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An Extensive Review on *Allium ampeloprasum* A Magical Herb

Purnima Dey[1], Kazi Layla Khaled[2]

[1, 2]Department of Home Science, Calcutta University, 20B, Judges Court Road, Kolkata-27, India

Abstract: ***Allium vegetable has been used as folk medicine since ancient times. Allium genus has over 600 members which differ in maturing, color and taste; however, they are similar in biochemical content. Allium ampeloprasum, is a monocotyledon plant of the lily family (Liliaceae) and belongs to the genus Allium. It has a characteristic taste and morphological features, making it to be considered as one of the popular herbal medicine. A scrutiny of literature revealed some notable pharmacological activities of the plant such as antidiabetic, hypolipidaemic, antimicrobial, free radical scavenging and anti-inflammatory role. This review attempts to encompass the available literature on Allium ampeloprasum with respect to its pharmacognostic characters, ethanobotanical and traditional uses, chemical constituents and summary of its various pharmacological activities and clinical effects.***

Keywords: Allium ampeloprasum, pharmagonostic, pharmacological, herbal medicine.

1. Introduction

The rapid industrialization & overgrowing urbanization have produces major health concerns globally [1]. Many factors like

- Normal metabolic process
- Intake of carcinogenic chemicals through food
- Harmful exposure to environmental factors like

a) Sunlight
b) Cosmic Radiation
c) Pollutant

All produces harmful free radicals which are responsible for many degenerative diseases like cardiovascular diseases, diabetes, cancer & aging [2].

Now a day's people are more dependent on the modern allopathic drugs for the treatment of these ailments. But sometimes their strong curing properties and prolonged use produce adverse reaction on human system. To avoid the unwanted side effects of synthetic drugs, 'Nutraceutical' compounds are getting popular in recent years. The word combines "Nutrition" and "Pharmaceutical" to mean, that food extracts which can be used as preventive drugs or food supplements. These compounds mainly have antioxidative property due to presence of many phytochemicals and thus prevent many degenerative & other diseases [3].

Garlic is one such spices having 'Nutraceutical' properties which is belong to the genus Allium. An extensive research has already been done on the medicinal property of common Garlic (*Allium sativum*). Ongoing researches on Allium now found that single pod garlic *(Allium ampeloprasum)* have more medicinal property than other Alliums, & traditionally used as remedies for over 5000 years. But only a few studies have been performed on *Allium ampeloprasum* in this area. *Allium ampeloprasum* Linn is a monocotyledon plant and member of the onion genus Allium. The wild plant is commonly known as (Broadleaf) wild leek. The single pod garlic with a single cloved highly prized for its medicinal property. [4]. It is believed that its medicinal benefit is much greater than the multiple clove garlic or *Allium sativam Linn* commonly used as condiments and spices.

2. Plant Description

2.1 Scientific name –*Allium ampeloprasum*

2. 2 Habitat *Allium ampeloprasum* L. is native to the Mediterranean region (S. Europe, Northern Africa to W. Asia), though it has been introduced in other regions of the world, such as North and South America and Australia [5]and cultivated in different parts of Asia including India. [6].

2.3 Physical Appearance and Characteristic

Allium ampeloprasum (Family Amaryllidaceae Subfamily-Allioideae) is a medicinal plant well known for its pharmaceutical potential. The wild plant is commonly known as (Broadleaf) Wild Leek. *Allium ampeloprasum* is a bulb growing to 1. 8 m (6ft) by 0. 1 m (0ft 4in). It is in flower from July to August, and the seeds ripen in August. The flowers are hermaphrodite (have both male and female organs) and are pollinated by bees, insects. In its second season of growth, it has a long, white stalk that is cylindrical and a small bulb. The leaves are flat, broad, long, and dark green and wrap around tightly like a rolled newspaper [7]. Rather than forming a tight bulb like the onion, the leek produces a long cylinder of bundled leaf sheaths, which are generally blanched by pushing soil around them (trenching). The plant grows to about 0. 9 meters (3 feet). Although leeks commonly are listed as a biennial, with their tall stocks and flowers forming in the second season, leeks actually are true perennials, perennating by means of small lateral growths. Larger bulbs can be produced if the plant is prevented from flowering in the second year [8].

2.4 Taxonomical Classification

Among Allium specices. the leek or garden leek is variously classified as Allium porrum, Allium ampeloprasum, *Allium ampeloprasum var. porrum, Allium ampeloprasum porrum, or Allium ampeloprasum Leek Group*[9], [10]. It is a species closely related to leek (Allium porrum L.), that have been traditionally considered as its wild progenitor. Although some authors [11], [12] adopt a broad sense of the taxon *Allium ampeloprasum* that considers cultivated leeks as a subspecies or variety of *A. ampeloprasum*, other prefer a more restricted taxonomical approach for the species that only includes wild leeks without considering any subspecies [5]. Two other related plants often are placed together with the leek as cultivated vegetables of *Allium ampeloprasum*. The kurrat, or Egyptian leek, is sometimes classified as Allium ampeloprasum var. kurrat [13]. However, it also is commonly listed as a different species, *Allium kurrat*. Kurrat is grown in the Middle East for its leaves. Elephant garlic or *Allium ampeloprasum* var. *ampeloprasum* is a variety with very large cloves and a tender, mild, slightly sweet flavor. It also is known as the great-headed garlic and listed as *Alliium ampeloprasum* Great-headed Garlic Group[14]. Unlike leeks, elephant garlic has been bred to produce larger edible cloves underground, with less of a focus on the green stalks of the plant. When allowed to fully mature, elephant garlic can develop cloves that are as big as cloves of regular garlic.

Kingdom: Plantae
clade: Angiosperms
clade: Monocots
Order: Asparagales
Family: Amaryllidaceae
Subfamily: Allioideae
Genus: *Allium*
Species: *A. ampeloprasum* [11].

(Z)-Propanethial S-oxide (onion lachrymatory factor), which is absent in garlic, is found to be formed from crushed elephant garlic (*Allium ampeloprasum*), consistent with the classification of this plant as a closer relative of leek than of garlic [15].

3. Aims and Objectives

a) To study the scientific literature of *Allium ampleoprasum*.
b) To map out the information regarding ethnomedicinal and traditional claims on *Allium ampleoprasum*.
c) To compile the physiological and therapeutic benefits of the *Allium ampleoprasum* in a systematic manner.
d) To study the nutritional components and bioactive
e) phytochemicals present in *Allium ampleoprasum*
f) To list out its pharmacological uses of newly found constituents.

4. Review of literature

4.1 Ethanobotanical and traditional uses

Allium genus is comprising of more than 600 different species, other common members are leek (*Allium ampeloprasum* var. porrum), chive, ampeloprasum, shallot and scallion[16]. *Allium ampeloprasum* var. *porrum* l. (liliaceae), is a bulbous perennial plant, which is consumed daily. Also, is used as medicine. For years, the bulbs have been used as traditional medicine for treating inflammatory symptoms. The crushed bulbs are used to treat initial stages of cough, mucous secretion and sore throat. The fresh juice is taken orally as a stomachic and antispasmodic and is also reputed to possess digestive properties [17].

Its bulb and the pseudostem formed by the overlapping leaves are traditionally consumed either as a vegetable or as a condiment in many Mediterranean countries [18], [19]. As a vegetable, it is sometimes consumed raw, but more frequently cooked, boiled and seasoned with olive oil and vinegar, fried or mixed with other ingredients [19], [20]. Though lesser than other Allium species, the wild leek has a very long folk medicinal history of use in a wide range of diseases, being mentioned by Dioscorides in the 1st century AD[21] and also in some modern ethnobotanical works for their perceived antihelmintic, diuretic, antihypertensive [22], or digestive properties [23].

4.2 Potentially active constituents

Leek (Allium porrum) is very commonly used vegetables in Bulgaria and is distinctive with high content of bioactive components[24]. The medicinal property of *Allium ampeloprasum* is mainly due to the presence of many sulpher containing **bio-active constituents** which include:

- dimethyl disulfide
- methyl propenyl disulfide
- propyl propenyl disulfide
- dimethyl trisulfide
- methyl propyl trisulfide
- methyl propenyl trisulfide
- S-methyl cysteine sulfoxide
- S-propyl cysteine sulfoxide
- S-propenyl cysteine sulfoxide
- N-(γ-glutamyl)-S-(E-1-propenyl) cysteine

[25]. *Allium ampeloprasum* has higher amount of methiin and propiin, respectively [26]. This is an important component of flavors or the precursors of flavors and odors of Allium vegetables. Moreover, they are thought to be beneficial to health also [27].

4.2 Physicochemical properties of *Allium ampeloprasum* :

New Zeeland institute for Crop & Food Research on their Confidential Report on “the nutritional attributes of Allium species” indicate its nutritional composition, whereas other researches on wild leek provide a detailed chemical quantification of organic acids[23], [28].

Table 2: Chemical and nutritional characterization of *Allium ampeloprasum* L. edible part. (per 100gm)

Composition	Units	Leek, bulb, raw
Water	g	86
Energy	Kcal	35
Protein	g	1. 9
Total fat	g	0. 4
Carbohydrate, available	g	5. 9
Dietary fibre(Englyst1988)	g	3. 3
Ash	g	1
Dry matter	g	14
Total nitrogen	g	0. 31
Total saturated fatty acid	g	0. 061
Total MUFA	g	0. 006
Total PUFA	g	0. 253
Total available sugars	g	5. 9
Glucose	g	2. 4
Fructose	g	2. 4
Sucrose	g	1. 1
Soluble non-starch polysaccharides	g	1. 6
Insoluble non-starch polysaccharides	g	1. 6

Table 1: Chemical composition

Proximate Composition	Unit	Amount
Oxalic acid composition	(mg/100gm)	91. 65
Glutamic acid	(mg/100gm)	51. 67
Malic acid	(mg/100gm)	132. 86
Citric acid	(mg/100gm)	38. 86
Succinic acid	(mg/100gm)	2. 14
pH		5. 76

Table 3: Macro and Micronutrient of *Allium ampeloprasum* (per 100gm)

Composition	Units	Leek, Bulb, Raw
Sodium	mg	9
Potassium	mg	310
Calcium	mg	63
Magnesium	mg	10
Manganese	µg	188
Iron	mg	1. 1
Zinc	mg	0. 4
Copper	mg	0. 1
Phosphorus	mg	43
Beta-carotene equivalents	µg	49
Total vitamin A equivalents	µg	8
Vitamin E	mg	0. 92
Thiamin	mg	0. 1
Riboflavin	mg	0. 05
Niacin	Mg	0. 6
Vitamin B6	mg	0. 25
Total folate	µg	86
Vitamin C	mg	18

Figure 1(a) Figure 1(b)

Figure 1(a) &(b): *Allium ampeloprasum* (leek and the bulb)

Fig -1(a) flowering plant with lateral bulblets (left); lateral bulblets of a non-flowering plant (right).

5. Review on Therapeutic Role

As it was already discussed in taxonomic section that *Allium ampeloprasum* include many subspecies and variously classified as *Allium porrum, Allium ampeloprasum, Allium ampeloprasum var. porrum, Allium ampeloprasum porrum or Allium ampeloprasum* Leek group, elephant garlic, the review compile the therapeutic role involving most of the species.

5.1 Pharmacological Role of Newly Found Compounds

Anti-toxic, antioxidative, immunostimulating, antiinflammatory property of *Allium ampeloprasum* (single pod garlic) crown it as a "Magical herb" in modern era where peoples are suffering from unwanted side effects of synthetic drugs.

Two pectic polysaccharides named galacturonic and glucuronic acid from leek were isolated which have **immunostimulating role** [24].

A new steroidal saponin was isolated from the bulbs of *Allium ampeloprasum* L. var. *porrum* which exhibited haemolytic activity in vitro assays, and **immunological adjuvant activity** on the cellular immune response against ovalbumin antigen [25].

Apart from these, many steroidal saponins, five flavonoids with human platelet **anti-aggregation** activity are also isolated[29].

Three new dibenzofurans, porric acids A (**1**), B (**2**) and C (**3**), have been isolated from the bulbs of *Allium porrum* L. When tested against *Fusarium culmorum*, porric acids A−C (**1**−**3**) were found to exhibit **antifungal** activity [30].

A new steroidal saponin isolated from the bulbs of *Allium ampeloprasum* var. *porrum* L that have **anti-inflammatory and antiulcerogenic** properties. On the basis of chemical evidence, comprehensive spectroscopic analyses and comparison of known compounds, its chemical structure has also been established [31].

5.2 Antimicrobial Role

Allium ampeloprasum give protection from microbes, thus exhibiting strong antimicrobial properties. A total of 12 Alliums, used for culinary purposes, were examined for anti-bacterial activity against Escherichia coli using disc assay and minimum lethal concentration methods. Along with the other 12 Alliums, leek (A. porrum); wild leek (A. ampeloprasum); also exhibited anti-bacterial activity [32].

Apart from these essential oils extracted from spices, as natural antimicrobial agents, attract particular attention due to their possible role in food protection from microorganisms, and their non-toxicity, in contrast to the synthetic preservatives.

Inhibitory effect of *Allium ampeloprasum* and two onions (Allium cepa), Junski srebrnjak and Kupusinski jabučar, essential oils in different concentrations (1, 4, 7 and 10%) on three yeasts (*Saccharomyces cerevisiae*, *Candida tropicalis* and *Rhodotorula* sp.) and three moulds (*Aspergillus tamarii*, *Penicillium griseofulvum* and *Eurotium amstelodami*) was investigated. All three essential oils showed the strongest inhibitory effect against *S. cerevisiae* in concentration of only 1%. Whereas, *Rhodotorula* sp. Was greatly influenced by *Allium ampeloprasum* essential oil. & P. *griseofulvum,* was inhibited(78. 3% of inhibition) by *Allium ampeloprasum* essential oil, in concentration of 10% [33].

Whereas other sub species of *Allium ampeloprasum* known as *Allium ampeloprasum* L. var, *atroviolaceum* (endemic to Kermanshah, Iran). The ethyl acetate extract showed greatest antimicrobial activity against *Klebsiella pneumonia* (250 µgr/ml)and *Shigella flexenry* (250 µgr/ml). Antimicrobial activity of *Allium ampeloprasum* L. var atroviolaceum may be due to its pinene and phenol contents [34].

5.3 Toxin Neutralizing Effect

The protective effect of garlic(*Allium ampeloprasum*) volatile oil(GVO) against trichothecene(T-2) induced swiss albino mice was studied. In this study experimental animals were divided into 4 groups [GVOtreated(GVO), T-2 toxin treated(T-2), GVO followed by T-2 toxin(GVO/T-2), T-2 toxin application followed by GVO(T-2/GVO)]. All animals were observed by Langerhans cell enumeration & pathological changes of the right footpad. Histopathological findings of the footpad skin in T-2 toxin treated group revealed epidermal desquamation and necrosis with edema and inflammatory cells infiltration, while GVO/T-2 & T-2/GVO showed a similar sequence but a lesser severe degree. These findings suggested that GVO both in pre- and posttreatment could protect T-2 toxin induced epidermal damage in a mouse footpad [35].

5.4 Hypocholesterolemic Effect

Apart from toxin neutralizing effect the herbaceous plant Allium porrum L. it is also proved to be useful for the treatment of **hypercholesterolemia**. In a 12 weeks study carried out on rabbits fed with hypercholesterolemic diet to evaluate the antihypercholesterolemic effect of a hydroalcoholic extract of A. porrum L. bulbs. Rabbits were divided into five groups--control, hypercholesterolemic control, and three treatment groups (hypercholesterolemic diet + 250, 500, or 1, 000 mg/kg of body weight of extract, respectively). Plasma total cholesterol, LDL decreased significantly in all groups treated with A. porrum extract with respect to the hypercholesterolemic group. Thus, these findings indicate that this plant may be useful for the treatment of hypercholesterolemia [36].

5.5 Antioxidant Property

The antioxidant capacity of leek (allium ampeloprasum var. porrum) is already established by different research work carried out throughout the world. The total phenolic contents and antioxidant activities of garlic (allium sativum) and elephant garlics (allium ampeloprasum) from california, oregon, washington, and new york were determined by fourier transform infrared (ft-ir) spectroscopy (400-4000 cm(-1)) [37]

It has long been recognized that garlic and petiveria, two plants of the Allium genus--which also includes onions, leeks and shallots--possess great medicinal value. In recent times, the biological activities of extracts of these plants have been ascribed to the radical trapping antioxidant properties of the thiosulfinate secondary metabolites allicin and S-benzyl phenylmethanethiosulfinate (BPT), respectively [38].

5.6 Androgenic Effeects

. *Allium ampeloprasum* may be promising effect in enhancing healthy sperm parameters. Many researches in this field indicate that oral administration of *Allium ampeloprasum* could be either worked directly on the central nervous system and gonadal tissues or their effects on hypothalamus-pituitary-testis axis can help to improve male fertility and secretion of testosterone, gonadotropins (LH, FSH) levels in normal rats. The authors attributed the improvement of reproductive functions of male rats by *Allium ampeloprasum* to its antioxidant and androgenic activities.

The effect of *Allium ampeloprasum* extract against testicular toxicity induced by carbon tetrachloride CCL4 was also studied. The oral administration of *Allium ampeloprasum* extract to toxicity induced male rats increased the weight of testes, seminal vesicles and prostate glands; improve semen quality and quantity and increased testosterone, lutein-izing hormone, follicle stimulating hormone levels in serum. The alleviation of testicular lesions, which were seen in toxicity induced rats after oral administration of *Allium ampeloprasum* ex-tract that reported in this study, may be explained by the previously reported antioxidant and androgenic effects. This study recommends the intake of *Allium ampeloprasum* in food is useful for patients who suffer from sexual impotency. [39-44].

5.7 Role in Diabetes and its related complication

The effect of *Allium Ampeloprasum* consumption on serum level of glucose, triglyceride, and total cholesterol of diabetic rats was identified. Oral administration of *Allium*

Ampeloprasum for one month caused significant reduction in the level of glucose, cholesterol and triglyceride in experimental models of diabetes mellitus induced by streptozotocin in rats. (45)

Hyperalgesia is considered as one of the marked signs of subchronic diabetes mellitus that could affect the life style of the patients. Considering the evidence on antidiabetic effect of *Allium ampeloprasum*. further investigation was done on the analgesic effect of *Allium ampeloprasum* on formalin-induced nociceptive response in streptozotocin (STZ)-induced diabetic rats. and the study indicate that one month administration of *Allium ampeloprasum* could attenuate nociceptive score in an experimental model of diabetes mellitus[46].

5.8 Role in Digestive Problem

Allium ampeloprasum leaf hydroalcoholic extract could affect the motor activity of rat ileum motor activity through affecting beta adrenergic receptors and voltage-dependent calcium channels, and considering its results, it could be used in treating digestive problems[47].

5.9 Anticancer Effect

Research also demonstrate potential effect of *Allium ampeloprasum* on osteosarcoma cells, U2OS. It depressed U2OS cell viability, proliferation and affected their morphology. It was also found that *Allium ampeloprasum* not only inhibited cancer cells directly via anti-proliferation, but also affected the cancer cells metastasis process. The metastasis was reduced for 66. 7% following exposure to garlic [48].

6. Conclusion

Garlic, from crushed to capsules, is consumed throughout the world. It has long been used to treat cardiovascular diseases, including atherosclerosis, strokes, hypertension, thrombosis and hyperlipidemias, as well as uses in Alzheimer's, diabetes, and cancer[49]. But most of the investigations were done with Garlic(*Allium sativam*), AGE (Aged Garlic Extract), Garlic oil, by isolating its active component etc.

The above findings from different scientific studies indicated that *Allium ampeloprasum* (single pod garlic) also prove to be beneficial in ameliorating different diseases. Parallaly its natural antimicrobial property makes it a useful spices in food preservation.

Antitoxic, antioxidative, immunostimulating, anti-inflammatory property of *Allium ampeloprasum* (single pod garlic) crown it as a "Magical herb" in modern era where peoles are suffering from unwanted side effects of synthetic drugs.

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Author Profile

Purnima Dey is presently working as a research fellow under the guidance of Dr. Kazi Layla Khaled in the Department Of Home Science, Calcutta University and has teaching experience in Food & Nutrition for about 5years. Apart from post graduation in Food & Nutrition from Department of Home Science, University of Calcutta, also awarded the Junior Research Fellowship by University Grant Commission

Dr. Kazi Layla Khaled, [2] Senior Assistant Professor is working as an Assistant Professor, Department of Home Science, University of Culcutta. Her research interests based on different aspect of Food & Nutrition. She is working in this University since 2003. Her works published in various renowned journals of Food & Nutrition. She is presently working in the field of **medicinal plants, herbs and unconventional food sources.**