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Review Article

Modified Triphala for Skin Detoxification: A Review of Ayurvedic Insights, Phytochemistry, and Formulation Strategies

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Abstract

In contemporary times, factors such as pollution, oxidative stress, and unbalanced lifestyles have slowed down skin health. Therefore, safe, effective, and detoxifying approaches are needed. Triphala connoted "three fruits" in Sanskrit. A traditional herbal concoction in Ayurveda, Triphala is composed of three fruits: Haritaki (Terminalia chebula), Bibhitaki (Terminalia bellirica), and Amalaki (Emblica officinalis). It is a versatile ingredient and possibly the most popular Ayurvedic formulation used in daily practice. Triphala is considered to have an antioxidant, rejuvenating, and systemic detoxifying effect. This review explores the ability of Triphala and its associated modification to detoxify the skin in the modern context from an Ayurvedic point of view. With tannins, gallic acid, ellagic acid, flavonoids, vitamin C, and more, the antioxidant, anti-inflammatory, and tissue-rejuvenation-related activity of Triphala makes it a rich source for skin healing. Research has been conducted on triphala modified by the inclusion of herbs such as Manjistha (Rubia cordifolia) and Gotu kola (Centella asiatica) and excipients, such as activated bamboo charcoal. The improved blood-purifying, de-toxifying, and skin-supporting qualities of the modified triphala were the aim. Other aspects include particle size, organoleptic properties, physicochemical stability, and microbiological safety for standardization and quality control. The modified Triphala formulations discussed in this review show promise for detoxifying the skin as well as treating dermatological ailments using herbs and other valuable ingredients. More studies, such as clinical validation, standardization, and mechanism studies, are needed to transform knowledge from traditional systems into scientifically sound and safe cosmeceuticals.

1. Introduction

The skin of the human body is the largest and most dynamic organ. It has a protective role in keeping the internal physiological environment separate from the outside one. It safeguards the body against a vast range of attacks, including physical, chemical, microbial, and environmental attacks, while also playing an important role in regulating temperature, immune defense, sensation, and beauty. In today's world, due to persistent exposure to environmental pollution, UV rays, man-made chemicals, unhealthy diet, psychological stress, disturbed sleep, and a lack of metabolic balance due to lifestyle-related changes, it has become increasingly difficult to maintain healthy skin[1]. Together, they cause oxidative stress, inflammation, inability to detoxify, accelerated ageing, acne, pigmentation, dullness, and chronic skin problems. Skin care involves the internal functioning of the body rather than using cosmetic or cleansing agents externally. Our skin is an indicator of our internal metabolism and efficiency of digestion, quality of blood, balance of hormones, and abilities of the immune system. Recently, there has been increasing curiosity in whole-body approaches that not only help protect the body from within but also assist in systemic cleansing, antioxidant shielding, and rejuvenation of the tissues. Declining skin health is prominent due to environmental pollution. Particles, smoke, and heavy metals, as well as industrial chemicals and emissions from automobiles, can accumulate on the skin surface and penetrate deeper tissue layers, generating free radicals and inflammation. When skin lipids, proteins, and cellular DNA are damaged, the skin's natural barrier function weakens[2]. Long-term exposure to pollution causes dry, sensitive, and pigmented skin with clogged pores and acne-like eruptions, followed by signs of premature ageing. Ultraviolet radiation speeds up oxidative damage and collagen degradation, creating wrinkles, uneven tone, and loss of elasticity. The skin's defense and repair mechanisms are constantly overloaded by both pollution and radiation. Consequently, proper skin detoxification must be performed not only externally but also internally. This refers to balancing the antioxidant system and inflammation level and improving metabolic elimination. Oxidative stress is also one factor affecting skin health. It occurs when reactive oxygen substance production is excessive compared to the body's natural antioxidant capacity. Pollution, poor diet, stress, smoking cigarettes, eating processed foods, and metabolic dysfunction produce free radicals that can damage cellular structure and normal skin function. Skin conditions such as acne, eczema, psoriasis, hyperpigmentation, delayed wound healing, and skin ageing occur due to oxidative stress. Today's lifestyles aggravate the problem as one has irregular food habits, less physical activity, excessive intake of refined foods, inadequate water intake, and poor sleep hygiene. Such disturbances may affect digestion, lead to toxin build-up, disrupt gut microflora, and effect widespread inflammation[3]. The gut-skin relationship has gained wide attention over the years. With regard to altered intestinal health and digestive imbalance, the gut's ability to influence skin conditions through immune, inflammatory, and metabolic pathways. According to traditional Ayurvedic thinking, when digestion is good and elimination is regular, skin glow and balance are also good. The Ayurvedic vision of skin health is a holistic understanding, involving Twak, Rakta, Mamsa, Pitta, Kapha, Agni, Ama, and the working channels of the body. Ayurveda states that skin diseases are often caused due to not just external factors but also internal factors including undigested food (Ama), vitiation of Rakta and Pitta, and blockages in metabolic pathways. Ama can be understood as partially digested metabolic waste or toxin. It is a major factor causing any imbalances in the system. If the body isn't able to digest and metabolize certain substances in your diet then they get stored. Likewise, injured blood and bile can cause inflammatory as well as pigmentary skin problems. Therefore, detoxifying the skin according to Ayurveda means to improve digestion, assist elimination, purify the blood, reduce oxidative and inflammatory burden, and balance the doshas. This classical concept can help in the development of herbal formulations to purify, detoxify, and rejuvenate the skin[4].

The rising quest for natural, safe, and effective skin care has stimulated renewed interest in herbal detoxifying agents. The ideal cosmetic product commonly produced by private label manufacturers offers not only temporary external effects but also long-lasting benefits. Herbal preparations with antioxidant, anti-inflammatory, antimicrobial, digestive, blood-purifying, and rejuvenating properties are most relevant for integrative dermatological care. The quality of raw material, proper selection of ingredients, standard processing, standardization, safety evaluation, and evidence-based assessment are essential for herbal preparations to be effective. Thus, analysis based on the review of classical formulations and their modern reproductive forms is important for evaluating the scope and limitations of their therapeutic efficacy[5]. Triphala is an Ayurvedic polyherbal formulation that is extensively used. There are three fruits in it: Haritaki, Bibhitaki, and Amalaki. Triphala is regarded in traditional medicine for its Rasayana, mild laxative,

digestive, and antioxidant properties. It is usually utilized to help with digestion, regulate bowel movement, metabolism, tissue feeding, and clear whole system toxins. From the perspective of Ayurveda, Triphala is thought to be useful as it helps to sustain a delicate balance among the three doshas while also regulating the naturally occurring elimination. This is essential for skin health because of its effects on digestion, detoxification, antioxidant activity, and tissue repair. In Ayurveda, clear and healthy skin is closely related to proper digestion and pure blood. Moreover, Triphala is particularly important as a base formulation for internal skin care[6].

Modern studies have supported many traditional claims of Triphala according to phytochemical and pharmacological studies. The formulation is likely to comprise bioactive compounds such as tannins, gallic acid, ellagic acid, chebulinic acid, flavonoids, phenolic compounds, and vitamin C-rich constituents. Antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, and rejuvenating activities are exhibited by these compounds. In skin detoxification, oxidative stress, inflammatory conditions, microbial imbalance, and the presence of metabolic toxins are the major contributors. The antioxidant properties of Triphala may protect the skin from free radicals and oxidative damage. The elegant cleansing and mild digestive effects may help further inner purification and elimination. These two internal processes are traditionally considered essential for healthy skin. Modification of classical Triphala Churna for skin detoxification is an attempt to enhance its original formulation[7]. It aimed to make it percutaneously active while retaining its role as a gut regulator. You may explore the use of some ingredients in conjunction with Bacillus Ferment to make this formulation suitable for skin health, detoxification, and tissue repair such as Manjistha, Gotu Kola, and activated bamboo charcoal. Manjistha has traditionally been associated with Rakta Shodhana for formulation of many skin-related conditions in Ayurveda. Gotu Kola is highly regarded for its ability to effectively promote wound healing. Activated bamboo charcoal has similar effect to activated charcoal, and has been utilized in detoxifying preparations due to *adsorptive action* and potential to bind unwanted substance. Combining such ingredients with Triphala in formulation may provide wider perspective of skin detoxification on oxidative stress, inflammation, blood purification, tissue repair, and cleansing. A review of modified Triphala based formulations is thus important with a view of bridging traditional Ayurvedic concepts with modern dermatological and pharmaceutical perspectives[8]. A classical review can deal with the classical importance of Triphala, reasons for modification of ingredients, phytochemical properties, possible mechanisms of action, formulation strategies, quality control parameters, and safety issues. This can also highlight an existing absence of research and the need for adequate standardization, pharmacological validation, and clinical evaluation. To ascertain its effectiveness, safety, dosage, stability, and acceptability over an extended period, scientific research is needed despite the aid of traditional use. Modified Triphala Churna could be considered a promising herbal option for skin detoxification, provided it is developed and assessed using sound scientific methods and within the norms of classical Ayurveda[9].

2. Classical Background of Triphala

Triphala is a well-known polyherbal formulation in ayurveda and has been used centuries as a base remedy to enhance health, longevity, and detoxification of the system. The term Triphala means three fruits and consists of Haritaki (*Terminalia chebula*)[10], Bibhitaki (*Terminalia bellirica*) and [11] (*Emblica officinalis*). Each of these fruits has its own special pharmacological properties, as well as an aggregate effect that is greater than the individual constituents. Haritaki is traditionally believed to rejuvenate the human body and improve digestion. According to classical Ayurvedic texts, such as the Charaka Samhita and Sushruta Samhita, it helps regulate digestion, reduce constipation, enhance the absorption of nutrients, and maintain healthy tissues. Haritaki affects all three doshas but is especially effective for balancing Kapha and Vata. Due to its astringent, bitter, and pungent qualities, this herb mildly cleanses the gastrointestinal tract, which is the first step in detoxifying the system and achieving healthy skin. Bibhitaki, the second ingredient in Triphala, is traditionally considered to detoxify, reduce inflammation, and aid respiratory function. According to ancient texts, the fruit is described as bitter, astringent, and slightly pungent. This helps eliminate metabolic waste and balance Pitta and Kapha doshas. Regular use of the liver and kidney tissues these organs help to naturally detoxify them both of which are important organs in the body[12]. Through promoting the body's internal cleansing mechanisms, Bibhitaki helps keep the skin healthy by minimizing unwanted impurities and toxins in the blood, thereby lowering the risk of inflammatory and pigmentary disorders. Amalaki is the third ingredient in this health elixir, which is a powerful Rasayana or rejuvenator according to Ayurveda. According to classical literature, Amalaki treats all three doshas, especially Pitta, and nourishes the dhatus. It

is considered to be high in vitamin C, phenolic compounds, and antioxidants. Its sweet, sour, and astringent taste, and cooling power, helps restore the health of cells, boosts immunity, and increases lifespan. The antioxidant and tissue regenerative properties of amalaki are important for the skin. This substance helps neutralize free radicals and synthesizes collagen, which counters damage to the skin due to the environment[13]. Triphala has traditionally been noted to be a Rasayana. This is a rejuvenating formulation that helps enhance vitality, longevity, immunity, and well-being. The synergistic effect of these three fruits is termed a triad as they complement each other's effects. A variety of formulations called Rasayana are designed to nourish the Dhatu (Tissue), enhance Agni (the digestive and metabolic fire), expel Ama (toxins), and pacify the dosha. This approach of targeting multiple organ systems is applicable to dermatological health, as good skin is closely related to effective digestion, blood purification, metabolism, and tissue nutrition. Meanwhile, classical texts mention the role of Triphala in Twak Roga (skin diseases) and dermatological maintenance. According to these texts, Triphala should be taken internally for systemic detoxification. It will enhance wound healing. Moreover, it also possesses anti-inflammatory properties[14].

The gentle laxative effect of Triphala, along with its ability to regulate the digestive system, is essential for removing internal toxins. If these toxins are not eliminated, they manifest as skin blemishes, dull skin, or inflammatory conditions. Apart from internal use, the powder or decoction of Triphala has been used externally in traditional medicine for a long time for numerous skin conditions. Classical sources refer to the application of this as a face mask, wash, or topical paste to enhance complexion, cure minor wounds, and inflammation. The component fruits are believed to provide skin-strengthening benefits, defend against infections, and alleviate inflammation owing to their astringent and antimicrobial characteristics[15]. This dual approach highlights the axiom of Ayurveda, which culminates in the systemic and spatial policies for balancing strengths. Triphala has been a staple of Ayurveda for hundreds of years. It is the basis of countless formulations that encourage health, purge toxins, and replenish skin vitality. Modern science is now beginning to prove many such classical uses. Reveal the phytochemical analysis of Haritaki contains chebulinic acid, tannins, and polyphenols having antioxidant and anti-inflammatory properties. Bibhitaki contain gallic acid, ellagic acid, and lignans that helps in detoxifying and hepatoprotective effects. Amalaki's flavonoids and tannins along with high ascorbic acid content exhibit potent antioxidant and immunomodulatory activities. When considered together, these bioactive constituents of Triphala correspond well with the classical description of Triphala (that is, properties that purify blood, help build/repair body tissue, help prevent oxidative stress, and improve systemic health) all of which are critical for skin health. The coming together of ancient knowledge and scientific validation further strengthens the belief of Triphala being a polyherbal Rasayana especially useful for internal skin detoxification and overall skin health[16].

3. Concept of Skin Detoxification in Ayurveda

In Ayurveda, skin health is determined by the balance of the body. Thus, skin or twak is considered to be related to rakta (blood), dhatus (tissues), doshas (forces), agni, and ama (toxin). Skin, or twak, is, of course, not a mere external covering but a representative of the body's internal metabolic status. In addition, it is a good index of the body's internal environment or homeostasis. A clean, bright, and healthy skin is interpreted as good functioning of substances, good functioning of doshas, digestive functioning, metabolic functioning, and cleansing functioning[17]. Rakta, or blood, plays an important role in Ayurveda's skin system because it nourishes twak, the skin, as well as other dhatus. Further, Rakta also helps carry important nutrients and oxygen to tissue while carrying waste products from the tissue. Rakta vitiation or accumulation of toxins in body fluid is believed to directly have an effect on skin as inflammation, rashes, discoloration, acne and more skin disorders. Thus, the purification of Rakta is vital for detoxifying the skin. Cleansing therapies, certain herbal interventions, and dietary regulation will help restore the functional integrity of Rakta. The balance of Doshas, particularly Kapha and Pitta, is essential for our skin. Pitta regulates metabolic activity, enzymes, heat, and inflammation; Kapha provides structure, moisture, and strength to the skin[18]. When the Pitta dosha gets vitiated, one has issues with inflammation, rashes, pigmentation problems, and sensitivity. When Kapha gets vitiated, one has excessive oiliness, dullness, and clogging of pores. The tridoshic balance ensures that metabolic waste is processed, tissues are nourished, and skin health is maintained. When any disruption occurs in these bio-energetic forces, Ama may result. In Ayurveda, Ama refers to the toxic, undigested, or improperly metabolized substance which interferes with the function of the tissue[19].

Ama is thought to be sticky and heavy, obstructing microchannels (Srotas) and preventing the delivery of nutrients with a local and systemic inflammatory response.

Ama accumulation in the skin may result in acne, dull skin, sensitive skin, pigmentation irregularities, and early ageing. As a result, detoxification of the skin in Ayurveda depends on Ama elimination, correction of Dosha, and optimization of Agni.

Agni, the fire of digestion and metabolism, is responsible for the production of tissues and the elimination of waste. When Agni functions properly, nutrients can be absorbed, metabolic waste is processed and excluded, and Ama is not produced or trapped. In the case of weak or irregular Agni, there is incomplete digestion and assimilation of food, resulting in the formation of Ama. Consequently, tissue nourishment is impaired, making one susceptible to skin disorders[20]. Ayurvedic detoxification therapies, including internal herbal formulations, Panchakarma procedures, dietary regulation, and lifestyle modifications, serve to stimulate Agni, ease Ama away, and revitalize tissues. This curing mechanism may not only take care of the skin but also help improve skin appearance.

Skin detoxification mechanisms are compatible with some classical beliefs. According to modern-day dermatologists, skin aging, pigmentation disorders, acne, and other dermatoses are caused by oxidative stress, inflammation, impaired circulation, and accumulation of metabolites. The ancient wisdom of Ayurveda, through its concepts of Ama, Rakta purification, and Agni optimization, can be interpreted as addressing these mechanisms of modern pathophysiology. Various herbs which are used for detoxification of skin like triphala, manjistha, gotu kola, etc. are known to have antioxidant, anti-inflammatory, hepatoprotective and immunomodulatory activity in the body which helps in fighting oxidative damage and enhance systemic detoxification and helping in the tissue repair. In Ayurvedic dermatology, blood purification and metabolic regulation have been the focus of natural treatments in accordance with modern strategies targeting the reduction of free radical load, detoxifying enhancing enzyme activity, and liver and kidney clearance support. The gut-skin axis, now commonly acknowledged by modern medicine, is aligned with Ayurveda's important relationship between healthy digestion, Agni, and Ama clearance, and skin health and complexion[21].

Ayurvedic skin detoxification encompasses overall wellness, digestive health, metabolic stability, blood cleansing, and tissue nourishment. Thus, addressing the physical and the spiritual, with nutrition. Healthy skin, as per Ayurveda, is the result of your holistic health. It results from your internal balance of the doshas and proper removal of toxic substances. Similarly, the metabolic fire, known as agni in Ayurveda, should also function well. Merging age-old wisdom with contemporary insights on processes such as oxidative stress, inflammation, and the gut-skin axis, Ayurvedic dermatological detoxification provides a unifying understanding for the development of herbal formulations and lifestyle changes contributing to skin health and wellness. This approach emphasizes an open mind to skin science. Internal support of skin physiology with external skin care is crucial. Application of polyherbal cocktails, nutritional regulation, and detoxification measures help to achieve and maintain clear, firm, and youthful skin[22].

4. Phytochemical Profile of Triphala

Triphala is a classical Ayurvedic polyherbal formulation of Haritaki (*Terminalia chebula*), Bibhitaki (*Terminalia bellirica*), and Amalaki (*Emblica officinalis*). It has been reported to have several therapeutic benefits and rich phytochemical properties and activities. The three representative fruits together possess an impressive array of bioactive compounds, including tannins, gallic acid, ellagic acid, flavonoids, vitamin C, and a broad spectrum of antioxidants that govern its pharmacological activity. The biochemical activity of the phytoconstituents of Triphala underlies its many physiological activities, such as detoxifying, rejuvenating, nourishing tissues, and improving the skin. Rich in tannins, chebulagic acid, chebulinic acid, corilagin, and other polyphenolics possessing strong antioxidant, anti-inflammatory, antimicrobial, and free radical-scavenging activities[23]. The tannins present in haritaki confer astringent properties that tighten the skin, thereby preventing the colonization of microorganisms. The polyphenolic constituents of haritaki are effective in neutralizing ROS, which prevents damage to cell membranes, proteins, and DNA, thereby assisting in imparting anti-ageing effects. Bibhitaki, the second ingredient, has a rich presence of gallic acid, ellagic acid, lignans, and flavonoids, and exhibits hepatoprotective, antioxidant, and anti-inflammatory effects[24]. Gallic acid is reported to scavenge reactive oxygen species, inhibit lipid peroxidation, and regulate inflammation pathways. This may support skin detoxification indirectly by alleviating oxidative damage of blood circulation and improving blood quality. The polyphenolic antioxidant ellagic acid has been demonstrated to inhibit collagen degradation, reduce melanin overproduction, and minimize inflammation, all contributing factors in maintaining skin integrity and promoting youthful skin. In Triphala, the presence of gallic acid and ellagic acid in Bibhitaki enhances the general detoxifying and anti-aging

potential of this widely popular Ayurvedic formulation. The capacity of Amalaki and the fact that it has the highest vitamin C content among the three, playing an important role in enhancing antioxidant capacity and tissue rejuvenation[25]. Due to its high vitamin C content, it assists in collagen formation, counteracts free radicals, and safeguards skin from UV damage. Moreover, flavonoids, tannins, phenolic compounds, and emblicanin present in Amalaki have immunomodulatory, anti-inflammatory, and tissue-regenerative activities[26].

Phytochemicals work together to improve skin firmness, brightness, and resistance to external stressors. The churning of Amalaki's vitamin C and polyphenols achieves clever detoxification by supporting the enzymatic antioxidant system and neutralizing metabolic waste while balancing the tissue. The overall antioxidant capacity of Triphala is enhanced by the interaction between its three fruits. Research has shown that Triphala extracts have powerful radical-scavenging activity, causing less oxidative injury to lipids, proteins, and nucleic acids. The antioxidant capability is vital in protecting against skin aging and wrinkle formation as a result of oxidative stress, pigmentation, the loss of elasticity, and cellular senescence[27]. The polyphenols and flavonoids in Triphala reduce inflammation and skin issues such as dermatitis, hyperpigmentation, and acne. The natural detoxifying potential of oak fruit is attributed to its tannins and phenolic compounds, which possess strong antimicrobial properties that limit pathogenic microorganisms causing skin disorders and toxins (from infectious diseases) that accumulate in the body. Studies on Triphala for skin detox, anti-aging, and rejuvenation for cosmetic applications are currently trending. In vitro and in vivo studies have established the formulation's capability to elevate antioxidant enzyme activity, diminish oxidative markers, and offer protection against ultraviolet-induced damage[28]. The content of polyphenols, especially gallic acid and ellagic acid, has been associated with the inhibition of melanogenesis, stabilization of collagen, and improvement of barrier function[12]. The combined contribution of these plant-based compounds suggests that Triphala could work systemically to maintain skin clarity, elasticity, and tone. According to the classical texts of Ayurveda, healthy skin largely depends on the internal purification and proper nourishment of the tissues, as well as proper doshic balance that provides systemic support and a reduction of toxins[29].

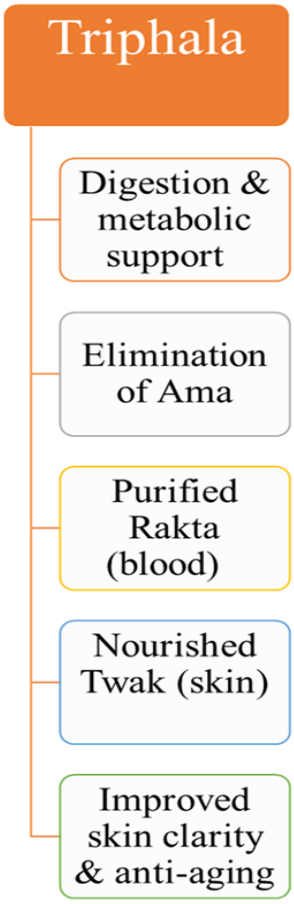

Figure 1 Mechanism of action of classical Triphala in skin detoxification, highlighting its effects on digestion, blood purification, and tissue nourishment.

In conclusion, the phytochemical richness of Triphala provides a scientific basis for its traditional use in detoxification, rejuvenation, and dermatological care. Tannins, gallic acid, ellagic acid, flavonoids, vitamin C, and other antioxidants work synergistically to combat oxidative stress, modulate inflammation, protect tissue integrity, and support systemic and skin health. These compounds are particularly relevant for skin detoxification and anti-aging, as they enhance cellular resilience, promote tissue regeneration, and prevent damage caused by environmental and metabolic toxins. The integration of classical Ayurvedic knowledge with modern phytochemical insights underscores the potential of Triphala as a safe, effective, and holistic polyherbal formulation for maintaining skin health and preventing premature skin aging. The combination of bioactive compounds not only validates traditional claims but also provides a strong rationale for its inclusion in contemporary cosmeceutical and integrative dermatological strategies[30].

Table 1 Phytochemical Constituents of Triphala and Their Dermatological Relevance

Constituent Fruit	Key Phytochemicals	Dermatological Activity
Haritaki	Tannins, Chebulagic acid, Chebulinic acid	Antioxidant, anti-inflammatory, antimicrobial, anti-aging
Bibhitaki	Gallic acid, Ellagic acid, Lignans	Blood purification, anti-inflammatory, collagen protection, pigmentation control
Amalaki	Vitamin C, Flavonoids, Tannins, Emblicanin	Antioxidant, tissue regeneration, collagen synthesis, UV protection

5. Rationale for Modification

Triphala, a classical herbal preparation, has enjoyed success in the medical field and is believed to have antioxidant, rejuvinative, and detoxifying properties. Recent herbal research and cosmeceutical applications have provided scope for modifying Triphala and fortifying its efficacy for skin health. One reason for the alteration is the increasing demand for the formulation to relieve a multi-faceted detox or skin's antidote, which has anti-inflammatory, blood purifying, tissue regenerating, and systemic detoxifying functions. Although Triphala helps in regulating digestion, scavenging free radicals, and Rasayana effect in which it plays a very important role, the other specific actions needed for the skin/disease such as improving circulation to the skin when there are circulatory disturbances such as diabetic ulceration, supporting the repair of connective tissue and/or binding and neutralizing environmental or metabolic toxins might be better served by the addition of a few other herbs with suitable, complementary pharmacological activities[31].

Manjistha (Rubia cordifolia) is an Ayurvedic herb traditionally connected with Rakta Shodhana (blood purification). This herb has been extensively referred to in classical texts for managing skin disorders. According to phytochemical studies, Manjistha contains anthraquinones, flavonoids, and glycosides that help with antioxidant benefits. These substances are known to reduce systemic and localized inflammation while facilitating elimination of metabolic toxins and stimulating tissue regeneration. Thus, Manjistha is a safe addition to Triphala for skin complaints. Manjistha will help the formulation to maintain the clarity of skin, reduce irregularities of pigmentation and help with microcirculation. Gotu kola (Centella asiatica) is another well-established medicinal herb with a long history in Ayurveda and traditional medicine. Gotu kola is known for its activities that heal wounds and promote collagen and antioxidants to facilitate connective tissue[32]. The presence of triterpenoids and asiaticoside encourages the growth of fibroblasts and collagen production. When mixed with Triphala, Gotu kola may enhance the regenerative effect on skin tissues but will still allow the overall detoxifying and antioxidant properties of the formulation. Activated bamboo charcoal has become a modern-day adjunct in herbal detoxification formulations because of its highly adsorptive abilities. It can bind and sequester toxins, environmental pollutants, and metabolic waste products, rendering them less available for biological absorption and preventing systemic or cutaneous overload. Including it as a part of a Triphala-based formulation adds a physical detoxification role, which supplements the biochemical and physiological detoxifying roles of the herbs. Activated charcoal does not inhibit Triphala's antioxidant or anti-inflammatory benefits but rather promotes its ability to clear waste from the gut and blood circulation in the human body[33].

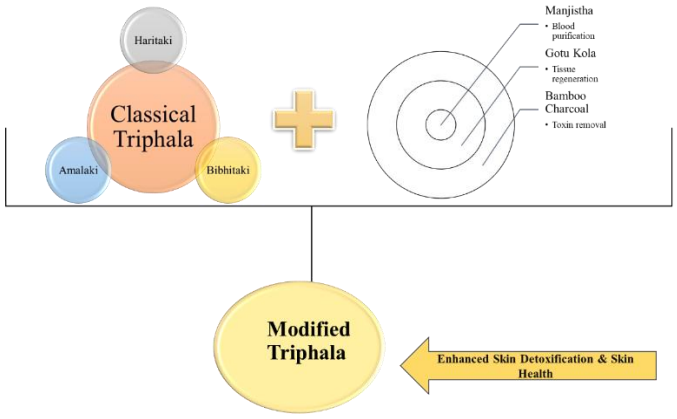

Figure 2 Rationale for modification of classical Triphala with Manjistha, Gotu Kola, and activated bamboo charcoal to enhance skin detoxification and rejuvenation.

The rationale for modifying classical Triphala with these herbs lies in the synergistic integration of traditional and modern knowledge of herbal medicine. By combining Triphala's digestive and antioxidant properties with Manjistha's blood-purifying effects, Gotu Kola's tissue-regenerative properties, and activated charcoal's adsorptive detoxification, the resulting formulation can address multiple pathways involved in skin health. This approach aligns with the Ayurvedic principle of holistic treatment, where systemic balance, doshic equilibrium, and tissue nourishment collectively determine dermatological outcomes[34]. Modern scientific perspectives support this strategy, as

oxidative stress, inflammation, impaired circulation, and metabolic toxin accumulation are recognized as contributing factors to skin aging, pigmentation disorders, and inflammatory dermatoses. Therefore, the modification of Triphala represents a rational, evidence-informed strategy to enhance its relevance for skin detoxification and integrative dermatological applications, providing a formulation that is both grounded in classical knowledge and optimized for contemporary health challenges[35].

Table 2 Rationale for Modification of Classical Triphala for Skin Detoxification

Added Component	Rationale/Function	Potential Benefits
Manjistha (Rubia cordifolia)	Blood purification, anti-inflammatory, antimicrobial	Clearer skin, reduced pigmentation, tissue repair
Gotu Kola (Centella asiatica)	Collagen synthesis, tissue regeneration, antioxidant	Enhanced skin resilience, anti-aging, wound healing
Activated Bamboo Charcoal	Adsorptive detoxification, toxin binding	Systemic and dermatological detox, reduced toxin accumulation

6. Formulation Strategies

Creating herbal preparations, particularly classical polyherbal preparations like Triphala, involves the integration of traditional Ayurvedic principles and modern pharmaceutical standards. Classical approaches to formulation generally involve the use of the best quality raw materials, following the correct harvesting and processing techniques, and preparing methods that preserve the therapeutic efficacy of the herbs. Triphala Churna was prepared classically by drying Haritaki, Bibhitaki, and Amalaki separately, grinding the above together, and mixing them in equal proportions. The effort was made to balance the three constituents, ensuring that their organoleptic qualities were maintained and that the final formulation aided in digestion, metabolic balance, and tissue nourishment[36]. Traditional preparation techniques ensure that the raw material is prepared at the correct season, at the correct maturity, and stored in clean, dry containers to prevent degradation or contamination. In classical Ayurvedic texts, a formulation's effectiveness does not just rely on the selection of the ingredients, but also depends on how they are combined. For instance, if the preparation is not properly dried, overheated, or exposed to excess humidity, the efficacy and bioavailability of the active compounds may change. In addition, the quality and consistency of the formulation, along with organoleptic characteristics (taste, color, and aroma), can also be useful tools for practitioners to assess the product.Although classical formulation approaches are still followed, modern approaches include present-day pharmaceutical knowledge in the formulation of drugs[37]. Further, it refers to the standardization, reproducibility, stability, and safety of drugs. Triphala-based preparations have taken on newer dimensions in recent times with the authentication of raw materials using macroscopic and microscopic evaluation, quality testing for moisture content, ash value, extractive values, and phytochemical profiling. Optimizing the particle size of powdered formulations improves solubility, bioavailability, and palatability. The fine particle size of a substance ensures uniform distribution, a faster dissolving rate, and improved surface area for absorption of orally administered detoxifying formulations. Moreover, the constituent herbs are checked to determine whether the combination of these herbs may cause chemical interactions, reducing efficacy or stability. Some polyphenolic substances may undergo oxidation in a humid environment or with the action of light, making it indispensable to protect them during processing or storage[38].

Dosage form considerations are key in modern formulations. Triphala Churna is generally used in dry powder form with honey, ghee, or water. However, more recent formulations may be in the form of capsules, tablets, or granules or with polyherbal powders with other skin-supportive herbs. Enhanced patient compliance, standardized dose, and increased shelf life are facilitated by such dosage forms. Encapsulation or granulation techniques can miss the protection of the sensitive bioactive material from light, heat, and moisture. Furthermore, excipients may be added to enhance flow properties, avoid caking, and maintain mixing uniformity. The properties of a dosage form that can be perceived by the senses are its organoleptic properties[39]. Color, taste, and aroma have not lost their significance in formulations of any dosage form and continue to influence acceptability and compliance. The addition of natural flavoring agents or sweeteners is often carried out in order to mask the bitter or astringent taste in a formulation, ensuring that taste-masking does not hamper the therapeutic activity. Stability is another major area of concern and focus with respect to the formulation of Triphala as well as modified versions. Herbal powders are prone to microbial infection, moisture sorption, oxidation and degradation of actives over

time. Accelerated stability studies, as commonly employed these days, they include study of pH, moisture content, microbial load, and phytochemical[13]. Using airtight opaque containers with desiccants helps to reduce the exposure risks of moisture, light, and oxygen which can affect the efficacy of the formulation and its shelf life. Temperature regulation during storage is vital to preserve labile compounds, such as vitamin C in Amalaki, which is prone to oxidation and heat.Compatibility among the ingredients is a very essential factor. Modified Triphala containing herbs like Manjistha, Gotu Kola, or activated bamboo charcoal, have been examined[40]. The solvability or bioavailability or stability of classical Triphala may alter due to interaction of these additives with polyphenolic compounds. The formulation strategies that are presently used require compatibility testing, sometimes using thin-layer chromatography (TLC), high-performance liquid chromatography (HPLC), spectrophotometry, etc., to ensure that the combination of herbs does not cause degradation or chemical change of bioactives. Also, potential herbal-drug interactions are evaluated for formulations that are meant only for prolonged usage or patients on other therapies[41].

Similar to internal standardization, the process cultivates therapeutically contemporary formulations without compromising tradition. Methods such as micronization, spray drying, and gentle milling are used to reduce particle size while minimizing heat generation to prevent harm to sensitive compounds. The mixing, drying, and blending processes are performed under strict control to ensure homogeneity and consistency. Organoleptic evaluation (color uniformity, characteristic odor, and smooth texture) and quantitative analysis ensure that the final product is of high quality[42]. Microbial load testing, heavy metal analysis, and water activity analysis are performed in compliance with Pharmacopeia and regulatory authorities' specifications. Overall, the classical and modern formulation approaches for Triphala target to retain and enhance the therapeutic potential of the individual fruits while ensuring quality, stability, safety, and acceptability. By incorporating principles into modern pharmaceutical technology formulations, it is possible to develop standardized reproducible formulations that are patient-friendly for systemic detoxification, skin health, and integrative dermatology. By considering dosage form, particle size, stability, organoleptic properties, and compatibility, the modern formulation of Triphala provides a congenial basis to offer the benefits of traditional wisdom in a scientifically validated and clinically relevant manner[43]. By doing the above, we learn that Triphala is still in vogue as a health promoter and skin detoxifier[44].

7. Evaluation Parameters

Assessing the qualities of Triphala and its modifications contributes to quality, safety, efficacy, and reproducibility. The organoleptic parameters, including phytochemicals, moisture, particle size variations, and microbial contamination of herbal powders, are prone to change owing to their natural origin and complexity. Organized evaluation should be performed using standard testing parameters for classical and modern formulations. Organoleptic examination is the first and simplest method for testing quality[11]. It assesses the color, taste, smell, texture, and appearance of the powder. Classical practices confirm that organoleptic characteristics are indicative of authenticity and therapeutic potential. Today, quantitative assessments are added to these for batch consistency and consumer acceptability. For instance, even color and typical aroma confirm the correct selection and handling of raw materials, while taste and texture indicate particle size, flowability, and moisture[15].

Physicochemical evaluation is another important parameter for analysis. The purity, minerals, and stability of the formulation may be determined by tests such as ash value, acid-insoluble ash, extractive values, and moisture content. Total and acid-insoluble ash indicate the presence of foreign materials, such as earth, sand, or other materials[45]. The concentrations of extractive values (water-soluble and alcohol-soluble) represent the bioactive value available for therapeutic action. Moisture content is of particular concern because excessive moisture can lead to microbiological growth, enzymatic degradation, and loss of phytochemical efficacy. Measuring and controlling moisture ensures the safe operation of the formulation over time. Particle size analysis is important because it influences dissolution, bioavailability, and dose uniformity[46]. An identifiable number of authors write in scholarly production the work of the intimate partner. The ease of processing, encapsulation, and mixing with other excipients is influenced by flow properties, which are affected by particle size and surface characteristics. The pH of aqueous suspensions provides an insight into the stability and compatibility of the formulation with the gastrointestinal environment and is important when assessing irritation and absorption. Microbial safety is a vital component of herbal formulation evaluation. Microbial contamination by bacteria, yeast, and molds in herbal powders can adversely affect their safety and shelf life[45]. Various standard tests are performed

on all ingredients and final products, such as total microbial count, detection of pathogenic microorganisms such as Salmonella, E. coli, Staphylococcus aureus, and fungal load, to ensure compliance with permissible limits. Testing for heavy metals and pesticide residues provides further assurance of the safety of the formulation for human consumption. Procedures are standardized to ensure evenness of quality and therapeutic effect. These include authentication of raw materials, control of particle size and moisture, quantitative phytochemical analysis such as HPLC and TLC, batch-to-batch reproducibility, and so on. The World Health Organization and different pharmacopoeia have set up protocols, covering organoleptic, physicochemical, and microbial parameters, for the evaluation of herbal powder formulations. This thorough assessment proves the classical therapeutic claims of Triphala. Moreover, it allows for production according to modern pharmaceutical and regulatory specifications for effective and safe use in systemic detoxification and skin conditions[46].

8. Safety and Toxicity Considerations

Classical and modified Triphala formulations are not exempt from safety and toxicity concerns. Although Triphala is typically considered safe in recommended doses, there may be risks involved when dosage amounts are changed or used for prolonged periods. If the drugs affect metabolism, anticoagulation, or liver function, Triphala and its adjunct herbs, such as Manjistha and Gotu Kola, could result in herb–drug interactions. Extended or high doses can cause gastrointestinal disturbance or modify the absorption of co-administered drugs[42]. Herbal powders can become contaminated with microorganisms or heavy metals or be adulterated if raw material processing or authentication fails. Hence, proper quality and genuineness investigation, pharmacopoeial abiding, and batch-to-batch repeatability are essential. To ensure safety and reproducibility, it is essential to standardize properly, control moisture, and test microbes and phytochemicals. Recently, the literature has gained traction in modified Triphala formulations for dermatological indications. Research indicates that the combination of Triphala with various herbs, such as Manjistha and Gotu Kola, is beneficial for blood purification, exerts an anti-inflammatory effect, regenerates tissue, and detoxifies the skin[47]. Although some studies indicate antioxidant, anti-inflammatory, and anti-aging activities of curcumin, human studies do not support this finding[48]. Many studies have investigated the traditional uses of plants, phytochemical characterization, or basic pharmacological assays. Standardization of clinical trials, comparative studies against standard therapies, and validation of formulation parameters for efficacy-safety/protection needs to be established for Indian herbal products. Filling these research gaps will strengthen the scientific basis for using modified Triphala in integrative dermatology and cosmeceuticals by merging ancient Ayurvedic wisdom with contemporary evidence[49].

9. Conclusion

Triphala, a classical Ayurvedic polyherbal formulation containing Haritaki, Bibhitaki, and Amalaki, possesses systemic detoxifying, antioxidant, and rejuvenating properties. Aloe vera is important for skin health, as it improves and supports digestion while also controlling metabolism. Moreover, it purifies the blood and ensures better nutrition to the tissues. Ayurveda believes that the skin is a reflection of the body's functions. The scientific principles underpinning these attributes are in agreement with the traditional use of Triphala for skin detoxification, anti-aging, and skin maintenance. Various modern Triphala formulations include herbs such as Manjistha, Gotu Kola, and activated bamboo charcoal to further enhance these valuable properties. Manjistha purifies the blood and alleviates inflammation, while Gotu Kola assists in regenerating and repairing tissues, enhancing collagen and skin strength and elasticity. Activated charcoal adsorbs toxins from the body, environment, and systemic detoxification. Blending these adjuncts with classical Triphala offers synergy to combat oxidative damage, inflammation, and toxin loading. The use of Triphala as a drug will have dermato-cosmetic applicability. Formulation strategies, which can be classical or modern, emphasize quality, stability, and standardization. Organoleptic evaluation, physicochemical analysis, moisture content, particle size, pH, microbial safety, and other evaluation parameters ensure reproducibility as per the pharmacopoeia and WHO. Quality assurance must ensure that there are no adverse effects from herb–drug interactions, long-term use, and contamination. Although there is strong preclinical and pharmacological evidence in support of the use of cannabinoids, their clinical validation is scarce. This emphasizes the necessity of studies in human subjects, standardization (e.g., different strains of cannabis), and comparative clinical trials.

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