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BENEFITS OF WHEAT GERM OIL AND CINNAMON OIL IN TREATMENT OF FOOT FISSURES

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Abstract
Foot fissures, a prevalent dermatological concern, pose challenges due to their potential for pain, discomfort, and susceptibility to infections. Conventionally, moisturizers and emollients are employed for alleviation. Yet, the upsurge in interest toward natural remedies has illuminated the potential of wheat germ oil and cinnamon oil in facilitating healing. Wheat germ oil, laden with vitamins, minerals, and essential fatty acids, and cinnamon oil, boasting antimicrobial and anti-inflammatory agents, have emerged as promising candidates for addressing foot fissures. This review elucidates the bioactive constituents and mechanisms underpinning their efficacy, substantiated by pertinent research, thus illuminating their promise in the realm of foot fissure treatment.

Keywords: Foot Fissures, Cracked Heels, Wheat Germ Oil, Cinnamon Oil, Wound Healing, Skin Moisturization, Antimicrobial, Anti-Inflammatory

Introduction

1. General

Heel Fissure is the most common foot problem. However, when the cracks or fissures grow deep, standing, walking, or applying weight to the heel can be uncomfortable. In most cases, the issue is just an eyesore and an annoyance[1]. However, as the pressure is raised, the splits deepen, engaging the dermis, causing them to bleed and cause discomfort when performing weight-bearing activities. These cracks are thought of as partial-thickness skin wounds and are more likely to become infected.[2] Our feet don't have oil glands like the rest of the body, thus their skin is naturally dry. Numerous factors can cause the skin on our feet to become dry, but there are ways to stop this from happening, such as keeping our feet moisturized and refraining from rubbing or scratching the area. In general, older women's broken heels are more noticeable than those of younger girls. Similar to how these issues are more severe in older women than men. Foot cracks allow germs to enter the body more easily, which can encourage foot ulceration, microbial attack, and even amputation. Unlike the skin on the rest of our bodies, the skin on our feet is naturally dry. Since our feet's skin lacks oil glands, it must rely on their hundreds of millions of sweat glands to keep them moist. Foot cracks allow germs to enter the body, which can encourage foot ulceration, microbial attach, and even amputation. The epidermis' outermost layer, the stratum corneum, is made up of dead cells. It serves as a barrier to shield underlying tissue from contaminants, dehydration, and mechanical or chemical stress. This thickness varied from 10 to 40 micrometers throughout the body. While a good

moisturizing substance takes care of the foot's moisture needs, a special technique must also monitor the foot's hydration patterns. The total fatty matter of the formula used to be indirectly associated with the hydration power in older times, however this would frequently lead the formulator incorrectly.[3] Triticum Aestivum (wheat) is a food product that is consumed by people all over the world. It is composed of approximately 80% endosperm, 15% bran, and 5% germ. According to reports, the embryo (wheat germ) is a good source of tocopherols, carotenoids, and antioxidants. 10% oil can be found in wheat endosperm. Both the food sector and the cosmetics business have numerous uses for WGO. WGO is thought to offer medicinal benefits, and its protein content is said to be a good supply of amino acids including methionine, threonine, and lysine. The highest concentration of undiscovered anti-inflammatory and antioxidant chemicals can be found in wheat germ oil (WGO).[4] Vitamin E and polyunsaturated fatty acids are especially abundant in wheat germ oil (WGO), which is also a strong source of other minerals.[5]

Cinnamon is frequently used as a cooking spice, it can also be employed in processing, medicine, and agriculture because of its antibacterial and pharmacological qualities.[6] The primary components of cinnamon are essential oils and their derivatives, including cinnamaldehyde, cinnamic acid, and cinnamate. It also has anti-inflammatory, anti-diabetic, antibacterial, and anticancer properties. Although Cinnamon is primarily used as a spice, its essential oils and other components also have significant health benefits, such as antibacterial, antifungal, and antioxidant properties.[7]

1.1 Skin

The integumentary system stands as the body's largest organ, creating a physical shield between the external surroundings and the internal milieu it shields and sustains. This system encompasses the epidermis, dermis, hypodermis, related glands, hair, and nails. Beyond its protective role, this system undertakes intricate responsibilities like maintaining body temperature, managing cellular fluid levels, producing Vitamin D, and sensing stimuli. The various constituents of this system collaborate to execute these tasks; for instance, temperature regulation is orchestrated through thermoreceptors that influence adjustments in peripheral blood circulation, perspiration levels, and body hair conditions.[8]

1.2 Epidermis

The skin is composed of two primary layers: the epidermis and the dermis. The epidermis is a specialized, fully developed stratified squamous epithelium, with the primary cell type being the keratinocyte. These keratinocytes produce keratin, a protein comprised of coiled polypeptide chains that join together to create supercoils composed of multiple polypeptides linked through disulfide bonds between neighboring cysteine amino acids. Additionally, keratinocytes generate cytokines when the skin is injured. The epidermis can be categorized into four layers based on its differentiation.[9]

1.3 Dermis

The dermis is a layer of connective tissue situated between the epidermis and the subcutaneous tissue. Comprising collagen, elastic tissue, and various extracellular elements, the dermis forms a fibrous framework housing blood vessels, nerve endings, hair follicles, and glands. Its functions encompass providing support and protection to both the skin and underlying layers, contributing to temperature regulation, and facilitating sensory experiences. While fibroblasts are the primary cellular inhabitants of the dermis, histiocytes, mast cells, and adipocytes also contribute significantly to maintaining the dermis' customary structure and operations.[10]

2. Causes of Heel Fissures

The skin on the heel is made up of a dense stratum corneum that provides the necessary strength to withstand the pressure exerted by body weight. The soles of the feet have numerous sweat glands but only a limited number of sebaceous glands, resulting in significant water loss from the skin surface.[11]Lack of financial resources and low levels of education results in incorrect utilization of

footwear. Societal and cultural habits, including walking barefoot, avoiding the use of socks (particularly among females), and delayed treatment of foot issues, have all been identified as factors that play a role in the occurrence of hyperkeratosis and heel cracks within the Indian population.[12]Primary factors involve extended periods of standing, especially on unforgiving surfaces, and the utilization of open-backed footwear that results in heel expansion and heightened pressure. Underlying medical conditions like diabetes can contribute to the development of dry skin. Skin conditions such as psoriasis and eczema are also potential catalysts for heel fissures. Obesity can be a contributing factor as well. Prolonged exposure to water can strip feet of their natural oils, leaving them dry and rough. In severe instances, cracked heels can become infected, potentially leading to cellulitis. [13]It can also result from dry and thickened skin (hyperkeratosis), the use of shoes with openbacks, and systemic medical conditions.[14]The primary reasons stem from the development of substantial calluses. Many foot-related issues emerge due to disregard and lack of attention to proper foot care.[15]The prevalent cause of this foot condition is a reaction to the periodic stresses of movement, although several skin-related conditions may exhibit thickening of the skin (hyperkeratosis) as a component of their underlying mechanisms.[16]
Cracked heels or fissure soles can develop in anyone, but specific factors that contribute to fissure soles include:

1. Congenital Factors: These encompass conditions like Juvenile Plantar Dermatosis present from birth.
2. Acquired Factors: Conditions such as Eczema, Atopic Dermatitis, Tinea pedis (fungal infection of the feet), Psoriasis (particularly Palmoplantar psoriasis), Palmoplantar Keratodermas and Leprosy, are acquired causes of fissure soles.
3. Systemic Influences: Medical conditions like Diabetes mellitus, Hypothyroidism, Scleroderma, and Rheumatoid arthritis can also predispose individuals to fissure soles.[2]

Fig:1 Foot fissures[17]

3. Cinnamon Oil

Cinnamon (Cinnamomum verum, also known as C. zeylanicum) is a small evergreen tree, reaching heights of 10-15 meters (32.8-49.2 feet), and belongs to the Lauraceae family. Its origin is in Sri Lanka and South India. The tree bears panicles of flowers with a greenish hue, emitting a distinctive fragrance. Its fruit is a purple berry about one centimeter in size, containing a solitary seed. The characteristic flavor is attributed to an aromatic essential oil, constituting 0.5 to 1% of its composition.[18] The inherent antimicrobial and potential anticancer characteristics of cinnamon bark's essential oil suggest its plausible application in the formulation of natural remedies aimed at topically treating infections.[19] Cinnamon also exhibits antifungal properties.[20,21,22,23]The oils were assessed for their ability to inhibit the growth of bacteria, including both Gram-positive types (Staphylococcus aureus and S. epidermidis) and Gram-negative types (Pseudomonas cepacia and P. aeruginosa). Additionally, their capacity to counter fungal activity against two Candida species (C. albicans and C. glabrata) and three dermatophytes (Microsporum canis, Trichophyton

mentagrophytes, and T. rubrum) was examined using the broth microdilution technique.[24]Possibly, the notable presence of cinnamaldehyde, eugenol, geraniol, benzyl benzoate, and methyl cinnamate, along with other lesser constituents, could be accountable for the oils' potent antifungal efficacy.[25]

3.1 Cinnamon Oil Extraction

The dried bark of Cinnamomum zeylanicum Blume was acquired from a local nursery. Around 150g of coarsely ground plant material were employed to extract essential oil using hydro-distillation over an 8-hour period. The resultant oily layers were isolated, desiccated using anhydrous magnesium sulfate, refined through an adapted wool filter, and ultimately preserved in airtight containers at 4°C for future use. Moisture content was gauged independently through the Dean's stalk method and conducted in triplicate.[26]

4. Wheat Germ Oil

Wheat, scientifically known as Triticum aestivum, is a globally consumed food source. It is composed of roughly 80% endosperm, 15% bran, and 5% germ[27] . The wheat germ, which is the embryo of the wheat plant, is known to contain significant amounts of antioxidants, carotenoids, polyphenols, and tocopherols, making it a valuable reservoir of these beneficial compounds.[28,29]Wheat germ is acknowledged for its exceptional nutritional value and has been integrated into various food items like bread, snacks, and breakfast cereals to enhance their nutritional content. Through a milling procedure, wheat germ oil (WGO) is derived from the wheat germ, while the wheat's endosperm contains about 10% oil. WGO finds extensive uses in both the food sector and the cosmetics sector due to its versatile applications.[30,31]Wheat germ oil (WGO) is thought to possess medicinal benefits, and the protein within WGO has been identified as a substantial reservoir of amino acids like methionine, threonine, and lysine.[32]Numerous studies conducted both in laboratory settings and within living organisms have showcased the antioxidant and anti-inflammatory properties of wheat germ oil.[33,34,35,36,37] Wheat germ oil stands out as a distinctive oil due to its elevated nutritional content, notably enriched with vitamin E.[38,39] The components found in WGO that are documented to possess anti-inflammatory characteristics include pentadecanoic acid, hexadecenoic acid, linoleic acid, and cyclohexanol.[40,41,42] The vitamin E content, represented by tocopherols, within wheat germ oil is exceptionally substantial.[43] Wheat germ is a remarkably nutritious substance, comprising approximately 10-15% lipids, 26-35% proteins, 17% sugars, 1.5-4.5% fiber, and 4% minerals.[44,45] Wheat germ, containing about 8% - 14% oil (average 10%), is mainly used in food, medical and cosmetic industries as a source of oil.[46]WGO finds application due to its nutritional significance, particularly its elevated vitamin E content. Its uses span across cosmetics, personal care products, pharmaceuticals, health-oriented foods, and dietary supplements[47]. Wheat germ oil is incorporated into cosmetics due to its ceramide content, which helps prevent skin aging and supports skin preservation.[48]Wheat germ oil is abundant in Vitamins A, D, and E, sought after for its capacity to counteract the impact of free radicals on the skin as an antioxidant, as well as its role as a natural preservative. It enhances the skin's inherent rejuvenation process, supports muscle and lymphatic activity, and holds special importance in addressing dry and maturing skin. Additionally, it finds utility in minimizing stretch marks and scars, and for addressing dry and coarse skin. Its enriching and healing properties contribute to a noticeably smoother skin texture.[49] Furthermore, wheat germ oil encompasses squalene, a primary constituent of polyunsaturated lipids on the skin's surface, which plays a significant role in maintaining skin functionality. Squalene is known for its emollient and antioxidant attributes, essential for preserving adequate skin moisture.[50]

4.1 Extraction of Wheat Germ Oil

A 1 kg sample of wheat germ was taken and subjected to different treatments: dry heat using an oven, wet heat through an autoclave, and microwave irradiation. For oven drying, the samples were spread on trays and exposed to temperatures of 90°C and 160°C for durations of 12 and 6 minutes respectively. Microwave treatment was conducted at 180 W for 12 minutes and 360 W for 5 minutes using a commercial microwave oven. Wet heat treatment was performed in heat-resistant glass jars

within an autoclave set at 121°C for 15 minutes. After each treatment, samples were cooled and stored at -18°C. Stabilized samples weighing 300 g each were subjected to hexane extraction using a shaking water bath at 30°C for 2 hours. The extracted oil was filtered, the extraction was repeated twice, and the solvent was evaporated using a rotary evaporator. The resulting oil was stored at 4°C for further analysis. An untreated sample was kept as a control.[44]

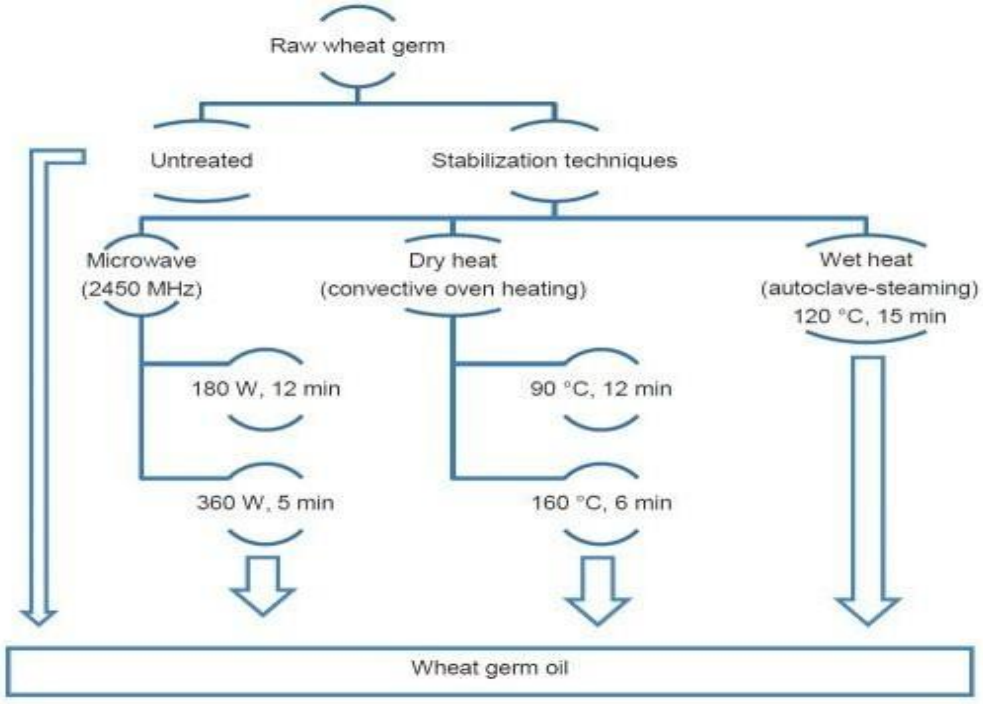

Figure:2 Extraction of Wheat Germ Oil [44]

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