ACADEMICIA
An International Multidisciplinary Research Journal
(Double Blind Refereed & Peer Reviewed Journal)

DOI: 10.5958/2249-7137.2021.02105.4

A BRIEF STUDY ON ONION

Dr. Manisha Rastogi*; Dr. Shiva Sharma; Mr. Ayush Madan*****

[1, 2]School of Biomedical Engineering,
Faculty of Engineering and Technology,
Shobhit Institute of Engineering and Technology,
(Deemed to be University), Meerut, INDIA
Email id: Manisha.rastogi@shobhituniversity.ac.in, [2]shiva@shobhituniversity.ac.in

***School of Biotechnology and Bioinformatics,
Faculty of Engineering and Technology,
Shobhit Institute of Engineering and Technology,
(Deemed to be University), Meerut, INDIA
Email id: ayush.madaan@shobhituniversity.ac.in

ABSTRACT

The onion (Allium cepa L.) is an important vegetable that has a high production, domestic, and international commerce. It is historically used as a food component in the Mediterranean diet. In the everyday diet, it is eaten raw, cooked, or processed into various onion products. When onions are added to certain meals, they produce a high concentration of bioactive chemicals that may have health benefits. One of the most widely researched advantages is its impact on cardiovascular disease, which includes hypocholesterolemic, hypolipidemic, anti-hypertensive, antithrombotic, and hypoglycemic actions. Onion consumption has also been shown to have antiproliferative effects in many cancer cell lines, to be involved in bone metabolism and behavior as a potential antidepressant agent, and to stimulate the growth of specific microorganisms in the colon (Bifidobacteria and Lactobacilli) with a general beneficial effect on health. Furthermore, the use of onion as an antibacterial, antioxidant, anti-inflammatory, and asthma-protective substance has been documented in folk medicine.

KEYWORDS: *Antibacterial, Cancer, Onion, Phytochemicals, Vegetable.*

1. INTRODUCTION

Since ancient times, the onion (Allium cepa L.) has been regarded as a culinary and medicinal plant. It is the second most commonly grown vegetable bulb crop after tomato, and it is a vegetable bulb crop that is familiar to most cultures and eaten globally. It's a low-latitude horticulture crop with a short growing season. Due to its highly appreciated flavor, fragrance, and distinctive taste, as well as the therapeutic qualities of its flavor components, it is often referred to as "Queen of the Kitchen." Throughout the year, onions are used in curries, as spices, in salads, as a condiment, or cooked with other vegetables, such as boiled or baked. It's also utilized in a variety of processed foods, including as pickles, powder, paste, and flakes, and it has therapeutic properties[1]–[4]. The depiction of Onion is shown in Figure 1.

Figure 1: Illustrates the vegetable Onion[5]**.**

It is typically eaten raw, but since fresh onion losses in storage have been estimated to be in the range of 20-30%, processed goods are the most practical option. As a result, the international market for onion is increasingly focusing on dehydrated products such as flakes, rings, granules, kibbles, powder, and frozen or canned onions, as well as onion in vinegar, brine, or as essential oil, despite the fact that its commercial products are less abundant than garlic's. Dehydrated foods have a significant economic value, not only because of their culinary applications, but also because of their medical qualities as nutraceuticals, since they contain greater quantities of beneficial chemicals than fresh foods.

1.1 Historical Aspects:

Humans have been eating onions since the Neolithic period, and they are still eaten all throughout the globe. There have always been individuals who enjoyed the usage of onions and utilized them in large amounts throughout this long time, but there have also been others who rejected and despised them. Onions have been grown for at least 5000 years in at least 175 nations across the world. The spherical bulb was considered as a symbol of the cosmos by ancient Egyptians. The name comes from the Latin word unus, which means "one," and the onion was brought to Britain by the Romans, from whence it may have spread to the Americas. The earliest written record of the onion is from 2600–2100 BC and comes from the Sumerians. We learn that leek had a significant part in the kingdom of Ancient Egypt in the Papyrus Ebers, which is based on ancient Egyptian texts and expertise[6]–[9].

a. Botany:

The genus Allium is extremely vast, with numerous wild edible species (only a tiny percentage is commercially grown), and it is widely spread across temperate zones in the northern hemisphere. The primary source of origin is thought to be Central Asia, with the Mediterranean areas serving as a secondary source. There are about 780 species in the genus Allium, with a wide range of physical characteristics. Onion's chromosomal number is 16 (2n).

1.2 Chemical Structure of Prominent Phytochemicals:

a. Saponin:

Saponins are a kind of amphipathic glycoside having foaming properties. One or more hydrophilic glycoside moieties are coupled with a lipophilic triterpene derivative in their structure. Polycyclic (C27) aglycones (C30) are linked to one or more sugar side chains, and the aglycone is either steroidal or triterpene.Figure 2 illustrates the chemical structure of Saponin.

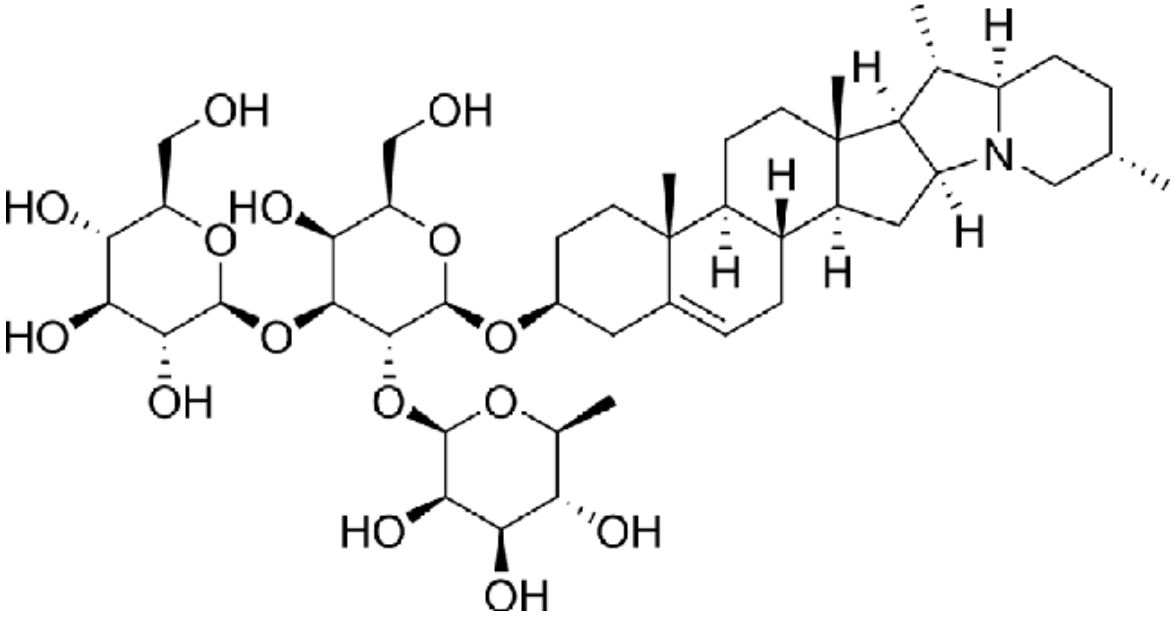

Figure 2: Illustrates the chemical structure of Saponin[10]

b. Quercetin:

Quercetin has five hydroxyl groups, which govern its biological activity and the number of derivatives it may produce. Glycosides and ethers are the two main types of quercetin derivatives found in onions. Only trace amounts of sulfate and prenyl substituents are detected.

c. Anthocyanin:

Organic molecules called anthocyanins are present in the epidermal layer of plant cells. They have a complicated structure that includes an aromatic three-ring molecular region with one or more sugar molecules attached. Anthocyanin is made up of a flavyliumcation (2-phenylbenzopyrilium) that connects hydroxyl (–OH) and/or methoxyl (–OCH3) to one or more sugars. The sugar-free anthocyanidinaglycones and the anthocyanin glycosides are split into the anthocyanins, which are mainly 3 glucosides of the anthocyanidins.

1.3 Properties and Biological Role of Onion Phytochemicals:

a. Properties:

Several studies have shown that alliums' biological and medicinal activities are mostly attributable to their high concentration of organosulfur compounds. The primary sulfur-containing constituents in whole onions and garlic are S alk(en)yl-L-cysteine sulfoxides (ACSOs), such as alliin, and -glutamylcysteines, which, in addition to serving as storage peptides, are biosynthetic intermediates for corresponding ACSOs; from these, and through different metabolic pathways in each vegetable, volatiles such as allicin, and lipid- Onions get their distinctive odor and taste from these chemicals, as well as the majority of their biological characteristics.

b. Biological Roles:

Onions not only provide taste to a dish, but they also contain phytochemicals that are good for your health. Onions include phytochemicals, which are natural substances that have the ability to improve human health and protect against a range of illnesses, including cancer. Antimicrobial, antiallergenic, anti-inflammatory, and antithrombotic properties are all found in organo sulfur compounds. In addition, flavonols found in onions, such as quercetin and kaempferol, have antiviral, antibacterial, anti-inflammatory, and anticancer properties, as well as heart and brain protection.

1.4 Antioxidant Activity:

Flavonoids have long been known to have anti-oxidant effects. It is onion flavonoids' most well-studied and documented action, which protects cells and tissues against reactive oxygen species (ROS). ROS produce free radicals, which cause exogenous damage to cells in many organs. Flavonoids, such as quercetin and kaempferol, have also been shown in vitro to stabilize free electrons produced by ROS. The hydroxyl configuration of flavonoids' B ring plays an important role in scavenging ROS by contributing hydrogen and an electron to hydroxyl and peroxyl, stabilizing them. The flavonoid heterocycle causes a reaction between a free 3-OH and the aromatic rings, resulting in antioxidant activity. Furthermore, studies show that the quantity, location, frequency, and amount of sugar residues all have a role in antioxidant action.

1.5 Antibacterial Activity:

Flavonoids have been shown in many studies to have potent antibacterial effects. Their antibacterial inhibitory effect obstructs the formation of microbial enzymes, adhesins, transport proteins, and other proteins.

Quercetin is a flavonoid that has been researched extensively for its ability to suppress bacterial growth. It has showed tremendous promise in totally inhibiting the development of Staphylococcus aureus. Kaempferol has been proven in studies to be an inhibitor of Helicobacter pylori. Onion and garlic extracts have been shown to have bactericidal effects against Streptococcus mutans, Strep tococcussobrinus, Porphyromonasgingivalis, and Prevotellaintermedia (Gram-positive bacteria), which are the bacteria that cause dental cavities and adult periodontitis, respectively. Onion, on the other hand, is ineffective against Gram-negative bacteria. Aside from organosulfur compounds, some quercetin oxidation products found

in onions have been shown to have antibacterial action against H. pylori and MRSA (multidrug resistant S. aureus).

1.6 Antiviral Activity:

Flavonoids have long been recognized to be effective against viruses, according to studies. Flavonoids have been shown by several scientists to have antiviral action, meaning they can suppress or destroy viruses. The blocking and destruction of viral protein and nucleic acids is the method for limiting viral proliferation.

1.7 Anticancer Activity:

Onion phytochemicals are important in the prevention of a variety of carcinogenic actions. Flavonoids have been shown in many studies to have a beneficial effect in cancer risk reduction. Flavonoids use a variety of mechanisms to prevent cancer, including cell cycle arrest, tyrosine kinase inhibition, p53 protein control, heat shock protein inhibition, and inhibiting Ras protein production (a class of cellular protein). Onion intake, according to Kumar and Pandey, lowers the risk of cancer in many organs, including the prostate, stomach, breast, and lungs. In a human phase I study, quercetin was evaluated as a tyrosine kinase inhibitory drug. Ovarian cancer, lung cancer, leukemia, bladder cancer, prostate cancer, breast cancer, and pancreatic cancer have all been linked to kaempferol.

1.8 Anti-inflammatory Activity:

Inflammation is a complicated biological reaction. Pathogen infection, chemical irritation, and damage to cells and tissues are all known to trigger it. Many animal models have been used to demonstrate the function of flavonoids in the prevention of inflammation, and quercetin and kaempferol have been shown to be effective anti-inflammatory drugs. In vitro, quercetin has been shown to block various isotypes of immunoglobulins such as IgM, IgG, and IgA, all of which are mitogen triggered.

1.9 Hepatoprotective Activity:

The term "hepatoprotective" simply refers to the ability to protect the liver from harm. The flavonoid's property in this respect has been well investigated. Quercetin supplementation has been found to protect mice's liver cells against iron excess hepatic damage. Hepatoprotective properties of anthocyanin have also been discovered. The anthocyanin cyanidin-3-O-glucoside (C3G) has been discovered to enhance hepatic Gclc expression for protein kinase A activation by raising cAMP levels, which aids in phosphorylation of the element binding protein for improved Gclc transcription.

1.10 Antihypertensive Effect:

A study of hypertension in rats found that quercetin and its methylated metabolite isorhamnetin, found in onions, can lower blood pressure and prevent angiotensin-II-induced endothelial dysfunction by inhibiting the overexpression of p47phox, a membrane NADPH oxidase regulatory subunit. The increased superoxide production resulted in a high nitric oxide level. Other studies in hypertensive rats using ethanolic extracts of onion and garlic found that oral administration of extracts on a normal salt diet or during a high salt diet had no effect on blood pressure.

1.11 Antiplatelet or Antithrombotic Effect:

In vitro, onion suppresses platelet aggregation, and many platelet inhibitors have been extracted and identified. According to studies on onion's antithrombotic properties, its aqueous extracts prevent the production of thromboxane, a powerful inducer of platelet aggregation. The antiplatelet action of onions is thought to be a characteristic of organosulfur compounds, according to many epidemiologic research. Antithrombotic action has been discovered in a family of -sulfinyl-disulfides (cepaenes) present in onion extracts.

2. DISCUSSION

The onion (Allium cepa) is a Central Asian native and one of the world's oldest cultivated plants, having been grown for almost 4000 years. Onions and other members of the genus Allium have long been used for a variety of functions, including food preparation and flavoring. The significance of onion stems from the flavor it gives to other meals as a result of its composition. When onions are added to certain meals, they produce a high concentration of bioactive chemicals that may have health benefits. One of the most widely researched advantages is its impact on cardiovascular disease, which includes hypocholesterolemic, hypolipidemic, anti-hypertensive, antithrombotic, and hypoglycemic actions. The significance of phytochemicals in the treatment of a variety of human diseases distinguishes the onion as a valuable commodity in the culinary and pharmaceutical industries. The creation of top cultivars with high phytochemical content is crucial for onions' future in the food sector.

3. CONCLUSION

The onion is one of the most often used vegetables for improving the flavor and taste of a broad range of dishes throughout the globe. Aside from that, onion plays a significant function in salads when eaten raw because of the health advantages of direct phytochemical consumption in the raw form. The significance of phytochemicals in the treatment of a variety of human diseases distinguishes the onion as a valuable commodity in the culinary and pharmaceutical industries. The creation of top cultivars with high phytochemical content is crucial for onions' future in the food sector. More study is needed at every step of production, from the farmer's field to the processing facility, and appropriate methods must be created to maintain the beneficial phytochemicals for human health.

By establishing a quality-based technique for processing raw onions, phytochemicals in onions may be maintained. There is a dearth of scientific data on the effects of postharvest processing techniques on the phytochemicals found in onions. More study is also required on the effect of preharvest techniques on phytochemical development, which has yet to be fully investigated.

REFERENCES:

1. A. Melnikovas, "Towards an explicit research methodology: Adapting research onion model for futures studies," *J. Futur. Stud.*, 2018, doi: 10.6531/JFS.201812_23(2).0003.

2. UK Essays, "Research Onion - Explanation of the Concept," *Essays*, 2017.

3. K. Sharma, N. Mahato, and Y. R. Lee, "Systematic study on active compounds as antibacterial and antibiofilm agent in aging onions," *J. Food Drug Anal.*, 2018, doi: 10.1016/j.jfda.2017.06.009.

4. H. Ouyang, K. Hou, W. Peng, Z. Liu, and H. Deng, "Antioxidant and xanthine oxidase inhibitory activities of total polyphenols from onion," *Saudi J. Biol. Sci.*, 2018, doi: 10.1016/j.sjbs.2017.08.005.

5. "the-health-benefits-of-onions-main-image-700-350-8425535." https://www.bbcgoodfood.com/howto/guide/ingredient-focus-onions (accessed Aug. 01, 2021).

6. E. Y. Ko, S. H. Nile, K. Sharma, G. H. Li, and S. W. Park, "Effect of different exposed lights on quercetin and quercetin glucoside content in onion (Allium cepa L.)," *Saudi J. Biol. Sci.*, 2015, doi: 10.1016/j.sjbs.2014.11.012.

7. J. Mitra, S. L. Shrivastava, and P. S. Rao, "Onion dehydration: A review," *Journal of Food Science and Technology*. 2012, doi: 10.1007/s13197-011-0369-1.

8. K. Sharma *et al.*, "Temperature-dependent studies on the total phenolics, flavonoids, antioxidant activities, and sugar content in six onion varieties," *J. Food Drug Anal.*, 2015, doi: 10.1016/j.jfda.2014.10.005.

9. I. Mehta, "'Origin and History of Onions,'" *IOSR J. Humanit. Soc. Sci. (IOSR-JHSS*, 2017.

10. "Chemical-structure-of-saponin." https://www.researchgate.net/figure/Chemical-structure-of-saponin_fig1_319703260 (accessed Aug. 01, 2021).