

## *Allium cepa*: An alternative medicine

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### Abstract

The need for herbs cannot be overemphasized. They are important for daily life endeavours and otherwise. *Allium cepa* is the common onion. Its bulbs have been used as food for centuries, and their popular and distinctive taste enhances the flavour of meals whilst contributing impressive health benefits due to its high contents of antioxidants compounds. *Allium cepa* is being discussed in this work as it will broaden your mind on the importance of this seriously overlooked vegetable and extensively show that its use should not be limited to just within the kitchen in preparing cuisines due to its flavor. Fresh onion juice is used externally to prevent bacterial and fungal infections. It contains thiosulphinate, a compound that is effective in killing many common bacteria, including *Salmonella typhi*, *Pseudomonas aeruginosa*, and *Escherichia coli*. Volatile oil of onion has been shown to be highly effective against gram positive bacteria, the extract or juice of onion has been reported to inhibit *in vitro* growth of some microbes. In addition to inhibitory effects against pathogenic bacteria, onions promote beneficial microorganisms. Onions contain Fructans (fructo-oligosaccharide (FOS)) in about 2.8% FOS (wet wt.) which are non-digestible prebiotics that encourage the growth of beneficial bacteria in the intestine. The vegetable being discussed can be applied in fields such as Pharmacology, Oncology, Dermatology, etc. This study is dedicated to enlightening the reader on some findings so far from experiments with *Allium cepa* as research is still being carried out currently to fully utilize this gift to mankind.

**Keywords:** *Allium cepa*, therapeutics, phytochemicals, herbal medicine

### Introduction

Herbs are nature's gift to mankind. Medicinal herbs contain substances known to modern and ancient civilizations for their healing properties such as phenolics and organosulphur compounds [1]. Most of the modern medicines in use originate from plant metabolites. Herbal medicines have become more popular in recent years because it is believed that these do not show much side effects or toxic effects in comparison to synthetic medicines [2]. Biological scientists have played significant roles in originating meaningful screening and testing models in the overall evaluation of new drug agents.

*Allium cepa* is the common onion. Its bulbs have been used as food for centuries, and their popular and distinctive taste enhances the flavour of meals whilst contributing impressive health benefits. The onion is one of the world's most widely cultivated vegetable [3], with their esteemed culinary use and gustatory qualities spanning history and the globe. Evidence shows they play an important role in protecting against life's major chronic diseases as well as health problems associated with ageing [3]. The fleshy bulb that grows below the ground is mainly used medicinally as well as for food, but other parts of the plant also have their place in traditional medicines [4].

Fresh onion juice is used externally to prevent bacterial and fungal infections. It contains thiosulphinate, a compound that is effective in killing many common bacteria, including

*Salmonella typhi*, *Pseudomonas aeruginosa*, and *Escherichia coli* [2]. It can be applied to wounds and stings on the skin, used to remove warts, used to stimulate hair growth, and even used to reduce unwanted skin blemishes [5]. Internally, onion has been recommended to treat bronchitis, whooping cough, asthma and other respiratory problems; it is believed to help loosen congestion in the lungs and expand the airways [6].

*Allium cepa* is a biennial garden plant having a scape which appears from the second year. As the onion matures, food reserves begin to accumulate in the leaf bases and the bulb of the onion swells.

Many of the active sulphur compounds that have health benefits are not formed until the onions are chopped. However, if left too long, these compounds can change further and lose activity. The compounds are present in a higher concentration when raw, thus it is ideal to chop and use within half an hour [6].

### Therapeutic Uses

#### Antimicrobial activity

Due to the indiscriminate use of antimicrobial drugs commonly used for the treatment of infectious diseases, the drug resistance of microorganisms has increased [7]. This problem has created a renewed interest to search for other new antimicrobial substances from various sources including medicinal plants like *Allium cepa*.

Onions have been shown to possess antibacterial activities. Volatile oil of onion has been shown to be highly effective against gram positive bacteria, the extract or juice of onion has been reported to inhibit *in vitro* growth of *Escherichia coli*, *Serratia marcescens*, *Streptococcus species*, *Acetobacillus odontolyticus*, *Pseudomonas aeruginosa* and *Salmonella typhosa*. Organosulphur compounds have been reported to be responsible for antibacterial effects of onion extract against oral pathogenic bacteria causing dental caries [2, 8].

In addition to inhibitory effects against pathogenic bacteria, onions promote beneficial micro-organisms. Onions contain Fructans (fructo-oligosaccharide (FOS)) in about 2.8% FOS (wet wt.) which are non-digestible prebiotics that encourage the growth of beneficial bacteria in the intestine; they are fermented by bifido bacteria in the body which help maintain the health of the gut and colon [8, 9].

Onions have also been shown to possess antifungal activities. Aqueous onions extract (AOE) shows dose-dependent protective effect against pathogenic yeasts and dermatophytes [10]. AOE inhibits the growth of *Trichophyton rubrum* and *T. mentagrophytes* by affecting their morphology at cellular and sub cellular level as it disrupts the cell membrane and other membrane-bound structures. Volatile oil of onion has been shown to be highly effective against the growth and aflatoxin production of some fungi genera, including *Aspergillus niger*, *Brettanomyces anomalus*, *Candida albicans*, *C. lipolytica*, *Cladosporium werneckii*, *Fusarium oxysporium*, *Geotrichum candidum* and *Saccharomyces cerevisiae*. Onion has also demonstrated protective effects against pathogenic yeasts (e.g. *Cryptococcus* and *Malassezia spp*) in a dose-dependent manner [11]. Welsh onion extracts have been reported to exert more inhibitory activity towards aflatoxin production by some fungi genera (*Aspergillus* and *Candida*) than the preservatives sorbate and propionate at pH values near 6.5, even at concentrations 3-10 folds higher than maximum level used in foods [12].

### Antioxidant activity

Antioxidants are compounds that help in the delay of the oxidative damages in cells. Some phytochemicals have excellent antioxidant activity, including the ability to neutralize potentially harmful free radicals [13]. Antioxidant activity helps prevent a number of chronic diseases, for example, antioxidants may protect against cardiovascular disease by preventing the oxidation of fats, which is part of the process of atherosclerosis (the buildup of fat cells in blood vessels, commonly known as 'hardening of the arteries') [1, 14]. Onion contains quercetin—a potent antioxidant from the group of flavonoids. Quercetin acts as scavenger of free radicals and also as an inhibitor to the oxidation of low-density lipoprotein (this oxidation of low-density lipoprotein is an important step in development of atherosclerosis and coronary diseases) [15]. Protection from arachidonic acid metabolites and lipoxygenase activity is important in prevention of vascular diseases. Quercetin has been shown to not only directly inhibit the lipoxygenase enzyme, but to also suppress consumption of  $\alpha$ -tocopherol, both of which are potent antioxidants against lipid peroxidation [15].

Extracts from the outer scales of onion have exhibited potent free radical-scavenging activities, and hot water extract of fresh aerial parts of *Allium cepa* exhibit

significant inhibition of lipid peroxidation [16]. The antioxidative effects of consumption of onions have been associated with prevention of cardiovascular diseases by inhibition of lipid peroxidation and lowering of low-density lipoprotein (LDL) and cholesterol levels [6]. According to Bhavnan *et al.* [17], quercetin regenerates the activity of other potent antioxidants like vitamin E, inactivates the transitional metal ions by chelation, and is also a catalyst of oxidative processes in the body.

### Cardioprotective activity

For heart diseases, onion is better to use raw or moderately cooked. According to Cavagnaro *et al.* [18], pungency has a positive correlation with antiaggregatory activity of onion which prevents the cardiovascular disease; over-heating significantly decreases these activities and this decrease in pungency and antiaggregatory activity of onion is due to the instability of sulfur compounds against heating. Ischemic heart injury (an important heart disease caused by reduced blood supply) and hypoxia induced cell death can also be treated with methanolic extract of onion [19].

### Anticancer activity

Cancer is a group of disease characterized by the abnormal and unrestrained growth of cells in body organ or tissues. Onions and garlic play an important role in the prevention of a wide range of cancers [20, 21]. The sulphur compounds in onions have proved to be strong anticarcinogens because they increase the activity of the body's own detoxifying enzymes, which remove potentially cancer-causing substances. Lee *et al.* [22] noted that nitric oxide scavenging might be the reason for the anticarcinogenic activity of onion, while El-Aasr *et al.* [23], isolated a new sulfur containing compound from onion which they found to have the potential to inhibit the growth of tumor cells.

Various researchers have suggested that *Allium* vegetable consumption have a strong impact on the prevention of cancer. Dorant *et al.* [24], published that high intake of onions (> 0.5 onion/day) was correlated with reduced risk of stomach cancer beyond the cardia and that neither leek nor garlic supplement use was shown to have this reduced effect. Yang *et al.* [25] also found an inhibitory effect of flavonoid containing vegetables in gastric cancer. Their results showed that intake of kaempferol and quercetin is protective while that of carotenoids is not. High consumption of *Allium* vegetables decreases the risk of *Helicobacter pylori* infection, which has been linked to stomach cancer through ulcer formation [21]. Quercetin has been shown to not only prevent the induction of gastric mucosal injury, but also to promote the healing of gastric ulcers through free radical scavenging [25].

Although high onion intake was associated with decreasing lung cancer risk in stratified analysis, upon correction for dietary and non-dietary determinants of lung cancer, the correlation was not statistically significant [26]. Khanduja *et al.* [27] performed an *in vivo* study of quercetin effects on mice with N-nitrosodiethylamine-induced lung tumorigenesis. The flavonoid was found to decrease tumor incidence by 32% in the initiation phase, but had no effect on already present carcinomas. The mechanism of benefit was thought to be a consequence of antioxidant activity and suppression of lipid peroxidation.

Tobacco smoking has been cited as the major cause of urinary bladder cancer in humans. Human urine was shown

to contain dietary phenols that had antimutagenic effect on a known tobacco-smoke related carcinogen [28]. Extracts from onions were shown to have corresponding effects as the phenols extracted from urine, suggesting absorption of flavonoids after ingestion and a possible role in protection against tobacco carcinogens from dietary intake of vegetables.

Fukushima *et al.* [20] found that both cysteine and S-methylcysteine, found in onions, have chemo-preventive activity for colon carcinogenesis in a rat model. The organosulfur compound S-allylcysteine (SAC) was shown to inhibit colon cancer precursors when administered orally to rats and the mode of action was proposed to be activation of detoxification systems such as glutathione S-transferase (GST). Only the initiation phase of carcinogenesis was affected while promotion and differentiation were not affected [21]. Quercetin, however, was shown to have a large inhibitory effect on colon tumor proliferation in mice suggesting protection at the promotion phase and not at initiation. Quercetin showed a protective effect on oxidative attack of human colonocyte from peroxide attack; thus, colonocytes as well as all cells can benefit from quercetin's scavenging ability. Quercetin was also shown to be highly effective in inducing apoptotic cell death in colorectal tumor cells while sparing normal cells [15]. Therefore, high dietary intake of onions may provide protection from colon cancer by inhibiting both initiation and proliferation through the effects of both organosulfur compounds and flavonoids.

An independent research showed a significant decrease in risk of breast cancer with high intake of onions [29]. Quercetin is suggested to have a significant anti-proliferative effect on breast cancer cells by increasing the activity of reductase enzymes which is known to inactivate cytotoxic carcinogenic compounds. Also flavonoids will not only induce apoptosis in the cancer cell but will at the same time increase the activation of quinoid (anticancer drugs) which would increase the efficacy of the drugs and enable use of lower dosages so as to reduce negative side effects such as those seen with chemotherapy. Another investigation suggested that the marked antiproliferation effect of quercetin was due to causation of conformational changes on the oestrogen receptor protein which inhibits gene transcription [17].

Vora *et al.* [30] reported that leukemia patients die frequently during therapy due to post-therapy infection, or hemorrhage. Onion powder obtained from hot vacuum and freeze-dried onion showed the ability to scavenge the free radical and inhibit the growth of leukemia cells [31].

#### Anti-diabetic activity

Diabetes manifests as a result of high level of sugar in the blood. Diabetes mellitus is affecting most of the human biochemical activities today, but then medicinal herbs have been found to be very useful in its control [32]. Several researches have been done on the effect of onion consumption on diabetic conditions. The organosulfur compounds S-methyl cysteine sulfoxide (SMCS) and S-allyl cysteine sulfoxide (SACS) were linked to significant amelioration of weight loss, hyperglycemia, low liver protein and glycogen, and other characteristics of diabetes mellitus in rats [20], and it was also found that their use (200mg/kg/day) gave results comparable to treatment with insulin or glibenclamide but without the negative side effect of cholesterol synthesis stimulation. A 3% onion powder

diet also reduced hyperglycemia, circulating lipid peroxides, and blood cholesterol (LDL-VLDL exclusively) [33].

The daily use of onion has preventive effects against many glucose disorders [31]. In an assessment of hypoglycemic activity of *Allium cepa* in type 1 and type 2 diabetic patients, it was observed that ingestion of crude *Allium cepa* caused a considerable reduction in fasting blood glucose levels by 89 mg/dl in relation to insulin (145 mg/dl) in type 1 diabetic patients and it reduced fasting blood glucose levels by 40 mg/dl, compared to glibenclamide (81 mg/dl) in type 2 diabetic patients, 4 hours later. Thus, it could be used as a dietary supplement in management of type 1 and/or type 2 diabetes [33].

#### Reno and hepatoprotective activity

Severe exposure to heavy metals like cadmium (Cd) can cause liver and renal defects [34]. Pretreatment with onion prevented the liver from defects like decrease in urine volume, plasma and tissue superoxide dismutase activity (SOD), renal clearance etc. caused by cadmium and this can be attributed to its anti-oxidant activities [35]. In their independent experiment, Obioha *et al.* [36] observed that high dosages of onion extracts can prevent Cd-induced oxidative damages in rat's liver. Cysteine and S-methylcysteine, two common organosulfur compounds found in onions, have chemopreventive activity for hepatocarcinogenesis [35].

A high level of serum uric acid not only directly damages the kidney but is also a risk factor for other diseases like cardiovascular and diabetes [34]. Administration of onion to artificially induced hyperuricemic rats significantly lowered their serum uric acid level. In an experiment performed by Sajitha *et al.* [37], increased Vitamin E level was found in rat's serum as a result of onion administration; this vitamin is reported to have beneficial effect on renal oxidative damage in rats. The flavonoid content of onion has also been shown to create a beneficial effect in aiding renal transplantation. Fermented onion having higher amount of quercetin aglycone prevents the hepatic damage of oxidative agents. So, the use of onion on daily diet can reduce the occurrence of liver diseases [38].

#### Antidepressant activity

Antidepressants are substances used in the treatment of depression. Higher concentration of oxidative species causes anxiety and depression which can be reduced by the use of onion [13], and the polyphenols present in onion are suspected to be protecting the brain from depression and anxiety. Quercetin found in onion has been suggested to be responsible for onion antidepressant activity [26].

#### Anti-ocular infections

Ocular infection could be due to some microbial infection or some defects of the eye like opacification of the lens, shortness of sight, etc. Fresh onion extract was observed to inhibit the growth of the bacteria isolated from ocular infection [39]. It is inferred that some varying quantities of alliin is present in the onion extract and the large quantity that is present in fresh onion extract confers its profound inhibitory effect on all the bacterial isolates obtained in the research [40].

Cataracts which are characterized by lens opacification, have been shown to be triggered by oxidative stress, primarily from hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). Quercetin scavenges the free radical superoxide ion (a major *in vivo*

source of H<sub>2</sub>O<sub>2</sub>). Sanderson *et al.* [41] in their research observed that opacity induced in rat lenses by exposure to H<sub>2</sub>O<sub>2</sub> was almost entirely reversed after incubation with 30 μM quercetin for 4 hours and pretreatment of lenses with quercetin before oxidation was shown to provide 46% protection as compared to control. Therefore, high daily consumption of onions may provide nutritional benefits against the risk of ocular infections and cataract formation [39].

### Androgenic effect

Sexual behavior is one of the major health issues in life. Several conditions can interfere with sexual behavior and many factors such as drug treatment, chemotherapy, toxins, air pollution, and insufficient vitamin intake may have harmful effects on sexual behavior. Onion is a very important aphrodisiac food. It increases libido and strengthens the reproductive organs [42]. Onions were prescribed by the early North American doctors to help with infertility in women. Recent research has reported that phenolic phytochemicals from onion have androgenic activity [43].

Hypogonadism and lack of secondary sexual characteristics in undernourished young men responded quickly to dietary supplemental zinc [44]. Also, patients with low seminal zinc concentrations and poor sperm motility showed great improvement of sperm motility and seminal zinc levels in response to zinc sulfate with fluoxymesterone. Intensive-swimming-induced oxidative stress causes dysfunction in the male reproductive system which can be protected by the administration of sodium selenite and zinc sulfate. Ghalehkandi *et al.* [43], in their research to evaluate the androgenic effect of onion on sperm quantity and viability in comparison with zinc sulfate supplementation in rats, observed that onion has the most important effect on sperm quality which is not seen in the combined use of these elements- sodium selenite, fluoxymesterone and zinc sulfate. They also observed that freshly prepared onion juice significantly affected the sperm number, percentage of viability and motility.

Men with epilepsy have reduced fertility, and this has been attributed to the chronic use of antiepileptic drugs (e.g. Lamotrigine). In a research to evaluate the effects of onion and ginger on sexual behavior of male rat after inducing an antiepileptic drug (lamotrigine), Khaki *et al.*, [45] observed that administration of (100 mg/kg/day) of ginger powder, and freshly prepared onion juice (3 cc for each rat), significantly lowered the adverse effects of lamotrigine, and can have beneficial effects on sexual behavior in male rat.

### Inhibition of dental diseases

Dental caries is defined as an infectious disease with microbial origin that results in destruction of the calcified tissues of the teeth. *Streptococcus mutans*, an acidogenic and aciduric microorganism, which are strongly stimulated by sucrose, is one major group of the bacteria attributed to

dental caries. It has been strongly implicated as the main etiological agents in human dental caries [46]. *Streptococcus sanguinis* competes with *Streptococcus mutans* for colonization sites on tooth surfaces. *Streptococcus sanguinis* is recognized not only for its association with bacterial endocarditis but also because of its antagonist role in dental caries. Assessment of antimicrobial activity of onion extract (*Allium cepa*) on *Streptococcus mutans* and *Streptococcus sanguinis* by Ebrahimi *et al.* [47] showed antibacterial activity when tested *in vitro*. However, pharmacological standardization and clinical assessment of this effect are essential before using onion extract as a preventive measure for human dental caries.

### Phytochemical Content of Onions

Some phytochemicals are biologically active compounds present in edible foods that when ingested, have the potential to prevent or delay the onset of disease. Onions contain high level of non-nutrient compounds which have protective effects against different degenerative pathologies such as cardiovascular and neurological diseases, cancer and other dysfunctions based on oxidative stress.

### Flavonoids

Flavonoids are the major phenolic compounds in onions. *Allium cepa* are among the richest sources of dietary flavonoids and contribute to a large extent to the overall intake of flavonoids [13]. Flavonoids are responsible for the red and yellow pigmentation in onions and they are synthesized by onion plants as protection against damage by UV radiation and by intracellular hydrogen peroxide. Quercetin and kaempferol are the major flavonoids in onions. However, anthocyanin pigments, concentrated in the outer shell of red/purple onions varieties, are only minor constituents of the edible portion. A distinct gradient in total flavonoid content was found between the outer, central and inner edible scales and along the longitudinal axis of the bulb. Also, differences in flavonoid levels between small- and large-sized onions were also found with the small sized onions having more flavonoid content.

Flavonoids are potent antioxidants and reportedly have a wide range of biochemical functions [13]. Flavonoids (C6–C3–C6) can be classified into different subclasses (flavones, flavanones, flavonols, isoflavones, flavanonols, flavanols, chalcones and anthocyanins) according to the degree of unsaturation and degree of oxidation of the 3-carbon skeleton [48].

Flavonoid biosynthesis begins with chalcone formation via chalcone synthase from malonyl CoA and coumaroyl CoA, a derivative of the amino acid phenylalanine. The chalcone is eventually isomerized to yield a flavanone. Specific enzymes then catalyze the formation of each flavonoid subclass [48]. Quercetin and kaempferol are found in the flavonol subclass. The degree of hydroxylation distinguishes them from one another.

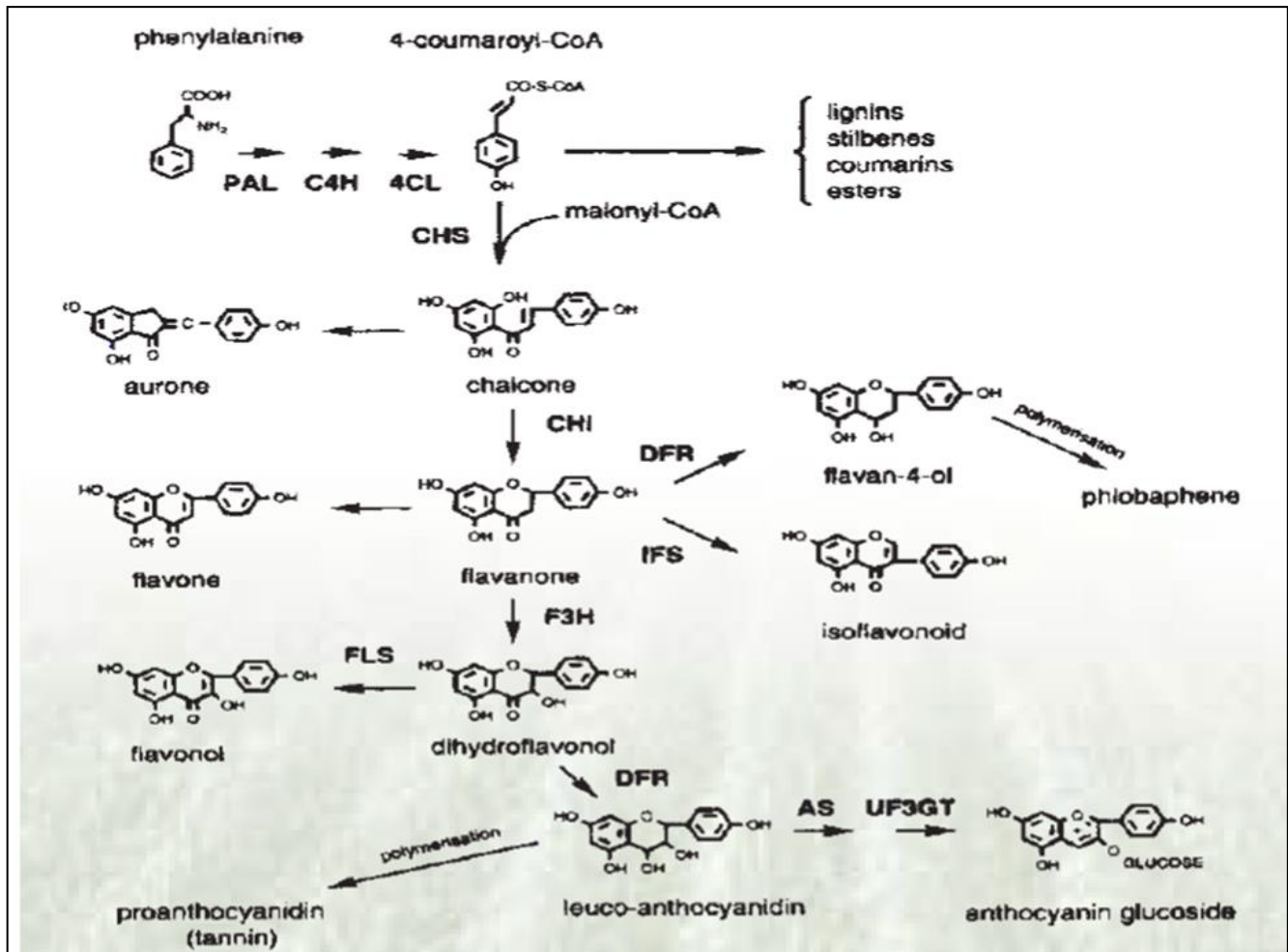


Fig 1: Flavonoid Biosynthesis

Research shows that flavonoids are involved in a host of important functions in the body, such as the immune system, gene expression, blood flow, reduced risk of coronary heart disease, different types of cancer and liver function [1]. The beneficial health effects of the flavonoids are thought to be primarily due to their antioxidative activity including metal ion chelation and inhibition of lipid peroxidation.

Kaempferol, while detectable in certain onion varieties, is present in much smaller quantities than quercetin. Total phenol and flavonoid content of *Allium cepa* were analyzed, and five quercetin chemical species, free quercetin and kaempferol were identified and quantified and quercetin was the major flavonoid accounting for about 80% of onion flavonoid [13]. Therefore, quercetin is the major flavonoid of interest in onions.

Quercetin is a potent antioxidant from the group of flavonoids. Total quercetin in onions differs significantly among varieties [4]. Quercetin has been shown to not only directly inhibit the lipoxygenase enzyme, but to also suppress consumption of  $\alpha$ -tocopherol and to preserve human serum paraoxonase which are both potent antioxidants against lipid peroxidation [26]. Quercetin also regenerates the activity of other potent antioxidant like vitamin E, inactivates transitional metal ions, and inhibits oxidation of low-density lipoproteins (an important step in development of atherosclerosis and coronary diseases). Mechanisms of action include free radical scavenging, chelation of transition metal ions, and inhibition of oxidases such as lipoxygenase enzyme activity [15].

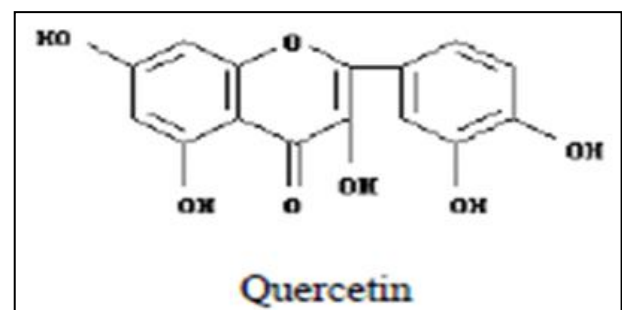


Fig 2: Quercetin molecule.

### Organosulfur compounds

Organosulfur compounds are a subclass of organic substances containing one or more carbon-sulfur bonds and are known for their varied occurrence and unusual properties. These compounds are present particularly in *Allium* vegetables and are converted to a variety of other sulfur containing compounds via hydrolysis by several enzymes when the intact bulb is cut or damaged [49].

Alliums contain numerous organosulfur compounds including thiosulfonates, cepaenes, s-oxide, sulfur, sulfur dioxide, (mono-, di-, tri-) sulfides, and sulfoxides. Sulfur-containing hydrolysis products constitute very diverse chemical structures and exhibit several bioactive properties as well as antimicrobial properties. Thiosulfonate is one of the most studied organosulfur compound, with functional group consisting of the linkage R-S (O)-S-R (where -R are organic substituent) [21], and alliin,

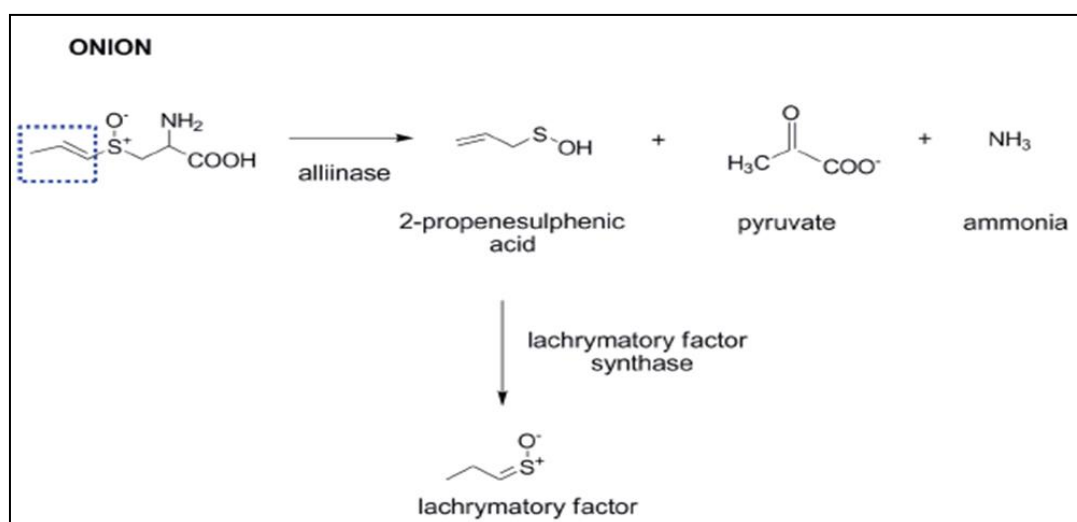
$\text{CH}_2=\text{CHCH}_2\text{S(O)SCH}_2\text{CH}=\text{CH}_2$ , is one of the active ingredients formed when allium is cut, minced or crushed [50].

When an allium is cut, the allinase enzyme released converts alliin (the  $\text{SO}_4^{2-}$ ) to produce sulfuric acids from a stable compound S-alk(en)yl cysteine sulphoxides (ACSOs) which rearrange to form various compounds such as thiosulfinates (allicin), cepaenes, and onion lachrymatory factor [51].

The sulphur transformation in onion is slightly different from that of the other *Allium* sp., and that is why chopping onions cause our eyes to water while garlic – another

member of the allium family – does not. It involves the activity of two enzymes stored in separate cellular compartments from the precursors [51].

Cutting the bulbs breaks the cells and allows the flavor precursors (alk(en)yl cysteine sulphoxide) to mingle with the first enzyme, allinase, a cysteine sulphoxide lyase that rapidly cleaves them to yield pyruvate, ammonia and unstable sulphenic acids (2-propenesulphenic acid) then, the second enzyme, lachrymatory factor synthase (LFS), acts on the sulphenic acid to yield the eye watering propanthial-S-oxide (lachrymatory factor, LF) that gives onions their distinctive pungency.



**Fig 3:** Sulphur Transformation in Onion

The organosulfur components of onion are primarily responsible for the observed antioxidant effects of onion, although other endogenous components, such as phenolics, may have antioxidant properties [25]. They are natural defense for onion against attacks by pest because of their toxicity to insects and microorganisms [51]. The antimicrobial activities of organosulfur content in onions have been reported against a wide spectrum of bacteria, fungi and viruses. The organosulfur compounds in onions have been associated with a reduction of symptoms associated with diabetes mellitus, inhibition of platelet aggregation, prevention of inflammatory processes associated with asthma. They possess anti-inflammatory, anti-allergic, anti-microbial, and anti-thrombotic activity by inhibition of cyclooxygenase and lipoxygenase enzymes. Most likely the compounds work through sulfur-sulfur or sulfur-oxygen linkages [35].

### Saponins

Saponins are a class of diverse range of chemical compounds found in particular abundance in various plant species, and are named for their ability to form soap-like solutions with water and are often bitter tasting.

A number of different saponins have been identified in the *Allium* species [52]. One use of the saponin class of natural products involves their complexation with cholesterol to form pores in cell membrane bilayers. Saponins are believed to be particularly useful in lowering cholesterol. It is thought that saponins cause bile acids to become attached to dietary fibre, which is then excreted in the faeces. To compensate for this, serum cholesterol is converted into bile acids, thus lowering levels of cholesterol in the blood. They

are thought to protect against some cancers by breaking down the cholesterol-rich membranes of cancer cells [38].

[53], in a phytochemical analysis of the polar extract from the red bulbs of *Allium cepa* discovered that the saponins possess antispasmodic activity in the guinea pig-isolated ileum. Such an effect might contribute to explaining the traditional use of onion in the treatment of disturbances of the gastrointestinal tract. Lanzotti *et al.* [54], in their research isolated three saponins- cepeoside A, cepeoside B and cepeoside C from the bulb of *Allium cepa*. The isolated compounds alone and in combination were evaluated for their antimicrobial activities on fungal species and they found a significant synergism in the antifungal activities of saponin against *Botrytis cinerea* and *Trichoderma atroviride*; they were strongly inhibited.

Some saponins have been shown to have anti-inflammatory, antifungal, antiyeast, antiparasitic, antibacterial, antimicrobial and antiviral activity. Because they are not well absorbed into the blood stream they are believed to be useful in a localized effect in the intestinal tract, such as in colon cancer [52]. In addition, the amphipathic nature of the class gives them activity as surfactants, which can be used to enhance penetration of macromolecules such as proteins through cell membranes [55].

### Prospects

Onions have been valued for their medicinal qualities by many cultures around the globe. Numerous health benefits have been attributed to the vegetable, including prevention of cancer and cardiovascular disorders. Scientific studies have shown a positive relationship between the vegetable intake and risk for these common diseases. This has led

many researchers to test whether the proposed medicinal attributes of onions are valid. Many of these studies used non-human subjects; others used experimental assays that mimic processes related to disease that occur in the human body. More research is underway to assess the effects of dietary intake of onions on health in human subjects.

Onion flavour is important to the international onion industry. When cooking with onions, predictability is important- ideally, a salad needs a mild hint of onion aroma, while a stew needs much more to survive the lengthy cooking process. So there is the need not only to avoid the eye watering effect of onion but to also maintain a good onion flavor.

The discovery of the lachrymatory factor synthase (LFS) has opened new exciting approaches to onion flavor. The enzyme lachrymatory factor synthase, was isolated from onions and the sequence of its gene obtained- this directs the decomposition of the products of the alliinase reaction, to give propanthial-S-oxide<sup>[51]</sup>. This suggests that suppressing this enzyme might be the way to avoiding eye watering effect and new flavours in onion. So it is now possible to search for onion varieties with a natural malfunction in the LFS gene and to screen chemical libraries to find inhibitors of the enzyme.

### Conclusion

Most people especially in the developing countries are suffering from many diseases like hypercholesterol, depression, liver and bone problems, due to the lack of or insufficient health facilities. Therefore, there is a need for less costly, effective and also nutritive alternative like onion (a natural cheap food) which has a number of therapeutic effects. It contains a large range of nutritive and non-nutrient compounds which are responsible for its significant activity against various health issues like inflammation, cancer, heart diseases, diabetes, kidney problems and infectious diseases. Incorporation of onion especially in its raw form in daily meals will have beneficial effect on human life and health especially for the common man.

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