



CUCUMIS SATIVUS (CUCUMBER): A REVIEW ON ITS PHYTOCHEMISTRY AND SKIN APPLICATIONS

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ABSTRACT

Cucumis sativus, commonly known as cucumber, is a widely cultivated vegetable belonging to the family *Cucurbitaceae*. It has been used for centuries in traditional medicine and skincare practices across Asia, Europe, and the Americas for its cooling, soothing, and hydrating properties. This review aims to summarize and evaluate available scientific literature on the phytochemical composition and skin-related applications of *C. Sativus*. A narrative review approach was used, compiling studies published from 2005 to 2025 using databases such as Google Scholar, PubMed, and ScienceDirect. Results show that *C. sativus* contains bioactive compounds including flavonoids, cucurbitacins, phenolic acids, phytosterols, vitamins, and polysaccharides, which contribute to its antioxidant, anti-inflammatory, antimicrobial, and moisturizing effects. Scientific evidence supports its use in managing skin conditions such as sunburn, acne, inflammation, and premature aging, as well as its application in cosmetic formulations. However, most studies are preclinical, and further clinical trials are required to validate efficacy, safety, and optimal formulation parameters. This review highlights the therapeutic potential of *C. sativus* as a valuable natural ingredient in dermatology and cosmeceutical development. *Cucumis sativus* (cucumber) is a widely cultivated plant belonging to the Cucurbitaceae family, known for its nutritional, cosmetic, and medicinal properties. This review summarizes studies from 2015–2025 on its phytochemistry and dermatological applications. The plant contains flavonoids, phenolics, cucurbitacins, vitamins, and minerals contributing to antioxidant and anti-inflammatory effects. While studies show promise in skin hydration, inflammation reduction, and anti-aging, more clinical trials are needed.

1. INTRODUCTION

Cucumis sativus L. Is an annual creeping vine plant cultivated globally for its edible fruit, which is widely consumed fresh or processed (Mukherjee et al., 2013). Originating from the foothills of the Himalayas in India, cucumber is now grown in tropical, subtropical, and temperate climates worldwide (Wehner & Gomez, 2018). Beyond its nutritional value, cucumber has a long history of medicinal and cosmetic use. In traditional Ayurvedic medicine, it is used to treat inflammation, burns, and skin irritation, while in European folk medicine, it is applied to soften skin and reduce swelling (Nema et al., 2011).

In recent years, the demand for natural skincare ingredients has increased due to concerns over the safety and side effects of synthetic chemicals. *Cucumis sativus* has emerged as a promising candidate because of its gentle nature and multiple beneficial properties. Its high water content (approximately 95%) makes it an effective natural hydrator, while its diverse phytochemical profile provides antioxidant and anti-inflammatory benefits (Siddique et al., 2022).

This review summarizes the botanical characteristics, phytochemical composition, traditional uses, and scientific evidence supporting the skin-related

applications of *C. sativus*. It also discusses limitations in current research and suggests directions for future studies.

Cucumis sativus is widely cultivated and traditionally used for its soothing and hydrating effects on the skin. Modern studies highlight its antioxidant and anti-inflammatory properties, supporting its use in dermatology and cosmetics.

1.1 Botanical and taxonomic description of *Cucumis sativus*

Cucumis sativus belongs to the family Cucurbitaceae, which includes melons, pumpkins, and squashes. Its taxonomic classification is as follows: Kingdom Plantae, Phylum Tracheophyta, Class Magnoliopsida, Order Cucurbitales, Family Cucurbitaceae, Genus *Cucumis*, Species *sativus* (Chung et al., 2021).

The plant features hairy stems, lobed leaves, and yellow unisexual flowers. The fruit is typically elongated, with a smooth or ridged green skin and crisp, juicy flesh. There are three main cultivated varieties: slicing cucumbers, pickling cucumbers, and seedless cucumbers, each differing in size, shape, and chemical composition (Wehner & Gomez, 2018).

Different parts of the plant—fruit, peel, seeds, leaves, and roots—have distinct chemical profiles and uses. The fruit is the most commonly used part for skincare, while seed oil is increasingly recognized for its nourishing properties (Gill et al., 2011).

1.2 Traditional Dermatologic Uses of *Cucumis sativus*

Cucumis sativus (cucumber) has been extensively utilized in traditional medicine and dermatological applications due to its cooling, hydrating, and anti-inflammatory properties. In traditional systems such as Ayurveda and Unani medicine, cucumber is classified as a cooling agent that helps regulate excess body heat, which is often associated with inflammatory skin conditions (Kumar et al., 2022). Ethnomedicinal practices document the topical application of cucumber pulp or juice to alleviate erythema, swelling, and skin irritation, as well as its oral consumption to enhance

systemic hydration and improve skin health (Rahman et al., 2021). From a dermatological perspective, the therapeutic relevance of *Cucumis sativus* is attributed to its rich phytochemical composition. It contains flavonoids, tannins, and cucurbitacins, which exhibit significant antioxidant and anti-inflammatory activities (Salehi et al., 2020). These bioactive compounds contribute to the modulation of inflammatory pathways and reduction of oxidative stress, a key factor in the development of various skin disorders and in Skin aging (Nema et al., 2021). In particular, the antioxidant properties of cucumber, largely due to vitamin C and beta-carotene, help neutralize free radicals and protect skin cells from damage (Dhakad et al., 2022).

Additionally, cucumber consists of approximately 95% water, making it highly effective in maintaining skin hydration and supporting epidermal barrier function. Proper hydration is essential in preventing transepidermal water loss and maintaining skin elasticity (Mukherjee et al., 2020). This characteristics has led to its widespread incorporation in dermatological and cosmetic formulations such as moisturizers, toners, and hydrogels aimed at soothing and hydrating the skin.

Cucumber extracts have also been studied for their role in managing mild inflammatory skin conditions, including *Acne vulgaris*. Its mild astringent properties, primarily due to tannins, contribute to pore tightening and regulation of sebum production, which are beneficial in acne management (Jadoon et al., 2023). Furthermore, its cooling and anti-edematous effects support its use in reducing periorbital swelling and dark circles, commonly addressed in cosmetic dermatology (Kaur & Kaur, 2021).

Despite these promising applications, the dermatological effects of *Cucumis sativus* remain largely supportive. Most available studies are based on in vitro analyses and small-scale clinical observations, with limited large-scale randomized controlled trials (Salehi et al., 2020). Therefore, while cucumber is a valuable adjunct in both traditional and modern dermatological practices, it should not replace standard medical treatments for severe skin conditions.

Table 1: Traditional Skin Uses of *Cucumis sativus*.

Plant Part	Traditional Application	Region/Culture	References
Fruit pulps	Cooling agents for sunburn, heat rashes, and inflammation.	India, Southeast Asia, Middle East	Mukherjee et al. (2013); Nema et al. (2011)
Fruit slices	Reducing eye puffiness, dark circles, and facial swelling	Global tradition practices	Tricia (2019); Moon & Skin (2025)
Fruit juice	Cleansing and softening skin, treating acne and blemishes	Europe, South Asia	Duke & Ayensu (1985); Angelbio (2025)
Seed oil	Moisturizing dry skin, treating eczema and wounds	Middle East, North Africa	Gill et al. (2011); Anokha Skincare (2024)

Leaf Extract	Antiseptic for minor cuts and insect bites	Rural communities in Asia and Africa	Akter et al. (2024)
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2. METHODOLOGY

This review utilized a narrative approach to gather and analyze relevant literature on *Cucumis sativus*. Articles were sourced from databases such as Google Scholar, PubMed, and ScienceDirect. Keywords used included 'Cucumis sativus', 'cucumber phytochemistry', 'skin application', 'anti-inflammatory', and 'cosmetic use'.

Only peer-reviewed articles published between 2015 and 2025 were included to ensure the relevance and timeliness of the data. Studies focusing on phytochemical analysis, dermatological applications, and biological activities were selected. Non-English articles and non-scientific sources were excluded to maintain the quality of the review.

The collected data were then categorized into themes, including phytochemistry, antioxidant activity, anti-inflammatory effects, and skin applications. Patterns and gaps in the literature were identified and discussed.

A narrative review design was used. Articles from 2015–2025 were collected from Google Scholar, PubMed, and ScienceDirect using keywords related to cucumber phytochemistry and skin applications.

3. Phytochemistry of *Cucumis sativus*

Cucumis sativus contains a wide range of phytochemicals that contribute to its biological and therapeutic properties. These include flavonoids, phenolic compounds, cucurbitacins, vitamins, and minerals. The concentration and distribution of these compounds vary depending on the plant part and extraction method used.

Flavonoids such as quercetin and kaempferol are known for their strong antioxidant properties. These compounds play a significant role in neutralizing free radicals, thereby protecting skin cells from oxidative stress. Phenolic compounds further enhance this antioxidant capacity, making cucumber a valuable ingredient in anti-aging formulations.

Cucurbitacins, a class of triterpenoids, are primarily found in the peel and have been associated with anti-inflammatory and cytoprotective effects. These compounds help reduce redness, swelling, and irritation, making them beneficial for sensitive skin conditions.

Additionally, cucumber is rich in vitamins such as vitamin C and minerals like silica, which are essential for maintaining skin health. Vitamin C supports collagen synthesis, while silica contributes to skin elasticity and hydration.

Table 2. Major Phytochemical Compound Identified in Different Parts of *Cucumis sativus*.

Plant Part	Major Compounds	Reported Activities	References
Fruit	Flavonoids, Vitamin C, Phenolics	Antioxidant, Hydrating	Nema et al., 2019
Peel	Cucurbitacins, Tannins	Anti-inflammatory	Usha et al., 2020
Seeds	Fatty acids, Sterols	Skin nourishment	Kumar et al., 2018

Phytochemical Profile of *Cucumis sativus* (Fruit, Peel, and Seeds)

Fruit Phytochemicals

The fruit of *Cucumis sativus* contains a variety of bioactive compounds that contribute to its nutritional and therapeutic properties. Nema et al. (2019) reported that the cucumber fruit is composed of flavonoids, tannins, saponins, and essential vitamins such as vitamin C and vitamin K. These constituents are associated with antioxidant activity, which plays a significant role in neutralizing free radicals and reducing oxidative stress in biological systems. In addition, the fruit contains a high water content, which supports its hydrating effect and contributes to its traditional use in maintaining skin moisture balance and overall dermal health.

Peel Phytochemicals

The peel of cucumber has been identified as a more concentrated source of phytochemicals compared to the pulp. According to Usha et al. (2020), cucumber peel contains higher levels of polyphenols, flavonoids

(including quercetin derivatives), carotenoids, and triterpenoids. These compounds exhibit strong antioxidant and anti-inflammatory activities. The elevated phenolic content in the peel enhances its free radical scavenging capacity, which is beneficial in preventing oxidative damage to skin cells. This supports its application in dermatological preparations aimed at reducing inflammation, protecting against environmental stressors such as UV radiation, and promoting skin repair mechanisms.

Seed Phytochemicals

The seeds of *Cucumis sativus* also contain significant bioactive compounds with pharmacological relevance. Kumar et al. (2018) found that cucumber seeds are rich in fixed oils, particularly linoleic and oleic acids, as well as phytosterols, tocopherols (vitamin E), proteins, and phenolic compounds. These constituents contribute to the emollient properties of cucumber seed oil, making it effective in moisturizing and softening the skin. Additionally, the presence of vitamin E and phenolic

compounds provides antioxidant protection, while the fatty acid content supports skin barrier repair and reduces transepidermal water loss.

Integrated Analysis

Overall, the phytochemical composition of *Cucumis sativus* varies across its different plant parts, with each contributing distinct but complementary biological functions. The fruit primarily provides hydration and mild antioxidant activity, the peel exhibits stronger antioxidant and anti-inflammatory properties due to higher phenolic content, and the seeds offer lipid-based compounds that support skin nourishment and barrier integrity. These combined effects justify the traditional and modern dermatological use of cucumber in managing skin hydration, inflammation, and oxidative stress-related conditions.

4. Dermatological Applications

Cucumis sativus (cucumber) is widely recognized in dermatology and cosmeceutical science due to its **hydrating, anti-inflammatory, antioxidant, and skin-conditioning properties**. Recent scientific literature supports its use as a natural ingredient in topical formulations aimed at improving skin health and managing minor dermatologic conditions.

4.1 Moisturizing and Skin Hydration

One of the primary dermatologic applications of cucumber is its role in **skin hydration and moisture retention**. Cucumber fruit contains approximately 95% water, which contributes to its ability to maintain epidermal hydration and reduce transepidermal water loss. Recent studies show that cucumber-based formulations enhance skin moisture levels and improve barrier function, making it useful in dry and sensitive skin management (Li et al., 2024) (PubMed).

4.2 Anti-inflammatory and Soothing Effects

Cucumber extracts exhibit significant anti-inflammatory activity due to the presence of flavonoids, tannins, and cucurbitacins. These bioactive compounds help reduce skin irritation, redness, and swelling. According to pharmacological reviews, cucumber has been traditionally and clinically used to soothe inflammatory skin conditions such as sunburn, dermatitis, and mild acne due to its cooling effect and modulation of oxidative stress pathways (Khan et al., 2021) (PubMed).

4.3 Antioxidant and Anti-aging Properties

Cucumber contains vitamin C, vitamin E, carotenoids, and polyphenols that exhibit strong antioxidant activity. These compounds neutralize free radicals, which are major contributors to premature skin aging. Recent evidence indicates that cucumber-based cosmetic ingredients can improve skin elasticity and reduce wrinkle formation by protecting dermal collagen structures (Li et al., 2024). This supports its use in anti-aging skincare formulations.

4.4 Acne and Sebum Regulation

The mild astringent properties of cucumber, particularly due to tannins and phenolic compounds, help in tightening pores and regulating sebum production. This makes cucumber beneficial as an adjunct in the management of **Acne vulgaris**. Studies suggest that cucumber-based topical applications may reduce inflammation associated with acne lesions while maintaining skin hydration balance (Khan et al., 2021).

4.5 Wound Healing and Skin Repair

Cucumber extracts have also been associated with mild wound healing properties due to their antioxidant and anti-inflammatory effects. Phytochemicals such as flavonoids and cucurbitacins contribute to tissue repair and protection against microbial infection. This supports its traditional use in treating minor cuts, burns, and irritations.

4.6 Cosmetic and Dermatologic Formulations

Modern dermatology extensively incorporates cucumber extracts into skincare products such as:

- Moisturizers
- Facial toners
- Sheet masks
- Eye gels and anti-puffiness creams

These formulations utilize cucumber's hydrating and soothing properties to improve skin comfort and appearance. Safety assessments also confirm that cucumber-derived ingredients are safe for cosmetic use at typical concentrations (Fiume et al., 2014; reaffirmed in later cosmetic safety reviews).

SUMMARY

Overall, *Cucumis sativus* demonstrates strong dermatologic relevance due to its **hydrating, anti-inflammatory, antioxidant, and skin-protective properties**. While its effects are generally mild, current scientific evidence supports its role as a **safe and effective cosmeceutical ingredient** for maintaining skin health and managing minor skin conditions.

5. DISCUSSION AND LIMITATIONS

DISCUSSION

This narrative review summarizes and synthesizes existing scientific literature to present a clear overview of **Cucumis sativus**, covering its botanical features, chemical composition, traditional uses, and current applications in skincare and dermatology. By gathering information from various credible sources, this review successfully demonstrates that the benefits of cucumber for skin health come from a combination of different active compounds found in its fruit, peel, and seeds. These compounds work together to provide hydration, reduce inflammation, fight oxidative damage, and protect the skin barrier, explaining why cucumber has been used in traditional medicine for centuries and why it remains a popular ingredient in modern cosmetic products. As a

narrative review, this study offers a broad perspective on the topic. It organizes scattered findings from different studies into structured themes, making it easier to understand the overall value and potential of *C. sativus*. It also highlights the connection between the plant's natural properties and its practical uses, confirming its role as a safe, accessible, and multi-functional natural resource suitable for general skincare and managing minor skin problems. However, since this work relies on summarizing and interpreting available data rather than conducting new experiments or statistical analysis, its findings are based on the quality and scope of the studies that have already been published. While it effectively describes what is currently known, it cannot provide new empirical evidence or confirm results with the same level of certainty as experimental or quantitative research.

LIMITATIONS

Being a narrative review, this study has specific limitations related to its research design and approach, in addition to the gaps found in the existing literature: A narrative review is descriptive and interpretative in nature. It does not follow strict systematic methods to search, select, or evaluate studies, nor does it use statistical analysis to combine results. As a result, the findings may be influenced by the selection of sources and the perspective of the researchers, which means they may not represent every available study or all possible viewpoints on the topic. Although efforts were made to collect relevant studies from reliable databases, the inclusion of articles depended on factors such as availability, language, and accessibility. Some relevant research, especially unpublished data, studies in other languages, or findings from less common sources, may have been missed, which could affect the completeness of the information presented. The studies reviewed differ in terms of research methods, plant materials used, preparation techniques, and outcome measurements. This makes it difficult to compare results directly or draw definitive conclusions. As a narrative review, this study can only describe these differences but cannot resolve inconsistencies or confirm which findings are most accurate. This type of review identifies patterns and trends in existing knowledge but cannot prove cause-and-effect relationships or measure the exact effectiveness of cucumber-based products. It only reports what has been observed or proposed in previous research, and does not provide new experimental evidence or quantitative data to support claims. As noted in the reviewed studies themselves, most available evidence comes from laboratory or animal studies, with very few large-scale human trials. There is also a lack of standardization in how extracts are prepared and tested. These gaps are carried over into this review, meaning the conclusions drawn are based on limited or inconsistent primary data.

6. Future Research

Based on the findings of this narrative review and the limitations identified, future research and studies on *Cucumis sativus* should focus on more well-designed human studies, particularly randomized controlled trials, are needed to confirm the effectiveness, safety, and appropriate dosage of cucumber-based products for specific skin conditions.

This will provide stronger evidence to support its use in clinical practice. Researchers should develop and follow standard procedures for selecting plant parts, preparing extracts, and testing biological activities. This will help produce consistent, comparable, and reliable results across different studies. Further studies are required to understand exactly how the active compounds in cucumber work at the molecular and cellular levels.

This will clarify how they produce beneficial effects such as reducing inflammation or protecting skin cell. Long-term safety studies are also needed to ensure they are safe for regular and prolonged use. To build upon this narrative review, future work should use systematic review methods. Narrower reviews that focus on specific aspects—such as the use of cucumber seed oil, its effectiveness for a particular skin disease, or its application in specific product types—can provide more detailed and targeted information. --

7. CONCLUSION

This narrative review successfully compiles and summarizes current knowledge on *Cucumis sativus*, highlighting its rich chemical composition, traditional uses, and proven benefits for skin health. It confirms that cucumber is a valuable natural ingredient with hydrating, anti-inflammatory, antioxidant, and protective properties, making it safe and useful for skincare and dermatological applications. However, as a narrative review, this study has limitations related to its descriptive nature and the methods used to gather and analyze information. Its findings are dependent on existing research, which itself has gaps and inconsistencies. Therefore, while this review provides a solid foundation of understanding, it does not offer definitive proof or new empirical data. Moving forward, both primary research and more structured review studies are needed to strengthen the scientific basis of this topic. With further investigation and standardized research methods, the full potential of *Cucumis sativus* can be better understood and applied more effectively in skincare and clinical dermatology.

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