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Review on Validation Preclinical and Traditional Claims of *Allium cepa* for Recent Clinical Use

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Abstract: *Allium cepa*, an annual herb (onion). Its Latin name is *Allium cepa*, and it is a member of the Liliaceae family. It is referred to as Pyaj in Hindi.

A versatile food plant called an onion is used to make traditional Indian spices. It has long been utilised for nutritional and physiological benefits and is highly significant to human health.

India is the world's second-largest producer and exporter of onions. It also has flavonoids, proteins, vitamins, and minerals, as well as some substances that contain sulphur.

As a therapeutic agent, it aids in the treatment (reduction) of conditions like high cholesterol, diabetes, joint problems, digestive problems, appetite loss, gallbladder diseases, angina pectoris, high blood pressure, atherosclerosis, sore throat, asthma, bronchitis, cough, intestinal gas, and intestinal worms.

Numerous biological effects, including anti-oxidants, anti-inflammatory, anti-cholesterol, antihypertensive, anti-cancer, anti-arthritis, anti-bacterial, bronchodilator, expectorant, antispasmodic, antiseptic, carminative, anti-coagulant, fibrinolytic, anti-helminthic, anti-platelet, hepatoprotective.

Keywords: *Allium cepa*, flavonoids, traditional & clinical use.

I. INTRODUCTION

The onion, *Allium cepa* L., is a versatile food plant and a long-used spice with significant health benefits. When diced, onions have a strong flavour and contain chemicals that can irritate the eyes. [1]

Due to their association with numerous pharmacological effects, onions and other plants in the *Allium* genus have historically been used as herbal remedies for a variety of diseases.

This practise dates back to ancient times, when (*Allium cepa*, L.) Have been an important dietary resource and have also been of interest for medical purposes. [2]

The consumption of onions is said to provide both nutritional and health benefits. Known as the "Queen of the kitchen," they have flavour, scent, a unique taste, and therapeutic characteristics.

A large genus with 4000 species, *Allium*. [3,4] Other names for *Allium cepa* include Onion in English, Vaengayam in Tamil, Savala in Malayalam, Ullipayalu in Telugu, Ulligadde in Kannada, Payaz in Hindi and Punjabi, piyaz in Bengali, Dungri in Gujarati, Sawalo in Konkani, Kandaa in Marathi, and piaja in Oriya [5].

Onions require specific conditions for the best growth, including stone-free, loamy, sunlight, excellent drainage, well-irrigated soil [6] with significant amounts of nitrogen, phosphorus, and potassium are required for maximum yield [7].

A. *Cepa* contains sugar, carbohydrates, water, proteins, vitamins, fibre, potassium, vitamin C, B6, and trace amounts of the mineral schromium.

Variety, sulphate fertility in soil, water supply, which plays a key role in determining pungency and flavour, storage, environmental conditions, and flavour of it is due to sulphur compounds developing throughout the season, growth of onion under dry conditions will increases nutritional value can vary with temperature, which plays an important role in onion development as in hotter conditions more sulphur and pungent flavour will be produced[8].

A Taxonomical Classification Of Allium Cepa

Table no. 1 Taxonomical classification

1	Scientific Name	<i>Allium cepa L.</i>
2	Kingdom	Plantae
3	Division	Magnoliophyta
4	Class	Liliopsida
5	Order	Asparagales
7	Genus	<i>Allium</i>
8	Species	<i>Allium cepa</i>
9	Edible parts	Leaves, flowers, seed, root

B. Organoleptic Properties[9,10].

Colour	-	Red
Odour	-	Strong, cutting the bulb stimulates lachrymation.
Characteristic	-	Alliaceous
Taste	-	Spicy

C. Nutritional Value of Onion Values per 100 gm Edible Portion

Table no. 2 Nutritional value of onion

Moisture	86.6%	Calcium	47mg
Protein	1.2%	Phosphorous	50mg
Fats	0.1%	Iron	0.7mg
Minerals	0.6%	Vitamins c	11mg
Fibre	0.4%	Carbohydrates	11.1%

D. General Phytochemicals Present In Plant Are Following

Table no. 3 Phytochemicals

Sr. No	Class	Phytoconstituents
1	Carbohydrates	Inulin, fructooligosacharides isorhamnetin-4-glucoside, galactose, glucose and mannose
2	phytoestrogens	coumestrol, zearalenol, isoflavones and humulone
3	essential oils	protocatechnic acid, thiocyanate
4	Vitamins	Vit A, B complex, C and E
5	minerals	selenium, phosphorus, iron, calcium and chromium)
6	flavonoids	quercetin, apigenin, rutin, myricetin, kaempferol, catechin, resveratrol, epigallocatechol-3-gallate, luteolin and genistein
7	Oganosulfuric compounds	thiosulphinates, cepaenes, cysteine, S-methyl cysteine sulfoxide, diallyl disulfide, allyl methyl sulfide, allyl propyl disulfide, gammaL-glutamyl-trans-S-1-propenyl- L-cysteine sulfoxide, S-propenyl cysteine sulfoxide, S-alk(en)yl cysteine sulfoxides and S-allyl cysteine sulfoxide)
8	allicin	Diallyl disulfide, diallyl trisulfide and ajoene
9	phenolic compounds	phenolics, phenolic acids, anthocyanins and hydroxycinnamic acid
10	Lipophilic antioxidant	Dialkyl disulfides

Sr . No.	Isolated Phyto	Chem ID (pubchem)	Plant Part	Extract/ fraction method	Traditional use	Pharmacological activity		MOA	Ref.
							Pre-clinical		
FLAVONOIDS									
1	Fistein(3,7,3,4-tetrahydroxy flavone	5281614	Bulb	Ethanolic#	inflammation	Anticancer		Inhibitory activity in B 16melanoma cells (melanin)	Battagani deepthi et.al.2021
2	1)Quercetin-4-glucosides and 2)isorhamnetin-4glucoside	5320844,44259381	Peel	Ethanol #	Heart disease	Neuroprotective		AChE inhibitory activity	Manoj Kumar.et.al 2021
3	1) Flavones 2 flavonols	597962,11349	Bulb	Methanol#	Malaria, tumor	Hypo-glycaemic &Antidiabetic			A.Airaodion. et.al.2020
4	1)Epicatechin, 2)morin, 3)catechin, 4)Myricetin, 5)kaempferol	72276, 5281670	Peel	Ethanol, Methanol,# Aqueous extract	Reduce bloodglucose	Anticancer		Human colorectal adenocarcinoma (HT-29) cells	Manoj Kumar.et.al 2021
5	1)Quercetin	5280343	Peel	Ethanol#	Viral infection	Anti-obesity, cardioprotective		Triglyceride was reduced due to OPE upregulated themRNA levels of (CPT-1a) & FABP4	Manoj Kumar.et.al 2021
6	1) quercetin 2) isorhamnetin	5280343,5281654	Seed	Methanol #	Hydroalcoholic ,ethanol , maceration	antihypertensive		prevent angiotensin-II-induced endothelial dysfunction by inhibitingthe overexpression of p47phox	M Kazem
7	1)querectin	5280343	Bulb	Methanol	Viral infection	Anti-spasmodic and anti-diarrheal effects*			F. Kianian. Et.al2020

8	1) Quercetin, 2) Kaempferol	5280343, 5280863	Root	Methanol	Inflammation, protect the liver	Anti-asthma effects*	Decreased nasal secretions and edema	F. Kianian. Et.al2020
9	1) Quercetin	5280343	Bulb Juice	Methanol	Viral infection	Urogenital system*	Decreased cellular proliferation, inflammation and apoptosis in atypical prostatic hyperplasia	F.Kianian. Et.al2020
10	1) flavonols – 2) quercetin and 3) kaempferol	528063, 5280343, 5280863	Bulb	ethanol	Prevent metabolic disease	Anti-allergenic		K p greeshma.et. al2020
11	1) quercetin	5280343	Peel	Aqueous	Viral infection	Anti-platelet	upregulation of cAMP levels and the reduction of TXA2, Ca ²⁺ , cyclooxygenase-1 (COX-1),	arka jyoti Chakraborty .et.al2022
12	Quercetin	5280343	Leaves	Hydroalcoholic		Anti-obesity	Pancreatic lipase inhibition	Kim .H,Y 2005
PHENOL								
13	1) Anthocyanins 2) phenolic acid	145858,	Bulb	Methanol, ethanol	Anti-diabetic, obesity	antibacterial	Inhibited by Listeria monocytogenes organism	Santas et al.2010
14	1) Methyl-4-hydroxyl cinnamate	5319562	Bulb	Ethanol #	Fungal infection, inflammation	Cancer preventive	Reduce murine hepatoma (hepatic) cells	Joaheer d. teshika.et. al2018
ORGANOSULPHUR COMPOUND								
15	1) S-methyl cysteine sulfoxide, 2) S-allyl cysteine sulfoxide	115015, 121922	Bulb	Methanol, aqueous	Reduce blood glucose level	Anti-diabetic *	Increased production and secretion of insulin, decrease in dietary glucose absorption	Farzaneh Kianian. Et.al 2020

16	1) diallyl disulfide, 2) s-allylcysteine (SAC), 3) allinase	16590,9793 905	Bulb	Ethanol (95%)#	Treatment of cancer	Anti-cancer		Kundan singh bara et.al
17	1) S-alk(en)yl cysteine sulfoxide,	115015	Bulb	methanol	Inflammation, pain, swelling, fever	Atherosclerosis*	by inhibiting lipid peroxidation	Farzaneh Kianian. Et.al 2020
18	1) Diallyl sulfide, 2) diallyl disulfide, 3) trisulfide	11617,1659 0,16315	Bulb	acetone	Obesity, hypertension	antifungal	-	Irkin 2007
19	Cepaenes, thiosulphinates		Bulb	methanolic		Neuroprotective	-	Richa shri et al 2008
20	1) Cycloalliin	12305351	Leaves	ethanol#	-	Fibrinolytic*	-	R k Agarwal 1977
21	1) dialkyl disulfide (Alicin), 2) diallyl disulfide (DAS)	(2)16590,				Serum testosterone level increase	reduced lipid peroxidation index [malondialdehyde (MDA)] and increased superoxide dismutase (SOD)	Vahid 2014
PROTEIN/AMINO ACID								
22	1) Methylcysteine,	225710	Bulb	Petroleum ether & ethanol #	Headache, heart diseases, parasitic infections	Antihyperglycemic	Not mentioned	Kumari. et al
23	1) lectin 2) agglutinin		Bulb			Immunomodulatory	Macrophage activation	Vaddi k.prasanna. 2015

24	1) anthraquinone 2) coumarin	323, 6780	Bulb	Methanolic#	Anxiolytic activity ,Anticonvulsant activity	Gaba agonism	Gummalla Pitchaiah et al
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*- clinical activity#- Soxhlet method

Sr no.	Publication number	Title	Assignee
1	US20020187207 A1 *	Method for extracting, fractionating and purifying polyphenolic compounds originating from fresh plant sorting deviations using a high adsorption and elution performance resin	Institut National De La Recherche Agronomique Inra
2	WO2009141834A3 *	The present invention deals with a process of preparing quercetin enriched and microencapsulated flavoured bioactive fraction from red onion (<i>Allium cepa L</i>), which possesses significant antioxidant and chelation properties.	Council Of Scientific & Industrial Research
3	EP2454950A1 *	An onion extract which contains glutamyl methionine, quercetin and protocatechuic acid were identified	Takasago International Corporation
4	US10328067B2 *	Pharmaceutical oral dose formulation and composition of matter, p – glycoprotein efflux transporter	David W. Thrower
5	US5093122A	A method of preparing a composition comprising an extract of an Allium genus plant and S-allylcysteine	Wakunnga pharmaceutical co ltd

E. Utilizing Onions In Alternative Medicine

- 1) It is mostly used as a traditional cold remedy.
- 2) It stimulates the respiratory system and aids in sputum ejection (phlegm).
- 3) It has essential oils that encourage perspiration by stimulating the sweat glands.
- 4) It makes blood pressure normal.
- 5) It makes you more hungry.
- 6) It aids in diarrhoea prevention.
- 7) It contains a lot of sulphur, a crucial ingredient that prevents or kills fungal diseases.
- 8) It prevents the formation of cancerous cells, particularly colon cancer. Traditional healers all around the world are well aware of the anti-colon cancer qualities of green onions.
- 9) Vitamins A and C are present. It also contains calcium in the white portion.
- 10) It's a tasty starter.

II. PHARMACOLOGICAL ACTIVITY

A. Antibiotic Activity

Gram-positive and Gram-negative bacteria are both susceptible to the antibiotic effects of onions [11]. The *Allium cepa* fresh raw extracts have strong antibacterial properties against microorganisms that are resistant to antibiotics [12]. The antibacterial activity of onion extracts against the test organisms has been demonstrated [13].

B. Antiviral Activity

The organosulfur chemicals quercetin and allicin, which are abundant in onions and garlic and have antiviral properties, limit viral infection [14]. The natural chemicals present in garlic and onions can be exploited as potent inhibitors against the primary protease of COVID-19 by investigating the molecular docking of that enzyme [15].

C. Antioxidants Activity

Due to the presence of large amounts of naturally occurring antioxidants like polyphenols, flavonoids, and organosulfur compounds, A. Cepa has the potential to be an antioxidant [16,17]. Antioxidant properties of quercetin-3'-O-beta-D-glucoside obtained from *Allium cepa*[18].

D. Effects of anti-obesity

Onion peel extracts (OPE) high in quercetin have been shown to have anti-obesity effects. According to the findings, after 12 weeks of taking 100 mg of OPE capsules on a regular basis, there was a significant decrease in body weight (from 70.0 kg to 69.2 kg), BMI (from 26.6 kg/m² to 26.3 kg/m²), and waist circumference (from 91.9 cm to 89.9 cm)[19].

E. Anti-arthritic Properties

The prevention of the main symptoms of arthritis and the reduction of joint damage brought on by CFA immune- mediate regulation monoarticular arthritis developed in rats were both demonstrated by extract of onion skin[20].

F. Cancer Prevention

Hepg2 cancer cells are resistant to an onion peel extract in ethanol (human liver cancer cell lines) Antigen- damaging action was found. Reduced intracellular ROS at doses of 1-100 g/ml. DNA damage in human leukocytes caused by reduced H₂O₂ and hydroxynonenal[21].

G. Hepatoprotective Properties

Onion extracts may be hepatoprotective against oxidative damage brought on by cadmium in rats. Onion methanolic extract significantly improves hepatoprotective action against hepatotoxicity brought on by paracetamol. In a dose-dependent way, *allium cepa* decreased total serum bilirubin and alanine aminotransferase. After the course of therapy, extract decreased the alanine aminotransferase level at 200 mg/kg by 15.79%, at 300 mg/kg by 20.67%, and at 450 mg/kg by 21.99% while also lowering the serum bilirubin[22].

H. Hypertension Prevention

The quercetin-containing hydroalcoholic extract of onion peel has anti-oxidant, antioxidant, and Ca²⁺ influx inhibitory properties in vascular smooth muscle cells[23]. Through inhibiting the overexpression of p47phox, a regulatory subunit of the membrane NADPH oxidase, a hypertension study using some rat models has shown that quercetin and its methylated metabolite isorhamnetin, found in onions, can lower blood pressure and prevent angiotensin-II-induced endothelial dysfunction. Nitric oxide had a high bioavailability as a result of the enhanced superoxide generation that followed[24,25].

I. Antiplatelet Activity

Inhibition of platelet aggregation was studied using various doses of quercetin and its glycosides, including quercetin (Q), quercetin-4'-O-monoglucoside (QMG), and quercetin-3, 4'-O-diglucoside (QDG). It was shown that the inhibitory impact of quercetin grew in a dose-dependent manner; 2.0 mg/ml demonstrated 100% inhibition of platelet aggregation, whereas 0.5 mg/ml nearly had no effect. Similarly, it was shown that quercetin glucosides at 2.0 mg/ml had 100% inhibitory effects on platelet aggregation. Quercetin-4'-O-monoglucoside (QMG) was more efficient than Quercetin-3, 4'-O-diglucoside (QDG) in the prevention of platelet aggregation, but both quercetin glucosides shown a distinct effect at 1 and 0.5 mg/ml.

J. Hypolipidemic effects

were demonstrated by sulphur compounds produced from onions, such as S-methyl cysteine sulfoxide and allyl propyl disulphide [26]. These have been demonstrated in rats and rabbits, and they reduce the effects of diet- induced atherosclerosis, preserve the action of hypolipidemia, and have inhibitory effects on platelet formation[27].

K. Anticoagulant Activity

Red onion aqueous extract has anticoagulant activity and had investigated by using the principles of prothrombin time test in In-vitro study [28]. Onion extract has anticoagulant property through prohibition of clot formation and coagulation process [29].

III. CONCLUSION

Allium cepa plant shows the presence of sulphur compounds, glycosides, quercetin, flavonoids, phenol compounds, diosgenin, organosulfur compounds, S-alk(en)yl cysteine sulfoxides, cycloallin, allylsulfides, seleno compounds, sugar, water, carbohydrates, proteins, vitamins, fibre, and potassium allium cepa. It also shows the presence of compounds demonstrating various therapeutic and pharmacological activity. as future aspect it may be shows various therapeutic importance.

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