



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Mini Review

Phytochemical Profiling of Banana Peel (*Musa paradisiaca*): Exploring its Potential as a Bioactive Constituent for Anti-Acne Formulations

Sonali Ghaytidak, Pragati Soni*, Hrutuja Khopkar, Pranali Jadhav, Komal Mali

YNP college of pharmacy, Vangaon, Palghar(401103), Maharashtra, India.

ARTICLE INFO

Published: 29 Apr 2026

Keywords:

Musa, Banana peel, Acne vulgaris, cosmetic

DOI:

10.5281/zenodo.19877306

ABSTRACT

One of the most popular fruits to promote and eat is the banana, which is botanically known as *Musa* spp. Each year, the banana's peels generate a considerable amount of waste. People usually discard banana peels because they are unaware of their health benefits. Banana peels are rich in a variety of bioactive compounds, such as phytosterol, polyphenols, carotenoids, and biogenic amines. It also contains healthy levels of minerals like iron, calcium, salt, phosphorus, and magnesium as well as dietary fiber. Considering the possible health benefits of banana peels, as well as their use in a number of commercial sectors, including the food and beverage, nutraceutical, and pharmaceutical industries. Bananas are used in a number of industries. These include the food processing, pharmaceutical, beverage, and agricultural industries. The nutritional qualities and bioactive components were the primary emphasis of this review article.

INTRODUCTION

Among all skin conditions, Acne is the most common Skin disease. Almost everyone has had skin that is prone to acne, especially teenagers. Even if acne is not thought to be a serious illness, practically all of its victims have a disordered appearance, which frequently lowers their self-esteem and interferes with day-to-day activities. It makes sense that the majority of customers who visit the skin care clinic are looking for a way to

get rid of their acne. One dermatologist claims that roughly 70% of patients have acne(1). A persistent inflammatory skin condition affecting the pilosebaceous units (sebaceous glands and hair follicles) on the face, neck, trunk, or proximal upper extremities is called acne vulgaris (AV). Acne is a common inflammatory skin disorder characterized by seborrhea, noninflammatory and inflammatory lesions, and possible scarring. Acne lesions typically appear on the face, neck, upper back, shoulders, and chest, which corresponds to

*Corresponding Author: Pragati Soni

Address: YNP college of pharmacy, Vangaon, Palghar(401103), Maharashtra, India

Email ✉: spragati003@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



the location and density of pilosebaceous units in acne sufferers(2). Erythematous papules, pustules, and chronic or recurrent comedones are the hallmarks of this illness.



Fig no. 1: Acne Vulgaris on Facial skin.

The degree of severity manifests as non-inflammatory open or closed comedones, followed by inflammatory pustules and papules, and persistent disease in the form of nodules and cysts. AV affects people of all colors, nationalities, and cultures. Even though it is harmless, self-limiting, and not fatal, persistent inflammation can cause scars, erythema, and hyperpigmentation, which can lead to both physical and psychological issues(3). Despite being one of the most prevalent diseases in humans, there are still many unanswered concerns about the precise pathophysiology, categorization, and therapy of

acne vulgaris. Through ongoing research over the years, the traditional four-factor acne pathogenesis has been altered to a more complex template: disruption of sebaceous gland activity linked to hyperseborrhoea and changes in sebum fatty acid composition; dysregulation of the hormone microenvironment; interaction with neuropeptides; aberrant differentiation of the follicular epithelium and follicular hyper keratinization; induction of inflammation; and dysfunction of the innate and adaptive immunity. The pilosebaceous unit's ability to function is compromised by these processes, which causes a normal follicular canal to change into microcomedone, which then develops into an inflammatory lesion(1).

Comedones, papules, pustules, inflamed nodules, superficial pus-filled cysts, and (in severe cases) canalising and deep, inflamed, occasionally purulent sacs are the most common features of acne vulgaris, a common inflammatory pilosebaceous illness. Although the face is most frequently affected, lesions can also occur on the neck, chest, upper back, and shoulders. Scarring and significant psychological discomfort are two consequences of acne. There are three categories for it: mild, moderate, and severe(4).

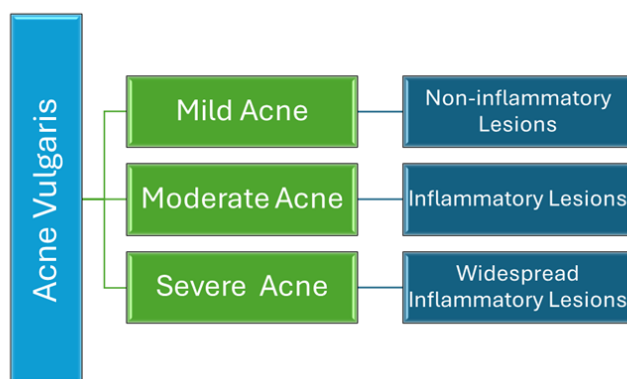


Fig no. 2: Classification of Acne on the Basis of Lesions.

The skin is the biggest organ in the body, covering up to 2m² and weighing around 4.5kg in an average adult (or about 12-15% of total adult body

weight). Skin is the initial physical barrier that protects us from the external environment. The skin consists of three layers: the epidermis on top,

the dermis underneath, and the subcutaneous tissue beneath(5). This layer act as barrier against the foreign particle affecting skin health. However, this skin disorder is common to Human lifestyle. Common skin problems include flaking, edema,

inflammation, itching, and dehydration. The World Health Organization (WHO) reports that 21-87% of dermatological illnesses occur in poor nations(6).

ACNE FORMATION

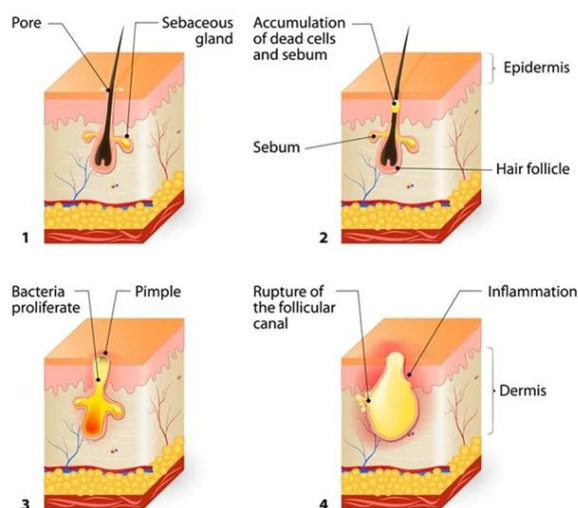


Fig no. 3: Acne Formation

Acne, blackheads, pimples, and dark circles are prevalent in today's youth. According to Ayurveda, blood impurities are typically the cause of skin issues. Skin-related disorders are brought on by accumulated toxins in the blood from unhealthy eating and lifestyle choices(7). People all over the world suffer from acne, sometimes referred to as acne vulgaris, a chronic, persistent skin inflammation of the pilosebaceous follicles. According to estimates, 9.4% of people worldwide suffer from acne, making it the eighth most common skin condition. Over 85% of teenagers suffer from acne, which can last into adulthood. It typically affects women and accounts for two-thirds of dermatologist visits(8). Post-inflammatory erythema and hyperpigmentation are common outcomes of acne. According to studies, 37% of acne sufferers experience skin sensitivity, and 3% to 7% may have scarring, which can have a major impact on their appearance and general health. Androgen-induced sebaceous gland enlargement, excessive sebum production, aberrant follicular duct keratinization, microbial

proliferation (such as *Cutibacterium acnes*), and inflammatory immunological responses are all directly related to the pathophysiology of acne vulgaris. Patients with acne vulgaris frequently have weakened skin barriers, according to recent research. Trans-epidermal water loss (TEWL), pH levels, sebum production, porphyrins, erythema, and decreased microbial diversity are all correlated with the severity of the condition and the integrity of the skin barrier, according to evidence.

Herbal medications are popular in the developed world for basic health care due to their effectiveness, safety, and minimal side effects(9). A variety of plants employed in herbalism, some of which have therapeutic properties, are referred to as medicinal plants. These therapeutic plants are thought to be rich sources of components that can be utilized in the synthesis and development of new drugs. In addition, these plants are essential to the global development of human cultures(10). Plant extracts and natural chemicals are excellent ingredients for cosmetics. Natural ingredients in cosmetic formulations can enhance their

performance. Additionally, they can improve the stability and bioavailability of cosmetic compositions. Plants were the primary source of cosmetics before synthetic compounds, and the cosmetic business is increasingly focusing on natural elements(11).

The worldwide skincare and cosmetics sector is progressively embracing natural, plant-based, and environmentally friendly materials. Banana peel, which constitutes a significant amount of the fruit, is frequently discarded as waste. However, studies have revealed that banana peel includes numerous beneficial components that can help maintain healthy skin. Banana peel contains natural antioxidants such as flavonoids, phenolic acids, carotenoids, and vitamins. These compounds serve to protect the skin from free radical damage, decrease the appearance of aging, and maintain collagen levels, all of which are necessary for firm and youthful skin. The peel also includes natural sugars, mucilage, potassium, and amino acids, which keep the skin hydrated, healed, and protected. These ingredients promote hydration, smoothness, and skin barrier strength. Bananas have been cultivated throughout Southeast Asia for over 7000 years. They subsequently expanded to India, Africa, and other warm regions worldwide. People have historically utilized banana peels to treat skin ailments. They applied the peel on irritated skin, bug bites, small dark areas, dry cracked skin, and minor wounds. In India and Indonesia, healers used peel poultices to moisturize skin and reduce inflammation. In other

tropical places, the inside of the peel was applied to acne, minor burns, and wrinkles(12).

Botanical Description & Taxonomical Data:

The humid lowland tropics within 30° of the equators are the ideal growing conditions for bananas, which most likely originated in Southeast Asia. Although growth is considerably slower and cropping is lighter, they are also produced commercially in the subtropics and at elevations of 1000 meters or more. According to Purseglove (1972), *Musa acuminata* Colla (*Musa* AA) and *Musa balbisiana* Colla (*Musa* BB) are the sources of all edible bananas, with the exception of Fe ions. The root axis emerges from the rhizome and may give rise to primary (first-order) laterals, from which secondary (second-order) laterals may branch. A root is an axis and its laterals. By definition, the root system that emerges from the rhizome is adventitious. The largest herbaceous plant is the banana, whose pseudostem can grow up to 10–15 m in certain wild species and 2–8 m in cultivated forms. The underground stem, which is roughly 30 cm long, bears the striking aerial shoot. Additionally, bananas have the greatest leaf area, albeit this varies depending on the cultivar and growth environment. Dessert banana leaves range in size from 1.27 to 2.80 m². At flowering, "Cavendish" varieties may have a total leaf area of 16.9–25 m². According to botanical studies, the fruit is a parthenocarpic berry. Depending on the cultivar and season, fruit takes 80–120 days to mature. The fruits change from green to yellow as they ripen(13).

Table no. 1: Taxonomical classification of Musa.

Sr. No.	Taxonomy Hierarchy	Taxonomical Data
1.	Kingdom	Plantae
2.	Phylum	Angiosperms
3.	Class	Monocots
4.	Order	Zingiberales
5.	Family	Musaceae
6.	Genus	Musa
7.	Species	<i>Musa</i> spp. (Multiple species)



Morphology Structure of Banana fruits:

The fruit contains essential nutrients. Additionally, it is a beneficial digestive aid that facilitates bowel movements and provides healthy fiber for your digestive system. Rich in vitamin C and B6, it improves the body's ability to absorb iron, raising hemoglobin levels and improving blood and cardiovascular health in general. Eating it throughout pregnancy is beneficial for the wellbeing of the fetus. It works well to treat high blood pressure and cholesterol and is also enhanced with potassium. Additionally, gastrointestinal problems including constipation and stomach ulcers are relieved by bananas. Banana leaves have numerous traditional and therapeutic uses, much like every part of the banana tree.

People will provide you that banana leaves are used for food wrapping, animal feed, garnishing, serving, and decoration.



Fig no.4: Banana Fruits.

Because it balances the body's blood sugar levels, the flower is beneficial for those striving to prevent and deal with type 2 diabetes. Additionally, it is rich in antioxidants, which makes it perfect for anti-aging and cell health. It is low in calories, increases metabolism, and contains a variety of vital vitamins and amino acids. Additionally, it is excellent for the general health of the reproductive organs, supporting nursing mothers and preventing infections. Numerous chemical components found

in banana leaves and flowers have such non-toxic and beneficial effects on skin and hair. They demonstrate their impact on skin by giving it a smooth, glossy, and healthy feel. Because banana leaves contain antibacterial and antioxidant qualities, they can be used as an ingredient in creams and lotions, according to laboratory investigations. Additionally, banana flowers and leaves have anti-aging qualities that help to avoid wrinkles and fine lines. Additionally, it works well for wounds, burns, rashes, itching, and fungal infections(14).



Fig no. 5: Banana Flower

Phytoconstituents:

Polyphenols, Lignin, Hemicellulose, Protein, Allantoin, Anthocyanin, Tannins, Flavonoid, and Rutin are among the health-promoting chemical components found in banana leaves.

1. **Polyphenols:** Polyphenols are another chemical component found in banana leaves. EPIGALLOCATECHIN GALLATE (EGCG), a major component of banana leaves, has a variety of effects on the body, particularly on the skin, since polyphenols are a powerful source of antioxidants. It has an anti-aging impact on skin and can be used to treat rashes, cuts, wrinkles, and dull skin. Additionally, it has anti-inflammatory qualities that are utilized to lessen inflammation. Additionally, it can be used to treat dark spots and fine lines on the skin(14).

2. **Allantoin:** One of the key components found in banana leaves is allantoin, which plays a major part in maintaining healthy skin. Allantoin exhibits astringent properties. By regenerating epidermal cells, it speeds up the skin's healing process. Allantoin is a skin-active substance that has calming, anti-irritating, and moisturizing qualities. It is hence in charge of moisturizing the skin.
3. **Hemicellulose:** Hemicellulose is another chemical component of banana leaves. The kind of carbohydrate called hemicellulose is partly in charge of the skin's innate capacity to absorb and hold onto water. By hydrating the skin, it also contributes to a stronger and longer-lasting bond. Additionally, banana leaves include proteins that maintain the skin's flexibility and healthy layers while strengthening and fortifying skin cells.
4. **Proteins:** The two types of proteins are collagen and elastin. They are mostly found inside the skin, usually in the middle layer. Skin cells are strengthened and made resilient by collagen. Elastin helps stretched skin restore its shape and increases skin's flexibility.
5. **Anthocyanins:** Anthocyanins are water-soluble substances with a molecular weight of 207.24724 g/mol and a chemical formula of $C_{15}H_{11}O$. In most cases, they are collections of polyphenolic pigments. Anthocyanins shield the skin from UV radiation and prevent UV-induced skin damage. Additionally, they aid in lowering inflammation, which may help lessen acne.
6. **Tannins:** Tannins are a class of polyphenolic, astringent biomolecules. They have anti-inflammatory qualities that aid in lowering redness and inflammation. By functioning as antioxidants against free radicals, they also shield the skin from harm. They function as a natural astringent to eliminate extra oil from the skin.
7. **Flavonoids:** Flavonoids are dietary components that fall under the category of plant compounds, or phytochemicals. There are currently about 5,000 different types of flavonoids. Flavonoids have the capacity to absorb ultraviolet (UV) light and are primarily composed of antioxidant qualities. They aid the body in combating dangerous chemicals because of their potent antioxidants. One of the immune system's reactions is inflammation. Toxins, allergens, bacteria, and other irritants can cause inflammation, which can lead to painful sensations. The body uses flavonoids to lessen these symptoms.
8. **Rutin:** As a member of the bioflavonoid family, rutin has antioxidant qualities that support healthy skin. Rutin reduces wrinkles and improves skin suppleness. As a result, it can prevent aging of the skin(14).

Pharmacological action:

- **Antibacterial Agent:** The antibacterial activity analysis of banana peel revealed that ethyl acetate extract was the most effective. Inhibition zones of less than 5 mm indicate mild activity, 5-10 mm indicate moderate activity, 10-20 mm indicate high activity, and larger than 20 mm indicate very strong activity(15). Medicinal plants contain bioactive chemicals and have been used as antibacterial agents for thousands of years. The growing interest in plant-based antibacterial agents stems from a better understanding of their mechanisms of action. A study of *M. paradisiaca* solvent extracts found that the methanolic extract had the highest antibacterial activity due to its high phenol content. Microbial enzyme activity, specifically dehydrogenase activity, is often



used to assess the ecotoxicity of environmental substrates. *M. paradisiaca*'s antibacterial activity was evaluated by inhibiting dehydrogenase activity in pathogenic bacteria isolates using aqueous extracts. This experiment examined dehydrogenase activity in nutritional broth-glucose-triphenyl tetrazolium chloride (TTC) medium with varying plant extract amounts. Two bacteria (*Staphylococcus* spp. And *Pseudomonas* spp.) were evaluated for their capacity to decrease TTC to triphenyl formazan, and the results were utilized to evaluate the antibacterial activity of the plant extract(16).

- **Anti-inflammatory:** Compounds with anti-inflammatory qualities found in the peel include lutein and carotenoids. This may lessen skin irritation, edema, and redness(17).
- **Anti-Microbial agent:** The antimicrobial properties of hexane, ethyl acetate, and methanol extracts from banana leaves, including *M. paradisiaca*, was reported. To determine their antibacterial. *E. coli*, *P. aeruginosa*, *Citrobacter* species, and other bacteria known to cause hospital-acquired infections were utilized as test organisms. The study found that ethyl acetate extracts outperformed methanolic and hexane extracts. Ethyl acetate extracts demonstrated varying effectiveness compared to chloramphenicol. *P. mirabilis* and *E. aerogenes* exhibited resistance to hexane extracts(18).
- **Anticancer agent:** Plantain peel aqueous extract-synthesized gold nanoparticles substantially inhibited A549 lung cancer cells

in vitro at doses ranging from 25 to 100 µg/mL compared to DMSO, saline, peel extract, and HAuCl₄. Peel extract outperformed other controls. The cytotoxic activity was attributed to the apoptotic pathway, resulting in an IC₅₀ of 58 µg/mL. This study supports the traditional usage of *M. paradisiaca* to treat cancer and inflammatory disorders.

- **Anti-hypertensive:** Ripe banana pulp has been shown to have an antihypertensive effect in rats with elevated blood pressure caused by desoxycorticosterone acetate (DOCA) administration. This effect may be attributed to the high tryptophan and carbohydrate content of bananas, which raise serotonin levels and have a serotonin-mediated natriorexic effect. *M. paradisiaca* has been shown to have an antihypertensive effect in albino rats. Nevertheless, it found that in isolated rat aortic rings, serotonin caused contraction rather than relaxation. Both noradrenaline- and potassium chloride-contracted rat aortic rings showed a concentration-dependent hypotensive effect when exposed to the aqueous extract of the ripe *M. paradisiaca* fruit(19).

Marketed Example:

Fiber-enriched banana peel and infant food made with banana flour are common formulations. To increase shelf life, banana pulp and peels are processed into value-added goods like flour, pasta, or snacks. Blanching to control viscosity, dehydrating, and producing powder for ingredient fortification are important methods. here are some examples of formulation available in market.



Fig no. 6: Banana peel Powder by (Aratya). Fig no. 7: Banana peel Powder by (Trust) Fig no. 8: Banana peel-based Skin Care product.

CONCLUSION

Numerous bioactive substances, including phenolic and non-phenolic antioxidants including ascorbic acid, carotene, and cyanidin, are found in banana peels. Because they reduce reactive oxygen species (ROS), shield protease inhibitors from oxidative damage, and stop fibroblast breakdown, antioxidants are crucial in the elimination of inflammatory products. Additionally, trigonelline, isovanillic acid, and ferulic acid are anti-inflammatory compounds found in banana peels. Trigonelline prevents the synthesis of nucleic acids and bacterial enzymes. Isovanillic acid inhibits the synthesis of TNF α because it is induced by LPS. Ferulic acid inhibits the synthesis of cytokines and proinflammatory signaling. Banana peels can be used in the food processing, beverage, cosmetic, pharmaceutical, and agricultural industries due to their nutritional and chemical properties, which also increase their potential health advantages. Banana peels are utilized in compliance with industry standards and objectives. Consequently, by significantly lowering agricultural waste and byproducts, this could aid in waste management and reduce pollution.

REFERENCES

1. Kusuma SAF, Abdassah M, Valas BE. Formulation and evaluation of anti acne gel

containing citrus aurantifolia fruit juice using carbopol as gelling agent. Int J Appl Pharm. 2018;10(4):147–52.

2. Huang C, Zhuo F, Han B, Li W, Jiang B, Zhang K, et al. The updates and implications of cutaneous microbiota in acne. Cell Biosci. 2023;13(1):1–18.
3. Savitri D, Djawad K, Hatta M, Wahyuni S, Bukhari A. Active compounds in kepok banana peel as anti-inflammatory in acne vulgaris: Review article. Ann Med Surg [Internet]. 2022;84(October):104868. Available from: <https://doi.org/10.1016/j.amsu.2022.104868>
4. Purdy S, de Berker D. Acne vulgaris. BMJ Clin Evid. 2011;2011(February 2010).
5. Lotfollahi Z. The anatomy, physiology and function of all skin layers and the impact of ageing on the skin. Wound Pract Res. 2024;32(1):6–10.
6. Bagheri S, Yasemi M, Safaie-Qamsari E, Rashidiani J, Abkar M, Hassani M, et al. Using gold nanoparticles in diagnosis and treatment of melanoma cancer. Artif Cells, Nanomedicine Biotechnol [Internet]. 2018;46(sup1):462–71. Available from: <https://doi.org/10.1080/21691401.2018.1430585>
7. Ashwini Gudigenavar*, Avinash Gudigenavar, A. B. Walikar, C. V. Nagathan, R. G. Patil VM and SCM, B. Formulation and



- Characterization of Herbal Face Pack: Research Article. World J Pharm Res [Internet]. 2024;13(12):981–7. Available from: <https://jopir.in/index.php/journals/article/view/119>
8. Vasam M, Korutla S, Bohara RA. Acne vulgaris: A review of the pathophysiology, treatment, and recent nanotechnology based advances. Biochem Biophys Reports [Internet]. 2023;36(November):101578. Available from: <https://doi.org/10.1016/j.bbrep.2023.101578>
 9. Sharma D, Namdeo P, Singh P. Phytochemistry and Pharmacological Studies of Glycyrrhiza glabra: A Medicinal Plant Review. Int J Pharm Sci Rev Res. 2021;67(1):187–94.
 10. Yudharaj P, Shankar M, Sowjanya R, Sireesha B, Naik EA, Priyadarshini RJ. Preclinical & Pharmaceutical Research IMPORTANCE AND USES OF MEDICINAL PLANTS-AN OVERVIEW. Int J Preclin Pharm Res [Internet]. 2016;7(2):67–73. Available from: www.preclinicaljournal.com
 11. Cerulli A, Masullo M, Montoro P, Piacente S. Licorice (Glycyrrhiza glabra, G. uralensis, and G. inflata) and Their Constituents as Active Cosmeceutical Ingredients. Cosmetics. 2022;9(1).
 12. Jadhav G, Katu YM, Pawar P, Singh V, Yadav A. Banana Peel in Skin Care : Unlocking the Power of Natural Antioxidant , Moisturizers & Anti-Aging Agent. 2026;14(1):618–26.
 13. Pareek S. Nutritional and Biochemical Composition of Banana (Musa spp.) Cultivars [Internet]. Nutritional Composition of Fruit Cultivars. Elsevier Inc.; 2015. 49–81 p. Available from: <https://dx.doi.org/10.1016/B978-0-12-408117-8.00003-9>
 14. Nagare Pratiksha Lahanu, Prof. R. Shinde DL. H. Formulation and Evaluation of Herbal Face Scrub. Int J Pharm Biol Sci Arch. 2022;10(7):315–31.
 15. Rita WS, Yanti NKLE, Swantara IMD. Antibacterial Activity and Characterization of Chitosan Nanoparticles Prepared from Hijau Lumut Banana (Musa paradisiaca L.) Peel Ethyl Acetate Extract. Nano Biomed Eng. 2023;15(3):278–87.
 16. OLUWAFEMI OMONIYI OGUNTIBEJU. Antidiabetic, Anti-Inflammatory, Antibacterial, Anti-Helminthic, Antioxidant and Nutritional Potential of Musa Paradisiaca. Asian J Pharm Clin Res. 2019;12(10):9–13.
 17. Prabhakar DV, R MM, Y GS, A SG. Research in Engineering Management the Potential Benefits of Banana Extract in Skin Care Products : a Comprehensive Review. 2024;1027–31.
 18. Ajijolakewu KA, Ayoola AS, Agbabiaka TO, Zakariyah FR, Ahmed NR, Oyedele OJ, et al. A review of the ethnomedicinal, antimicrobial, and phytochemical properties of Musa paradisiaca (plantain). Bull Natl Res Cent [Internet]. 2021;45(1). Available from: <https://doi.org/10.1186/s42269-021-00549-3>
 19. Imam MZ, Akter S. Musa paradisiaca l. and musa sapientum l.: A phytochemical and pharmacological review. J Appl Pharm Sci. 2011;1(5):14–20.

HOW TO CITE: Sonali Ghaytidak, Pragati Soni, Hrutuja Khopkar, Pranali Jadhav, Komal Mali, Phytochemical Profiling of Banana Peel (Musa paradisiaca): Exploring its Potential as a Bioactive Constituent for Anti-Acne Formulations, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 4, 4733-4741, <https://doi.org/10.5281/zenodo.19877306>

