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TO EXPLORE THE GRAPE SEED OIL POTENTIALLY IN THE MANAGEMENT OF AGEING

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Abstract

The passage of time (intrinsic ageing) and cumulative exposure to external effects (extrinsic ageing) such as ultraviolet radiation (UVR), which encourage wrinkle formation and tissue flexibility, can both cause skin to age. While both ageing processes cause phenotypic alterations in cutaneous cells, structural and compositional re modeling of ordinarily long-lived dermal extracellular matrix proteins causes the major functional signs of ageing.

Before focusing on the processes, functional consequences, and treatment of elastic fiber remodeling in ageing skin, this article briefly discusses the impact of ageing on dermal collagens and proteoglycans. The differential degradation of elastic fiber proteins characterises the early stages of photoageing, and while the activity of extracellular matrix proteases is elevated in photo exposed skin, the substrate specificity of these enzymes is poor. However, we recently discovered that isolated fibrillin micro fibrils are vulnerable to direct UV-B destruction at physiologically achievable concentrations, and that elastic fiber proteins are substantially concentrated in UV-absorbing amino acid residues as a group. Elastic fiber remodeling events can have a negative impact on: tissue mechanical properties, immune cell recruitment and activation, matrix metalloproteinase production, and cytokine signalling (via disrupting TGF sequestration in fibrillin micro fibrils). Finally, newly proposed topical therapies appear to be capable of regenerating elements of the elastic fiber system in ageing skin, while systemic treatments may be able to avoid pathological tissue remodeling processes that occur as a result of elastic fiber degradation.

INTRODUCTION

With growing chronological age and, more importantly, cumulative exposure to environmental elements such as ultraviolet radiation (UVR) and smoking, the look and mechanical function of human skin undergoes substantial changes (for recent reviews see [1,2]). Fine wrinkles [3] and decreased elasticity (both compliance and capacity to recoil) that define intrinsically old skin are accentuated in photoaged skin, where UVR exposure is linked to the formation of deep wrinkles and a significant loss of elasticity [4, 5]. While phenotypic changes in cutaneous cells are associated with both intrinsic and extrinsic ageing processes, major structural and functional changes occur in the dermal extracellular matrix (ECM), where fibrillar collagens, elastic fibers, and proteoglycans are required to confer tensile strength, resilience (recoil), and hydration, respectively. The extraordinary lifespan of these macromolecules [6,7], compared to intracellular proteins [8,] exposes these assemblies to cumulative damage, affecting their capacity to confer mechanical characteristics and mediate tissue homeostasis [9,10] Before considering: I the cellular and acellular mechanisms that may drive differential ECM remodeling, (ii) recent progress made in understanding the central biochemical role played by elastic fibers in maintaining tissue homeostasis, and (iii) the potential for interventions to prevent or reverse age-related remodeling of dermal collagens, proteoglycans, and, in particular, elastic fiber components, this review briefly summarizes the current state of knowledge regarding age-related remodeling of dermal collagens,.

What Exactly Is Aging?

Growing old is the process of ageing. It is a multifactorial, time-dependent phenomena characterized by a decrease in the size and number of cells, as well as a decrease in the rate of numerous organic functions at the cellular and molecular levels. The largest and most exposed organ of the body, the skin is susceptible to infection, sickness, and injury. It's also the first to exhibit indications of ageing. Cell replacement, damage response, barrier function, sensory perception, immunological and vascular responsiveness, thermoregulation, sweat production, sebum production, and vitamin D production are among skin processes that have been proven to deteriorate.[11]

The Skin

In terms of surface area and weight, the skin is the body's largest organ. It covers the entire body's exterior surface. It defends the body, aids in the maintenance of a consistent body temperature, and offers sensory information about the surroundings. Skin is the most vulnerable organ in the body to infection, disease, and injury. [12, 13]

The Surface of the Skin

There are two main sections to the skin. The epidermis is the thin outer layer, whereas the dermis is the thicker inner layer. The subcutaneous layer, which is not a part of the skin, is deep to dermis. The subcutaneous layer has numerous blood arteries that supply the skin with nutrition and functions as a fat storage depot. It also contains pressure-sensitive nerve terminals known as Pacinian corpuscles.

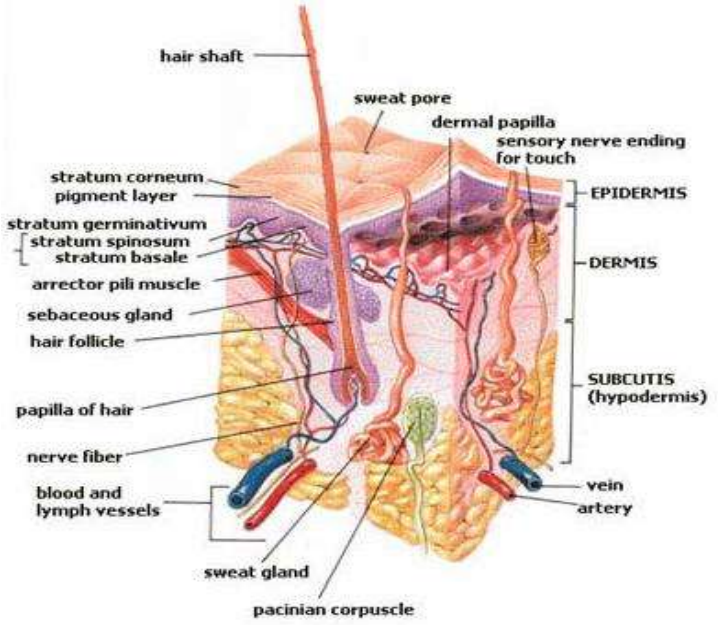

Figure 1: Skin Structure (Diagram Showing Different Layers of Skin)

Epidermis

It is made up of four main cells.

i) Keratinocytes - These cells comprise up 90% of the skin's epidermal layer and create the protein keratin. Heat, germs, and chemicals are all protected by the protein, which protects the skin and underlying tissues. It also makes lamellar granules that emit a water-resistant sealant.

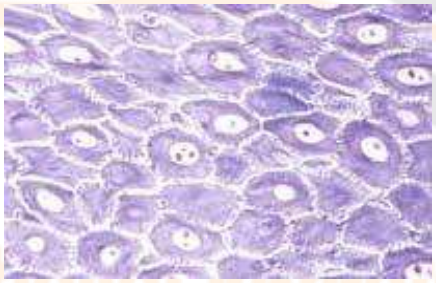

Figure 2: Under the microscope, keratinocytes 5

ii) Melanocytes - Melanocytes comprise up 8% of the epidermis. It generates melanin, a pigment that contributes to skin colour and absorbs harmful UV rays.

Figure 3: Melanocytes

iii) **Langerhans Cells**- are red bone marrow cells that migrate to the epidermis. They play a role in the immunological response to pathogens that infiltrate the skin, and UV light can readily harm these cells.

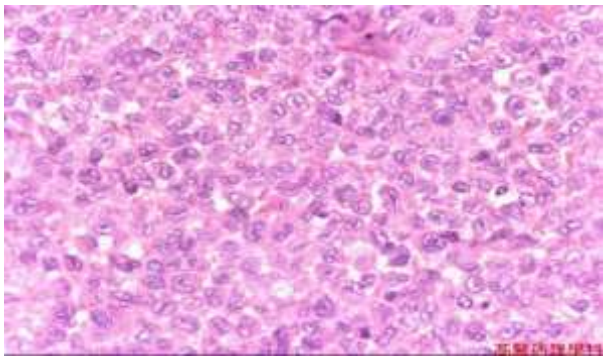

Figure 4: Langerhans cells 6

iv) **Merkel Cells** - These cells are found in the epidermis' lowest layer. These cells are in touch with the flattened process of the tactile disc, a sensory neuron structure. The tactile disc and Merkel cells work together to detect different components of touch experience.

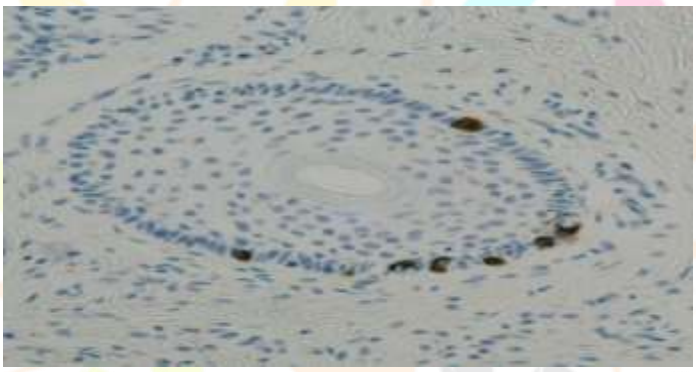

Figure 5: Merkel cells 7

EPIDERMIS LAYERS

The epidermis of the skin normally contains four layers, although some places, such as the fingertips, palms, and soles, have five layers. The layers are as follows:

i) Stratum Basale - This is the epidermis' lowest layer, with a single layer of keratinocytes. It's also known as the germinative stratum.

ii) Stratum Spinosum - The stratum spinosum is located beneath the stratum basale. It gives the skin both strength and elasticity. This layer is made up of 810 keratinocyte layers.

iii) Stratum Granulosum - This is the epidermis's middle layer. It is made up of keratohyalin, a protein that transforms ton filaments into keratin. This layer is made up of 35 layers of keratinocytes that have been flattened. Membrane-enclosed lamellar granules that release lipid are also found in Keratinocytes.

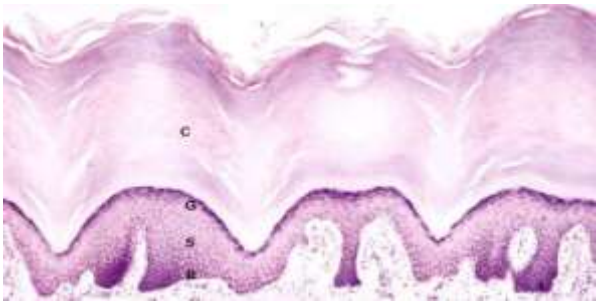

Figure 6: layers of epidermis (B) = stratum basale, (S) = stratum spinosum,(G) = stratum granulosum, (C) stratum corneum.

Dermis2.3, 11

Collagen and elastic fibers make up the majority of the connective tissues in the dermis. The following cells can be found in the dermis:

i) Fibroblasts - Fibroblasts provide the structural basis for numerous tissues and are important in wound healing. They are also in charge of producing dermal proteins.

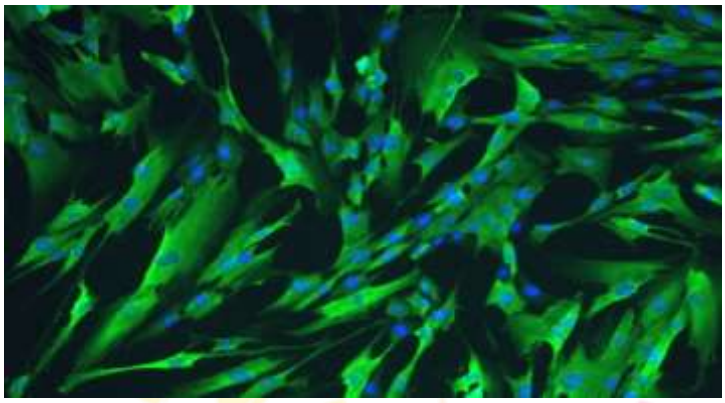

Figure 7: Fibroblast

ii) Macrophages — Also known as "giant eaters," macrophages phagocytoze cellular waste and infection

Figure 8: Macrophages

iii) Adipocytes - Adipocytes are cells that specialize in storing energy in the form of fat.

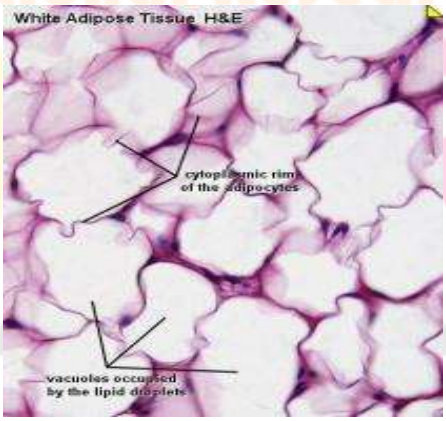

Figure 9: Adipocytes

Dermis is separated into two parts based on tissue structure.

i) Papillary region - This is the dermis's most superficial layer. Dermal papillae, little fingerlike projections, considerably enhance the surface area of the papillary region. Tactile receptors, also known as corpuscles of touch or Meissner corpuscles, are nerve endings that are responsive to touch in some dermal papillae. Free nerve endings are also found in dermal papillae, which send out signals that cause sensations of warmth, coolness, discomfort, tickling, and itching.

ii) Reticular area - This is the dermis's deeper layer. Collagen fiber bundles are interwoven in a net-like pattern in this area. The area between the fibers is occupied by adipose cells, hair follicles, nerves, sebaceous glands, and sweat glands. The skin's strength, extensibility, and elasticity are provided by a combination of collagen and elastic fibers in the reticular region.

COMPONENTS OF A DERMAL MATRIX

i) COLLAGEN- is the most prevalent protein in humans and a fundamental structural component of the dermis. It is in charge of giving human skin its strength and support.

ii) ELASTIN- is an elastin-like protein found in connective tissue that allows various tissues in the body to return to their original shape after stretching or contraction. When the skin is pinched or punctured, it helps it return to its normal place.

iii) GLYCOSAMINOGLYCANS - Glycosaminoglycans are a component of the dermal skin, along with collagen and elastin, and are responsible for the skin's look. They are made up of polysaccharides that are connected to a core protein by repeating disaccharide units. They have the ability to bind 1000 times their volume in water. Hyaluronic acid is the most important member of the glycosaminoglycan family. Dermatan sulphate and chondroitin sulphate are two others. They plump, soften, and moisturize typical skin while also maintaining adequate water and salt balance. Hyaluronic acid can be present along the edges of collagen and elastin fibers, as well as where these fibers cross. It is created by fibroblasts and keratinocytes in the skin and is found in all connective tissues. Hyaluronic acid is found not just in the joints but also in the skin.

What is ageing?

The book Evolutionary Biology of Aging, published in 1991, defined ageing as "a sustained fall in an organism's age-specific fitness components attributable to internal physiological degradation" (Rose, 1991) [22].

Figure 10: Stages of ageing

What is the mechanism of skin ageing?

Skin ageing occurs in all layers of the skin and manifests itself on the surface.

Layers of the epidermis

Roughness and dryness are more likely as hyaluronic acid content decreases, cell turnover slows, and sebum production decreases on the skin's surface. This layer of the skin grows more vulnerable to the sun's rays as it ages. Skin is less effective at self-healing, and a weakened immune system can contribute to an increase in skin infections as well as slower wound healing. Layers of the skin Collagen, one of the skin's building blocks, diminishes by 1% per year beyond the age of 25. Dermal tissue disorganization occurs as a result of this, as well as a decrease in functional elastin. The skin's structure is weakened, making fine lines and wrinkles more prevalent. As we age, our skin's suppleness decreases and deeper wrinkles appear. The generation of hyaluronic acid, which is abundant in young skin, slows down as we age, making skin cells less effective at binding in water and making skin more prone to dryness. It also weakens and becomes more susceptible to injury and broken capillaries. Reduced microcirculation means less efficient delivery of nutrition and oxygen to the skin's surface, resulting in a loss of youthful glow.

Layers beneath the surface of the skin

The reduction in size and quantity of lipid-storing cells in the adipose layer is the most noticeable change in the deeper layers. This causes drooping skin, a loss of volume, and deep creases, as well as hollow temples and cheeks.

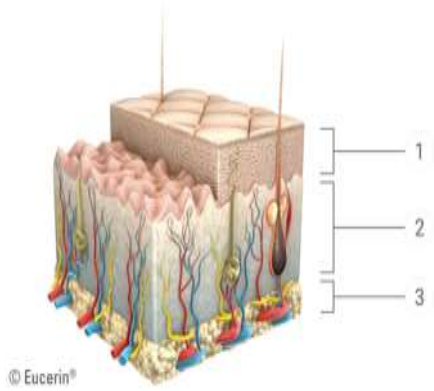

Figure 11: The skin ageing effect on 1) epidermal layers 2) dermal layers 3) subdermal layers.

What are the internal factors that contribute to skin ageing?

Some of the factors that contribute to skin ageing are unavoidable. The structure of our skin and the efficacy of cell processes are determined by our biological age. With each passing year, these slow down.

Hormonal factors come into play. Reduced communicating between cells occurs when oestrogen (instruction-giving hormones) levels fall.

The transport of nutrients and oxygen to the skin's surface is hampered by a low blood supply to the skin. The youthful brightness of the skin diminishes, and the complexion becomes bland.

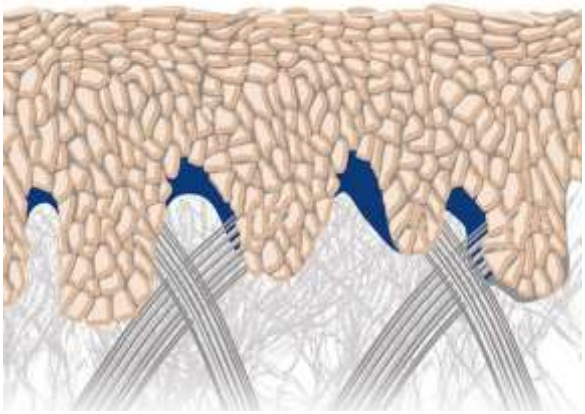

Fig 12: Strong connections between the layers in young skin allow moisture and nutrients to be efficiently transported to the visible layers. (Illustration schematic)

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Genetics-The way skin ages is heavily influenced by genetics. How soon signs of ageing show on the skin's surface are influenced by our phototype and skin type. As an example, Phototype I – II and/or sensitive skin is more prone to wrinkles at a younger age than phototype V – VI skin.

Although phototype III is prone to uneven skin tone, wrinkles emerge later in life than other phototype.

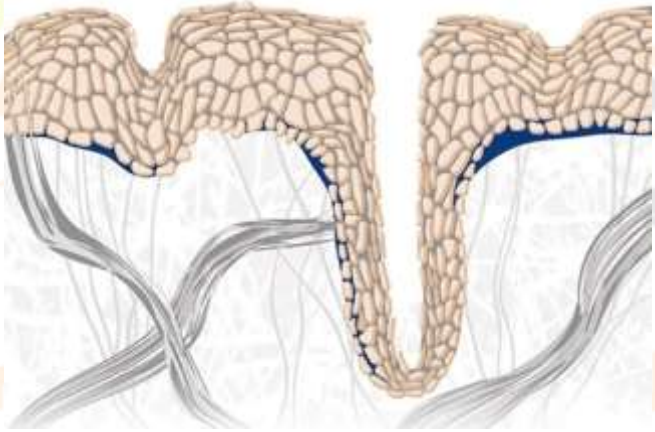

Fig 13: These connections and systems slow down with time. (Illustration schematic) What are The external factors that contribute to skin ageing?

External factors that influence the rate at which the skin ages are all caused by the same thing: oxidative stress.

Free radicals are molecules made up of a single unpaired electron in an outer shell that are released as a result of oxidative stress. Free radicals damage skin cell structures and break down skin components like hyaluronic acid, collagen, and functional elastin, causing accelerated ageing. Free radicals are collected and neutralized by antioxidants in the skin under normal circumstances: molecules having the ability to absorb and stop them. The skin's ability to deactivate free radicals, on the other hand, deteriorates over time. As a result, all components of the skin's cells are damaged. A multitude of lifestyle factors can cause and accelerate oxidative stress:

SUN

The sun's rays are the principal external cause of oxidative stress, which causes skin ageing. Photoageing is the term for skin damage produced by the sun, and uneven pigmentation is generally one of the first obvious indicators. And it's not only long-term UV radiation that damages skin; daily UV exposure has an impact as well.

Figure 14: Effect on sun's rays on the skin (One of the earliest indicators of skin ageing is uneven pigmentation).

Pollution

Pollution, which is most prevalent in cities, can cause the release of skin-damaging free radicals. Pollution exacerbates the effects of sun exposure, hastening the onset of oxidative stress.

Figure 15: Pollution, (especially when combined with sun exposure, can hasten the consequences of free radical damage).

Nutrition

Antioxidants are chemicals that have the power to neutralize free radicals, which cause skin damage and accelerate ageing. Antioxidant-rich fruits and vegetables are a crucial element of maintaining our skin's health as we age.

Unsuitable skincare

If you don't take care of your skin or use things that irritate it, it will age faster. Skin can be cared for by thorough washing with mild products appropriate for skin type, as well as the regular application of care products aimed at the skin's major concern. Preventing premature skin ageing requires effective sun protection.

Symptoms & Signs

What are the indications of ageing on the skin?

There are three basic symptoms of skin ageing, each of which has a particular effect on facial **skin**

Wrinkles

Fine lines and wrinkles are the first visible indications of skin ageing. Laughter lines, also known as crow's feet, are little, shallow creases that appear around the outer corners of the eyes. These may begin to develop around the age of 30, although everyone ages differently, and how we age is influenced by our genetics and lifestyle. Wrinkles appear on the forehead after these small lines. Dynamic wrinkles are wrinkles that appear when our skin moves in response to our changing facial expressions. They get more noticeable as we get older, and eventually turn into permanent wrinkles that are evident even when our faces aren't moving. Vertical lines between the brows can be caused by frowning.

Figure 16: The first obvious symptom of skin ageing is usually fine lines and wrinkles.

Volume reduction

A loss of volume and face features can be difficult to detect. When lipstick starts to bleed, it's usually the first indicator of a loss of volume in the lips. Sagging skin, a flattening of the cheekbones, and the impression of a "turkey neck" are all signs of a loss of facial volume. It alters the entire appearance of the face, making it appear negative, unhappy, or exhausted. The nasolabial fold, which forms between the nose and the lips, has also been linked to drooping skin and volume loss.

Figure 17: As our skin ages, it loses elasticity and becomes less firm, resulting in deeper wrinkles

Deep wrinkles and a loss of suppleness

Our skin's structure degrades as we age, and it loses elasticity and suppleness. Skin also becomes drier, more 'creepy,' and lacks the shine that we associate with youth. Because our skin is as unique as we are, these changes appear at different ages, but they are most frequent in those aged 50 and up.

TREATMENT

Grapeseed oil for antiageing

Grapeseed oil is high in antioxidants and vitamin E, which help to keep skin looking young. Because of its small droplet size and ability to permeate through the epidermis barrier, nanoemulsions are an excellent method for delivering grapeseed oil as an active ingredient. The goal of this study was to develop grapeseed oil as an anti-aging product by varying its concentration as an active ingredient in nanoemulsions and to determine the stability of nanoemulsions after 8 weeks of storage under various settings. Three formulae were created utilizing different concentrations of grapeseed oil (2 percent, 4 percent, and 6 percent), as well as 30 percent tween 80 and 15 percent PEG 400 as surfactant and co-surfactant. The stability test was carried out after 8 weeks of storage. A total of 18 people participated in the anti-aging activity. All nanoemulsions compositions were shown to be stable after 8 weeks of storage. Nanoemulsions remained stable for 12 days in a cycling test. The particle size of grapeseed oil nanoemulsions containing 2%, 4%, and 6% grapeseed oil was 137.49 nm, 160.01 nm, and 163.82 nm in the beginning, and had grown after 8 weeks of storage. In all criteria of skin condition, the anti-aging efficacy of nanoemulsions outperformed emulsion. Grapeseed oil can be made as a nanoemulsions as an anti-aging product, and nanoemulsions is the most stable preparation compared to emulsion during 8 weeks of storage, and nanoemulsions has superior anti-aging efficacy than emulsion.

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