

Garlic in dermatology

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Abstract

Garlic (*Allium sativum* L. fam. Alliaceae) is one of the best-researched, best-selling herbal remedies and is also commonly used for treating various health problems. Garlic is widely known for its biological properties and plays an important role as an antioxidant. The purpose of this review is to gather and summarize all dermatologic-oriented *in vitro* and *in vivo* experiments and clinical trials on garlic preparations. Extensive literatures search was carried out and twenty three studies were included. The results suggest that oral administration of garlic is effective on immunologic properties, cutaneous microcirculation, protection against UVB and cancer treatment. Additionally, topical application of garlic extract can potentially be effective on psoriasis, alopecia areata, keloid scar, wound healing, cutaneous corn, viral and fungal infection, leishmaniasis, skin aging and rejuvenation. Clinical effectiveness of oral and topical garlic extract is not sufficiently and meticulously explored as so far.

Introduction

Garlic (*Allium sativum*) is one of the best-researched, best-selling herbal remedies and has been commonly used for treating various health problems for centuries.¹ Garlic is a genus of some 500 species belonging to the family Liliaceae and *Allium* class of bulb-shaped plants.² Its constituents include enzymes (for example, alliinase), sulfur-containing compounds such as alliin, and compounds produced enzymatically from alliin (for example, allicin).^{2,3} Other constituents such as arginine, oligosaccharides, flavonoids, and selenium are available in garlic.^{2,3}

Four garlic preparations including, raw garlic juice (RGJ), heated garlic juice (HGJ), dehydrated garlic powder (DGP) and aged garlic extract (AGE) are available. Different types of garlic preparations have different pharmacologic properties, and among the four garlic preparations, AGE is the most useful of them.⁴ Garlic extract is made from whole or sliced garlic cloves that are soaked in an alcohol solution for different amounts of time.⁵

Ingredients

Aged garlic extract (AGE) is a complex mixture. Its components include allin, cycloalliin, S-allyl-L-cysteine, S-methyl-L-cysteine, S-ethylcysteine, S-1-propionyl-L-cysteine, S-allylmercaptocysteine, fructosyl-arginine, and beta-chlorogenin. It also consists of L-arginine, L-cysteine, and L-methionine.⁶

Mechanism

The compounds involved in the biological mechanisms such as flavenols, sulphur and seleno compounds have been identified.⁷ Garlic is also characterized by more polar compounds of phenolic and steroidal origin showing interesting pharmacological properties.⁸ Aged garlic extract stimulate immune functions such as proliferation of lymphocyte, cytokine release, NK activity and phagocytosis.⁹

Adverse reactions

Adverse reactions, related to garlic are potentially consist of irritant contact dermatitis, allergic contact dermatitis, protein contact dermatitis, zosteriform dermatitis, contact urticaria and induction of pemphigus.¹⁰ The purpose of this review is to gather and summarize all *in vitro* and *in vivo* and clinical trials on garlic preparations and their uses in dermatology.

Dermatologic applications of systemic garlic

Antioxidant effects

Importantly, S-allylcysteine (SAC) and S-allylmercaptocysteine (SAMC) are the major organosulfur compounds in aged garlic extract which prevent oxidant damage. AGE exerts antioxidant action by scavenging reactive oxygen species (ROS), enhancing the cellular antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase and increasing glutathione in the cells. AGE protects DNA against free radicals and defends against UV-induced damage. It also protects against some forms of UV-induced immunosuppression.^{11,12}

Cutaneous microcirculation

A randomized placebo-controlled double-blinded study show that 5 h after the administration of garlic powder a significant increase in capillary skin perfusion occurs by 55% in the healthy volunteers. The increased erythrocyte velocity results from vasodilation of precapillary arterioles which increases diameter of erythrocyte column by an average of 8.6%.¹³

Immunomodulatory effect

The major immunomodulatory proteins have been identified are known as garlic lectins. Aged garlic extract has more potent immunomodulatory effects than raw garlic.¹⁴

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Garlic extract potentially induces the lymphocytes proliferation and macrophage phagocytosis, stimulates the infiltration of macrophages and lymphocytes in transplanted tumors, induces splenic hypertrophy, stimulates release of interleukin-2, tumor necrosis factor-alpha and interferon-gamma and enhances natural killer cell and lymphokine-activated killer cell activity. These activities reflex effective stimulation of the immune response.¹⁵

Anti cancer

Two garlic-derived organosulfur compounds such as Se-methyl selenocysteine and gamma-glutamyl-Se-methyl selenocysteine show anticancer activity.¹⁶ These include the effect on drug metabolizing enzymes, antioxidant properties, tumor growth inhibition, apoptosis, angiogenesis and increasing of natural killer (NK) cells.^{4,17} A molecular study displays that diallyl trisulfide (DATS) is a potential anticancer compound for skin cancer.¹⁸ Studies show that diallyl disulfide (DADS) induces caspase-dependent apoptosis through a mitochondria-mediated by intrinsic pathway in melanoma cells¹⁹ and appears to be a good candidate as an antitumor agent against melanoma.²⁰

UVB protection

Garlic stimulates the proliferation of macrophages and lymphocytes and protects against the suppression of immunity by ultraviolet radiation.²¹ Aged garlic extract contains ingredients that protects from UVB-induced suppression of contact hypersensitivity and suggest that the mechanism of protection is by antagonism of the cis-urocanic acid mediation of this form of immunosuppression.²²

Dermatologic applications of topical garlic extract

Psoriasis

The activation of nuclear transcription fac-

tor kappaB has now been linked with psoriasis. Extensive researches in the last few years have shown this pathway. This transcription factor can be interrupted by garlic (diallyl sulfide, S-allylmercaptocysteine, ajoene).²³

Alopecia areata

A double-blinded randomized controlled trial shows that the use of garlic gel significantly adds to the therapeutic efficacy of topical betamethasone valerate in alopecia areata and it can be an effective adjunctive topical therapy for alopecia areata.²⁴

Keloid scar

Keloid scar is a chronic fibro-proliferative disease. It is hypothesized that garlic extract is able to inhibit nuclear factor-k B (NF-κB), nitric oxide (NO), matrix metalloproteinase (MMP)-2, Interleukin-6 (IL-6) and angiotensin converting enzyme (ACE); therefore, it can be potentially an effective treatment for keloid scar.²⁵

Wound healing

According to a study conducted by Bojs *et al.*, contact allergy to garlic can be effective on wound healing.²⁶ Investigation on chicken skin wounds exposed to aged garlic extract show an increase in the re-epithelialization and profuse dose-dependent neovascularization.²⁷

Viral infection

Components of garlic have been shown to have antiviral effect and inhibit cellular proliferation of virally infected cells. One placebo-controlled trial demonstrates that the application of chloroform extracts of garlic result in the complete resolution of cutaneous warts without recurrence after 3-4 months.²⁸

Cutaneous corn

A clinical trial reveals that the application of garlic extract on the cutaneous corns causes the complete removal of locations. The surrounding fibrin tissue of the corn capsule is lysed and the capsule is separated from the main tissue. It seems due to the fibrinolytic effect of garlic extract.²⁹

Fungal infection

According to a study diallyl sulphide (DAS) and diallyl disulphide (DADS) significantly inhibit proteinase, phospholipase secretion and dimorphism in candida albicans. These compounds can, therefore, act as a potent antifungal in the management of candidiasis.³⁰ On the other hand, ajoene (allium-derived thiosulfinate compound) has been shown to be effective in short-term treatment of tinea pedis. One study shows the use of ajoene as a 0.4% (w/w) cream results in complete clinical cure of tinea pedis. Therefore, ajoene can be an alternative, efficient and low-cost antimycotic drug for short-term therapy of tinea pedis and

superficial mycoses. The fact that ajoene can be easily prepared from an alcoholic extract of garlic may make it suitable for Third World public health care.³¹⁻³³

Leishmaniasis

Treatment of leishmaniasis potentially relevant to Th1-type immune response. *In vivo* and *in vitro* studies demonstrate that garlic extract reduces footpad lesions in leishmania mexicana-infected BALB/c mice by inducing IFN-gamma production from T cells as a Th1 immunomodulator. *In vitro*, garlic extract reduce macrophage infection through induction of nitric oxide (NO) production. It may thus act on both T cells and macrophages to stimulate IFN-gamma production and NO synthesis for parasite killing.³⁴ On contrary, a double blinded, placebo controlled study on 197 patients who received garlic cream 5% or placebo demonstrated it is not effective treatment for cutaneous leishmaniasis.³⁵

Anti-aging

According to an investigation garlic shows beneficial effects on the maximum proliferative capacity of fibroblasts on long-term, therefore, garlic can play a role as an anti-aging and rejuvenative agent.³⁶

Conclusions

Garlic extract can inhibit photocarcinogenesis and garlic extract -containing sunscreens may be valuable in Australasian countries and in cancer-provoking conditions, such as Gorlin's syndrome and xeroderma pigmentosum. Additionally, it can be effective on maximum proliferative capacity on fibroblasts and garlic extract -containing creams may be of particular value in preventing of skin aging and as a novel addition to rejuvenation. On the other hand, garlic extract has been reported as a Th1 immunomodulator and the pathogenesis of psoriasis is relevant to Th1, therefore, it maybe effective on psoriasis in combination with topical steroid and emollient as a new addition to psoriasis therapy.

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