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SUN PROTECTION FACTOR ACTIVITY OF SOME MEDICINAL PLANTS IN INDONESIA – A REVIEW

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ABSTRACT

Indonesia, being classified as a tropical nation, experiences intense sunlight, which consequently impacts the skin. As one of the protective organs of the body, the skin is susceptible to excessive dryness. At present, scholars are commencing the search for novel sunscreen compound candidates derived from naturally occurring substances that have demonstrated sunscreen properties through empirical evidence. In its place, sunscreen, which presently has numerous side effects, is implemented. A number of indigenous Indonesian medicinal plants, such as *Etlingera elatior*, *Oryza sativa*, *Syzygium cumini*, *Apium graveolens*, *Solanum lycopersicum*, *Annona muricata*, and *Moringa oleifera*, have been scientifically demonstrated to possess sunscreen properties via various mechanisms. Therefore, this review article is aimed at discussing the potential of several native Indonesian medicinal plants that have sunscreen effects.

KEYWORDS: Sun protection factor, *Etlingera elatior*, *Oryza sativa*, *Syzygium cumini*, *Apium graveolens*, *Solanum lycopersicum*, *Annona muricata*, *Moringa oleifera*.

INTRODUCTION

As the most external organ comprising the human body, covering the entire body surface, the skin is vulnerable to harmful external influences, including ultraviolet (UV) radiation exposure.[1] Skin damage can be caused by excessive UV radiation exposure. Sunburn, skin cancer, oxidative stress, and photoaging may result from this damage, the specifics of which are contingent upon the quantity and type of UV radiation encountered and the individual.[2] The ultraviolet light electromagnetic spectrum consists of three distinct regions: UVA, spanning 320–400 nanometers; UVB, extending from 290 to 320 nanometers; and UVC, spanning from 200 to 290 nanometers. In the atmosphere, UVC radiation may be filtered prior to reaching the earth. In contrast, skin damage can be caused by UVB radiation that is not fully filtered by the ozone layer. On the other hand, premature aging of the skin can be induced by UVA radiation that can penetrate the epidermis and dermis layers. As a consequence of this issue, the majority of skin preparations, including lotions, moisturizers, shampoos, and creams, contain sunscreen in an effort to mitigate the damaging effects of ultraviolet radiation.[3] The sun protection factor (SPF) value, which is calculated by dividing the UV energy necessary to induce a minimal erythema dose (MED) on protected skin by the UV energy needed to induce MED on unprotected skin, serves as an indicator of the efficacy of sunscreen.[3] The term "minimal erythema dose" (MED) refers to the shortest duration or quantity of ultraviolet light irradiation required to induce negligible erythema symptoms that are perceptible on exposed skin.[4] A sunscreen that possesses a greater SPF value offers enhanced protection against solar radiation. Nevertheless, an increasing number of studies indicate that sunscreen is not entirely risk-free for safeguarding the skin against solar radiation.[1] Consequently, the exploration of potential novel sunscreen compounds, including those derived from natural constituents, is imperative.[5,6]

Indonesia boasts the second-most extensive forest biodiversity of any country globally, encompassing a staggering 28,000 plant species, of which 2,500 are classified as medicinal plants.[7,10] Presently, ongoing research endeavors are focused on discovering novel sources of sunscreen derived from natural components. One such approach involves investigating active compounds present in medicinal plants, which have historically been utilized by individuals in different regions of Indonesia to shield the skin from solar radiation.[11,13] The objective is to identify novel

sunscreen compounds that are non-toxic and have minimal adverse effects on patients.[14,16] Therefore, this review article is aimed at discussing the potential of several native Indonesian medicinal plants that have sunscreen effects. Therefore, this review article is aimed at discussing the potential of several native Indonesian medicinal plants that have sunscreen effects.

Etlingera elatior

Traditional medicine and cooking use the rhizomes of *Etlingera elatior*, a herbal plant, as a spice. According to Chan et al., this plant possesses antioxidant, antibacterial, antifungal, and hepatoprotective properties.[17] According to Diah et al., in vitro administration of *E. elatior* lotion at concentrations of 200, 400, 600, and 800 g/mL yielded SPF values of 16.32, 17.15, 18.06, and 18.59, respectively, placing these values in the ultra-protection category.[18]

Oryza sativa

Oryza sativa is an important plant because it is a staple food source for most humans. This plant has been widely reported to have various pharmacological activities, including antioxidant, antiinflammatory, antiproliferative, anticancer, antidiabetic, antihyperlipidemic, antiaging, anti-ultraviolet, antiviral, antiobesity, anti-neurodegenerative, gastroprotective, nephroprotective, immunomodulatory, antiplatelet, and hepatoprotective.[19,20] In vitro administration of *O. sativa* emulgel with concentrations of 0.1%, 0.5%, and 1% is reported to have SPF values of 3.13, 5.71, and 16.07, respectively, where these values are included in the minimum protection, medium protection, and very maximum categories, respectively protection.[21]

Syzygium cumini

Syzygium cumini, commonly known as jamun in India, is an evergreen tree distributed throughout the Indian subcontinent, Southeast Asia, and East Africa. Medically, the fruit of this plant is reported to have various pharmacological activities, including antidiabetic, antihyperlipidemic, antioxidant, antiulcer, hepatoprotective, antiallergic, antiarthritis, antimicrobial, anti-inflammatory, antifertility, antipyretic, neuro-psychopharmacological, nephroprotective, and antidiarrheal. The various beneficial health effects of *S. cumini* are mainly caused by various phytoconstituents such as tannins, alkaloids, steroids, flavonoids, terpenoids, fatty acids, phenols, minerals, carbohydrates, and vitamins present in the fruit.[22] In vitro administration of *S. cumini* serum with concentrations of 0.5%, 0.8%, and 1.1% was reported to have SPF values of 9.35, 13.26, and 26.05, respectively, where these values fall into the maximum protection, maximum protection, and ultra categories, respectively protection.[23]

Apium graveolens

Apium graveolens is a plant belonging to the *Umbelliferae* family. *A. graveolens* seeds contain various substances, such as essential oils, flavonoids, coumarin, and linoleic acid. *A. graveolens* seeds have long been used to treat arthritis, gout, and help reduce muscle spasms, calm nerves, and reduce inflammation.[24,26] In vitro administration of *A. graveolens* lotion with concentrations of 2%, 4%, and 6% is reported to have SPF values of 4.55, 7.31, and 8.15, respectively, where these values are respectively included in the medium protection, maximum protection, and maximum protection categories.[27]

Solanum lycopersicum

Solanum lycopersicum is a plant that is spread throughout the world and is a plant that has special nutritional value, containing important nutrients such as lycopene, beta-carotene, flavonoids, vitamin C, and hydroxycinnamic acid derivatives.[28] In vitro administration of *S. lycopersicum* lotion with concentrations of 1% and 1.5% was reported to have SPF values of 18.84 and 22.24, respectively, where these values are included in the ultra-protection category.[29]

Annona muricata

Annona muricata is a tropical plant with dark green, oval-shaped leaves and white-fleshed fruit with spiny green skin. This plant has fruit with a sweet and sour taste and is often used in making juice, ice cream, or as an additional ingredient in food.[30,31] The *A. muricata* plant is reported to have properties for treating several diseases such as cancer, gout, tumors, hypertension, diabetes mellitus, ulcers, diarrhea, and allergies.[32, 33] In vitro administration of *A. muricata* extract with a concentration of 5000 µg/mL was reported to have an SPF value of 12.78, where this value is included in the maximum protection category.[34]

Moringa oleifera

Moringa oleifera is a plant belonging to the *Moringaceae* family that is traditionally used as antiasthma, antidiabetic, hepatoprotective, anti-inflammatory, anti-fertility, anti-cancer, antimicrobial, antioxidant, cardiovascular, anti-ulcer, central nervous system activity, anti-allergy, wound healing, analgesic, and antipyretic.[35,36] In vitro administration of *M. oleifera* lotion and gel with a concentration of 5% each was reported to have SPF values of 24.98 and 25.89, respectively, where these values are included in the ultra-protection category.[37]

CONCLUSION

Indonesia is a country that has various types of medicinal plants that have potential properties to be developed as sunscreen. Scientists have empirically proven and scientifically tested all of these plants to be effective sunscreens. This cannot be separated from the active compounds contained in these plants, which have sunscreen properties with different working mechanisms. It is expected to use research on medicinal plants to promote the use of the latest sunscreens derived from these plants.

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