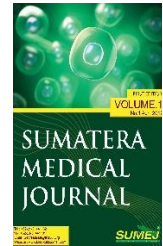




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Skin Care in Dermatology: Between Organic versus Synthetic Products

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ABSTRACT

Various skin care products have been used and played essential roles in maintaining good skin conditions. Over the last few decades, cosmetic industries and pharmacies have evolved and created skin care products according to the needs of each skin type, either based on organic or synthetic products. Natural or organic products were produced from natural ingredients, such as plants, flowers, and fruits, while synthetic products were made from a combination of organic chemical compounds. Both products work effectively on the skin according to their contents, but adverse effects can also occur, such as mucocutaneous reactions, edema, and allergies. This article compares organic and synthetic products based on their ingredients, functions, and side effects.

Keyword: Skincare, Synthetic skincare, Organic skincare



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1. Introduction

The skin is the largest organ found in the human body. The hue, color, and characteristics of the skin surface are a reflection of health. In the last few decades, several cosmetic and pharmaceutical industries have revolutionized and increased knowledge about skin physiology to offer various skin care products and procedures for their use. Various methods of cleansing, soothing, restoring, strengthening, protecting, and nurturing are introduced to achieve good skin conditions [1,2,3].

Natural sources are materials that are produced by nature or found in nature and extracted directly from plants or animal products, such as plants, fruits, flowers, leaves, minerals, water, and soil. Herbal extracts serve as antioxidants, pigmentation inhibitors, and antimicrobial activities that are beneficial for treating and preventing various skin conditions [4,5,6].

Synthetic ingredients are generally mean that a naturally-derived ingredient has been molecularly replicated and designed to eliminate certain limitations associated with natural ingredients. Synthetic ingredients can work directly on all skin types efficiently but can cause various unwanted side effects [7,8].

SKINCARE

A healthy skin barrier protects against dehydration, various microorganisms, allergens, irritants, reactive oxygen species, and radiation. For this reason, daily skin care may increase skin regeneration, elasticity, and

smoothness and thus temporarily change the skin condition. The appearance of the skin is affected by several factors, such as regular facial cleansing, lifestyle, sun exposure, diet, and daily skin regimens. Extrinsic factors that cause aging, including ultraviolet exposure, pollution, and lifestyle choices such as smoking, sleeping positions, diet, and daily skincare habits, are estimated to account for 80% of signs of skin aging [7,10,11].

Cosmeceuticals are derived from the formulation of ingredients that come from the list of safe raw materials. Plants are rich in endogenous antioxidants because they must survive in an environment exposed to ultraviolet radiation. Plant extracts are also considered safe and meet United States Food and Drug Association (FDA) criteria for substances that can be included in over-the-counter (OTC) formulations [7,10,12,13].

SKIN TYPE

Baumann Skin Typing System (BSTS) is a validated questionnaire for diagnosing skin types which are divided into four parameters: (1) oily versus dry skin; (2) sensitive versus resistant skin; (3) pigmented versus non-pigmented skin; and (4) Wrinkled versus tight (non-wrinkled) skin. This questionnaire can provide information on 16 different skin types represented by the designation of the four-letter prefixes (Figure 1). Each skin type is associated with a color and a number. BSTS is very useful because it can provide specific guidance for doctors and patients in identifying the most suitable skin products [7,14].

Dry skin (D), or xerosis, is characterized by barrier disorders, lack of natural moisturizer (NMF), and lack of sebum production. The characteristic of dry skin is dull (usually white-gray) and rough texture and may be associated with a pulling or itching sensation. The etiology of dry skin is multifactorial, but the most significant factors are the role of the stratum corneum (SC) skin barrier and its water-retaining capacity. Dry skin types are more prone to irritation caused by retinoids, acne medications, and other irritants. Oily (O) skin is characterized by adequate increased sebum production. Sebum is an oily occlusive substance that coats the skin's surface prevents water evaporation, and protects the skin from irritation. Combination skin is defined as one of two things: (1) an oily T zone or (2) dry in winter and oily in summer, thus requiring two seasonally appropriate skin care regimens [7,14].

DRPT 13 DRY RESISTANT PIGMENTED TIGHT	DRNT 14 DRY RESISTANT NON-PIGMENTED TIGHT	DSPT 1 DRY SENSITIVE PIGMENTED TIGHT	DSNT 2 DRY SENSITIVE NON-PIGMENTED TIGHT
DRPW 15 DRY RESISTANT PIGMENTED WRINKLE PRONE	DRNW 16 DRY RESISTANT NON-PIGMENTED WRINKLE PRONE	DSPW 3 DRY SENSITIVE PIGMENTED WRINKLE PRONE	DSNW 4 DRY SENSITIVE NON-PIGMENTED WRINKLE PRONE
ORPT 9 OILY RESISTANT PIGMENTED TIGHT	ORNT 10 OILY RESISTANT NON-PIGMENTED TIGHT	OSPT 5 OILY SENSITIVE PIGMENTED TIGHT	OSNT 6 OILY SENSITIVE NON-PIGMENTED TIGHT
ORPW 11 OILY RESISTANT PIGMENTED WRINKLE PRONE	ORNW 12 OILY RESISTANT NON-PIGMENTED WRINKLE PRONE	OSPW 7 OILY SENSITIVE PIGMENTED WRINKLE PRONE	OSNW 8 OILY SENSITIVE NON-PIGMENTED WRINKLE PRONE

Figure 1. Baumann Skin Typing System (BSTS) [14]

Sensitive skin (S) is divided into four types: acne, rosacea (redness), burning/stinging, and allergies, which need different skin care regimens. Resistant skin is characterized by vital SC, which protects the skin from allergens, other environmental irritants, and water loss. It has a strong skin barrier but requires a higher percentage of cosmeceutical ingredients because it is difficult to penetrate [7,14].

Pigmented (P) skin types have an uneven skin tone. Solar lentigo, melasma, and hyperpigmentation tend to occur. This skin type refers to the even distribution of skin pigment and specific ethnicity skin color. Non-pigmented (N) skin types have a consistent style and do not require skin-lightening ingredients [7,14].

Skin types prone to wrinkles (W) are at risk of experiencing skin aging due to age or lifestyle factors such as smoking, sun exposure, and the use of tanning beds. Wrinkle skin types should use daily sunscreen, retinoids, and antioxidants, including ascorbic acid. Tight skin types (T) with no history of sun exposure, smoking, or other lifestyle factors are more prone to skin aging. This skin type needs daily SPF to minimize the risk factors for aging and skin cancer [7,14].

FUNCTION OF SKIN CARE PRODUCTS

1. Cleanser

The basic function of a cleanser is to clean the skin from the dirt caused by pollutants, sebaceous gland secretions, sweat found in the hydrophilic film on the skin surface, corneocytes, and microorganisms that are also present in this film. The mechanism of the cleanser is by adding emulsion to washing water or cleaning wipes [7,4,15].

2. Exfoliant

Exfoliant helps desquamate the superficial layer of SC, so that smooth skin can be achieved and improve its ability to reflect more excellent light. Exfoliants are often used by skin care product companies, although their benefits are brief and deceptive if the products are not combined with a moisturizer [7].

3. Toner

Toners are products applied to the skin after cleansing and are designed to refresh and prepare before moisturizing. The function of toners are to remove alkaline residues, restore skin acidity, remove oil and dirt and help the absorption process of other products that will be applied to the skin. Many toners have astringents as their main components, such as witch hazel, ethanol, orange extract, and potassium [15].

4. Moisturizer

Moisturizers must meet four basic needs: smoother and softer skin hydration, improved appearance, and allowing nutrients to enter the skin surface. All moisturizers work through the primary mechanism of restoring moisture to the skin by occlusion, humectant, hydrophilic matrix, and protection against light [15,16].

5. Sunscreen

Repeated exposure of the skin to the sun can cause short-term and long-term changes in the skin's structure.⁴² The utilization of sunscreens for protection against the harmful effects of sun rays has been increasing over the last few decades. UV section of light contributes significantly towards skin damage. Broadly, sunscreens are classified as either topical or systemic based on the route of administration [43].

1. ORGANIC SKIN CARE PRODUCTS

Organic products are products that are certified free from the use of synthetic chemicals and obtained from nature. Herbals secondary metabolites (SM) are small molecules used for storage or protection and are ingredients incorporated into skincare and cosmetic products. Using plants that are ultimately incorporated into a product is very complex and is influenced by various factors. The efficacy of plant extracts added to topical preparations depends on the concentration. Herbal extracts which added to skin care act as antioxidant, inhibit pigmentation and have an antimicrobial activity, which is beneficial in the treatment and prevention of various skin conditions [12,17,18].

1.1 ANTIOXIDANT EFFECT

Oxidative stress is one of the mechanisms that cause skin aging, which is commonly caused by ultraviolet radiation from sunlight. Continued exposure to environmental factors causes changes in connective tissue due to the formation of lipid peroxides, reactive oxygen species (ROS), and enzymes that cause some skin damage. The antioxidant effect of plants is obtained from the adaptability of plants to the environment from constant oxidative attack and damage due to exposure to ultraviolet light. Antioxidants are free radical scavengers that inhibit various oxidizing reactions and suppress the damage [19,20,21,22].

- **Vitamin C**

Vitamin C can be found in citrus fruits, blackcurrants, red peppers, and greenish vegetables, which act as antioxidants and stimulate fibroblasts to produce collagen. Vitamin C has been shown to destroy ultraviolet light-induced free radicals by reacting to superoxide anions or hydroxyl radicals. The topical application of vitamin C in combination with UV-A or UV-B sunscreen results in better sun protection than using sunscreen alone [12,14].

- **Vitamin E**

Vitamin E has emollient and antioxidant properties. Alpha-tocopheryl acetate and alpha-tocopheryl linoleate are the forms of vitamin E used in cosmetics. The photoprotective effects of alpha-tocopherol can reduce the damage caused by UV-B and inhibit photocarcinogenesis. Vitamin E can be found in various vegetables such as asparagus, spinach, whole grains, nuts, and olives [12,14,23].

- **Grape Seed Extract**

Grape seed extract (*Vitis vinifera*) is rich in polyphenolic proanthocyanidins and has been considered a free radical scavenger which is much stronger than vitamins C and E. Topical application of grape seed extract can increase the sun

protection factor. The bioflavonoid content in grape seed extract increases the body's ability to absorb vitamins, thus providing a symbiotic environment for other nutrients. Bioflavonoid also found in berries (strawberry, cranberry, bilberry, and blueberry), black tea, red wine, and red cabbage [12,14,24].

- **Broccoli flower extract**

Broccoli flower extract (*Brassica oleracea* var. *italica* Plenck) is an antioxidant plant that has been studied in dermatology. Sulforaphane, the most potent antioxidant in broccoli, has an anti-inflammatory effect, which is shown by preventing erythema from sunlight [40]. Broccoli flower extract increased procollagen type 1 and decreased the level of MMP-1 expression both at mRNA and protein levels in the photoaging induced by UVB, including protection against UV irradiation and antioxidant homeostasis irradiated in vitro [41]. The imbalance between collagen degradation and synthesis plays a significant role in the formation of wrinkles in photoaging. Broccoli (*Brassica oleracea* L. var. *italica* Plenck) is a crucifer group vegetable with significant antioxidants [44].

1.2 PIGMENT INHIBITOR

Melanin is a pigment responsible for the eyes, hair, and skin color. Melanin is produced and secreted by melanocytes and distributed in the basal layer of the dermis. Melanin protects the skin against damage from exposure to ultraviolet by absorbing and eliminating ROS. Excess tyrosinase activity leads to the overproduction of melanin. Licorice extracts, soybeans, and various plant extracts can inhibit tyrosinase catalytic activity and interfere with the synthesis and release of melanin pigments, thereby reducing total melanin production [25,26].

- **Licorice extract**

Licorice is the root of the glycyrrhiza plant species used as herbal medicine. Glabridin glabra is the main active ingredient in licorice extract which inhibit tyrosinase activity without disturbing the synthesis of DNA. Topical application of 0.5% glabridin has been shown to inhibit UVB-induced pigment and erythema in rabbit skin. Glabridin glabra is effective in treating melisma and superior to hydroquinone [12,14,27].

- **Topical Soymilk Extract**

Soy milk proteins, trypsin, and Bowmann-Birk inhibitors can induce skin depigmentation by inhibiting protease-activated receptor-2 activation (PAR -2), which plays a role in the regulation of melanosomes. In a double-blind, randomized clinical trial, soy moisturizer containing both proteins and given twice daily for 12 weeks showed significant improvement in overcoming pigmentation patches, blotchiness, dullness, fine lines, overall texture, and skin tone [12,14,28].

- **Flavonoid**

Flavonoids are a group of natural substances with varying phenolic structures which have de-depigmentation activity and show the capacity to inhibit tyrosinase in the distal melanogenesis oxidative pathway directly. Flavonoids are found in fruits, vegetables, whole grains, bark, roots, stems, flowers, tea, and grapes [12,14,19].

1.3 ANTIMICROBIAL ACTIVITY

The cosmetics and pharmaceutical industries have increased interest in replacing synthetic antimicrobials in topical products. Phenolic compounds are synthesized by plants and can interact with microorganism cell membranes or cell walls which causes changes in membrane permeability and results in cell damage. Phenolic can also penetrate bacterial cells, which makes it has antimicrobial properties [19,20].

- **Curcumin/Tumeric**

Curcumin has anti-inflammatory properties through the regulation of Decreased production of proinflammatory cytokines interleukin-1 (IL-1) and tumor necrosis factor- α (TNF- α) and inhibits the activation of the transcription factor nuclear factor-kB (NF-kB) and activator protein-1 (AP-1), -35 (AP-35).

Curcumin has been shown to have wound healing and antimicrobial activities. Currently, only a few cosmetic and anti-aging moisturizing products contain curcumin which is difficult to formulate because of its odor and color [30,31].

- **Passion fruit purple variant**

Passion fruit is used commercially for consumption and in beverages. This plant exhibits various pharmacological properties and possesses a complex phytochemistry. This plant has been shown to have potential antimicrobial activity in recent years. The seeds contain a high amount of piceatannol, which exhibits an inhibitory effect on *Propionibacterium acnes*. Therefore, the root extract of the purple variant, *Passiflora edulis* Sims var. *edulis*, may have potential antibacterial activity against *P. acnes*. Found seed extract of *P. edulis* Sims var. *edulis* had good antibacterial and antimicrobial activity [38].

Natural products cannot be equated with safe products. Twenty-three additional herbs have been reported to cause death because of topical use, including *Echinacea purpurea*, German chamomile, birthwort, aloe vera, *Aristolochia*, *Arnica*, black mustard, comfrey, cascara, henna, Chinese rhubarb, croton, kava kava, mistletoe, rue, *Rhus* species, senna, oleander, Scotch pine, fir, St. John's wort, tobrandi, yohimbine. Severe mucocutaneous reactions include anaphylactic shock, angioedema/urticaria erythroderma, linear IgA bullous dermatosis, lupus erythematosus, malignancy, pemphigus, Stevens-Johnson syndrome, Sweet's syndrome, ulcerative stomatitis syndrome, and vasculitis were found. Chinese practitioners are concerned about the side effects of hepatotoxicity, contact dermatitis, and teratogenicity, which are known to occur in one-third of people using topical Chinese herbal preparations. Furthermore, many inherited disorders were found when these herbs were used topically during pregnancy [18].

Besides, microbial contamination in personal care, skin care, and cosmetic products can cause instabilities such as product separation, discoloration, gas formation, and odors. Without appropriate and effective natural preservatives for all spectrums of microorganisms (gram-positive and gram-negative), fungi and viruses can cause toxic side effects [32].

2. SYNTHETIC SKIN CARE PRODUCTS

Skincare products, especially cosmetics, are commercially available products used to enhance the appearance of the skin. Currently, synthetic ingredients have been widely used in the elements of skin care products. This can have a good impact as well as adverse side effects [8].

The use of retinoids in anti-aging products provides many of the desired benefits, and there were no organic products analog to retinoids. Retinoids act through retinol and retinoic acid binding sites to regulate growth and differentiation, inhibit tumor formation, reduce inflammation and boost the immune system. Hydroquinone (HQ) is often the primary treatment for hyperpigmentation, especially in melasma. HQ can inhibit the reversible tyrosinase activity in cellular metabolism by affecting DNA and RNA production and reducing tyrosinase activity by up to 90%. HQ is available over the counter in the United States at a 2% and 4% concentration. HQ is a derivative of benzene which raises concerns about its safety. However, HQ has been used for more than 50 years under the supervision of doctors, and there have not been any skin malignancies due to the use of this drug [14].

Hyaluronic acid (HA) regulates diverse biological processes such as skin repair, cancer diagnosis, wound healing, tissue regeneration, anti-inflammatory, and immunomodulator. Almost all products with moisturizing, skin-protective, and anti-aging properties consist of HA. Based on the evidence of meta-analysis studies, HA has extraordinary properties in improving various skin problems such as wrinkles, nasolabial folds, and skin aging because of its ability to induce soft tissue augmentation, increase skin hydration, collagen stimulation, and facial rejuvenation. HA is used in many forms (gels, creams, injectable dermal fillers, skin fillers, facial fillers, autologous fat gels, lotions, serums, and implants) [13].

Many products containing synthetic chemicals have adverse side effects on the skin, but on the other hand, they also provide desired results faster. Several chemicals are dangerous and can be found in anti-aging products, such as bentonite, parabens, propylene, and ethylene glycol. Parabens are the most common ingredients that can be found in all types of cosmetics that are used as cosmetic preservatives. Recent studies have reported that methylparaben can affect the aging and differentiation of keratinocytes in long-term use by influencing the rate of keratinocyte proliferation, cell morphology, and the expression of hyaluronic acid and collagen type IV synthesis. Based on previous research, methylparaben and ethylparaben can induce oxidative stress on the skin after reacting with single oxygen (O⁻) to produce the glutathione conjugate from hydroquinone. Esters parabens are found in human breast tissue, suggesting the possibility that paraben estrogen activity may affect the growth of estrogen-responsive breast cancer. Bentonite and kaolin are water-

absorbent which can cause edema of skin cells. It can also affect body temperature through water retention and sweat production. The use of formulated petroleum-based chemicals is often associated with skin sensitization problems. Most petroleum products have a degreasing effect that can cause a fat loss on the skin. These side effects are also related to the level of contact, intensity, and duration of product use [34,35,36].

Aluminum has been used commercially in antiperspirants. Aluminum salts used in dermatological products have higher concentrations (10-30% aluminum chlorohydrate) than antiperspirants. There has been a discussion about whether using antiperspirants containing aluminum can cause breast cancer. Increased levels of aluminum were observed in the fluid aspirated from the nipple of patients with malignant breast cancer. However, aluminum does not appear as a tumor trigger but is stored in tumor tissue [37].

Synthetic ingredients are also found in various skin care products, such as nitro and polycyclic musk. The most important variants of polycyclic musks are galactoside and tonalite. Musk ketone is the most widely used compound [34].

There was a difference between soap and detergent. Detergents clean or wash synthetic surfactants, whereas soap is a natural surfactant made from sodium or potassium salts. Surfactants are chemicals that facilitate the removal of waste from the skin's surface. Soaps are made from alkaline salts from fatty acids and can be formulated as either liquid or solid. Synthetic detergents are used as an alternative to lighter soaps which are also produced in liquid or bar form. Although soap is considered a natural detergent, it has disadvantages: high pH, poor rinsing properties, and scum residue when rinsed with water. This disadvantage has led to the development of mild detergents containing synthetic surfactants [38].

2. Conclusion

Dermatologists need further understanding of various ingredients in skin care products, so they do not have difficulty choosing the right product for the patients. Using both organic and synthetic products has advantages and disadvantages based on its use, efficacy, efficiency, and price. The main determining factor in choosing a product is the safety of its use both in the short and long term. Clinical trial evidence is needed to support that organic product are safer and better than synthetic products.

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