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Aged Garlic Extract – A Health Benefit Review

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ABSTRACT - Garlic ranks highly among foods that help to prevent disease, largely due to its high content of organosulfur compounds and antioxidant activity. However fresh garlic, is not for everyone; it can cause indigestion and its pungent odour that lingers on the breath and skin is a social deterrent. This is the reason why an alternative source to the fresh garlic that is odourless and richer in antioxidants becomes necessary as a dietary supplement- Aged Garlic Extract (AGE). AGE has been found to meet these conditions. AGE has been found to help prevent atherosclerosis and protect against cardiovascular disease, increase circulation and immunity; in preclinical studies AGE has been shown to prevent various kinds of cancer, neurodegenerative disease and have antiaging effects in improving memory, endurance and learning; AGE is also been reported to have potentials as an adjuvant in cancer therapy. The unique characteristics of AGE, its safety and its scientifically proven health benefits are discussed in this article.

KEY WORDS - Aged Garlic Extract, antioxidant, organosulfur compounds

INTRODUCTION

Allium sativum (Liliaceae), commonly known as garlic ranks highly among foods that help to prevent disease, largely due to its high content of organosulfur compounds and antioxidant activity. However fresh garlic, is not for everyone; it can cause indigestion and its pungent odour that lingers on the breath and skin is a social deterrent. These disagreeable effects of fresh garlic are due to allicin, an oxidant, released upon cutting or chewing the clove. Scientific studies, however, showed that garlic does not have to be fresh to be effective nor its smell required for its health benefits (1).

Aged garlic extract (AGE)

An alternate source of garlic, that is odourless and richer in antioxidants than the fresh bulb is the dietary supplement Aged Garlic Extract. AGE is a concentrated form of organic garlic, that has been shown in numbers of scientific studies (2) to be safe and effective in providing health benefits; in humans, AGE has been found to help prevent atherosclerosis and protect against cardiovascular disease, increase circulation and immunity; in preclinical studies AGE has been shown to prevent various kinds of cancer and neurodegenerative disease and have antiaging effects, improving memory, endurance and learning; (1,3) new data also show that AGE has potential as an adjuvant in cancer therapy (4). The unique characteristics of AGE, its safety and its scientifically proven health benefits are discussed in this article.

Production and content of AGE

AGE provides the health benefits of fresh garlic, without its unpleasant side-effects (1-7). The highly standardized AGE is produced by extraction with water and ageing of organic fresh garlic, at room temperature (37°C), for 20 months. The process increases antioxidant levels, well above those of the fresh bulb and converts harsh unstable compounds, such as allicin to stable health-promoting substances. AGE contains mostly stable water-soluble organosulfur compounds, which are powerful antioxidants and are largely responsible for AGE's health benefits; they include S-allyl mercaptocysteine, unique to AGE and S-allyl cysteine that has a 98% absorption rate into the blood circulation (high bioavailability) and is used for standardising AGE (7). AGE also contains some oil soluble organosulfur compounds, flavonoids, a phenolic compound (allixin) and other beneficial nutrients, including selenium (1-6).

Antioxidant effects of AGE

Damage to DNA, lipids and proteins, by Reactive Oxygen Species (ROS), leads to disease and ageing, as ROS damage induces cancer-causing mutations, disrupt enzymes, injure membranes and reduce immunity. ROS, that are by-products of normal metabolism, are normally neutralised by cellular antioxidant enzymes and small molecules, such as glutathione and by

vitamins, minerals and phytochemicals, obtained in the diet. An increased levels of ROS, in inflammation and during exposure to sunlight, ionising radiation, pollutants, exercise and some medications, requires additional antioxidant protection and in its absence oxidative stress occurs. Oxidative stress plays a role in arthritis, atherosclerosis, heart disease, stroke, Acquired Immunodeficiency syndrome (AIDS), cancer, ageing, and in programmed cell death (apoptosis) of neurons, that leads to Alzheimer's disease and other neurodegenerative conditions (1,3).

AGE is richer in antioxidants than other commercial garlic preparations and fresh garlic (1-7) and it also boosts cellular antioxidants such as glutathione that helps in maintaining a healthy immune system and prevent drug toxicity, and peroxidases that eliminate toxic peroxides (8).

Cardiovascular protection

Reducer of cholesterol and blood pressure

Increased levels of Low density of Lipoprotein (LDL) cholesterol, triglycerides and high blood pressure are major risk factors for heart disease and stroke. Clinical studies show that AGE and S-allyl cysteine can help reduce the risk (1,3,9). A daily AGE dose of 2.4 - 4.8 g, for 6 months, reduced total cholesterol by 5-7%, lowering LDL, triglycerides and blood pressure, inhibited platelet aggregation and increased High density Lipoprotein (HDL). The LDL of patients taking AGE showed resistance to oxidation, compared to LDL from controls (9).

S-allyl cysteine, the major compound in AGE, lowers cholesterol by interfering with its synthesis, by inhibiting the enzyme HMA-CoA, the same mechanism as that of the cholesterol-lowering statin drugs (10). When statins are combined with AGE the suppression of cholesterol synthesis is additive (11). AGE may serve as a safe and effective cholesterol-lowering nutrient without the side effects of fatigue and muscle pain associated with statin treatment.

Homocysteine reducer

High blood levels of homocysteine that can result from B vitamin deficiency, including folate, is a major risk factor for heart disease, stroke, Alzheimer's disease and cancer. Preclinical studies at Pennsylvania State University showed that AGE added to the diet lowers homocysteine, in folate deficiency, potentially helping prevent the dire consequences of high levels of this toxic amino acid (12).

Artery and heart protector

A new breakthrough from the University of California Los Angeles (UCLA) showed that AGE cuts heart attack risk factors (13). In a year long, double blind, placebo controlled, clinical trial nineteen cardiac patients, on statin therapy, who received 1200 mg AGE/day, reduced coronary plaque build-up by more than 67%, as measured by electron beam tomography, and improved HDL, compared to placebo (13). AGE also lowered blood homocysteine, while patients on placebo showed an increase.

The UCLA study, adds new critical information to the body of data showing that AGE reduces multiple risk factors associated with heart disease. These include an anticlotting effect (9), stimulation of blood circulation in capillaries (14), anti-inflammatory effects, by inhibiting prostaglandin synthesis (15) protecting arteries from inflammation that accelerates clot formation (15) and as seen above, reduction of LDL, triglycerides, blood pressure and inhibition of LDL oxidation (11).

Though the study was small, their striking results on coronary artery protection by AGE in people with heart disease is hopeful news for those at high risk for heart attacks. AGE can be added to other routine medications for heart disease, such as statins, without side effects, potentially enhancing treatment and helping to postpone the need for cardiac surgery. As for healthy people, adding AGE to the diet could serve as a health strategy, to help prevent atherosclerosis and maintain a healthy heart.

Immune booster

The immune system consists of many types of cells and protective substances that fight infections and help battle life threatening diseases, such as cancer. A strong immune system defends against bacteria, viruses and fungal diseases. When immunity is damaged, such as in the case of AIDS, or compromised by poor diet, stress, environmental pollution, disease and ageing the body is at a loss to fight off infectious organisms. AGE has been shown to stimulate immunity and help combat infection (16).

Antiviral

Preclinical studies showed that influenza virus infection is preventable when AGE is added to the diet for 10 days, before viral infection and is as effective as a vaccine treatment (17). AGE enhances macrophage and spleen cell activity, improves the ratio of helper/suppressor cells in AIDS patients, increases the activity of natural killer cells (NK), that kill invading organisms and cancer cells, stimulates T lymphocyte proliferation, increases lymphocyte toxicity against cancer cells and boosts activity of phagocytic cells (18-20).

In a clinical study, subjects ingesting 1800 mg of AGE/day for 3 weeks, showed a 155.5% increase in NK cell activity, while those receiving 35 grams of fresh garlic/day (equivalent to 10 cloves) had only a 139.9% increase, indicating the superior immune-enhancing benefit of AGE (20). In another study, with AIDS patients, NK cells, that are depleted in AIDS, rose to normal levels after receiving AGE supplement for 6 weeks (21).

Antifungal and antibacterial

AGE inhibits the growth of the yeast *Candida albicans*, the cause of prevalent oral infections in HIV-positive patients and sexually transmitted conditions that have far reaching consequences (22).

AGE kills *Heliobacter pylori*, a virulent organism, linked to stomach ulcers and cancer (23). Since about 84% of people infected with *H. pylori* show resistance to antibiotic treatment, AGE supplementation may be an important cure.

Protection against UV light-suppressed immunity

Ultraviolet light lowers certain types of immunity, by suppressing T lymphocytes, and increases the risk of UV induced cancer. AGE protects against UV induced immunosuppression, by preventing free radical damage and other photoproducts that lower immunity (24).

Anti-allergy effects

Allergies, produced by the release of histamine from mast cells, in response to a stimulus, can interrupt our daily lives in most unpleasant ways. Treatment of histamine-releasing cells with AGE, prevented histamine release by 50% to 90 %, depending on AGE dose (25). Preclinical studies showed that AGE reduced allergic reactions by 24 - 45% following exposure to skin irritants or by an allergant injected into the blood circulation (25).

Combating stress and enhancing vigour

Traditional medicine has long prescribed garlic as an invigorating and anti-stress herb. Studies with AGE confirm this notion, showing that AGE reduces fatigue and enhances vigour (26). Preclinical studies on endurance showed close to a two fold increase in swimming endurance, following an AGE-containing diet (swimming 90% of the time, compared with those who received a placebo who swam only 50% of the time). When tested on a treadmill, AGE supplementation enabled a 1611 second run, nearly twice as long as controls that runs 929 seconds.

In a clinical study in Japan, 130 hospitalized patients showed improved stress symptoms related to their conditions, following intake of AGE and vitamins B1 and B12. The stress conditions were related to respiratory, digestive, neuromuscular, cardiovascular and digestive complaints. AGE supplementation also reduced weakness and fatigue in the patients (27).

Cancer prevention

Cancer, the second major killer in Western countries, results from DNA mutations, that accumulate over time, increasing risk with age. Free radical injury and chemical carcinogen-binding are major causes of DNA damage (28). Garlic-rich diets have been shown to lower the risk of human stomach, colon and prostate cancer (29). For example, an Iowa study of 42000 older women showed that those who ate garlic more than once a week, were half as likely to develop colon cancer, compared with non-garlic eaters. A recent clinical study showed that aged garlic extract prevented new tumours in patients with precancerous adenomas, indicating its potential to help prevent early stages of colorectal cancer (30).

AGE has been shown in preclinical studies to protect against cancer by disabling DNA-damaging free radicals (1), increasing glutathione levels and by blocking carcinogen binding to DNA and by increasing the disposal of carcinogens that enter the body (31). AGE, S-allyl cysteine and allixin, as well as diallyl disulfide, have been shown to inhibit early and late stages of carcinogenesis and prevent cancer in mammary glands, bladder, colon, stomach, liver, lung and oesophagus (32,33).

Cancer therapeutic

AGE and its components may help in cancer therapy. Cancer of the prostate, breast and colon are leading causes of cancer related deaths. Recent cellular studies show that S-allyl cysteine and S-allyl mercaptocysteine inhibit the growth of human prostate cancer cells, the latter, by close to 80%. AGE acts on several fronts in blocking prostate cancer growth; inhibiting polyamines needed for cell division, increasing breakdown of testosterone, that is needed for prostate cancer growth and reducing prostate specific antigen (PSA) levels, a prostate cancer marker (34,35). Other studies showed that S-allyl mercaptocysteine stops the growth of breast cancer cells, erythroleukemia (36) and colon cancer cells (37). S-allyl mercaptocysteine prevented colon cancer cell growth by 71%, disrupting cellular microtubules that form the cytoskeleton and the mitotic spindle in cells, thus disrupting cell division. In addition, S-allyl mercaptocysteine induced cell suicide (apoptosis) in the colon cancer cells, by activating apoptosis signalling pathway enzymes, including caspase that ultimately kills the cells (37).

Sickle cell anaemia therapy

Sickle cell anaemia is a life threatening hereditary disease, in which oxidative stress plays a prominent role. AGE with its high antioxidant activity, has therapeutic effects on the disease. In a 4 week study 5 per patients with sickle cell anaemia ingested AGE at 5 ml a day. The results showed antioxidant protection of the red blood cells and a significant reduction in the sickle cell markers (38).

Neuroprotective effects

Approximately 10% of persons older than 65 years have Alzheimer's disease. The hallmarks of the disease are deposits of beta amyloid protein (Abeta) in the brain and neuron death that also occurs after an ischaemic event and stroke that rob the brain of oxygen and nutrients and can lead to dementia.

AGE has potential to protect the brain against neurodegenerative conditions (39-44), by preventing brain injury following ischaemia (39), protecting neuronal cells against apoptosis, by inhibiting caspase (41,42) and preventing A-beta induced oxidative death (43, 44). S-allyl cysteine also prevents neuronal death following ischaemia and increases cell survival in the hippocampus, the memory region of the brain, by 30%, compared to controls (40).

Anti-ageing effects

Preclinical studies in models that are genetically prone to early aging show that AGE has additional anti-aging effects (45-47). Treatment with AGE or S-allyl cysteine, prevented the degeneration of the brain's frontal lobe, improved learning and memory retention and extended lifespan (45, 46). Isolated neurons from the hippocampus area, grown in the presence of AGE or S-allyl cysteine, showed an unusual ability to grow and branch, which may be linked to the findings that AGE increases learning and cognition (47).

The safety of AGE

The safety of AGE has been confirmed in toxicological tests and in clinical studies with more than 1000 subjects (48,49). High quality control in AGE production, by the Wakunaga company, and standardization by its stable key compound S-allyl cysteine, provides assurance that AGE in capsule, tablet or liquid form, always contains a standard amount of stable beneficial ingredients, as labelled. These facts have made Kyolic AGE the choice garlic preparation in scientific research on the health benefits of garlic, with over 350 studies in major universities.

As there are other garlic products on the market, there is often confusion over allicin, since garlic powder manufacturers advertise allicin as a measure of the product's activity and benefits. Allicin is a volatile and reactive oxidant (50) that is not bioavailable (51).

CONCLUSION

AGE (kyolic) provides the health benefits of fresh garlic and often improves upon it. Safe, effective and rich in antioxidants, AGE:

- Protects against cardiovascular diseases, reducing risk factors for heart attacks and stroke: lowers LDL cholesterol, by the same mechanism as statins, reduces triglycerides, elevates HDL, reduces homocysteine and blood pressure, increases circulation in capillaries, prevents LDL oxidation, clot-forming platelet activity and inflammation, preventing coronary atherogenic plaques.
- Has anti-cancer activity, protects against free radical and carcinogens induced DNA damage and increases carcinogen detoxyfication.
- Protects against toxic effects of pollution, UV light and drug toxicity.
- Boosts immunity and prevents viral, bacterial and yeast infections and allergies.
- Enhances vigour, reduces fatigue and stress.
- Anti-ageing and neuroprotective effects, prevents neuron death, enhances memory, learning and cognition and stimulates growth and branching of neurons of the memory region of the brain, the hippocampus.
- Stops the growth of a wide variety of human cancer cells, including breast, colon, and prostate cancer, melanoma and erythroleukemia and has potential as an adjuvant in cancer therapy.

Taken regularly, AGE provides a comprehensive health care regimen.

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