Journal of the Turkish Academy of Dermatology
eISSN 1307-394X

Review DOI: 10.6003/jtad.1372r2

Effects of Ginger (*Zingiber officinale*) on Skin Conditions: A Non Quantitative Review Article

Afshin Kazerouni,* MD, Ory Kazerouni, Nader Pazyar, MD

Address: Department of Dermatology, Imam Hospital, Azadegan Street, Ahwaz, Iran. Postal code: 6193673166
Jundishapur University of Medical Sciences, Department of Dermatology, Ahwaz, Iran.
E-mail: okaz40@yahoo.ca
** Corresponding Author:* Afshin Kazerouni, MD, Resident of Dermatology, Imam Hospital, Azadegan Street, Ahwaz, Iran

Published:
J Turk Acad Dermatol 2013; **7 (2)**: 1372r2.
This article is available from: http://www.jtad.org/2013/2/jtad1372r2.pdf
Key Words: Zingiber officinale, ginger, zerumbone, skin cancer, topical anti-inflammatory activity, anti-tumor promotion, chemoprevention.

Abstract

Background: To review the evidence highlighting the clinically important effects of Ginger on skin conditions and medicine. There are many articles including randomized control trials and experiments, about the effects of Ginger on the skin and on the body in general. This review would give practitioners access to the most relevant medical information on this topic in one article. A systematic review was conducted to synthesize available research literature on the effectiveness of Ginger on skin and medicine. Thirty four articles were chosen to be reviewed. Material from those written in English and most relevant to skin and medical health. The findings suggest that moderate evidence exists to support the use of Ginger in dermatology and general medicine. Ginger is used for its anti-inflammatory effects, anti-oxidant effects, anti-cancerous effects and wound healing effects. Use of Ginger in different dermal and medical situations and its application in the pharmaceutical industry should be based on the strength of evidence. Currently, there is moderate evidence that Ginger helps wound healing, inflammation, aging, and cancer. Continued research is needed to establish a solid base of evidence proving its effectiveness in human.

Introduction

Ginger is gaining considerable attention as a botanical dietary supplement in North America and Europe due to positive results in treating various human ailments like rheumatic disorders, gastrointestinal problems and inflammatory conditions [1]. South Asian people have been known to use ginger as a dietary spice for centuries [1, 2]. The important active components of ginger root are thought to be pungent phenol compounds (such as gingerol and paradol) and volatile oils [3]. Ginger rhizome has been used as fresh paste, flavoring tea, dried powder and preserved in slices, and has been used as a traditional medicine in Asian, Arabic and Indian herbal traditions for many centuries [4]. Population-based studies have shown a lower risk of colon, prostate, gastrointestinal and other cancers in these countries compared to their Western counterparts [5]. Some phenolic substances in ginger have strong anti-oxidative and anti-inflammatory properties; consequently, they can possess significant anti-carcinogenic and anti-mutagenic activities. Ginger root has been shown to possess properties that inhibit the growth of those factors responsible for tumor cell proliferation [6, 7, 8, 9].

Literature Search and Method

CINAHL, PUBMED, Ovid databases were searched with the following keywords 'Zingiber officinale, Ginger, Zerumbone, skin cancer, topical anti-inflammatory activity, Anti-tumor promotion, chemoprevention. There were 35 results; however, one article was excluded as it was not in English. Out of 35 articles, 6 were systematic reviews, 29 were original research publications and there were only two human-based studies.

Findings

1.1. Anti-carcinogenic effects on skin

Chemical chemoprevention is a concept defined as the prevention of cancer by the administration of natural or synthetic pure chemicals, or by daily foods enriched with cancer preventive components [**10, 11**]. Many plant derived compounds have shown inhibitory effects on the tumor promoting stage [**12, 13**]. Tumor production is linked to oxidative and inflammatory stress, so any compound that exhibits an anti-inflammatory and anti-oxidative effect can act as an anti-carcinogenic and anti-mutagenic agent [**5].** Positive evidence illustrating a slowing down, or inhibiting of the carcinogenic process by using phytochemicals in the skin, is receiving increased interest among researchers. Overall, a significant number of in vitro and laboratory animal studies have provided substantial evidence that ginger and its organic pungent vallinoid compounds are effective inhibitors of the carcinogenic process via multiple pathways. Multiple studies showed that rhizome of ginger can abrogate the activation induced by a phorbol-ester promoter, 12-O-hexadecanoylphorbol-13acetate (HPA) and 12-O-tetradecanoylphorbol-13-acetate (TPA) of *Epstein-Barr* virus (EBV) in *Raji* cells; however, no cytotoxicity of rhizomes was observed in these cells [**9, 13, 14, 15**].

[6]-Gingerol has potent anti-oxidant activity. It inhibits phospholipid peroxidation induced by FeCl3-ascorbate and xanthine-oxidase system responsible for the generation of free oxygen radicals such as superoxide anion [**16, 17**]. Another suggested action of these compounds is to suppress proliferation of human cancer cells through induction of apoptosis in transformed and cancerous cells [**18**, **19**]. [6]-gingerol is also known to possess anti-angiogenic activity which may inhibit tumor growth and metastasis as angiogenesis is required for tumor progression [**20, 21**]. Zerumbone mediates its anti-inflammatory and anti-proliferative activities through the modulation of NF-kB activation and inhibition of NF-kB regulated gene expression [**22, 23**]. The carcinogens induce this gene expression, thus its inhibition may provide a molecular basis for the treatment and prevention of cancer [**5, 23**].

These extracts are shown to possess appropriate physiochemical properties for transcutaneous absorption. [6]-gingerol is the main phenylalkanol which has been studied extensively but other vinyl ketones like [6]-paradol have also been shown to possess such properties [**7**]. Increasing the concentration of only [6]-gingerol in plasters applied to skin did not improve the topical anti-inflammatory activity to a great degree, indicating that other vinyl ketones and zerumbone play a significant role [**7, 23**].

1.2. General effects on skin

As humans get older, the skin deteriorates as a result of the aging process [**24**]. This process may be enhanced due to certain diseases like Diabetes Mellitus or use of topical drugs like steroids due to their inhibitory effect on collagen synthesis [**25, 26**]. Topical steroid use may slow down the recovery from skin wounds [**26**]. A simple bruising or abrasion may lead to the development of chronic ulcers with devastating consequences [**25, 26**]. Studies have shown that ginger extract use on skin can improve the structure and function of the skin and concomitantly may reduce the formation of non-healing wounds in at-risk skin [**27, 28**]. [6]-Gingerol helps new blood vessel formation in inflamed and damaged skin which has a reduced vasculature [**3**].

Naturally occurring ginger with skin repair potential and anti-oxidant/anti-inflammatory properties does not cause skin irritation when used in patients suffering from abrasions or slow healing ulcers and may be a better topical drug to use in such cases to improve patient compliance and better skin repair [**28**]. A study on corticosteroid-treated rats showed that pretreatment with topical ginger and curcumin

extract improved healing of induced abrasion skin wounds. No irritation was observed during pre-treatment and wounding/wound healing phases [**28**]. The only approved treatment for such patients in the United States is through the use of all-trans retinoic acid (RA) which is known to cause skin irritations [**29**, **30**]. If the irritation from the treatment is too great, the treatment itself may be counterproductive and lead to noncompliance [**7, 29**].

Minghetti et al. evaluated ginger dry extract for its in–vivo topical activity [**30**]**.** They were of the opinion that it inhibited croton-oil-induced ear edema in mice and this effect can be seen in humans. This anti-inflammatory effect can be through various mechanisms like the inhibition of 5-lipooxygenase, the inhibition of cyclooxygenase, and inhibition of nitric oxide production and/or induction of genes encoding pro-inflammatory cytokines involved in inflammatory reactions [**31, 32, 33**].

Conclusion and Discussion

Overall there is substantial evidence from animal and in vitro studies that ginger and its organic vallinoid compounds are effective anti-inflammatory agents and inhibitors of the carcinogenic process in cell culture systems. Ginger is safe to be consumed by humans and has been found to be non-toxic. Regular use of ginger can be investigated to develop skin cancer strategies at the tumor promoting stage as epidemiological evidence argues strongly that tumor promotion is a critical stage in the development of human cancers [**9, 10**]. Communities with high risk of skin malignancies should be encouraged to consume plants with anti-tumor promoting properties to avoid the use of currently expensive and toxic therapeutic agents [**34**]. The topical use of ginger extract is also possible and can be conveniently used to develop medicated anti-inflammatory plasters which can be assessed for their effectiveness with future clinical studies. Until now, the majority of studies are focused on animals with human experimental studies remaining sparse in this field.

Further Research

Further studies to determine the anti-inflammatory and anti-cancerous activity of this easily accessible and inexpensive natural product should include human intervention trials; although the factors of genetic and environmental vulnerability may act as confounding factors for such diseases within the humans under trial. There is a need for further investigation to identify and isolate the biologically active compounds in ginger and to demonstrate their anti-tumor promoting activity in in-vivo experiments [**9**]. Moreover, there should be studies comparing the systematic versus topical-only routes.

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