

A Study on the Latest Research Trends in Natural products with Anti-Aging Effects

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항노화 효능을 가진 천연물에 대한 최신 연구 동향에 관한 연구

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Abstract In this study, four types of retinol, retinyl palmitate, adenocin, and polytoxyolate-dretinamide, which are the ingredients of the Ministry of Food and Drug Safety Notice, included in the study. also we looked at trends in research on *Sciadopitys verticillata*, *Prunella vulgaris*, *Celosia cristata* L., Brazilin, *Persicaria hydropiper*, *Astragalus membranaceus* Bunge, *Forsythiae Fructus*, *Lithospermum* root, *Rheum undulatum* L. and *Cistanche deserticola* Y. C. Ma a natural material that has the efficacy of antioxidant aging. The anti-aging study so far has been found to be centered mainly on collagen production and elastase synthesis inhibition mechanisms. However, given that the aging process of the skin is caused by various ageing processes, it is believed that anti-aging studies using safe and effective natural materials that can help the skin age with various mechanisms should be conducted.

Key Words : Anti-aging, Ministry of Food and Drug Safety, Elastase, Wrinkle Improvement, Natural Materials, Collagen

요약 본 연구에서는 식약청 고시 원료인 레티놀, 레티닐팔미테이트, 아데노신, 폴리옥실레이티드레틴아마이드 4종류와 항 노화의 효능을 가진 천연 원료인 금송, 하고초, 맨드라미, 브라질린, 여뀌, 황기, 연교, 자근, 대황, 육종 용에 대한 연구 동향을 살펴보았다. 현재까지의 항 노화 연구는 주로 콜라겐 생성과 엘라스타아제 합성 억제 기전을 중심으로 이루어지고 있는 것이 확인되었다. 하지만, 피부의 노화 과정은 여러 가지 원인에 의해서 발생하는 것으로 볼 때, 다양한 기전에 맞춰 피부 항노화에 도움을 줄 수 있는 안전하고 효과적인 천연 원료를 활용한 항 노화 연구가 지속적으로 이루어져야 할 것으로 사료되어 진다.

주제어 : 항노화, 식품의약품안전처, 엘라스타아제, 주름개선, 천연원료, 콜라겐

1. Introduction

The upgrading and cutting-edge of modern industries are leading the trend of the fourth industrial revolution era, signaling a revolutionary yet new paradigm shift. Although material

affluence, income improvement, and personal free time have increased, there are many negative aspects to mental health and stability as well as various changes in values. Recognizing the ills of this modern industrial society, the well-being culture manifested to realize a beautiful and happy

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life through harmony of physical, social and mental health refers to a lifestyle that means health, happiness, welfare and well-being, and socially seeks to enhance the quality of real life rather than accumulation of wealth. It brought about various changes in the cosmetics market as well as growing interest in eco-friendly due to the craze for well-being and eco-trends.

Cosmetics are used directly on the skin, so their importance is further increased as they are recognized as a second food, and the need for research on the development of cosmetics materials related to efficacy for natural products derived from plants that can be effective but guaranteed stability has been steadily raised as toxicities and skin side effects related to functional cosmetics caused by conventional synthetic materials have been continuously raised. The safety assessment study on natural materials is conducted across all living animals and plants. In the case of plant resources, the research on the development of cosmetics raw materials using materials including plants not only in Korea but also overseas has been carried out actively[1,2]. New research on validity evaluation through the application of new extraction methods for natural products with pharmacological properties, such as phytochemical, is emerging[3]. Phytochemical, which has the effect of suppressing cell damage and aging in the human body, is any chemical made from the roots or leaves of plants, also called plant physiologically active nutrition or intraplant nutrition, and is studied as a functional ingredient[4].

Due to its superior efficacy and safety over chemical synthetic materials, these natural ingredients are widely used as raw materials for beauty and cosmetics as they have no side effects and are highly effective even during long-term use[5]. In addition, natural substances contained in medicinal plants are being researched to restore skin function and to develop functional cosmetic

materials with excellent efficacy such as antioxidation, anti-inflammation and anti-aging without damaging the body and skin[6].

Among the functional cosmetics market, the industry for anti-aging has a lot of interest worldwide, and at BBC Research, the market size of the global anti-aging industry is growing 7.8 percent annually from 2013 to 2019. The average annual growth rate is reaching 5.5 percent, indicating a significant growth potential[7]. In particular, the cosmetics market to prevent skin aging has continued to grow as a global aging society, with the size of the global cosmetics market reaching \$364.9 billion as of 2016, with growth in the anti-aging market reaching \$433.4 billion in 2019[8]. Therefore, in this paper, among the cosmetics industry where constant interest and growth are being made, the prior study on the ingredients of the Ministry of Food and Drug Safety Notice, where anti-aging effect has been verified, and the natural materials with efficacy in anti-aging is analyzed, so as to examine the latest research trends and provide basic data.

2. Anti-aging research method

The aging of the skin is described by various theories, including evolutionary and biological perspectives, with a lot of research being done on the correlation with skin aging, especially in relation to the reactive oxygen species(ROS). ROS is known to activate several in vivo signal delivery systems, including activator protein(AP)-1 and nuclei (NF)-kB, to disrupt collagen production of various inflammatory reactions and dermal tissue, to destroy extracellular substrate proteins, to facilitate DNA damage and skin cell function, and to promote skin aging[9].

Collagen is synthesized in the form of procollagen and released out of the cell and is synthesized through intermediate products such as pN collagen and pC collagen. To date, 19 types of

collagen have been discovered[10]. Collagen decomposition is broken down into extracellular substrates and procollagen and collagen by matrix metal proteolysis (MMPs) induced by AP-1[10]. MMPs are protein-dissolving enzymes that need zinc ions that break down extracellular substrate proteins, and up to now 24 kinds are known. Among MMPs, MMP-1 (collagenase) dissolves collagen-type I, III, MMP-3 (stromelysin-1) breaks collagen-type IV, and MMP-9 (Gelatinase B) breaks down the product broken down by collagenase into smaller hydrolysis[11].

At this time, skin aging may play an important role in inhibiting skin aging by inhibiting activity of collagen and elastase, the major causes of skin aging.

3. Antioxidant materials and latest research trends

3.1 Definition of wrinkle-improvement cosmetics

Wrinkle-improvement cosmetics are products that enhance the skin's ability to regenerate and help prevent aging. The ingredients notified in Korea as the main ingredient to make cosmetics that help improve wrinkles in the skin at the Ministry of Food and Drug Safety are currently four types of retinol, retinyl palmitate, adenosine and polyethoxylated Retinamide. The Ministry of Food and Drug Safety recognizes crease-improvement cosmetics on a certain basis, and the detailed criteria and contents are as shown in Table 1.

Table 1. Ministry of Food and Drug Safety Wrinkle Improvement Notice Material

	Ingredient	Content
1	Retinol	2,500 IU/g
2	Retinyl Palmitate	10,000 IU/g
3	Adenosine	0.04%
4	Polyethoxylated Retinamide	0.05-0.2%

3.2 Notice materials and characteristics of Ministry of Food and Drug Safety

3.2.1 Retinol

Retinol, also known as Vitamin A1, is reported to be an effective substance that prevents skin from becoming over-absorbed [13] and promotes the synthesis of collagen[14-15]. It is also known to improve wrinkles, to be used as a treatment for acne due to sebum inhibition, to increase the thickness of epidermis when applied to the epidermis, and to affect the cell membrane structure of epidermis cells[12-14]. However, it is reported that retinol can cause side effects such as skin irritation or photosynthesis because it is easily oxidized when exposed to the air and is not activated by ultraviolet light etc[15,16]. Therefore, products containing retinol should only be used at night, and when first used, the skin patch test ensures that they are safe for the skin.

3.2.2 Retinyl Palmitate

Retinyl palmitate is a very unstable substance, so retinyl palmitate, a conductor of retinol, is used. Retinyl palmitate is absorbed into the skin as an esteric substance and then decomposed by esterase and then metabolized to retinol to retinoic acid for effect. More than 0.1% of retinyl palmitate was reported to significantly increase skin thickness and collagen synthesis[17], and several studies have shown that it is an effective ingredient for wrinkle improvement[18,19]. However, while stability and safety are better than retinol, absorption is less characteristic.

3.2.3 Adenosine

Adenosine is a nucleoside involved in the transmission of signals outside the cell and has a role in promoting the synthesis of DNA in skin fibrous cells, increasing protein synthesis, and increasing cell size. Adenosine is also known to increase collagen synthesis in cells or inhibit

activity of collagenase and Matrix metallo proteins (MMPs), enzymes that break down collagen[20,21]. Adenocin, unlike retinol, which should only be used at night, is available at night and during the day, and has features that have less irritation to the skin and good safety.

3.2.4 Polyethoxylated Retinamide

Polyoxylate-dretinamide, also called Medimin A, is classified as a type of retinoid in the vitamin A system. On average, 10.7 moles of polyethylene glycol are combined into the form of amateurs, and the molecular weight is about 831. Through PEG-Amide synthesis technology, the stability of retinol is improved, and features with collagen synthesis promotion and cell regeneration effect.

3.3 anti-aging raw materials using natural medicinal plants

Recent trends in anti-aging research and raw material development have been active in anti-aging research, looking for effective substances from nature, not synthetic ones.

Sciadopitys verticillata, a substance that contains various active ingredients, is known to contain large amounts of flavonoid and terpene, making it highly effective to use bio-aging materials[22].

Prunella vulgaris is known for its efficacy in diuretic, extermination, fever and blood pressure enhancement[23]. It is reported that the major active ingredients include triterpenoid, oleanolic acid, ursolic acid, rutin, rhin, rhinolary acid, hyperoside, and caffeic acid[24,25]. In particular, the primary physiological agent of *Prunella Vulgaris* has the effect of protecting the skin from ultraviolet rays, and the effect of promoting collagen production in the skin, suppressing MMP-1 generation, and inhibiting elastase activity are reported[26].

Celosia cristata L. has long been used as a traditional Chinese drug, and as a major active

ingredient, it contains phenolic, which is widely present in the plant system, so it has various medicinal and biological activities and antioxidants[27,28]. In particular, it is reported to have antioxidations through the effects of inhibiting enzymes and inhibiting hyaluronidase and elastase expression by engaging in the transcription phase of elastase issuance or by engaging in post-translation modification stage[29].

Brazilin reported in a recent study that he had various biological effects such as bruising by blood, menstrual occlusion, high blood pressure, blood sugar degradation, antibacterial action and anti-inflammatory action[30]. It also increased the expression of the COL1A1 and COL3A1 genes reduced by UV rays, and increased the production of Type I collagen proteins. In addition, it is reported that Brazilin has an effect on antioxidants as it has been found to reduce the incidence of MMP1 genes and increase the number of antioxidant enzyme SOD3, which regulates active oxygen, such as MMP1, that induces activity of exoplanylase[31].

Persicaria hydropiper is a double-toothed plant of the genus *Madiphynchus*, containing quercetin 3-O- β -L-rhamnoside(quercitrin), kaempferol-3-glucoside, 6-hydroxy-apigenin, galloyl kaempferol 3-glucoside, scutillarein, 6-hydroxyluteolin, 6-hydroxyluteolin-7-O- β -D-glucopyranoside, quercetin 3-O- β -D-glucuronide, galloyl quercetin, quercetin as its main ingredient[32]. Recent studies have confirmed that it has anti-aging effects as it shows superior elastase inhibitory activity of *Persicaria hydropiper* extract[33].

Physiological activations of *Astragalus membranaceus bunge* are reported as blood pressure enhancement, diuretic action, immune enhancement and anti-inflammatory action[34,35]. Physiological activations are reported as triterpenoids, isoflavonoids and polysaccharides. In particular, isoflavonoids are phytoestrogen compounds with similar activations to estrogen, and are known to be representative of

Zenithane, serotonin derivatives, and rignanin, which have antioxidant effects, whitening, and improved wrinkles. In addition, recent studies have identified anti-aging effects by increasing collagen synthesis[36].

Forsythiae fructus is the fruit of the Uiseongidae, belonging to the family of Mulpurethaceae. The main ingredients are lignans, lignan glucosides, flavonoids, and glycodes of 3,4-dihydroxyethylene alcohol[37]. Synthetic effects of collagen and manifestation of MMP-1 by UVA are reported in the preceding study[38].

Lithospermum root is the root of *Lithospermum officinale* L. var. *erythrorhizon* Maxim. It has been used in the treatment of antibacterial, detoxification, frostbite, and burn due mainly to its efficacy in the Chinese medicine[39]. The Lithospermum root contains various ingredients such as allantoin, cyanoglucoid, fumaric acid, succulent anhydride, shikonin, acetyl lauhikonin, and so on[40]. The Lithospermum root extract is reported to contain collagenase and elastase inhibiting activity and good low-activation effects associated with skin framing[41].

Rheum undulatum L. in is a perennial herb plants belonging to the polygonaceae. In general, spitting blood, the antipyretic efficacy for treating constipation and outside and used to treat the hematuria, species known to be.

Antraquinone derivatives such as chrysophanol and emodin and several types of glucoside compounds were reported as the main components of *Rheum undulatum* L.[42]. In the preceding study, the effect of MMP-1 activity inhibiting effect involved in skin aging and the effect of UV rays on the expression of MMP-1 in the skin fibrous cells of the irradiated person was verified. In the measurement of MMP-1 active inhibitory effect and manifestation inhibitory effect of MMP-1 in human skin fibrous cells in which ultraviolet light was irradiated, *Rheum undulatum* L. extract was found to have very good synthetic inhibitory effect[43].

Cistanche deserticola Y. C. Ma is a medicinal plant belonging to the fructose family in Cistanche that reports antioxidant, antioxidant, anti-inflammatory and sedative actions[44]. The *Cistanche deserticola* Y. C. Ma extract is reported to have high antioxidant efficacy and good inhibitory activity of elastase, collagenase and hyaluronidase[45].

4. Conclusion

With the expansion of the well-being trend and cosmetics market, this paper has been done to look at the crease-improvement cosmetics materials currently certified by the Ministry of Food and Drug Safety, and to examine the raw materials that represent the effects of anti-aging among natural plants, which have long been used as medicine, and to present basic data on natural materials with anti-aging effects. So far, four types of ingredients have been declared in Korea as the main ingredient to make cosmetics that help improve wrinkles in the skin are currently available in four types of retinol, retinyl palmitate, adenocin and polyethoxylated Retinamide. Other antioxidants using medicinal plants include *Sciadopitys verticillata*, which contains several active ingredients and is effective in preventing aging. *Celosia cristata* L., which shows hyaluronidase suppression and elastase expression suppression, Brazilin, which increases the expression of the COL1A1 and COL3A1 genes reduced by ultraviolet light, and increases the production of Type I collagen proteins, *Prunella vulgaris*, *Persicaria hydropiper*, *Astragalus membranaceus* Bunge, *Forsythiae Fructus*, *Lithospermum root*, *Rheum undulatum* L, and *Cistanche deserticola* Y. C. Ma with collagen production facilitation and MMP-1 and elastase active suppression are reported in the studies.

However, only about 5 percent of the 300,000 species of plants worldwide have been studied. This suggests that the possibility of developing

anti-aging through various natural materials is very high.

So far in anti-aging research, studies looking at, mainly elastase with production of collagen synthesis inhibitor is being done around the mechanisms through. Considering that aging of skin occurs due to various causes such as natural aging due to biological aging, photoreaction by ultraviolet light, and aging by genes, it is believed that anti-aging studies should be conducted in accordance with various mechanisms related to skin aging.

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