CHAPTER 12

Anti-aging skincare: the natural and organic way

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1. Introduction

There is increasing awareness and advocacy for the use of natural compounds as a replacement for chemical and synthetic compounds not only in the beauty and dermatological product industries but also in medicines, pharmaceutics, and food supplements [17,48]. The sustainability concept has also become an emerging paradigm among various global institutions, governments, manufacturers, and consumers owing to the increasing concerns about the safety of cosmetics ingredients and products as well their environmental and social impacts [13]. In recent times, natural substances such as plant extracts and essential oils have been thought to be sustainable and safe antimicrobial alternatives to the common chemical preservatives such as benzyl alcohol, formaldehyde, methylchloroisothiazolinone, methylisothiazolinone, parabens phenoxyethanol, sodium benzoate, and triclosan all of which are known to exhibit some adverse health effects despite their ease of production, cheapness, and effectiveness [51]. Their immense potential and remarkable multipurpose effects on the human skin have been appreciated from time immemorial. Plant products in the form of creams, decoctions, lotions, infusions, ointments, and teas were traditionally employed several thousands of years ago to treat various skin diseases and for discolorations, skin elasticity, wound healing, and other medical purposes [23].

The skin is the social interface between an individual and other members of society [73]. It is the body's largest, fastest-growing, and most diverse and extensive organ of the human body [67]. It is considered an organ because it regulates many important physiological processes of the body, such as sensing stimuli, environmental and mechanical protection, thermoregulation, immune surveillance, moisture regulation, and vitamin D synthesis [8].

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Skin aging is a biologically and mechanically governed time-dependent event [42]. The skin aging process is a progressive manifestation of deteriorations in skin physiology and morphology [75]. The main vital functions of the skin include homeostatic regulation of fluid balance, body temperature, body proteins and electrolytes, vitamin D production, immune surveillance, waste removal, and sensory perception, as well as ultimate protection of the body's internal organs against deleterious environmental factors [69,76]. As the skin's governance deteriorates over time, a dry cutaneous appearance, a rough texture, wrinkles, lost elasticity, and the decreased production of dermal extracellular matrix (collagen, hyaluronic acid, and elastin) are the main clinical manifestations of skin aging [28].

Therefore, there is increasing interest in the search for remedies against the skin aging process as well as "anti-aging products." The entire beauty industry, especially anti-aging cosmetics, continues to boom and expand due to the strong association between an individual's sense of self-identity and physical appearance. Thus, the search for anti-aging treatments is at the forefront of the cosmetic industry and dermatological research.

2. Current global trends

The major signs and manners of skin aging depend mainly on age, genetic risk factors, anatomical sites, and race [40]. On the other hand, the population of adults aged 60 or more throughout the world is also significantly increasing and growing faster than all younger age groups. The global population is projected to contain almost a quarter or even more of people aged 60 and above by 2050, except for only Africa. This undoubtedly makes aging— and in particular skin aging— an increasingly important current and emerging issue. Every human being should not only have the opportunity to live a long and healthy life but should also experience healthy aging, according to the demand of the World Health Organization [61]. Consumers nowadays are becoming more concerned about their overall health, thereby advocating for the incorporation of functional ingredients and natural bioactive into cosmetic products for health enhancement [2,71]. The increased concern about the environmental and ecological impacts of synthetic materials has also lent support to the use of biodegradable materials [46]. For instance, the minimal side effects and therapeutic effects of traditional Chinese medicines are responsible for the continuous use of several valuable Chinese resources in the development of

cures for many skin diseases over thousands of years [72]. The global demand for natural and organic skincare products was estimated to have reached $13.2 billion in 2018. Personal care products, with global sales of more than $630 billion, are the largest category in the beauty business [22].

3. The effects of skin aging

Aging processes are biochemical and natural process events that are responsible for the gradual damage accumulation, which in turn leads to disease and ultimately death. The skin is the first bearer of the marks of time passage and an easily accessible model for the assessment of the molecular mechanism involved in the aging process [76]. As the body gets older, the skin also starts to become clear (translucent), drier, paler, and more fragile [55]. The epidermis and dermis become naturally thinner and flatter (Fig. 12.1).

The skin does not remain smooth and plump like before when it ages. Thus, old skin gets bruised easily. Other inevitable consequences of aging are the appearance of fine lines, sagging, pigmented spots, telangiectasia, and wrinkles [65].

The complex physiology, biochemistry, and structural integrity of the dermis are dramatically altered as the skin ages owing to the cumulative effects of both extrinsic and intrinsic aging [18]. Other main biologic intrinsic factors are qualitative and quantitative hormonal alterations, genetic predisposition, and cellular metabolic pathways [76].

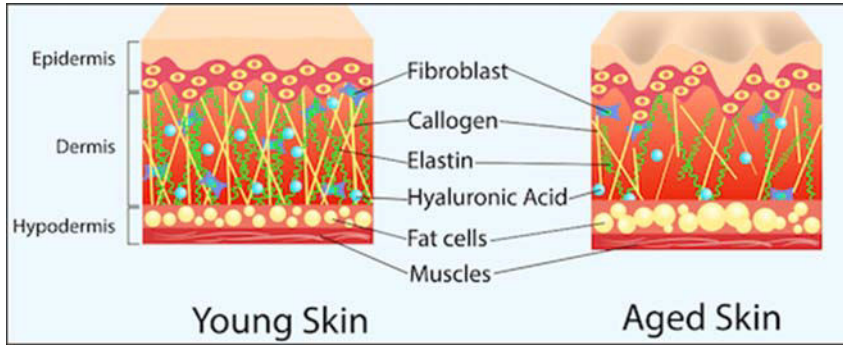

Figure 12.1 Structure of the skin layers (epidermis, dermis, and hypodermis). The epidermis and dermis become naturally thinner and flatter as the skin gets older, drier, and more fragile. Aged skin is also characterized by a dry cutaneous appearance, loss of elasticity, rough texture, and wrinkles, as well as a decrease in the production of dermal extracellular matrix (collagen, hyaluronic acid, and elastin).

Nevertheless, the ultraviolet (UV) radiation that accumulates in the tissues over the years of life from both natural and artificial sources remains the principal environmental factor responsible for skin damage. Photodamage is mainly linked to solar elastosis (or dermal elastosis, actinic elastosis), a structural complexity that clinically manifests as thickened, yellowish, and coarsely wrinkled skin. The other factors responsible for the acceleration of aging signs are poor nutrition, chemical pollution, other ionizing types of radiation (microwaves and X-rays), reactive oxygen radicals, smoking, lifestyle and diet, and overeating [36,59,61].

Aging also disrupts the sensitive balance of the enzymes that regulate remodeling and repair of the dermal matrix, thereby contributing to the loss of connective tissues and collagen production [24]. Another sign of aging is cellular senescence as a result of both excessive intracellular and extracellular stresses [61]. Similarly, an aged epidermis is characterized by a significant increase in the number of stratum corneum layers in addition to other remarkable structural changes such as epidermal thinning, orthokeratosis, flattening of the rete ridges, uneven distribution of melanocytes in the basal layer, and a significant decrease in Langerhans cells, as well as various changes and skin barrier impairments, such as a decrease in tight junction components (such as claudin-1 and occluding), increased sensitivity to irritants, increased transdermal drug delivery, the development of pruritus, and the aggravation of xerosis [18].

4. Changes in connective tissues and skin surface pH in aging skin

The degenerative changes that occur in aging skin have always been increasingly studied. In older adults, for instance, about 20%–80% of dermal thickness disappears. The largest component of normal skin is the extracellular matrix, a complex meshwork of carbohydrates and proteins. It consists of collagen, elastin, fibronectin, laminins, proteoglycans/glycosaminoglycans, and several other glycoproteins [15]. Collagen, hyaluronic acid, and elastin are the major components of the dermis that contribute to smooth, supple, and elastic skin. Collagen determines the skin's strength and firmness, while elastin maintains the elasticity of the skin, and hyaluronic acid maintains the moisture of the skin by filling the free space of the skin matrix with water and giving it a fuller, firmer, and youthful appearance [14]. Both environmental (extrinsic) and natural (intrinsic) factors are involved in the decline in the production of these important

elements as humans age, thus making the skin prone to damage, sagging, and wrinkles [25]. The process of wrinkle formation characterized by a marked loss of fibrillin-positive structures and reduced collagen type VII content is associated with the weakening of the bond between the dermis and epidermis of extrinsically aged skin. Decreased collagen content and its sparse distribution in photoaged skin are also caused by serine, matrix metalloproteinases (MMPs), and other proteases [38,75].

Furthermore, the adult dermis contains more decorin, which mainly regulates collagen fibrillogenesis, while various models of skin aging also suggest a progressive accumulation of senescent fibrocytes in an aged dermis, as well as a dramatic reduction in the production of collagen I, loss of its volume, and local overproduction of MMP [61]. The upregulation of caveolin-1(Cav-1) expression levels in the human corneal epithelial of aged subjects is also caused by oxidative stress [36].

Furthermore, normal healthy skin requires a pH of 5.4—5.9 for normal bacterial flora. Using ingredients or products with high pH, however, could increase skin pH, thus leading to irritability, altered skin bacterial flora, and increased dehydration [63]. Skin with pH values < 5.0 is in better condition than skin with pH values > 5.0, using common biophysical parameters such as barrier function, moisturization, and scaling [37]. In general, an alkaline skin pH (8—9) promotes the dispersal of resident bacterial flora from the skin, whereas acidic skin pH (4—4.5) supports the firm attachment of florae. The normal acidic pH of the stratum corneum greatly contributes to skin-protective functions, such as the integrity, permeability, barrier homeostasis, and cohesion of the stratum corneum, primary cytokine activation, and epidermal antimicrobial defense. Women, younger people, and those with black skin usually have lower skin pH than men, older individuals, and white-skinned people [18]. Effective and excellent skincare products should be safe and skin-friendly. Thus, consumers, cosmetic formulators, and manufacturers must give due consideration to the pH factor, especially for acne-prone and sensitive skin [63].

5. Intrinsic and extrinsic aging factors

Both intrinsic (genetically determined process or internal physiological factors) and extrinsic (external factors) mechanisms are responsible for skin and hair aging [16]. Intrinsic (chronologic) aging is the natural, inevitable process of skin decline and is controlled by genetics [12]. On the other hand, extrinsic (photoaging or environmentally induced) aging is caused by

external factors. Intrinsic aging is commonly characterized by a thinned epidermis and fine wrinkles, whereas externally, photoaging through chronic exposure to the sun leads to lentigines, deep wrinkles, telangiectasias, and skin laxity [38].

Aging is a continuous process that cannot be precisely measured due to its complexity and the frequency of subtle structural and physiologic changes that occur over time. Though both intrinsic and extrinsic factors jointly and synergistically influence the onset of age-related changes in the skin), the extrinsic aging factor, however, is the main culprit responsible for the weakening of the skin. The extrinsic aging factors mainly involve UV radiation, cigarette smoking, diet, air pollution, lack of sleep, topical applications, alcohol consumption, lifestyle, and repetitive muscle movements. The intrinsic aging factors only represent about 10% of all aging factors, while only about 3% of skin-aging processes are due to genetic factors [66].

Nevertheless, both the intrinsic and extrinsic factors are majorly responsible for the structural rearrangement of elastin and collagen as well as the decrease in their contents, reduction in skin moisture content, increase in trans-epidermal water loss, vessel walls thinning, diminished production of sebum, arteriosclerosis of both small and large vessels, reduction in mast cells, Langerhans's cells, melanocytes, Merkel cells, Meissner cells, and Pacinian corpuscles as well as an increase in the skin surface pH [39].

6. Natural and organic skincare

Using natural products for health, well-being, and cosmetics has been traditionally explored for ages. They are relatively safe, sustainable, effective, and cheap [4–6,60]. Most conventional skincare products used regularly, however, are loaded with potentially toxic chemicals harmful to human health and the environment [56]. Natural products are highly useful as complementary medicines and remain a potentially sustainable resource platform for drug discovery and development and other relevant industrial uses [47]. Natural products mainly contain naturally derived chemical compounds such as carbohydrates, essential fatty acids, crude fibers, proteins, minerals, squalene, and vitamins. They also contain antioxidants, such as polyphenols, phytosterols, terpenoids, tocochromanols, and organosulfur, which are obtained from living organisms found in nature, such as plants, animals, algae, and microbes [35]. A trending producer of high-value natural bioactive products for potential use in the cosmetic and

cosmeceutical industries is microalgae. Microalgae are photosynthetic organisms producing valuable metabolites due to their constant exposure to stress conditions such as high salinity, changing and unstable temperature, photo-oxidation, osmotic pressure, and ultraviolet radiation. Microalgae's valuable metabolites are rich ingredients for anti-aging, skin whitening, and sunscreen owing to their anti-microbial, skin healing and repair, anti-inflammation, and skin-protective properties against UV [74].

Organic skincare, on the other hand, implies that the ingredients are grown without the use of synthetic pesticides, herbicides, fertilizers, or genetically modified organisms. They often come with certain organic certifications. Organic skincare products offer richer benefits with a mostly decreased risk of allergies, skin irritation, and diseases [34]. There are over 20,000 different medicinal plants found in 91 different countries, across the globe, including the 12 mega-biodiversity countries, according to the World Health Organization [53]. Thus, the cosmetics industry could explore and harness the potential offered by these abundant and sustainable sources of beauty ingredients. Natural products have several specific biological and pharmacological activities such as anti-aging, anti-allergy, anti-hyperpigmentation, anti-inflammatory, antioxidants, anti-carcinogenic, pro-collagen, moisturizing, anti-wrinkling, and UV protective. Currently, plants are used extensively in the beauty industry to create novel and functional cosmeceutical formulations [17].

7. Natural anti-aging ingredients groups

Natural skincare uses natural or naturally derived ingredients to produce topical balms, creams, cleansers, lotions, masks, scrubs, serums, and toners. Some skincare ingredients are derived from plants. They include flowers, fruits, vegetables, cereals, nuts, legumes, roots, oils, herbs, spices, and pulses, while others are derived from animal products such as honey and beeswax [33]. Several natural ingredients had been used traditionally in Ayurvedic, Ancient Chinese, and Greco—Persian schools of Medicine for the treatment of various dry skin conditions such as eczema and psoriasis [3]. Natural anti-aging ingredients may offer similar benefits to the skin, such as moisturizing, barrier repairing, antioxidants, anti-inflammation hydroxy acids, skin lightening, sunblock, and vitamins. The penetration of any substance through the skin mainly depends on certain factors such as the quality of the outermost layers of the skin (stratum corneum), the vehicle used, the skin physicochemical properties of the substance such as charge, duration, and area of

Figure 12.2 Common categories of cosmetic ingredients.

exposure, lipophilicity, and molecular weight while the integrity of the stratum corneum, the site of the body, thickness of the epidermis, and the influence of other physiological determinants like local blood flow and temperature are the main biological factors affecting materials absorption into the skin [54]. The major categories are foundation ingredients, functional ingredients, active botanicals, additives, and aromaceuticals (Fig. 12.2).

7.1 Foundation ingredients

Foundation ingredients mainly include butter, waxes, oils, and water. One of the most important ingredients in the cosmetic formulation is oil. They are obtained mainly from different plant parts such as seeds, flowers, roots, and leaves. Plant oils, particularly from seeds, are traditionally used for food, medicine, energy, cosmetic applications, soaps, lubricants, and other personal care products, and topical treatment of various skin diseases such as hair dandruff, varicose veins, muscle spasms, and wounds. The high fatty acid composition of oils (including essential fatty acid), phytochemicals, natural antioxidants, and other bioactive components such as α-tocopherol, β-sitosterol, phytosterols, and carotenoids, is responsible for their popular use in cosmetic products as well as in the treatment of cancer, cardiovascular diseases, diabetes, hyperglycemia, and several diseases [10,57,62,68]. Fatty acids contribute several beneficial biological properties to cosmetic and personal care products. Fatty acids are either saturated acids (such as palmitic, stearic, and arachidic) or unsaturated acids (such as oleic and linoleic). Linoleic acid not synthesized by the body is the most frequently used fatty acid in cosmetic products because it helps moisturize the skin, treats acne vulgaris, and aids in the healing process of sunburns and dermatoses [68].

Table 12.1 Potential benefits of common carrier oils.

Oil	Benefits	References
Grapeseed oil	Rich in vitamins A, E, B, and D, amino acids, fatty acids (linoleic, palmitic, stearic, and oleic acids), tocopherols, and tocotrienols. These are essential for keeping the skin looking youthful and healthy.	[10,44]
Sweet almond oil	Rich in vitamin E and unsaturated fatty acids. Known for its gentleness and skin-nourishing benefits. It is a great oil for massages, neither too greasy nor too absorbing.	[3,11]
Jojoba oil	Similar to body oil and easily absorbed into the skin. Used in skin-care products, such as lotions, moisturizers, massage oils, and soothing creams.	[21,52]
Coconut oil	Fractionated coconut oil is light, nongreasy, odorless, and perfect for a deep-tissue massage.	[67]
Avocado oil	Full of healthy fatty acids, vitamins A, B, D, and E, plus amino acids, essential fatty acids, and antioxidants.	[62]
Sesame oil	Rich in antioxidants and contains a low level of saturated fatty acids. Helps in the elevation of antioxidants, modulation of electrolytes, and reduction of lipid peroxidation.	[57]
Olive oil	Very rich in monounsaturated fatty acids (oleic acid), hydroxytyrosol, tyrosol, oleuropein, oleocanthal, flavonoids, and squalene.	[26]

Oils are obtained mostly through cold pressing extraction, solvent extraction, mechanical expeller pressing techniques, hot water extraction, supercritical fluid extraction, pressurized liquid extraction, microwave-assisted extraction, and ultrasound-assisted extraction [44]. Some commonly used oils and their most important benefits are provided in Table 12.1.

7.2 Functional ingredients

Functional ingredients are basic ingredients that may not have a therapeutic role but have a physical function within the product, e.g., as an emulsifier, an exfoliator, or a humectant (emollient). A successful attempt has been made to replace synthetic surfactants with natural emulsifiers like amphiphilic proteins, biosurfactants, bioparticles, polysaccharides, and phospholipids. Furthermore, some naturally derived nanoparticles such as chitosan, cellulose, and starch have been effectively employed to stabilize emulsions

[45]. The use of Quillaja saponin (Q-Naturale 200) as a natural emulsifier has been reported, particularly in model coffee creamers [19]. Exfoliators provide a boosting effect and other benefits to the skincare regimen. Glycolic acid and sugar scrubs, for instance, are common chemical and physical exfoliators, respectively [50]. Emollients (humectants), on the other hand, serve mainly as long-lasting skin moisturizers [58]. An effective moisture balance approach is to replenish the skin's homeostasis by restoring the stratum corneum's moisture-retention functions [70].

7.3 Active botanicals

Active botanicals are primarily medicinal and therapeutic plants added to skincare product formulations to offer certain skin-healing values. They are mostly prepared through crushing, infusion, and maceration. Medicinal plants have been traditionally applied for various cosmetic applications, such as enhancement of skin complexion, skin smoothness, maintenance of skin health, skin softening, spot removal, sunlight protection, and the treatment of pimples, body rashes, and sunburns [49]. The safety assessment of most botanical ingredients is quite important, however. Being natural does not necessarily mean it is safe [4]. The phytochemical characterization of the plant source, in addition to data on adulteration, contamination, hazardous residues, adverse dermal effects (such as immediate-type allergy, irritation, phototoxicity, and sensitization), and skin penetration, is essential [9].

7.4 Additives

Additives are related to functional ingredients. They are usually added in skincare as an extra or a legal necessity. Common additives used in beauty and personal care products include preservatives, citric acid, and vitamin E. Additives are required to improve the physical and chemical stability of various cosmetic formulations [30]. Though synthetic and conventional preservatives such as benzyl alcohol, formaldehyde, methylchloroisothiazolinone, methylisothiazolinone, parabens, phenoxyethanol, sodium benzoate, and triclosan are cheap, effective, and easy to produce, controversies surrounding their adverse health effects have lately necessitated advocacy for the use of natural substances like essential oils and plant extracts as alternative antimicrobials [51].

7.5 Aromaceuticals

Essential oils (EOs) are volatile oils derived naturally from plants and extracted by various methods from various plant parts such as barks, stems, flowers, leaves, roots, and fruits. They have potential benefits not only in

Table 12.2 Potential benefits of common essential oils.

Oil	Benefits	References
Lavender oil	Calming and relaxing, nurtures creativity, promotes well-being, balances the body and mind, and promotes sleep	[64]
Bergamot oil	Reduces stress and tension; calming, uplifting, refreshing	[27]
Peppermint oil	Invigorating, cooling, pain-reducing, improves mental performance, reduces nausea and vomiting	[41]
Clary sage oil	Hormonal balancing, improves autonomic function, and calms mood swings	[29]
Coriander oil	Increases energy, relaxes, decreases nervousness, calming, reduces irritability, counteracts anxiety, and depression	[20]
Frankincense oil	Improves concentration and emotional balancing, enhances spiritual awareness and meditation, eases irritability and impatience, modulates the biological processes of inflammation and skin tissue remodeling	[31]
Eucalyptus oil	Analgesic effects, cooling, and respiratory support	[43]
Grapefruit oil	Eases anxiety, reduces fatigue, balances, uplifts, and suppresses appetite	[32]

neurodegenerative diseases but also in relieving other emotional disorders. EOs have several other pharmacological potentials and thus are commonly explored in cosmetic, medical, olfactory, massage aromatherapy, psychological, and therapeutic fields [1,7]. Some commonly used EOs with their most important benefits are provided in Table 12.2.

8. Conclusion

Graceful and healthy aging requires good anti-aging skincare practices in addition to a healthy, balanced diet and lifestyle habits and avoidance of overexposure to the sun. The use of natural products caters to sustainability practices and the avoidance of harsh ingredients owing to increasing concerns about the safety of cosmetics ingredients as well as their environmental and social impacts. Natural and organic anti-aging skincare ingredients are categorized as foundation ingredients, functional ingredients, active botanicals, additives, and aromaceuticals. The various natural anti-

aging ingredients offer similar benefits to the skin, such as moisturizing, barrier repairing, antioxidants, anti-inflammation hydroxy acids, skin lightening, sunblock, and vitamins.

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Further reading

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