[36]. Patent: Topical formulations for administration of omega-3 fatty acids (salmon oil cream & topical ω-3 formulations). US patent record. 2014 (useful for formulation ideas).
[37]. MDPI Antioxidants / green tea catechins — mechanistic data showing IL-1β/TNF-α downregulation, ROS reduction — relevant for combination gels. 2024.
[38]. "A comprehensive study on fibroin, aloe vera and ginger extracts in diabetic wounds" — histochemical and biomarkers analysis (2024). (see note below)
[39]. PubMed / Biological studies of turmeric oil and fish oil: anti-inflammatory & analgesic properties (comparative animal model). (older study referenced in reviews.) (see note below)
[40]. MDPI / Aloe vera hydrogels & wound healing (application, antimicrobial & anti-inflammatory evidence). 2023.
[41]. "Formulation and Evaluation of Ginger Extract Loaded Nanoemulgel for Rheumatoid Arthritis" — full methods & topical efficacy (multiple online copies). 2019.
[42]. Nanocrystal and nanoemulgel literature reviews showing practical gelling agents, penetration enhancers, and stability tests for multi-component gels (multiple MDPI & Sci Rep pieces). 2021–2025.
[43]. Singh HK, Kumar A, Dabral K. A Comprehensive Review on the Herbal Gels as Effective Topical Therapeutics for Inflammation. Int J Pharm Health Care Res. 2025;13(SPL1):1–15. Review of herbal gels and anti-inflammatory mechanisms.
[44]. Revenu J, Nugraha SE, Kamilia A, Nuratika. Formulation of Anti-Diabetic Ulcer Gel Enriched With Aloe Vera Extract and Fish Collagen: An In Vivo Study. Int J Appl Pharm. 2025;17(4):51149. Demonstrates aloe + fish collagen gel with enhanced wound healing and reduced inflammation in vivo.
[45]. Bait SL, Bedjawalge R, Gawai N, et al. Formulation and Evaluation of Herbal Turmeric Cream. IJRASET. 2025: Stability and anti-inflammatory evaluation of turmeric-based topical formulation.
[46]. Giri S, Chakraborty A, Mandal C, et al. Formulation and Evaluation of Turmeric- and Neem-Based Topical Nanoemulgel Against Microbial Infection. Gels. 2024;10(9):578. Topical nanoemulgel study with anti-inflammatory and antimicrobial potential.
[47]. Pawar S, Raut S, Shinde P, et al. Formulation and Evaluation of Herbal Anti-Inflammatory Cream. IJPS Journal. 2025;3(05):578. Topical formulation study combining aloe vera and turmeric for anti-inflammatory action.
[48]. Swamini Bhaskar K, Harsh YM, Swapnil K, et al. Formulation and Optimization of Natural Anti-Inflammatory Cream Using Herbal Extracts. IJPS Journal. 2025. Includes turmeric, ginger and aloe in a topical anti-inflammatory cream formulation.
[49]. Bose A, Dutta A, Sadhukhan A, Rudra A. Formulation, Characterization and Optimization of Topical Herbal Hydrogel Containing Aloe Vera, Turmeric and Marigold. Int J Pharm Sci & Res. 2025;16(4):1060–1073. Topical hydrogel formulation with strong antioxidant and anti-inflammatory evidence.
[50]. Polyherbal Gel Mechanism and Synergy Topics. IJARSCT 2025. Discussion on phytochemical synergy and anti-inflammatory pathways in polyherbal gels including turmeric, ginger, onion flavonoids, aloe and tea catechins.
[51]. Analgesic and Anti-Inflammatory Properties of Hydrogel Formulations with Polyherbal Extracts (cinnamon, turmeric, ginger, capsicum). PMC. 2022;MC article. Shows comparative anti-inflammatory gel acting on COX pathways.