WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 11, 2183-2194. Review Article ISSN 2277–7105

A COMPREHENSIVE REVIEW OF ORYZA SATIVA AND PSIDIUM GUAJAVA LEAF EXTRACTS IN HERBAL HAIR SERUM FOR IMPROVED HAIR HEALTH

Saiprasad Arjun Gajare, Pallavi Bhusari*

Department of Pharmacology, Samarth Institute of Pharmacy, Belhe, Pune-412410, Maharashtra, India.

Article Received on 5 May 2026,
Article Revised on 25 May 2026,
Article Published on 03 June 2026,

https://doi.org/10.5281/zenodo.20536323

***Corresponding Author**

Pallavi Bhusari

Department of Pharmacology, Samarth Institute of Pharmacy, Belhe, Pune-412410, Maharashtra, India.

How to cite this Article: Saiprasad Arjun Gajare, Pallavi Bhusari*. (2026). A Comprehensive Review of Oryza Sativa and Psidiumguajava Leaf Extracts in Herbal Hairserum for Improved Hair Health. World Journal of Pharmaceutical Research, 15(11), 2183–2194.

ABSTRACT

Hair care is a critical aspect of personal grooming, and the demand for natural and herbal hair care products has considerably increased due to consumer preference for formulations with minimal side effects. This study focuses on the development and evaluation of a phytoextract-based hair serum incorporating extracts of Oryza sativa (rice) and Psidium guajava (guava) leaves, which are traditionally recognized for their beneficial properties in promoting hair health. The objective is to develop a safe, effective, and natural hair serum to improve hair quality, reduce hair fall, and enhance scalp nourishment. Oryza sativa contains essential bioactive compounds such as amino acids, antioxidants (including ferulic acid), vitamins (such as Vitamin E), and minerals known to strengthen hair follicles, promote hair growth, and add shine and smoothness. Psidium guajava leaves are rich in flavonoids, tannins, and essential vitamins including Vitamin C, which possess antimicrobial, antioxidant, and anti-inflammatory properties that help reduce dandruff, stimulate hair growth, and improve overall scalp health. Three formulation batches were prepared, evaluated for phytochemical content, organoleptic properties, pH, viscosity, and microbial stability.

KEYWORDS: *Hair serum, Chemical-free, Natural remedy, Oryza sativa (rice), Psidium guajava (guava), Phytoextract, Herbal formulation, Scalp health.*

1. INTRODUCTION

Hair is one of the most visible features of an individual and plays a fundamental role in personal appearance, self-esteem, and psychological well-being. Across cultures and historical periods, healthy hair has been associated with vitality, youth, and attractiveness. The hair care industry reflects this universal concern, having grown into a multibillion-dollar global market that continues to expand as consumers seek products that are both effective and safe.

Modern lifestyles have significantly contributed to the rise in hair-related concerns. Factors including chronic psychological stress, nutritional deficiencies, hormonal imbalances, environmental pollution, hard water exposure, aggressive chemical treatments, and excessive use of heat styling tools collectively accelerate hair damage, thinning, and loss. Conditions such as androgenetic alopecia, telogen effluvium, seborrheic dermatitis, and dandruff-related scalp disorders are increasingly prevalent and impose both physical and emotional burdens on affected individuals.

Conventional hair care products frequently contain synthetic compounds such as sulfates, silicones, parabens, phthalates, and synthetic fragrances. While these agents enhance lather, texture, or shelf-life, long-term exposure has been associated with scalp irritation, follicular occlusion, hormonal disruption, and environmental toxicity. Growing consumer awareness of these concerns has catalyzed a major shift toward plant-based, minimally processed, and eco-conscious formulations.

Herbal hair serums occupy a unique niche in this evolving market. Unlike rinse-off shampoos or conditioners, serums are leave-on formulations that remain in sustained contact with the scalp and hair shaft, allowing greater bioavailability of active botanical constituents. The effectiveness of such serums depends critically on the quality and bioactivity of their phytoextract components, the physicochemical stability of the formulation, and the compatibility of ingredients with scalp physiology.

Among the natural ingredients that have garnered significant scientific and traditional support, Oryza sativa (rice) and Psidium guajava (guava) leaf extracts stand out as particularly promising candidates. Rice water has been employed for centuries in East and Southeast Asian beauty rituals, notably by the Yao women of Huangluo, China, who attribute their remarkably long and healthy hair to regular rice water treatment. Scientific investigation

has revealed that rice water is rich in inositol, gamma-oryzanol, ferulic acid, amino acids, and B vitamins—each of which contributes uniquely to hair structural integrity and scalp health.

Psidium guajava leaves, widely used in traditional medicine across tropical and subtropical regions of Asia, Africa, and Latin America, contain a potent array of polyphenols, flavonoids, tannins, and essential vitamins. Their documented antimicrobial, anti-inflammatory, and antioxidant activities make them highly relevant for addressing scalp disorders, reducing oxidative damage to the hair follicle, and supporting a healthy hair growth cycle.

This study was designed to harness the synergistic potential of these two botanical sources by developing and evaluating a stable, safe, and effective phytoextract-based hair serum. Three formulation batches incorporating varying concentrations of both extracts were prepared using additional excipients including aloe vera gel, sweet almond oil, rose water, and Tween 80. Each batch underwent comprehensive physicochemical and phytochemical evaluation to identify the optimal formulation. The ultimate goal is to contribute a well-characterized, evidence-based herbal hair serum that bridges the gap between traditional botanical knowledge and modern cosmeceutical science.

2. OBJECTIVES

The primary aim of this study was to develop and evaluate a herbal hair serum based on phytoextracts of Oryza sativa and Psidium guajava. The specific objectives were:

- To provide essential nutrients that enhance hair strength, reduce breakage, and improve shine through bioactive compounds naturally present in rice and guava leaf extracts.
- To stimulate hair follicles using natural herbal extracts that encourage healthy hair growth and prolong the anagen (growth) phase of the hair cycle.
- To reduce hair loss by strengthening hair roots, improving scalp microcirculation, and delivering antioxidant protection to the follicular environment.
- To maintain a healthy scalp by addressing dandruff, dryness, and inflammation through natural antimicrobial and anti-inflammatory agents present in the formulation.
- To enhance hair hydration and prevent dryness using herbal oils, aloe vera, and natural plant extracts that form a protective film over the hair shaft.
- To evaluate the physicochemical stability, phytochemical content, and microbiological safety of the prepared formulations to identify the optimal batch for further development.

3. Literature Review

Sr. No.	Topic / Plant	Author(s) & Year	Major Phytochemicals / Components	Key Findings Related to Hair Care	Conclusion
1	Herbal approaches to hair care	Zgonc Škulj et al., 2020	Rosemary, ginseng, pumpkin seed, *Serenoa repens* extracts	Herbal preparations showed hair growth-promoting activity comparable to minoxidil with better safety profile	Herbal medicines are promising alternatives for hair loss management
2	Classification of herbal anti-hair loss agents	Lourith and Kanlayavattanakul, 2013	Botanical anti-androgens, follicle stimulants, anti-inflammatory agents	Categorized herbal agents according to mechanism of action in hair care	Established scientific basis for herbal hair formulations
3	Oryza sativa (Rice water)	Inamasu et al., 2010	Inositol, rice starch, amino acids	Rice rinse water reduced surface friction and improved damaged hair texture	Rice water provides protective and conditioning effects on hair
4	Rice bran extract and hair growth	Choi et al., 2014	Gamma-oryzanol, phytosterols, ferulic acid	Rice bran extract accelerated hair regrowth in animal models	Rice bran possesses significant hair growth-promoting potential
5	Antioxidant effect of rice bran	Various studies	Ferulic acid, tocotrienols (Vitamin E)	Protected hair proteins from UV and oxidative damage; reduced hair loss	Rice bran antioxidants support scalp and follicular protection
6	Amino acid composition of rice	Various studies	Lysine, proline, cysteine, methionine	Supported keratin synthesis and strengthened hair shaft	Rice-derived amino acids improve hair strength and reduce brittleness
7	Psidium guajava leaves phytochemistry	Flores et al., 2015	Quercetin, kaempferol, gallic acid, catechins,	Guava leaves contain high phenolic and antioxidant	Guava leaves are rich sources of therapeutic phytochemicals

			tannins	content	
8	Antimicrobial activity of guava leaves	Various studies	Tannins, flavonoids, phenolic acids	Effective against *Staphylococcus aureus*, *Candida albicans*, and *Malassezia furfur*	Guava leaf extract may help control dandruff and scalp infections
9	Anti-inflammatory effects of guava leaves	Various studies	Quercetin, apigenin, kaempferol	Inhibited COX enzymes and inflammatory cytokines	Guava leaves reduce scalp inflammation linked to hair loss
10	Vitamin C content in guava leaves	Various studies	Ascorbic acid	Promoted collagen synthesis and antioxidant protection in follicles	Guava leaves support healthy follicular structure
11	Aloe barbadensis as excipient	Various studies	Acemannan, polysaccharides	Improved moisture retention and penetration of active ingredients	Aloe vera acts as an effective humectant and vehicle
12	Rosa damascena (Rose water)	Various studies	Phenylethanol, flavonoids	Provided fragrance, mild astringency, and soothing effect	Rose water enhances sensory and anti-inflammatory properties
13	Prunus dulcis oil	Various studies	Oleic acid, linoleic acid, Vitamin E	Reduced water loss and improved softness of hair	Almond oil acts as a nourishing emollient
14	Tween 80 as emulsifier	Cosmetic formulation studies	Polysorbate 80	Stabilized oil-water interface in serum formulations	Suitable non-ionic emulsifier for herbal serums
15	Methylparaben as preservative	Pharmaceutical studies	Paraben derivative	Prevented microbial contamination during storage	Effective preservative at approved concentrations

4. Plant Profile

A comprehensive botanical and phytochemical overview of the two primary plant materials used in this formulation is provided below.

Parameter	*Oryza sativa* (Rice)	*Psidium guajava* (Guava)
Scientific Name	Oryza sativa L.	Psidium guajava L.
Family	Poaceae	Myrtaceae
Kingdom	Plantae	Plantae
Class	Liliopsida (Monocots)	Magnoliopsida (Dicots)
Order	Poales	Myrtales
Origin	Southeast Asia (domesticated ~7000 BCE)	Tropical Americas; now pantropical
Part Used	Grain (bran, endosperm water)	Leaves (fresh or dried)
Key Phytochemicals	Inositol, ferulic acid, gamma-oryzanol, Vitamin E (tocotrienols), amino acids (lysine, cysteine), B vitamins, phytosterols	Quercetin, kaempferol, gallic acid, ellagic acid, catechins, tannins (psidiin), Vitamin C, beta-sitosterol, caryophyllene
Hair & Scalp Uses	Anti-dandruff, antioxidant protection, follicle strengthening, improved hair shaft texture, UV protection, shine enhancement	Anti-inflammatory, antimicrobial (anti-dandruff), antifungal, follicle stimulation, scalp circulation improvement, anti-aging
Traditional Uses	Skin brightening, wound healing, gastrointestinal tonic, ceremonial cosmetic use (East and Southeast Asia)	Antidiarrheal, wound healing, antimicrobial, antidiabetic, skin health (tropical traditional medicine)

4.1 Oryza sativa — Detailed Profile

Oryza sativa is an annual grass cultivated on flooded paddy fields across tropical and subtropical Asia, constituting the primary caloric staple for over half the world's population. Its relevance to hair care stems primarily from its outer bran fraction and the water produced during grain washing. The rice bran layer, comprising approximately 8–10% of the grain by weight, is densely packed with lipid-soluble antioxidants (tocopherols, tocotrienols), gamma-oryzanol (a mixture of ferulic acid esters of phytosterols), and water-soluble compounds including inositol and various B-complex vitamins.

Inositol is particularly noteworthy for its hair care applications. Unlike most cosmetic actives that sit on the hair surface, inositol readily penetrates into the hair cortex through the cuticle and is substantive—meaning it remains bound within the fiber even after repeated rinsing. This unique property allows it to repair and reinforce the hair shaft from within, reducing porosity, improving tensile strength, and restoring a smooth, aligned cuticle structure. The net result is reduced breakage, increased shine, and a visibly healthier appearance.

4.2 Psidium guajava — Detailed Profile

Psidium guajava is a fast-growing tropical tree that produces edible fruit widely consumed across the Global South. While the fruit is nutritionally acclaimed, the leaves have attracted

greater pharmacological interest due to their rich and diverse phenolic content. Guava leaves are typically collected before full maturity, as younger leaves exhibit higher flavonoid and tannin concentrations relative to mature foliage.

The quercetin and kaempferol content of guava leaves has been shown to directly stimulate dermal papilla cells—the mesenchymal cells residing at the base of the hair follicle that orchestrate hair growth cycles. In vitro studies have demonstrated dose-dependent increases in proliferative activity of dermal papilla cells following treatment with guava leaf flavonoid fractions, suggesting a direct follicle-stimulating mechanism independent of the antimicrobial and anti-inflammatory effects. This multipronged bioactivity profile makes guava leaf extract a highly versatile ingredient in hair care formulations targeting multiple pathological mechanisms simultaneously.

5. MATERIALS AND METHODS

5.1 Raw Material Collection and Authentication

Fresh guava (Psidium guajava) leaves were collected from cultivated trees in the vicinity of Pune, Maharashtra, India, during the early morning hours to minimize loss of volatile secondary metabolites. Collection was timed to the pre-mature leaf stage (approximately 4–6 weeks after emergence) to capture peak polyphenol content. Rice grains (Oryza sativa) were procured from a local certified grain supplier. Both plant materials were botanically authenticated by a qualified taxonomist, and voucher specimens were deposited in the institutional herbarium for traceability.

5.2 Extract Preparation

Plant materials were cleaned thoroughly under running water to remove surface debris and incidental contamination. Guava leaves were spread in a single layer on clean trays and dried at 45°C in a hot-air oven for 48 hours to a constant weight. Dried leaves were powdered in a mechanical grinder and passed through a 60-mesh sieve to yield a uniform coarse powder. Rice grains were washed twice with distilled water and then soaked in distilled water at a ratio of 1:5 (w/v) for 24 hours at room temperature. The resultant milky rice soaking water was collected, filtered through Whatman No. 1 filter paper, and concentrated using a rotary evaporator at 50°C under reduced pressure. Guava leaf powder was subjected to aqueous decoction: 20 g of powder was boiled in 200 mL distilled water for 30 minutes, allowed to cool, and filtered through Whatman No. 1 paper. Both extracts were stored at 4°C until formulation.

5.3 Preliminary Phytochemical Screening

Both extracts were subjected to qualitative phytochemical analysis prior to formulation to confirm the presence of pharmacologically active secondary metabolites. Standardized wet chemical tests were performed according to the methods described by Harborne (1998) and Trease and Evans (2002). The following classes of compounds were tested: alkaloids (Mayer's and Dragendorff's reagents), flavonoids (lead acetate test), tannins (ferric chloride test), saponins (foam test), phenolic acids (ferric chloride precipitation), coumarins (NaOH test), and terpenoids (Liebermann–Burchard test). All tests were conducted in triplicate, and results were recorded as positive or negative based on the development of characteristic color reactions or precipitates.

5.5 Preparation Procedure

The preparation process was conducted aseptically under controlled conditions to minimize microbial contamination. The stepwise procedure was as follows:

- Fresh guava leaves and rice grains were collected, washed under running distilled water, and air-dried. Guava leaves were further oven-dried at 45°C and powdered prior to extraction.
- Phytoextracts were prepared using the aqueous decoction method (guava leaves) and cold-water soaking method (rice), as described in Section 5.2.
- Measured volumes of Oryza sativa extract and Psidium guajava leaf extract were combined in a clean glass beaker according to the batch-specific ratios.
- Aloe vera gel, rose water, and sweet almond oil were added sequentially to the combined extract with continuous stirring at 300 rpm using a calibrated magnetic stirrer.
- Methylparaben (0.1 g) was dissolved in a minimal volume of hot distilled water (60°C) and incorporated into the mixture as a preservative agent.
- Tween 80 was added dropwise as an emulsifier, with vigorous stirring maintained throughout to achieve a homogeneous dispersion.
- Distilled water was added in increments to bring the final volume to 50 mL per batch.
- The formulated serum was gently heated to 60°C for 10 minutes to ensure complete solubilization, allowed to cool to room temperature, filled into sterile amber-colored glass vials, labeled, and stored at room temperature away from direct light.

5.6 Evaluation Parameters

Each batch was evaluated for the following parameters within 48 hours of preparation and at regular intervals during a 30-day accelerated stability study:

5.6.1 Organoleptic Evaluation

Visual and sensory assessment was performed by three trained evaluators. Parameters assessed included color (using a standard Munsell color chart for objectivity), odor (classified as absent, mild, aromatic, or pungent), physical state (liquid, gel, semi-solid), and appearance (clear, translucent, turbid, or phase-separated).

Table 2: Organoleptic Parameters.

Sr.	Character	F1 Batch	F2 Batch	F3 Batch
1	Colour	Dark Brown	Brown	Light Brown
2	Odour	Aromatic	Aromatic	Aromatic
3	Appearance	Clear	Translucent	Slightly Turbid

5.6.2 pH Determination

The pH of each batch was measured at 25°C using a calibrated digital Auto pH Meter (accuracy ±0.01 pH units) following a two-point calibration with standard buffer solutions at pH 4.0 and 7.0. Measurements were performed in triplicate and mean values reported. The physiologically acceptable pH range for scalp-applied formulations is 4.5–6.5, aligned with the natural acidic mantle of the scalp, which inhibits microbial overgrowth and maintains cuticle integrity.

5.6.3 Viscosity Measurement

Viscosity was determined using a Brookfield Digital Viscometer (Model DV-II+Pro) with spindle No. 62 at a rotational speed of 30 rpm and temperature of 25°C. Readings were taken after 60 seconds of equilibration. Values were expressed in centipoise (cP). Appropriate viscosity is essential for a leave-on serum: too low a viscosity results in product dripping and poor scalp coverage, while excessive viscosity impedes spreadability and consumer acceptance.

5.6.4 Microbial Stability

Microbial contamination testing was conducted by inoculating 1 mL of each formulation batch onto nutrient agar and Sabouraud dextrose agar plates for bacterial and fungal assessment, respectively. Plates were incubated aerobically at 37°C for 48 hours (bacteria)

and 25°C for 72 hours (fungi). Colony counts were expressed as colony-forming units per milliliter (CFU/mL) and compared against acceptance criteria of <100 CFU/mL for total aerobic microbial count and absence of specified organisms (S. aureus, P. aeruginosa, E. coli, Candida albicans).

5.6.5 Solubility

The solubility behavior of each formulation was assessed by diluting a 1 mL aliquot into 9 mL of distilled water and observing the resultant solution for clarity, uniform dispersion, or phase separation. This parameter reflects the compatibility of the formulation matrix and the likelihood of user-reported issues such as residue or cloudiness during application.

6. CONCLUSION

This study successfully demonstrates the feasibility and promise of a phytoextract-based hair serum combining Oryza sativa (rice) and Psidium guajava (guava) leaf extracts for improved hair health. The dual botanical platform was selected on the basis of complementary bioactive profiles: rice provides structural and nutritive benefits through inositol, ferulic acid, gamma-oryzanol, and amino acids, while guava leaf extract addresses scalp inflammation, microbial dysbiosis, and oxidative damage through its rich polyphenolic content.

The serum preparations exhibited appropriate color, aromatic odor, and satisfactory viscosity profiles consistent with leave-on cosmeceutical serums. pH values across all batches fell within or close to the physiologically desirable range for scalp health (4.5–6.5), supporting their safety and biocompatibility with the scalp's natural acidic environment.

Future directions for this research include the incorporation of modern analytical techniques such as HPLC quantification of marker compounds (ferulic acid, quercetin, gamma-oryzanol), in vitro antioxidant assays (DPPH, ABTS), in vitro cytotoxicity assessment on human dermal fibroblasts, and clinical trials with validated outcome measures including hair tensile strength, scalp sebometry, and standardized hair count photography. Nanoformulation strategies such as nano-encapsulation or liposomal delivery systems may also be explored to enhance the follicular penetration of key actives and further improve the stability profile of the serum.

REFERENCES

1. Flores G, Wu SB, Negrin A, Kennelly EJ. Chemical composition and antioxidant activity of seven cultivars of guava (Psidium guajava) fruits. Food Chem., 2015; 170: 327-335.
2. Naseer S, Hussain S, Naeem N, Pervaiz M, Rahman M. The phytochemistry and medicinal value of Psidium guajava (guava). Clin. Phytosci., 2018; 4: 32.
3. Nantitanon W, Yotsawimonwat S, Okonogi S. Factors influencing antioxidant activities and total phenolic content of guava leaf extract. LWT-Food Sci. Technol., 2010; 43: 1095-1103.
4. Gutiérrez RMP, Mitchell S, Solis RV. Psidium guajava: A review of its traditional uses, phytochemistry and pharmacology. J. Ethnopharmacol., 2008; 117: 1-27.
5. Choi JS, Jeon MH, Moon WS, et al. In Vivo Hair Growth-Promoting Effect of Rice Bran Extract Prepared by Supercritical Carbon Dioxide Fluid. Biol. Pharm. Bull., 2014; 37: 44-53.
6. Zgonc Škulj A, Poljšak N, Kočevar Glavač N, Kreft S. Herbal Preparations for the Treatment of Hair Loss. Arch Dermatol. Res., 2020; 312: 395-406.
7. Lourith N, Kanlayavattanakul M. Hair Loss and Herbs for Treatment. J. Cosmet. Dermatol., 2013; 12: 210-222.
8. Inamasu S, Ikuyama R, Fujisaki Y, Sugimoto KI. The Effect of Rinse Water Obtained from the Washing of Rice (YU-SU-RU) as a Hair Treatment. Int. J. Cosmet. Sci., 2010; 32: 392-393.
9. Meera K, Smita M, Haripriya S, Sen S. Varietal Influence on Antioxidant Properties and Glycemic Index of Pigmented and Non-Pigmented Rice. J. Cereal. Sci., 2019; 87: 202-208.
10. Fu D, Huang J, Li K, et al. Dihydrotestosterone-induced hair regrowth inhibition by activating androgen receptor in C57BL6 mice simulates androgenetic alopecia. Biomed Pharmacother., 2021; 137: 111247.
11. Harborne JB. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. 3rd ed. London: Chapman and Hall; 1998.
12. Trease GE, Evans WC. Pharmacognosy. 15th ed. London: Saunders Publishers; 2002.
13. Cunha AP, Roque OR, Gaspar N. Plantas e Produtos Vegetais em Cosmetícia e Dermatologia. 2nd ed. Lisbon: Fundação Calouste Gulbenkian; 2004.
14. Patel S, Gogna P. Tapping botanicals for essential oils: Progress and hurdles in cancer mitigation. Ind. Crops Prod., 2015; 76: 1148-1163.

15. Kimura Y, Sumiyoshi M. Effects of various Eleutherococcus senticosus cortex on swimming time, natural killer activity and corticosterone levels in forced swimming stressed mice. J. Ethnopharmacol., 2004; 95: 447-453.