

Coffee Extract as an Antioxidant in the Prevention of Photoaging: Literature Review

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ABSTRACT

Photoaging leads to dry skin, wrinkles, darkening of skin pigmentation and a reduction in skin firmness. The effects of photoaging may be overcome by compounds which have antioxidant activity. Coffee is a potential candidate for synthetic chemicals in cosmetic preparations. It contains active compounds, including polyphenols, caffeine, chlorogenic acid, flavonoids, and alkaloids which are effective for use on the skin as antioxidants, anti-aging, sunscreens, moisturizers, anti-cellulite, and brighteners. That makes coffee a potential antioxidant in the treatment of photoaging. The purpose of this literature review is to determine whether coffee extract is an anti-oxidant in the treatment of photoaging. A comprehensive literature search was conducted using several databases, namely Google Scholar, PubMed, Scopus, and Crossref, using the keywords "coffee AND antioxidant AND photoaging." This literature review concluded that coffee extract could be used as an antioxidant in treating photoaging.

Keywords: Coffee, Antioxidant, Photoaging

INTRODUCTION

The skin is the body's outermost and largest organ, which protects it from various kinds of disturbances and stimuli from the outside. Skin health is essential to avoid disease and skin aging [1]. Skin aging is a degenerative process driven by decreased physiological function. Skin aging is characterized by decreased collagen density, dermal

thickness, and reduced synthesis and replacement of vital structural proteins. This causes the dermis to lose its integrity and flexibility, causing the skin to become loose and wrinkled [2]. Intrinsic and extrinsic factors can cause skin aging. Intrinsic skin aging is a natural skin aging process that occurs with age. Meanwhile, extrinsic skin aging is caused by external factors such as repeated facial expressions, pollution, and exposure to sunlight, especially ultraviolet (UV)[3]. Extrinsic skin aging that is affected by ultraviolet (UV) is also known as photoaging [4].

Photoaging due to exposure to UV rays can trigger free radicals Reactive Oxygen Species (ROS). To overcome cell damage and oxidative stress due to UV exposure, one of which can be used antioxidants [5]. To overcome the negative effects of photoaging, protective efforts are needed in the form of application of a material which can protect the effects of direct sunlight on the skin by using natural ingredients that contain antioxidants such as coffee.

Coffee contains high concentrations of antioxidant polyphenols. Coffee also contains multiple secondary metabolites, such as caffeine and polyphenols. Several studies have indicated that the polyphenolic compounds present in coffee skin are flavan-3-ol, hydroxynamic acid, flavonol, anthocyanidins, catechins, epicatechines, rutin, tannins and ferulic acid [6].

Coffee contains various bioactive compounds that can interact intricately with the human body. This leads to many beneficial results, including increased antioxidant properties, stimulation of the nervous system and also weight management through accelerated metabolism. It has been recognized that the beneficial effects of coffee consumption are associated with its high content of antioxidants such as chlorogen, ferulic, caffeine and coumaric acids for green coffee [7].

Coffee can be used as an antioxidant because it contains polyphenols in coffee beans of 37-55 mg GAE/g and coffee leaves of 12-77 mg GAE/g [8]. The antioxidant activity of the coffee plant was tested using the DPPH (1,1-diphenyl-2-picrylhydrazyl) test, it was found that coffee leaf extract had an IC₅₀ value of 35.24 ppm and coffee bean extract had an IC₅₀ value of 57.45 ppm compared to vitamin C which has an IC₅₀ of 6.13 ppm. IC₅₀ <50 ppm results show very strong antioxidant activity while 50-100 ppm shows strong antioxidant activity [9].

METHOD

The method used in this article is a literature search in the form of Indonesian national journals and international journals using Google Scholar, Science Direct, Elsevier, and PubMed with the keywords Coffee, Antioxidants, photoaging, with emphasis on the newest. Journal publications have been published for the past ten years. The inclusion criteria of topic were studied on coffee that showed antioxidant activity in photoaging prevention in the results of studies that only explained the coffee antioxidants. Firstly, the articles gathered were listed, and the journal category used was research on coffee antioxidants. Then a selection was made, only those items that provided data on the antioxidant activity of coffee and photoaging were selected. After obtaining the research data from the articles, they are combined and studied to obtain a combination of data that can describe the

antioxidant activity of coffee and the prevention of photoaging.

DISCUSSION

Coffee Extract Increases Procollagen Type 1

Photoaging is the aging of the skin as a result of exposure to the sun's UV rays. UVB radiation can lead to reactive oxygen species (ROS) generation. Reactive Oxygen Species (ROS) activate Mitogen-activated protein kinase (MAPK), a pathogenic pathway and MMP production factor in fibroblasts. C-Jun NH₂ terminal kinase (JNK) and p38 modulate c-Fos expression. Then c-Fos and c-Jun synthesize activator protein-1 (AP-1), which will induce the synthesis of Matrix Metalloproteinases (MMPs), which play a role in collagen degradation [10].

Coffee extract can reduce the expression of MMPs and increase procollagen type 1. Coffee has a UV protective effect because it contains polyphenolic compounds (caffeinated acid and chlorogenic acid) that effectively suppress PMM expression like MMP-1, MMP-3 and MMP-9. It has the potential to to increase the synthesis of procollagen in fibroblasts, so that it can be effective in reducing photoaging which leads to the formation of wrinkles [11].

The content of the coffee, namely the polyphenols composed of caffeic acid and chlorogenic acid, inhibits the activation of MAP kinase. Polyphenols inhibit the expression of ERK, JNK, and p38 (which modulates c-Fos expression) so that they can suppress c-Fos and c-Jun expression and then inhibit AP-1 expression so that they can reduce MMPs expression and collagen degradation does not occur. As a result, inhibiting the production of ROS will prevent the skin from photoaging [12].

Coffee Extract Prevent photoaging

Wrinkles and photoaging may occur because UV exposure can lead to ROS formation. Then ROS will reduce the expression of TGF- β which causes a decrease in collagen production resulting in changes in skin structure which are

clinically manifested by deep wrinkles, rough texture, telangiectasia and pigmentation [13].

Coffee extract has been shown to be an effective heat control ingredient with results similar to hyaluronic acid [14]. The reduction in wrinkles occurs because the polyphenols found in coffee increase the expression of TGF- β . This cytokine increases collagen production, thereby increasing collagen production and causing areas of wrinkles and photoaging to decrease [12].

Coffee has a lot of polyphenols, which play an important role as antioxidants. Antioxidant activity may inhibit the development of oxidizing reactions by forming free radicals. The antioxidant activity of Robusta coffee beans grown in one region to another has different characteristics according to the age of the plants used, the time of harvest, the growing environment, or the highland ecology [15]. Moreover, the coffee extract may reduce TEWL. Trans-epidermal water loss (TEWL) is water which passively evaporates through the skin into the external environment. High TEWL is associated with dysfunctional skin barrier, which causes dry skin and leads to the process of photoaging. Study from Rodrigues et al. (2015) showed that TEWL levels decreased and the skin barrier improved markedly by increased skin hydration levels in 15 women and 5 men who were given coffee extract cream treatment for 30 days [16].

The reduction in TEWL can occur due to the inhibitory activity of hyaluronidase (an enzyme that can degrade hyaluronic acid in the skin, which can reduce viscosity, increase permeability, and cause damage to the extracellular matrix (collagen and elastin fibers), resulting in dry skin) from the polyphenol content of coffee, namely caffeic acid. The chlorogenic acid, which can increase the hydration and firmness of the skin, thus preventing photoaging. [17].

CONCLUSION

Based on the literature review results, it can be concluded that coffee extract can be used as an antioxidant in treating photoaging. The process of preventing photoaging is by reducing the expression of MMPs and increasing procollagen type 1, thereby reducing the area of wrinkles and TEWL.

Declaration by Authors

Ethical Approval: Not Applicable

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