

SANDALWOOD OIL CAN BE A MIRACULOUS TACKLE ON SKIN AGING, SKIN APPEARANCE AND WRINKLE SKIN – A REVIEW**Dr. Md. Shahinoor Rahman Dulal^{1*}, Mohammad Abu Taher² and Hasib Sheikh²**

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ABSTRACT

Sandalwood oil has been utilizing for a variety of purposes throughout history, with its integration into foods, cosmetics, and pharmaceutical products. It's now being increasingly recognized for effects on wrinkle skin. In this review article, a brief analyze has been discussed on various skin disorders especially skin ageing, skin appearance and wrinkle skin & description of sandalwood oil and use of sandalwood oil by topical skin applications. Thus, it focuses on the therapeutic benefits of sandalwood oil according to their antioxidant and anti-inflammatory action, it is to describe the Nitric Oxide (NO) scavenging activities and cell regulatory properties on wrinkle skin.

KEYWORDS: Sandalwood oil, antioxidant effects, anti-inflammatory properties, Nitric Oxide (NO) scavenging activities, Skin aging and wrinkle skin.

INTRODUCTION

Skin aging is a part of a natural human “aging mosaic” which becomes evident and follows different trajectories in different organs, tissues and cells with time. While the aging signs of internal organs are masked from the ambient “eyes,” the skin provides the first obvious marks of the passing time.^[1]

The skin is well known to be the first element influencing human socio-cultural relationship. How we exteriorly look is very important for self-accepting and for the social life. The skin is where emotions take place and the expression of health and wellness status. The color, the opacity and the hydration levels give a signal of the psychophysical status. The wrinkle is a furrow on the skin surface. It is due to a progressive collagen loss, causing a low elasticity of the tissue and to a lower cellular reproduction.^[2]

The aging of our skin can be discussed as two entities: chronological and environmentally influenced ageing.^[3] Clinically, chronological and environmentally-influenced ageing show skin changes including thinning, loss of elasticity, roughness, wrinkling, increased dryness, and impairment of the skin barrier. Chronological aging depends on a decrease in cellular replacement (senescence) of the epidermis, dermis, and hypodermis, but also from Impairment in the remodeling of the extracellular matrix (e.g., collagen bundles and elastic

fibers).^[4] The second type of skin aging is mediated by extrinsic factors such as UV radiation, air pollution, smoking, changes in external temperature, and other agents of skin aging exposome.^[5]

Santalum album L. (Santalaceae) commonly known as Indian Sandalwood is one of the oldest and precious sources of natural fragrance with immense medicinal and commercial significance. *S. album* has been grown in India for the last 25 centuries and esteemed all over the world for its sweet, long-lasting and medicinally valued fragrant oil. Sandalwood and the essential oil derived from sandal heartwood have been used in various traditional systems of medicine, like Ayurveda, Siddha and Unani medicine in the treatment and prevention of wide range of ailments. The versatile therapeutic and healthcare importance of sandalwood is attributed to the rich source of phytochemicals particularly sesquiterpenes.^[6]

Sandalwood oil is obtained from the heartwood of the plant. This volatile oil contains about 90% alpha- and betasantalols with a variety of minor components including sesquiterpene hydrocarbons (about 6%). The santalols are responsible for the pleasant odor of sandalwood, although 2-furfuryl pyrrole also may contribute an effect. The seeds yield about 50% of a viscid, dark red, fixed oil. This oil contains stearolic acid and santalbic acid. Gas chromatography fingerprinting of

sandalwood oils has been used successfully in light of the complex nature of the components of the oils.

Sandalwood is mainly used as coolant, and also sedative effect and astringent activity, making it useful as disinfectant in genitourinary and bronchial tracts, diuretic, expectorant and stimulant. The sweet powerful and lasting odor makes Sandalwood oil useful in perfume industry. The same is also used as tonic for heart, stomach liver, anti-poison, fever, and memory improvement and as a blood purifier. Various uses mentioned in Ayurveda system about sandalwood are in treatment of various other ailments like diarrhea with bleeding intrinsic hemorrhage bleeding piles, vomiting, poisoning, hiccoughs initial phase of pox, urticaria, eye infections and inflammation of umbilicus.^[7,8]

What is skin aging?

There are two main processes that induce skin aging: intrinsic and extrinsic. A stochastic process that implies random cell damage as a result of mutations during metabolic processes due to the production of free radicals is also implicated. Extrinsic aging is caused by environmental factors such as sun exposure, air pollution, smoking, alcohol abuse, and poor nutrition. Intrinsic aging reflects the genetic background and depends on time. Various expressions of intrinsic aging include smooth, thinning skin with exaggerated expression lines. Extrinsically aged skin is characterized by photo damage as wrinkles, pigmented lesions, patchy hypopigmentations, and actinic keratoses. Timely protection including physical and chemical sunscreens, as well as avoiding exposure to intense UV irradiation, is most important.^[9]

Changes in skin appearance

Dry skin

Dry, scaly skin is frequently seen in the elderly. The degradation or loss of skin barrier function with increasing age is partly accountable for this manifestation. The recovery of damaged barrier function has been demonstrated to be slower in aged skin, resulting in greater susceptibility to developing dryness. This is a multifactorial process due, in part, to lower lipid levels in lamellar bodies and a decrease in epidermal filaggrin. Increased trans-epidermal water loss (TEWL) is also exhibited by aged skin, leaving the stratum corneum more susceptible to becoming dry in low-humidity environments. In addition to dryness, aged skin is often characterized by roughness, wrinkling, skin pallor, hyper- or hypopigmentations, laxity, fragility, easy bruising and benign neoplasms.^[10]

Benign neoplasms in ageing skin

With age, the appearance and surface texture of skin can change dramatically, as represented by the development of acrochordons (skin tags), cherry angiomas, seborrheic keratoses, lentigos (sun spots) and sebaceous hyperplasias, among other lesions and cutaneous alterations. Patients of dermatologists and plastic surgeons often request removal of these benign

neoplasms. Various destructive treatment modalities are available, including hyfrecation and sundry laser options.^[10]

Wrinkles classification^[11]

The wrinkles are distinguished in

- **Texture**

The skin, even the infants' one, show on its surface a texture composed by depressions or groves, which intersecting form small rhomboid area.

- **Expressional**

These are those lines forming on the face where skin has to adapt to the facial muscles movements. Indeed, the facial muscles find their insertion beneath the skin. Consequently, the skin moves together with them. These cranes are visible at the age of 30, but they do not increase in number during the years; instead, they become deeper. Their direction is perpendicular to the muscular fibers direction.

- **Joint lines**

They are located in the scheletric articulations place and necessary for the natural movements of the skin.

- **Grooves from muscular skin laxity**

They normally appear as part of ageing process, due to the loss of elasticity of collagen texture. Therefore, dermis is no more able to contrast the gravity and the muscle tissue is reduced. This kind of groove appears normally on the face as the natural fall of the skin. The treatment in this case is just surgical.

- **Lines from sleeping**

These folds are created from the lateral position during the sleep. They appear later on the photo damaged skin.

How Wrinkles Develop^[12]

The skin is made up of multiple layers of cells that are constantly going through self shedding and regeneration once every 30 days or so in repeated cycles. The layers can be broadly divided into two sections - the top epidermis and the underlying dermis.

Histological studies of the skin show that a wrinkle is formed following a series of major cellular changes:

During the sub-clinical phase of aging (from age 35-45), there is a gradual and progressive slowing of cellular turnover and regeneration. This results in the skin getting thinner. As a result, the normally undulating ridge-like dermal-epidermal interface (DEI) becomes flatter. This flatness reduces the surface area of nutritional exchange between the underlying dermis on the bottom and the epidermis on top.

Reduced nutrition to the epidermis from aging is one factor that causes cellular exhaustion and weakness. Without proper nutrition to the epidermis, cellular metabolism of the epidermal cell is slowed. Furthermore,

the transportation of certain unwanted byproducts of cellular metabolism such as free radical is reduced. The accumulation of such free radicals within the cell can lead to undesirable mutational damages in the cell and ultimately cancer.

The adhesion between in the DEI is normally supplied by collagen IV (a multi-sheet structure or basal layer) and collagen VII (anchored to the sheets structure). The progressive loss of nutrients to this area slows the circulation of the messengers that serve to promote the neo-synthesis process of such collagen. A vicious cycle is set up. Without an optimal amount of collagen, the skin sags even more, propagating the dearth of nutrients.

Paradoxically, matured aging skin contains more elastin, which the body uses to fill in the empty space left by the

deficiency of collagen. Such elastin, unfortunately, is fragmented, calcified, and contains excessive lipids.

In addition to the loss of skin thickness due to lack of collagen support, the aging skin is looser and lacks elasticity. These two properties are hallmarks of wrinkles.

This process of aging and appearance of wrinkles is accelerated during the clinical phase of aging (age 45 and higher). By age 50, very few women can escape wrinkles. The difference only lies in the degree of the blemish.

Skin Anti-aging Approaches^[13]

The skin anti-aging strategies attempted to reverse the dermal and epidermal signs of photo- and chronological aging can be grouped under the following approaches (Table 1).

Table 1: Skin anti-aging approaches.

Cosmetological care	Daily skin care, correct sun protection, aesthetic non-invasive procedure
Topical medical agents or topical agents	Antioxidants, cell regulators
Invasive procedures	Chemical peelings, visible light devices, intense pulse light (IPL), ablative and non ablative laser photo-rejuvenation, radiofrequency (RF), injectable skin biostimulation and rejuvenation, prevention of dynamic wrinkles, correction of static, anatomical wrinkles, restoration (redistribution) of fat and volume loss, skin augmentation and contouring.
Systemic agents	Hormone replacement therapy, antioxidants.
Avoiding of exogenous factors of ageing, correction of life style and habits.	Smoking, pollution, solar UV irradiation, stress, nutrition, diet restriction and alimentary supplementation, physical activity, control of general health.

Plant Description of Sandalwood

The plant was mainly exploited for fragrant sandalwood oil obtained by steam distillation. A small evergreen glabrous tree with slender drooping branches the sapwood white and odorless. The heartwood yellowish brown strongly scented. Leaves of dimension 3.8 – 6.3 by 1.6 to 3.2 cm; are elliptic lanceolate, subacute glabrous and entire thin base acute; petioles 1 – 1.3 cm long slender flowers, brownish purple indurous, in terminal and auxiliary paniculate cymes shorter than leaves. Perianthcampanulated limb of 4, valvate triangular segments stamens 4, exerted, alternating with 4 rounded obtuse scales. Drupe globose 1.3 cm diameter. Purple black; endocarp hard ribbed fruit concealed about size of pea, spherical crowned by rim like remains of perianth tube, smooth, rather flesh, nearly black, seed solitary.^[14]

Phytochemical Investigation of Sandalwood oil

The volatile oil extracted from *Santalum album* L derived from the roots and heartwood is colorless to yellowish, viscous (ref. index-1.499-1.506, specific gravity 0.962-0.985 opt, rotation -19-200) liquid with peculiar heavy sweet odor, the chief constituents of the oil is santalol (90% or more) a mixture of two primary

sesquiterpene alcohols, C₁₅H₂₄O viz, α -santalol (bp-1661670C) and β -santalol(bp-177-1780C) in which the α - form predominates.^[1,3] More than hundred constituents of sandalwood oil in categories of tannins, terpenes, resins and waxes have been reported which include such as hydrocarbons- santene (C₉H₁₄), nortricyclo-ekasantalene (C₁₁H₁₈), α - and β - santalenes (C₁₅H₂₄), alcohols-santenol (C₉H₁₆O), teresantalol (C₁₀H₁₆O), aldehydes- nor-tricyclo-kasantalal (C₁₁H₁₆O).^[15]

Sandalwood oil restores and rejuvenation of skin aging & wrinkle skin by the following ways

Antioxidant properties

The phytochemical and pharmacological investigations proved the presence of antioxidant principles that justify their traditional medicinal values.^[16] It has been reported to have nitrous oxide scavenging activity and DPPH antioxidant activity.^[17] Anthocyanicpigment cyanidin-3-glucoside from *S. album* was shown to be antioxidant and nutritionally important.^[18] A comparative study shown that in vitro grown callus cells demonstrated comparable antioxidant activities with sandalwood oil, using nine in vitro antioxidant tests.^[19]

Sandalwood oil increased glutathione S-transferase (GST) activity and acid soluble sulfhydryl (SH) levels in the liver of adult male Swiss albino mice in oral doses of 5 and 15 μL in 10 and 20 days, respectively.^[20]

Methanolic extracts of sandalwood demonstrated acetyl cholinesterase inhibitory (180 $\mu\text{g mL}^{-1}$) and DPPH and super oxide free radical scavenging activities (IC50 values of 160-191 $\mu\text{g mL}^{-1}$) in albino mice.^[21]

The Evaluation of Nitric Oxide Scavenging Activity

The extracts of Indian medicinal plants including *S. album* were examined for their possible regulatory effect on nitric oxide (NO) levels using sodium nitroprusside as an NO donor in vitro. Most of the plant extracts demonstrated direct dose dependant scavenging on NO and exhibited significant activity.^[22]

Anti-inflammatory property

Treat dry skin conditions such as eczema with East Indian Sandalwood, as it is an anti-inflammatory condition, as well as an emollient so it will take the heat and agitation away from the skin, and help produce healthy skin cells. Sandalwood oil relieves itching and inflammation of the skin, and is most effective in relieving dehydrated skin, making it great for anti-ageing skincare - and the astringent action has a great toning effect and is also used with great results in oily skin conditions and to prevent the skin from forming ugly scars and for fighting dry eczema.^[23]

Santalum album possessed anti-inflammatory and antiulcer activities as evidenced by its significant inhibition in the carrageenan induced paw edema, cotton pellet induced granuloma, as well as pylorus ligation induced ulcer. These findings could substantiate the inclusion of this plant in the effective management of inflammatory disorders like ulcer in traditional system of medicine. The in vitro antioxidant and in vivo analgesic and anti-inflammatory activities in mice were established for methanolic extracts of sandalwood.^[24]

Cell regulatory property

Applied to the skin, sandalwood oil is soothing, cooling and moisturizing and primarily used for dry skin conditions caused by loss of moisture and skin inflammations. It may be used to relieve eczema and psoriasis and for the treatment of oily skin and acne. The emollient properties of sandalwood render it useful in skin care. Sandalwood oil is soothing, cooling and moisturizing for dry skin conditions caused by dryness and treatment of oily skin and acne.^[25-27]

Metabolic property

Sandalwood oil reported to demonstrate changes in neonatal hepatic xenobiotic metabolizing enzymes in suckling mouse pups on trans-mammary exposure. It is further observed that sandalwood oil and its constituents passed through milk and modified the hepatic xenobiotic metabolizing enzymes such as increased hepatic

glutathione-S-transferase, glutathione reductase and glutathione peroxidase activities, with concomitant increase in hepatic cytochrome b5 and acid soluble sulphhydryl contents and lowering of hepatic cytochrome P 450 content.^[28]

Method of uses of sandalwood oil

- To reduce face wrinkle, Take a large bowl of steaming water and add 1-2 drops of Sandalwood oil. Keep your face over the bowl with cover head by a towel for 10 minutes.
- Massage few drops of sandalwood oil every corner of body.
- To restore silky and moisture of hair apply few drops of sandalwood oil in hair.
- Sandalwood oil can be mixed with your bath water to help you relax and better sleep.
- Add a few drop of sandalwood oil to your milk to boost up your energy.
- Add few drops of sandalwood oil with lotion or cream to remove dry and itchy skin.
- Add several drops of sandalwood oil to coconut or other favorite oil and apply to the hair to help with dryness.
- To relax body sandalwood rubbed on the skin.

CONCLUSIONS

Topical applications of sandalwood oil may have different effect on the skin according to their composition. The constituents of sandalwood oil may restore and rejuvenate wrinkle skin by several mechanisms: (i) antioxidative activities; (ii) anti-inflammatory properties; (iii) Nitric Oxide (NO) scavenging activities (iv) cell regulatory properties and (v) metabolic properties. Further studies can be added to allow for better understanding of sandalwood oil, with the potential to develop dermatological treatments and skin care products using this oil.

Conflict of interest: We have no conflict of interest.

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