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# COSMECEUTICALS FOR HAIR AND NAILS SHORT REVIEW

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## ABSTRACT

The principal focal point of this review article is to show the cosmeceuticals of hair and nails, it shows how the cosmeceuticals perform in the hair cycle where there are supposed to perform in the improvement of hair appearance by promoting growth and influencing hair color, volume, and conditioning. Even if there are natural growth factors of hair that performs in the hair cycle such as insulin like growth factor and Hormones such as androgens, estrogen and thyroxine which also influence the hair growth. Cosmeceuticals do there apart by speeding up the wellbeing of the hair fast. The article shows also the important of cosmeceuticals on nails as there are to hair, nail cosmeceuticals perform in the protection of nails from getting damaged by environmental factors such as water, soap, and detergents. That's why there are difference nail cosmeceuticals such as cuticle and nail care products, cuticle removers and nail hardeners.

**KEYWORDS:** Hair cosmeceuticals, Nail cosmeceuticals and Conclusion.

## INTRODUCTION

The hair and nails play important roles in the self-esteem and psychological well-being of humans. In the last few years, the range of cosmeceuticals available for hair and nail care has rapidly expanded. Natural hair and nail care products are very popular in the community, as is what may be a false belief in the scientific benefit, safety and lack of side effects of these natural products.

Cosmeceuticals (a combination of the words "cosmetic" and "pharmaceutical," originally introduced by Kligman.[1] are topical cosmetic products that claim a biological benefit or improvement resulting from an improved pharmacologic action when compared to an inactive cosmetic.[2] Cosmeceuticals contain active ingredients such as antioxidants, botanicals, minerals, vitamins, enzymes or essential oils, as well as components including moisturizers, fragrances, preservatives, emulsion stabilizers, surfactants, and viscosity controlling substances.[3] Although some cosmeceuticals may provide a benefit, given the range of ingredients in cosmeceuticals, like medicinal drugs, the potential for misuse and adverse side effects exists. As clinicians, it is important to understand if any scientific basis underlies these compounds and be familiar with these compounds which our patients will use in hair and nail care products.

The term "cosmeceutical" is not recognized by the US Food and Drug Administration (FDA).[2] The definition of a cosmetic in the FDA Food, Drug and Cosmetic Act is a compound intended to be applied topically to any part of the human body for cleansing, enhancing attractiveness or for changing the appearance without altering structure and function.[2,4–7] A drug, however, is defined as a compound intended for use in the diagnosis, treatment or prevention of diseases or used to affect the structure and/or function of the body.[2,4] A cosmeceutical then is an intermediate between a cosmetic and a drug, having pharmaceutically active compounds affecting a cosmetic improvement by a physiologic action on the skin.[7] Cosmeceuticals are not subject to the extensive scientific testing that drugs approved by the FDA must be.[3] The ingredients in cosmeceuticals need only to be tested as safe, and the beneficial claims of the active ingredient do not need to be proven.[3] Similarly, there are few biological studies and even fewer randomized double-blind placebo-controlled trials testing on humans the efficacy and safety of these products. Attractive characteristics of a cosmeceutical are safety, effectiveness, stability of formulation, cheap manufacturing, metabolism within the skin, and novelty and patent protection.[7,8] Botanicals or natural plant extracts, essential oils, amino acids, vitamins, and other active ingredients are incorporated into many cosmeceutical preparations for hair care such as shampoos, conditioners, styling products, and colors.

Some cosmeceutical ingredients also have a therapeutic value in hair conditioning, growth promotion, and even treating scalp infections such as seborrheic dermatitis and head lice.[3]

Nail cosmeceuticals also can contain botanical extracts and vitamins and claim to have a value in nail strengthening and conditioning. To review and ensure the ingredients of cosmeceuticals are safe, the Cosmetic Fragrance Toiletry Association (now the Personal Care Products Council) established the Cosmetic Ingredient Review (CIR), supported by the FDA and the Consumer Federation of America, which has been operating for over 30 years reviewing the safety of cosmetic ingredients.[3] The difficulties encountered by the CIR regarding botanical ingredients used in cosmeceuticals are lack of data on the part of the plant used, the origin of the plant and any possible contaminants such as heavy metals or pesticides in the plant or soil, and the actual documented biological activity of the botanical/plant on human skin.[3,9] Plant biology is complex and differs with each species. The chemistry of different parts of the plant is also specific and can alter the final botanical extract.[3] The extraction, processing and storage of a botanical or plant-based ingredient is also not standardized and impurities in the processing techniques can potentially contaminate the final extract and vary from batch to batch.[3,10] The cosmetic industry has endeavored to follow the recommendations of the CIR, ensuring that these products are as safe as possible for the community.[3]

**Hair Cosmeceuticals**

Hair condition is affected by age, cosmetic grooming practices, and diseases such as androgenetic alopecia and seborrheic dermatitis. Hair cosmeceuticals claim to improve the appearance of hair by promoting growth (Table 7.1) and influencing hair color, volume, and conditioning. Hair cosmeceuticals can include both botanical and non-botanical products. Some botanicals and active ingredients may potentially affect the regulation of the hair cycle and hair growth. Other botanical products are also available to remove excess or unwanted hair.

*Table 7.1* Botanical Cosmeceuticals with Hair Growth Promoting Properties

| |
|---|
| *Serenoa repens* (saw palmetto) |
| *Ginkgo biloba* |
| Aloe (*Aloe barbadensis, A. vera, A. capensis*) |
| *Asiasari radix* |
| *Sophora flavescens* |
| *Illicium anisatum* |
| *Ginseng radix* |
| *Hydrangea macrophylla* |
| *Vitis vinifera* |
| *Hibiscus rosa-sinensis* |
| Bergamot |
| Dabao Chinese herb |
| Amino acids |
| Lygodii Spora |
| Unsaturated fatty acids |
| Green tea and polyphenols |
| Pinacidil and potassium channel openers |

**The Hair Cycle**

Anagen, the active growth phase of the hair cycle lasts two to six years.[11] Catagen, a transition phase follows, ending with telogen, a resting phase that lasts two to three months.[11] (Fig. 7.1). Approximately 80–85% of scalp hair follicles are in anagen, with 10–15% in catagen and telogen,[12] with a normal loss of 50 to 150 telogen hairs per day,[11] The hair cycle has a complex regulation and the trigger for each phase is thought to involve the interaction of growth factors and Growth factors such as insulin like growth factor -1 (IGF-1) are important in hair follicle cycling and IGF-1 increases hair follicle growth in vitro.[11] Other studies have shown that the transforming growth factor β 3 (TGF- β 3) and basic fibroblast growth factor (bFGF) are present in anagen, but their levels are much lower in catagen.[13] Hormones such as androgens, estrogens, and thyroxine can also influence hair growth.[11] Testosterone is converted at the level of the hair follicle into the more potent dihydrotestosterone (DHT) by type II 5- α – reductase.[11] Androgens act on the dermal papillae to produce growth factors to either stimulate or inhibit growth of the hair follicle depending on the body site.[13] For example, in the axillae and pubic area at puberty, vellus hairs enlarge to terminal pigmented hairs. On the scalp, androgen-susceptible follicles miniaturize and revert back to vellus hairs.

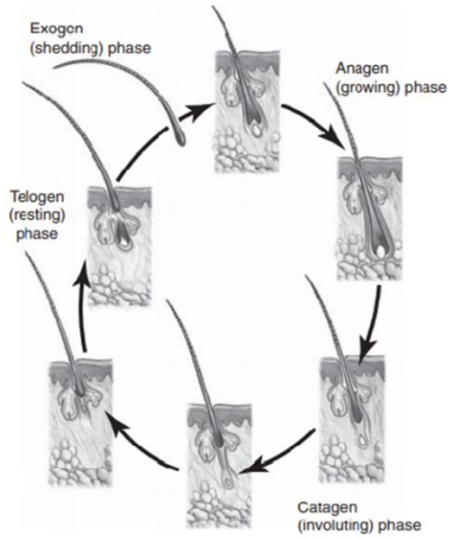


*Figure 7.1* The hair growth cycle.

**Hair Growth Promoters**

*Serenoa Repens (Saw Palmetto)*

Serenoa repens extract originates from the berries of a small evergreen palm tree native to North-Eastern America.[14] (Fig. 7.2). The name derives from its saw-shaped leaves.[14] It has properties of a 5- α -reductase inhibitor and has been used for prostate conditions such as benign prostatic hyperplasia.[10] In a randomized double-blind placebo-controlled trial over 4.6 months using an oral liposterolic extract of serenoa repens and β -sitosterol, 6 out of 10 patients improved on a 7-point investigator rating scale compared to only 1 out of 9 patients in the placebo group.[15] Some over-the-counter topical hair loss products contain saw palmetto as the active ingredient, but no studies have been done using this topical extract to determine whether it has any benefits topically.[3]

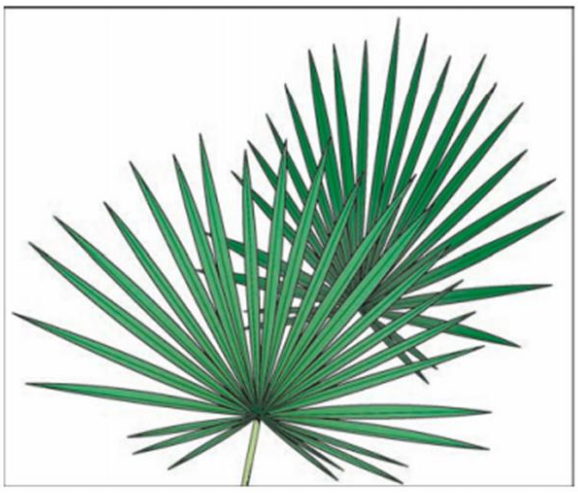

*Figure 7.2 Serenoa repens* (saw palmetto).

***Ginkgo biloba***

Ginkgo biloba has long been used in traditional Asian medicine (Fig. 7 .3). The extract originating from the tree's leaves is a mixture containing flavone glycosides including quercetin and kaempferol, and terpenes.[16] As well, as anti-inflammatory properties, a study has shown that Ginkgo biloba extract promoted hair growth in vitro by promoting follicular proliferation and inhibiting apoptosis (17). It is used commercially in several hair care products.[3]

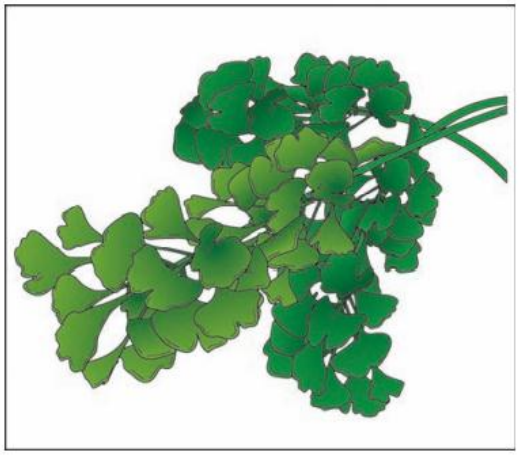

*Figure 7.3 Ginkgo biloba.*

***Aloe (Aloe barbadensis, Aloe Vera, Aloe capensis)***

Aloe is a traditional Asian therapy used for its antibacterial, antiviral and antifungal activity.[18] Apart from anti-inflammatory activities, it is believed to have hair growth promoting activity (19). Aloe is a succulent plant found in Florida, USA, and South Africa[14] (Fig. 7 .4). Aloe gel is derived from broken down leaves, particularly, the pericyclic cells below the plant's skin and in the inner central leaf region[3] The gel contains mucopolysaccharides, allantoin, and anthracenes such as aloin, alkylchromone, flavonoids, amino acids, minerals, hydroxyquinine glycosides, and carboxypeptidases[18] CIR safety data exists only for certain aloe species. The anthraquinone levels in Aloe barbadensis / Aloe Vera should be kept below the industry established level of 50 ppm in cosmetic formulations[20] Inadequate data for the extracts from other aloe species exists[3] The CIR has also recommended that the total polychlorinated biphenyl pesticide contamination of plant-derived cosmetic components should be restricted[3,20] Possible side effects include allergic contact dermatitis, phototoxic reactions, and mutagenicity (18). It is contraindicated in pregnancy and lactation.[18]

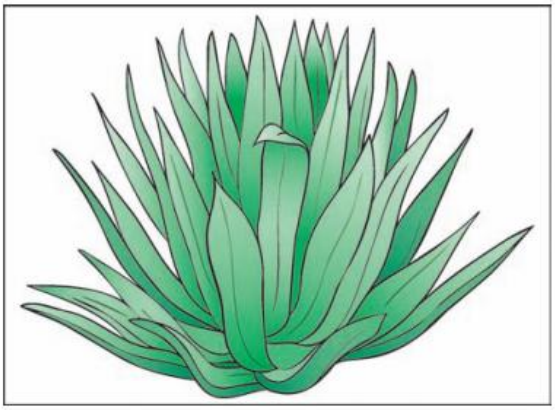

Figure 7.4 Aloe vera.

***Asiasari radix***

Asiasari radix has hair growth promoting potential. Topical A. radix dried root extract induced transition from telogen to anagen and increased protein synthesis in mice hair follicles, stimulating hair growth[21] In cultured human dermal papilla cells A. radix extract increases cellular proliferation and upregulates expression of growth factors such as VEGF,[21] Vascular endothelial growth factor is important in angiogenesis and may be an autocrine growth factor for dermal papilla cells.[22] Similarly, minoxidil, a useful drug treatment for hair loss may also upregulate the expression of VEGF in dermal papilla cells of anagen follicles[23] A. radix, however, does not have an inhibitory effect on 5- α –reductase.[21] At present this extract is not available in any cosmetic preparations[3]

***Sophora flavescens***

Sophora flavescens has hair growth stimulating potential. Topical S. flavescens dried root extract stimulated transition of telogen to anagen in mice hair follicles and induced growth factors such as IGF-1 and keratinocyte growth factor (KGF) in cultured human dermal papilla cells[24] Unlike A. radix, S. flavescens has an anti-androgen effect with an inhibitory effect on type II 5- α -reductase[24] This ingredient is presently not available in any cosmetic preparations[25]

***Illicium anisatum***

Hair growth depends on a supportive vascular supply for the anagen hair follicles. Illicium anisatum extract increases subcutaneous blood supply in mice and supports hair growth[26] I. anisatum water-soluble extract derived from leaves, roots and fruits on an organ culture system of mouse vibrissae hair follicles demonstrated hair growth longer than controls[26] This water-soluble extract is believed to contain shikimic acid, but the exact compounds are not clearly known, and shikimic acid induced IGF-1, VEGF, and KGF mRNA expression in hair follicles[26] Extract in acetone inhibited hair follicle growth and was found to contain toxic sesquiterpene compounds[26] Although the potential dermatologic implications are that I. anisatum extract may be helpful as a hair promoting compound, it has not yet been used in any hair products.[27]

***Ginseng radix***

Ginseng has been used for years by China and Russia for its medicinal value (Fig. 7.5). The dried root is the medicinal part, but the root can take at least six years to reach marketable size[14] The plant can live up to 100–400 years and the older the root, the smaller amount or dose of ginseng that should be used[14] The major active constituents of ginseng are the ginsenosides, claimed to have anti-aging, anti-inflammatory and antioxidant properties[16] One dermatologic benefit is purported to be hair growth. A study on cultured mice vibrissae hair follicles and a 70% methanol extract from red ginseng (steamed and dried roots) showed hair growth promoting activity[28] This function of red ginseng is better than white ginseng[28] Ginsenoside–Rb (1) or G-Rb (1) exhibited hair promoting activity as did the bioactive component 20(S)-ginsenoside[28] Ginseng extract is used in some hair care products.[25]

Figure 7.5 Ginseng radix.

***Hydrangea macrophylla***

Hydrangea macrophylla extract has potential hair growth activities. In the hair cycle, catagen, the involution phase, is characterized by an increase in TGF- β 2.[29] H. macrophylla extract reduced synthesis of an inducible TGF- β 2 protein and helped suppress the apoptotic caspase cascade, thus elongating hair growth and delaying catagen progression.[29] This may provide an avenue for new treatments for hair loss. Currently this is not an ingredient in any cosmetic preparations.[25]

***Vitis vinifera***

Vitis vinifera or grape seed extract activity is derived from the proanthocyanidins. Proanthocyanidins have good antioxidant activity.[18] Grape seed oil also contains other active compounds such as flavonoids, stilbenes, fruit acids, tocopherols, essential fatty acids, and phenyl acrylic acids[18] Proanthocyanidins promote hair follicle

growth and initiate anagen[30] likely by inhibition of TGF- β 1[31] Resveratrol is strong antioxidant and anti-inflammatory present in grape seed oil and grape skin[16] Resveratrol has phytoestrogen activity, as well as antiviral activity.[18] A topical solution of grape seed, jojoba, lavender, rosemary, and thyme was successfully used for alopecia areata and statistically significant hair regrowth was seen after seven months of daily use compared to placebo.[32] Proanthocyanidins are presently not listed in any hair care products.[25]

***Hibiscus rosa-sinensis***

Hibiscus rosa-sinensis in murine models promotes hair growth.[33] Petrolatum ether extracts of the leaves and flowers of H.rosa-sinensis found that the leaves are the more potent hair promoter.[33] Hibiscus-derived extracts are in several available hair care products.[25]

***Bergamot***

Bergamot extract, a citrus derived oil from the rind of the bergamot orange, has a pleasant fragrance, which until a few years ago was found in many perfumes.[34] It has been restricted due to its phototoxicity due to its fucocoumarins.[34] However, bergamot and boxthorn in murine studies applied topically for 42 days has shown hair growth promoting activities[35] Bergamot oil is used in some hair care products[25] Phototoxic reactions have been reported with oil of bergamot in aromatherapy oils.[34]

***Dabao Chinese Herb***

A Chinese herb extract "Dabao" has been used as a hair restoring lotion.[36] The dabao preparation contains water, ethanol and extracts of mulberry leaves, saffron flowers, stemona root, sesame leaves, ginger root, fruits of the hawthorn, fruits of the pepper plant, Chinese angelica root, bark of pseudolarix, and the skin of a Sechuan pepper fruit.[36] In a randomized, placebo-controlled study, dabao applied topically to the scalp twice daily for six months resulted in increased hair in men with androgenetic alopecia compared to placebo of 133 hairs and 109 hairs, respectively in a studied 5cm 2 area ( $p < 0.03$).[36] However, allergic contact dermatitis has been reported and folliculitis was a potential side effect with treatment.[36] Dabao is not available in any cosmetic hair products.[3]

***Amino Acids***

High sulphur proteins, arginine/ L -arginine and cysteine/ L –cysteine are thought to be involved in hair growth promotion as they are an important component of the keratin intermediate filaments[10] Cysteine is a cosmetic ingredient in some topical hair care products with activities that theoretically comprise hair conditioning and hair waving/straightening.[3,25,27]

***Lygodii Spora***

Lygodii Spora is the spore of Lygodium japonicum and a 50% aqueous ethanol extract in vitro demonstrated 5- α –reductase inhibitory activity and in vivo anti-androgenic properties.[37] It showed hair regrowth after shaving in testosterone treated mice and suppressed the growth of the flank organ in castrated Syrian hamsters.[37] The main active ingredients with anti-5- α -reductase activity were the fatty acids: oleic, linoleic, and palmitic.[37]

***Fatty Acids***

Certain unsaturated fatty acids can inhibit 5- α -reductase in cultured cells and cell-free systems[38] A study has found that γ -linolenic acid has the most potent 5- α -reductase inhibitory activity followed in decreasing order of potency by arachidonic acid and α -linolenic acid, followed by linoleic acid, palmitoleic acid, oleic acid, and myristoleic acid.[38]

Other fatty acids such as erucic acid and undecylenic acid had no 5- α –reductase inhibitory function.[38] Another Chinese herb used for hair growth, the seeds of Sesamun indicum contain large amounts of fatty acids and this mechanism of action may be how S. indicum influences hair growth.[37] Another botanical, Boehmeria nipononivea in acetone extract also inhibits 5- α -reductase and encourages hair growth in mice.[39] Fractionation of the leaves extract revealed six fatty acids including α -linolenic acid, linoleic acid, palmitic acid, elaidic acid, stearic acid, and oleic acid.[39] α –Linolenic acid, elaidic acid, and stearic acid, in addition to the acetone extract of B. nipononivea showed hair growth promotion.[39] Other Boehmeria species such as B. longispica and B. plantanifolia have similar 5- α -reductase inhibitory effects.[39] The CIR has examined the safety of fatty acids and have approved them in cosmetics at the current available concentrations and uses.[40,41]

***Green Tea and Polyphenols***

Green tea, as well as black tea, is derived from the leaves of Camellia sinensis.[42] Green tea comprises 2–4% caffeine and 8–12% polyphenols.[18] Topical and oral green tea in studies has been found to be antibacterial, anti-cancer and promote keratinocyte differentiation.[42] Epigallocatechin gallate (EGCG) is the most potent antioxidant and the largest polyphenol catechin in green tea, with green tea having the highest concentration of EGCG of any tea.[18] EGCG has been shown to inhibit 5-α -reductase, with the type I being more affected than the type II 5- α -reductase[43] Other polyphenols such as biochanin A, daidzein, and myricetin were also found to have inhibitory effects on 5- α -reductase activity[43] Furthermore, EGCG in vitro increased hair growth and dermal papilla cell proliferation.[44] Kaempferol, found in green tea seed extract, has been shown to also inhibit type I and II 5- α –reductase enzyme activity in cell lines[43] Green tea oral intake also may influence sex hormone binding globulin (SHBG) concentration[45] With higher levels of SHBG, more testosterone is bound in circulation, therefore the free and active testosterone fraction decreases, reducing the androgen effect on hair follicles. These functions of green tea may suggest a possible role in the treatment of hair loss[43] It is

important to note that high intake of naturally occurring 5- α -reductase inhibitors may have adverse effects on male fetus sexual development in pregnant women[43]

***Pinacidil***

Minoxidil is a FDA-approved drug for the treatment of hair loss. The exact mechanism by which minoxidil promotes hair growth is unknown, but is believed to influence potassium channel opening, blood supply and hair cycling.[46] Otheragents that influence potassium channel opening such as pinacidil, P-1075 (an active pinacidil analogue), cromakalim, and nicorandil have been shown to support growth of cultured hair follicles.[46] Some over-the-counter hair growth promoters claiming to be natural, contain minoxidil as an active ingredient[3]

**Hair Removal or Hair Growth Inhibitors**

***Thioglycollate Preparations***

Chemical depilatory creams are usually thioglycollate preparations, which can break down disulfide bonds, removing hairs at the level of the skin surface[47] They are painless and inexpensive, however, they can cause irritant dermatitis[47]

***Soy Protein***

Topical soy claims to delay hair regrowth and have anti-aging properties[16] Soy contains phospholipids such as phosphatidyl choline and essential fatty oils.[18] Soy also contains small amounts of isoflavones, saponins, essential amino acids, phytosterols, calcium, iron and the proteases, Kunitz-type trypsin inhibitor or the soybean trypsin inhibitor (STI) and the Bowman-Birk protease inhibitor (BBI), which are the most active soy components[18] The strongest isoflavenones are genistein and daidzein.[18] A study has shown that topical fresh soymilk, BBI, and STI decrease the rate of hair growth and reduce hair shaft dimensions in mice and in a small human study.[48] The pigmentation of hair was also reduced with soybean protease inhibitors and soybean extracts.[48] It is believed that the STI is the main agent in soymilk that influences hair growth and dimensions[48] The soy isoflavone, genistein, has also been shown to reduce hair growth on cultured hair follicles, likely due to its phytoestrogen effect.[49] These natural proteins may have a role in managing unwanted hair in patients with hirsutism. Side effects of soy rarely include gastrointestinal upset, asthma, dermatitis, and itch.[18] Patients with a family or personal history of breast or other estrogen-dependent cancers should avoid soy-derived products.[16]

**Natural Hair Colorants**

Hair colors can improve the appearance of the hair by enhancing color, eliminating grey hairs, and improving the apparent hair volume.

***Henna***

Henna is well known as a red-brown natural hair colorant/dye and is available in hair care preparations for this function. It also has antibacterial properties and has been used to treat wounds.[50] Different types of henna are available to give the hair colors of red, neutral, brown, and black. Egyptian henna characteristically causes the red-brown hair color.[51] Henna is derived from the leaves of Lawsonia Alba, Lawsonia spinosa, and Lawsonia inermis.[50] (Fig. 7.6). The shrubs grow in India, North Africa, and Sri Lanka.[51] The chemical dye is lawsone, a naphthoquinone (2-hydroxy-1,4-naphthoquinone), which attaches to keratin of the hair, probably via thiol group binding, as a substantive dye and gives it the red color.[50,51] It does not penetrate the hair shaft.[50,52] This red color can also be found in walnut, Juglans regia.[50] Other colors can be produced by adding other dyeing agents to the henna or by treating the hair with another rinse from different plants including apigenin from Chamomile flowers to produce a yellow color, onion (Allium cepa) to give a copper color and curcumin to develop colors from yellow to deep orange.[3,51,53,54] It is also an ingredient of shampoos, conditioners, and other products that do not alter the hair's color to add volume, control split ends, and aid manageability.[51] Adverse effects of natural henna are staining of the skin, nails, and clothes if accidentally contacted.[51] These natural hair dyes have low allergic potential, but both irritant and allergic contact dermatitis have been reported to occur.[51,55,56]

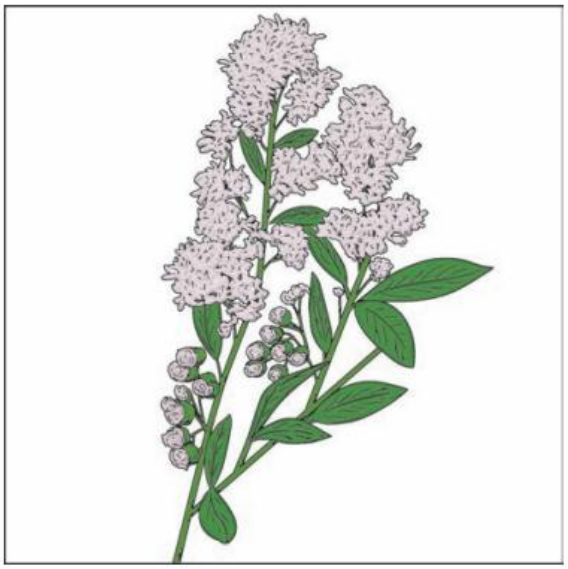

*Figure 7.6 Lawsonia alba* (henna).

**Hair Shampoo, Conditioning Agents and Anti-dandruff Agents**

Hair products can improve the texture, volume, and tensile strength of the hair, in addition to aiding manageability.[57] Hair shine and texture are dependent upon the hair surface, whereas hair structural integrity depends on the hair cortex[57] Many varieties of shampoos and conditioners exist for hair care. Shampoos are formulated to cleanse the hair by eliminating sebum, sweat, yeast, scale, dirt, and styling products [57]. Shampoos are also directed at hair type such as dry or

oily, the frequency of hair shampooing and also underlying conditions like seborrheic dermatitis.[7,58] Shampoos may contain up to 30 ingredients including cleansing agents, stabilizers, preservatives, fragrances, conditioning agents, and special care ingredients with active properties to treat specific hair conditions such as oily hair or an inflamed scalp.[7] Oily or greasy hair is due to accumulation of sebum from the sebaceous glands of the scalp and sweat gland secretions.[7] Oily hair needs to be washed frequently to reduce this build-up of natural grease and over-conditioning should be avoided. Some herbal ingredients in shampoos claim to help oily hair such as rosemary. Growth promoting ingredients in shampoos are unlikely to have an effect on the hair due to their short duration of contact with hair during shampooing and their dilution with water.[7,59] Seborrheic dermatitis is caused by Malassezia species, previously known as Pityrosporum species.[59,60] Seborrheic dermatitis presents with scalp pruritus, erythema, and yellowish scale.[60]

Treatment consists of prescription and over the-counter drugs such as zinc pyrithione, ketoconazole, imidazole, selenium sulphide, and tar.[61] The botanical agents reported to be useful for seborrheic dermatitis are extracts of sage, rosemary, thyme, garlic, and walnut,[3] (Table 7.2). With age, the hair greys and growth slows. The hair and scalp are exposed to physiologic aging and environmental factors causing oxidative stress such as ultraviolet light, smoking, poor diet, and pollution.[59,62] Topical anti-aging hair compounds would therefore require antioxidants and photo-protectors.[59,62] The current antioxidants in shampoos such as ascorbic acid (vitamin C) and photo-protectants shield the shampoo from oxidative degradation and not the hair and scalp.[59,62] Possible future antioxidants and anti-aging compounds for shampoos are green tea and phytoestrogens.[59,62] Cinnamidpropyltrimonium chloride, a UV absorber, is an ingredient in shampoos that has conditioning and photo-protective effects.[59,62]

Hair dyes also provide a photo-protective effect for the hair,[59,62] Lipid nanoparticles of UV blockers are being developed for photo-protection in shampoos for hair.[63] Shampoos with amino acids are also being created.[59,62] Hair conditioners improve cortical and cuticular function.[57] Shampoos can also contain conditioning agents.[62] Cuticular degeneration and cortex hair damage occurs due to weathering and exposure to chemical and hair grooming practices. Conditioners should leave the hair smooth, glossy, and hydrated.[57] Conditioners also help with the manageability of the hair and reduce frizz and fly-away.[57,58] Weathered and dry hair obtain more benefit from conditioners than normal hair.[59] Conditioning agents may be wax, lanolin compounds, vegetable oils, silicones, quaternary ammonium compounds, and protein hydrolysates.[62] Panthenol is a potent humectant and is absorbed into the hair shaft adding moisture and condition.[58,62] Panthenol is used in hundreds of hair care products at concentrations up to 6% and has been found safe by the CIR.[64] Intensive conditioners are available which can moisturize the hair and restore conditions that have dimethicones, gum extracts and poly-quarternium polymers.[57]

*Table 7.2* Natural Anti-dandruff Agents

| |
|---|
| *Rosmarinus officinalis* (rosemary) |
| *Salvia* species (sage) |
| *Thymus vulgaris* (thyme) |
| *Allium sativum* (garlic) |
| *Juglans regia* (red walnut) |
| *Melaleuca altrenifolia* (tea tree) |

**Oligosaccharides**

Oligosaccharides such as 1% Cotton Honeydew (Gossypium hirsutum) extract rinse-off mask has been shown to be effective in softening the hair surface by smoothing the cuticle cells and protecting from cuticle lifting compared to placebo.[65] The extract contains oligosaccharides such as fructose, glucose, inositol, melezitose, saccharose, trehalulose, and trehalose suggesting a role for them in hair conditioning.[65] Essential oils, such as chamomile, rosemary and West Indian Bay, are incorporated into hair care products for their fragrance and conditioning effects on the hair.[66] They can be extracted from different parts of the plant including the leaves, the flowers, and the root.[66] The mechanism of action of these oils is not clearly understood, but is believed to be the combined effect of both the active and inactive ingredients that modulate the action.[66] Other plant-derived substances can also condition the hair. Coconut oil, predominantly containing a triglyceride of lauric acid, reduced protein loss in damaged and undamaged human hair samples in both pre- and post-wash grooming products, while no reduction was observed in applications with sunflower and mineral oils.[67] Using secondary ion mass spectrometry with time-of-flight mass spectrometry, it was found that coconut oil was able to penetrate into the hair cortex and reduce swelling of the hair fiber when the hair is exposed to water, protecting hair hygral fatigue.[68] Coconut oil also functions as a fragrance ingredient in cosmetic formulations.[27] The CIR (2008) recently

completed a safety assessment of coconut oil (termed Cocos Nucifera (Coconut) Oil on cosmetic product labels) and found it to be safe in the present practices of use and concentration.[69]

***Rosmarinus officinalis (Rosemary)***

In traditional folk medicine, rosemary is used as a hair rinse to promote hair growth, body and shine.[66] It contains rosmarinic acid and caffeic acid, which are believed to have antioxidant properties.[66] It is also used as a conditioner for oily hair and used as a rinse for treatment for dandruff.[66] The effect on hair growth will need further study. Rosemary extract, flower extract, flower/leaf/stem extract, and leaf extract are found as ingredients in hair care products.[3,25]

**Salvia Species (Sage)**

Salvia officinalis , also known as common sage or garden sage, is believed to condition hair, add shine particularly to dark, curly hair and to promote hair growth (66) ( Fig. 7.7 ). Sage extract is also used for dandruff as a massage oil into the scalp (66). Sage contains tannins, camphor, borneol, saponins vitamins A, C, and B-complex, calcium, and potassium (3, 66). The effect on hair growth will need further study. Sage extract, flower/leaf/stem extract, and leaf extract are used in hair care products.[3,25]

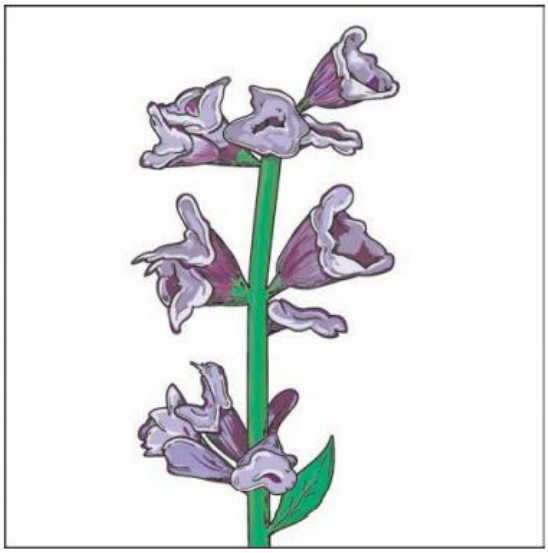

*Figure 7.7 Salvia officinalis* (sage).

***Thymus vulgaris (Thyme)***

Traditionally, thyme has been used as a massage oil for the treatment of dandruff and hair shedding and a rinse with sage and rosemary to promote hair condition.[66] (Fig. 7.8). The effect on hair growth will need further study. Thyme flower/leaf extract and leaf extract are used in hair care products.[3,25]

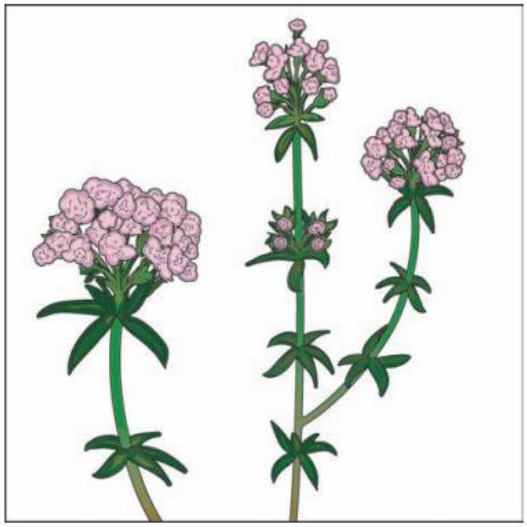

*Figure 7.8 Thymus vulgaris* (thyme).

***Allium sativum (Garlic)***

Garlic lotion has been used as a dandruff treatment in folk medicine.[66] It also has antiseptic and antioxidant properties.[70] in addition to antibacterial effects.[71] Irritant and allergic contact dermatitis can develop when neat garlic is applied to the skin.[66] Garlic bulb extract and oil are listed as ingredients in hair care products.[3,25]

***J. regia (Walnut)***

Walnut leaves have been used for hair loss and dandruff. It also has emollient properties.[66] Black walnut (Juglans nigra) is used mainly for dandruff,[71] J. regia (Walnut) leaf extract is found in hair care products.[3,25,27]

***Melaleuca altrenifolia (Tea Tree)***

Tea tree oil (malaleuca oil) has long been used as an antiseptic and antimicrobial agent.[16] It is an essential oil extracted from the leaves of the Australian Melaleuca altrenifolia (3) (Fig. 7.9). Tea tree oil contains hydrocarbons and terpenes such as cineole (18). A study has shown that a 5% tea tree oil shampoo has antimicrobial activity against Pityrosporium ovale, and showed a 41% improvement compared to placebo for seborrheic dermatitis.[73] Adverse effects are irritant and allergic contact dermatitis. The monoterpene, terpinen, is the significant sensitizing agent in tea tree oil.[18] Prepubertal gynecomastia has been reported in young boys receiving topical formulations of lavender and tea tree oils.[74] Melaleuca alternifolia (tea tree) leaf oil is listed in hair care products.[3,25,27]

*Figure 7.9 Melaleuca alternifolia* (tea tree).

**Natural Anti-head Lice Agents**

Natural alternatives to medicinal head lice treatment are becoming more popular and in demand by the public.

***Annona squamosa (Custard Apple)***

Traditionally, in Thai medicine, Annona s quamosa (custard apple) seeds have been used for the treatment of head lice. The hexane extract of A. s quamosa contains oleic acid and triglyceride with one oleate ester.[75] The hexane extract and the triglyceride with one oleate ester have anti-head lice activity.[75] It has been shown that a 20% w/w oil in water cream applied for three hours was effective in clearing the lice compared to a 25% benzyl benzoate emulsion.[76]

***Herbal Head-lice Shampoo***

Paw paw (Asimina triloba), Thymus vulgaris, and M. alternifolia are anti-sarcoptic agents. The mechanism of action involves the inhibition of adenosine triphosphate (ATP) production, resulting in a depletion of ATP stores, which kills the lice[77] An herbal lice removal shampoo containing a standardized extract of 0.5% paw paw, 1.0% thymol, and 0.5% tea tree oil was successful in clearing 16 individuals with head lice after three applications of one hour, eight days apart in conjunction with a lice comb[78] The active ingredients of paw paw are bullatacin, asimicin, and trilobacin[77] The active constituent of tea tree oil, M. alternifolia, is 1-terpinen-4-ol.[77] Thymol is the active ingredient of the essential oil of T. vulgaris and has been studied by the CIR. Thymol is safe for use in cosmetics at concentrations up to 0.5% (78) and is found in cosmetic hair products.[3,25]

**Nail Cosmeceuticals**

**Nail Biology**

The normal nail has not only a cosmetic function, but also is also important in touch, fine manipulation, and protection for the distal phalanx.[79] Environmental factors such as water, soap, and detergents can damage the nail. The colourless, translucent nail plate is the creation of the nail matrix. Hard and soft keratins form the bulk of the nail plate.[80]

Its tensile strength derives from the disulfide cystine bonds crosslinking the keratin fibers.[80] The nail is inserted into the proximal and lateral nail folds. The matrix is inferior to the proximal nail plate and forms most of the nail plate.[81] The nail bed is from the lunula to the hyponychnicum.[81] The cuticle is formed by the stratum corneum of the ventral and dorsal surface of the proximal nail fold fusing and is loosely attached to the nail plate.[81] The cuticle gradually desquamates and seals the nail for protection from bacteria and fungi.[81]

**Cuticle and Nail Care Products**

Cuticle emollients can be creams, lotions, oils, waxes or ointments.[79] They soften the keratin of the nail plate and surrounding skin. Emollients used in cuticle care preparations include lanolin, mineral oil, urea, and petroleum jelly.[79] Plant oils such as safflower oil, wheat germ oil, tea tree oil, grapeseed oil, apricot kernel oil, and avocado oil can be added[79] Multiple other ingredients such as vitamin C (ascorbic acid), vitamin E (tocopherol acetate), aloe vera, amino acids, collagen, wheat protein, and salicylic acid can also be added.[80] Green tea products are also now available for nail care claiming to increase nail strength and act as an antioxidant. The efficacy of these additives has not been evaluated in human randomized controlled trials.

**Cuticle Removers**

The cuticle plays an important protective function for the nail. In manicures, the cuticle is softened by a cuticle remover and pushed proximally with a metal or wooden cuticle pusher.[79] Occasionally a cuticle trimmer is used to remove excess cuticle.[82] If this manipulation of the cuticle is too forceful, injury to the cuticle and proximal nail fold can occur and lead to acute and chronic paronychia.[79] Cuticle removers are placed over the cuticle and the proximal edge of the nail plate for a few minutes to soften the cuticle and then removed.[79] Cuticle removers contain substances to break the cystine sulphide bonds, which soften the cuticle, such as 2–5% sodium hydroxide or potassium hydroxide in a liquid or cream base.[79,83] The cuticle removers may also contain propylene glycol and glycerol to decrease irritation and evaporation.[83] Organic bases like trolamine and inorganic salts such as trisodium phosphate and tetrasodium pyrophosphate are weaker and less helpful cuticle removers.[83] Irritant dermatitis can occur if the cuticle remover is left too long on the nail, however, allergic contact dermatitis is rare.[83]

**Nail Hardeners**

Nail hardeners assert to make the existing nail harder and stronger and are applied like nail polish.[79] They can contain Teflon, zirconium/silicon/titanium polymers, nylon, acrylic resins, and silk.[79] In addition, some claim to make the growing nail stronger with supportive ingredients such as minerals and vitamins like biotin and

calcium.[79] Other types of nail hardeners contain up to 5% formaldehyde, which can cause allergic contact dermatitis, painful onycholysis, subungual hyperkeratosis, and haemorrhage as well as nail plate discoloration.[79] In the USA, these formaldehyde resins are for use on the free edge of the nail only, while the skin is protected.[79] Formaldehyde causes crosslinks of the keratin and increases strength and hardness of the nail, but reduces the flexibility of the nail leading overall to a brittle nail.[83] Vitamin supplements orally of biotin daily may assist brittle nails.[80]

## CONCLUSION

Cosmeceuticals have experienced exponential market growth, popularity and use in the community. As clinicians, it is important to be aware of the botanical ingredients and other active chemical ingredients incorporated into these products for hair and nail care in order to counsel patients on the safety of products and the efficacy of the marketing claims. Since cosmeceuticals are considered an intermediate between an OTC product and a drug, they usually contain higher concentrations of the active ingredients. The FDA does not directly monitor their use, but claims of biological activity can promote an investigation of the product and an occasion withdrawal of a product from the market. Few available clinical studies support the use of active botanicals and chemical ingredients in hair and nail care products, however, unpublished and published safety data reviewed by CIR, can support the safety of some chemical ingredients and can apply any necessary restrictions in their current practices of use. The botanicals and other active cosmeceutical ingredients, like other topical products, have potential for side effects, such as contact dermatitis. Clinicians should be familiar with the panoply of cosmeceutical ingredients which patients will use in hair and nail care products and be alert for side effects.

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