CUCUMIS SATIVUS (CUCUMBER): A REVIEW ON ITS PHARMACOLOGICAL ACTIVITY

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Medicinal plants have been used for centuries, and numerous cultures still rely on plants for their primary health care needs. In the recent past there has been a tremendous increase in the use of plant based health products in developing as well as developed countries resulting in an exponential growth of herbal products globally. The present article gives an account of such a medicinally important of *Cucumis sativus* belonging to family Cucurbitaceae which comprise both wild and cultivated species and is consumed in different ways like vegetable and salads, but less is known about its medicinal importance. Phytochemical analysis of these plants confirms the presence of various phytochemicals like tannins, cardiac glycosides, terpenoides, carbohydrates, resins, Saponins and phytosterols. While other phtochemicals like alkaloids, flavonoids, glycosides, steroidal terpenes and phylobatamins were found to be cucumber fruits. The plant exhibits various pharmacological activities such as anti-bacterial activity, antifungal activity, cytotoxic activity, Antacid & Carminative activity, Activity against ulcerative colitis ,Hepetoprotective activity, Hypoglycemic and Hypolipidemic activity, Wound healing activity etc. A study on safety profile suggests the plant to be safe for its therapeutic uses.

Keywords: *Cucumis sativus*, Phytoconstituents, Pharmacological activity

INTRODUCTION

A plant which has active constituents of medicinal properties and is used to treat disease in different systems of medicine or traditionally used for the treatment of disease is considered as medicinal plant. Plants have been used as medicines from the ancient time. Medicinal plants are widely and successfully used on every continent. In Asia, the practice of herbal medicine is extremely well established and documented. As a result, most of the medicinal plants that have international recognition come from this region. Plants, plant parts and plant products served as the materials for the preparation of medicine and these medicinal plants and plant parts constitute an important natural wealth of a country.[1] They play a significant role in primary health care service to rural people. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions, and to defend against attack from predators such as insects, fungi and herbivorous mammals. Many of these phytochemicals have beneficial effects on long-term health when consumed by humans, and can be used to effectively treat human diseases. At least 12,000 such compounds have been isolated so far; a number estimated to be less than 10% of the total. Chemical compounds in plants mediate their effects on the human body through processes identical to those already well understood for the chemical compounds in conventional drugs; thus herbal medicines do not differ greatly from conventional drugs in terms of how they work. In 2001, researchers identified 122 compounds used in modern medicine which were derived from "ethnomedical" plant sources; 80% of these have had an ethnomedical use identical or related to the current use of the active elements of the plant. Many of the pharmaceuticals currently available to physicians have a long history of use as herbal remedies, including aspirin, digitalis, quinine, and opium. The use of herbs to treat disease is almost universal among non-industrialized societies, and is often more affordable than purchasing expensive modern pharmaceuticals. Herbal medicines are generally regarded as safe based on their long-standing use in various cultures. Total global herbal market is of size 62.0 billion dollars. European Union is the biggest market with the share 45% of total herbal market and the India's contribution is only one billion dollars. But there are positive signals also for us in the global market. India has 16 Agroclimatic zones, 10 Vegetative zones, 15 Biotic provinces, 426 Biomes, 45000 different plant species and 15000 medicinal plants that include 7000 Ayurveda, 700 in Unani medicine, 600 in Siddha medicine and 30 in modern medicine. This makes India one among 12 mega biodiverse countries of the world, which despite having only 2.5 % total land area, accounting for over 8 % of the recorded species of the world.[1] It is estimated that at least 25% of all modern medicines are derived, either directly or indirectly, from medicinal plants, primarily through the application of modern technology to traditional knowledge. In the case of certain classes of pharmaceuticals, such as

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antitumor and antimicrobial medicines, this percentage may be as high as 60%.[2] The scientific evaluation of safety and efficacy of herbal products and medicinal preparation is thus of vital importance from both medicinal and economic perspectives . Now a day's our world is facing a crisis in economic conditions so the use of herbal products is much more reliable than allopathic products because of its expensiveness. [3,4] Cucurbits are vegetable crops, belonging to the family Cucurbitaceae, which primarily comprised species consumed as food worldwide. Cucurbits are an excellent fruit in nature having composition of all the essential constituents required for good health of humans. But still this family is not considered much important medicinally and taken as vegetables and salads for daily consumption also because of its availability at low cost.

Botanical Name: *Cucumis sativus Linn.*
Local Name: Hindi- Khir
Kingdome- Planate
Division - Angiosperms
Class- Eudicots
Order- Cucurbitales
Family- Cucurbitaceae
Subfamily- Cucurbitaceae
Genus- Cucumis
Species- *C. sativus*

Fig no.1 Fruit of *C. Sativus*

Fig. no. 2 Flower of *C. sativus*

Habital and Description:

Cucumbers (*Cucumis sativus*) are botanically categorized as berries, which are available in many different sizes shapes and colours. They range from thick, stubby little fruits (10 - 12 cm long) to Dutch greenhouse varieties (of up to 50 cm long). The most popular variety is the long smooth salad cucumber which has a smooth, dark-green skin. Its little brother, the "gherkin" is actually a cucumber that has been harvested when little and pickled in brine. The true gherkin is a different species (Cucumis anguria), which is primarily grown in the West Indies. Cucumber may not contain a lot of food value, but they make up this lack of nutrients with a wide variety of healthy substances.[12]

Cultivation and collection:

Soil requirements: Soil should be medium textured, neither too light and sandy, nor too heavy. The plants will grow rapidly in sandy soil but, unless irrigation is provided, they will dry up during the midsummer months. A heavy, wet soil, on the other hand, interferes with proper root development and leads to fungus and disease problems. Heavy soils also tend to produce later crops.

Nutrient requirements: Cucumbers are heavy users of organic materials and produce better and more heavily when organically fed. A balanced fertilizer should be used if the soil is deficient in the necessary elements. This should include a minimum of 5 percent nitrogen and about 20 percent of such organic materials as ground-up cottonseed, dried blood, dehydrated manures, and bone and fish meal.

Planting: Cucumbers may be planted any time in May after danger of frost is past. About the middle of the month is best. Before plowing the field, scatter plenty of seasoned manure, aged at least four months so as not to burn the tender plants. This manure will serve two purposes in the soil: one, feeding the plants; two, helping retain moisture during the hot spells and keeping the soil porous. Adequate moisture in the soil at all times spells the difference between weak, unproductive plants, and green, robust ones. Plant the seed just one inch below the surface to prevent damp rot in case of heavy rains. Most cucumber rows are planted six to seven feet apart running from east to west for maximum sun. [25]

Botanical Description and Identification features:

Cucumbers (*Cucumis sativus*) are botanically categorized as berries, which are available in many different sizes shapes and colors. They range from thick, stubby little fruits (10 - 12 cm long) to Dutch greenhouse varieties (of up to 50 cm long). The most popular variety is the long smooth salad cucumber which has a smooth, dark-green skin. Its little brother, the "gherkin" is actually a cucumber that has been harvested when little and pickled in brine. The true gherkin is a different species (Cucumis anguria), which is primarily grown in the West Indies. Cucumber may not contain a lot of food value, but they make up this lack of nutrients with a wide variety of healthy

substances. They were already used in ancient times to dissolve stones caused by uric acid. Their cleansing effect on the intestines, kidneys, lung and skins was also known. People suffering from stomach or liver diseases also benefit from the consumption of cucumbers. They have been known to cure some headaches, bleeding, dizziness, and pale skin. Cucumber juice contains a substance, which promotes blood circulation of the skin. It is for this reason that it is widely used in cosmetics.[24,25]

Useful parts of plants: The parts which are traditionally used of these Cucumis sativus Plants are leaves, flowers, seeds, fruits, and bark. These parts contain some active ingredient which is responsible for giving particular pharmacological activity. It is used in traditional medicine for the treatment of various ailments. The Fruit of the plant is an astringent and is used in the treatment of laxative, anthelmintic and antipyretic; useful in hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhoea, coughs hoarseness of voice, eye diseases and scorpion-sting; used as a hair tonic. . Decoction of the green fruit is used for cough. Pulp of the fruit is useful in dysenteric-diarrhoea, dropsy, piles and leprosy. Half ripe fruit is used as purgative. Kernel of the fruit is narcotic. Fruits are used in menstrual disorder in Khagrachari. Seed oil is used in rheumatism. Gum of the bark is demulcent and purgative. The triterpenoid present in the fruits possess significant antimicrobial activity. Kernel oil has purgative action and its prolonged use was well tolerated in mice.[16]

Parts of Plant	Medicinal Properties
Fruit	Astringents, hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhoea, cough hoarseness of voice, eye diseases.
Seed of fruit	Rheumatism
Kernel of Fruit	Narcotic, purgative action
Pulp of fruit	dysenteric-diarrhoea, dropsy, piles and leprosy
Gum of Bark	Demulcent, purgative

Table 1: Part of *C. sativus* Used for medicinal purpose

Phytoconstituents: Every plant contains several Phytoconstituents in its different parts showing various pharmacological activities and toxicities, like wise *Cucumis sativus.* It also was showing many pharmacological activities due to the presence of medicinally active compounds.

Cucumber fruit is composed mostly of water; more than 96% of edible unpeeled fruit is water. Other constituents of Cucumis-is sativus, according to one source, are vitamins, minerals, amino acids, phytosterols, phenolic acids, fatty acids, and curcurbitacin. According to another source, traces of essential oil, amino acids, pectins, starch, sugars, vitamin C, and curcurbitacin are found in cucumbers. Glycosides, steroids, flavonoids, carbohydrates, triterpenoid, and tannins were identified in an aqueous extract of the cucumber fruit.[15, 16]

UTILIZATION

Traditional Use: Fruits are laxative, astringent, anthelmintic and antipyretic; useful in hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhoea, coughs hoarseness of voice, eye diseases and scorpion-sting; used as a hair tonic. Decoction of the green fruit is used for cough. Pulp of the fruit is useful in dysenteric-diarrhoea, dropsy, piles and leprosy. Half ripe fruit is used as purgative. Kernel of the fruit is narcotic. Fruits are used in menstrual disorder in Khagrachari. Seed oil is used in rheumatism. Gum of the bark is demulcent and purgative. The triterpenoid present in the fruits possess significant antimicrobial activity. Kernel oil has purgative action and its prolonged use was well tolerated in mice.

Industrial Use: Medicinal plants are the richest bio resource of drugs for traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs. The first step in the value addition of medicinal bio resources is the production of herbal drug preparations, using a variety of methods from simple traditional technologies to advanced extraction techniques. The extract is further processed to be incorporated in any dosage form such as tablets and capsules. With the increasing demand for herbal medicinal products, nutraceuticals, and natural products for aceuticals, and natural products for health care all over the world, medicinal plant extract manufacturers and essential oil producers have started using the most appropriate extraction technologies in order to produce extracts and essential oils of defined quality with the least variations from batch to batch.[13]

Pharmacological Activity: *Cucumis sativus* showing various pharmacological activities such as anti-bacterial activity, antifungal activity, cytotoxic activity, Antacid & Carminative activity, Activity against ulcerative colitis ,Hepetoprotective activity, Hypoglycemic and Hypolipidemic activity, Wound

healing activity etc due to its presence of various active constituents all over the parts of plants i.e. vitamins, minerals, amino acids, phytosterols, phenolic acids, fatty acids, and curcurbitacin. According to another source, traces of essential oil, amino acids, pectins, starch, sugars, vitamin C, and curcurbitacin are found in cucumbers. It was consists Glycosides, steroids, flavonoids, carbohydrates, triterpenoid, and tannins.[14'15'16]

Antimicrobial activity: Three antimicrobial sphingolipids were separated by bioassay-guided isolation from the chloroform fraction of the crude methanol extract of cucumber (Cucumis sativus.) stems and identified as (2S,3S,4R,10E)-2-[(2'R)-2-hydroxytetra-cosanoylamino]-1,3,4-octadecanetriol-10-ene,1-O-β-D-glucopyranosyl(2S,3S,4R,10E)-2-[(2'R)-2-hydroxy-tetracosanoylamino]-1,3,4-octadecanetriol-10-ene (2) and soyacerebroside I (3) by their physicochemical properties and spectroscopic analysis. They were evaluated to show antifungal and antibacterial activity on test microorganisms including four fungal and three bacterial species. Among them, compound 1, a relatively low polarity a glycone, exhibited stronger antimicrobial activity than its corresponding glycoside 2. The results indicated that sphingolipids could be the main antimicrobial compounds in the crude methanol extract of cucumber stems.[18]

Anti bacterial activity: The antimicrobial activity of CS against 4 human microbial pathogens. Antimicrobial assay was performed by Agar well diffusion method. Specific concentration of seed extract was showed highest zone of inhibition against S. aureus. These pathogens were highly sensitive to the methanol extract also except E. coli (enter pathogen) and P. aeruginosa. Finally they concluded that CS seeds possess potential broad spectrum antimicrobial activity.[18]

Anti-Tumor Promotion: The effect of Cucumis sativus (cucumber) on tumor promotion was examined in Swiss Webster albino mice. The test article was prepared by homogenization of the fruit and expressing the juice. Ten mice (sex not specified) were used per group. The mice were shaved, and 6 days later 0.2 ml of 410 µg of dimethylbenz[a]anthracene (DMBA) in acetone was applied to the back of each mouse. Four days after DMBA application, 0.2 ml of 0.03% croton oil in acetone was applied to the shaved back of each animal; this application was made three times per wk for 20 wks. Three protocols were used for the application of the cucumber extract. In Protocol 1, the extract was applied for 5 days prior to application of DMBA and 1 h before the croton oil. In Protocol 2, the extract was applied 1 h before the croton oil. In Protocol 3, the extract was applied immediately after the croton oil dried. Initially, a dose of 5.0 mg cucumber extract/0.2 ml acetone was "splashed on" the back of each animal. However, this reportedly caused 60-80% mortality prior to tumor development.[20]

Skin Irritation/Sensitization: The irritation and sensitization potential of two formulations containing 0.00055% Cucumis Sativus (Cucumber) Fruit Extract was evaluated in a modified occlusive human repeat insult patch test (HRIPT). A 21-day induction phase, 10-24 day non-treatment period, and 4-day challenge phase was used. Distilled water was the negative control and sodium laurel sulphate (SLS) was the positive control in both studies. In the first study, a moisturizer containing 0.00055% Cucumis Sativus (Cucumber) Fruit Extract was applied neat to 101 subjects. The standardized cumulative irritation score was 0 for both the test material and distilled water and was 2430 for 0.5% SLS. (The scoring scale was not defined.) The formulation containing 0.00055% Cucumis Sativus (Cucumber) Fruit Extract was not predicted to be a significant skin irritant, and it was not a sensitizer.[18'17]

Wound healing activity: Patil et alwere studied on pharmacological evaluation of wound healing potential of Cucumis sativus. He stated that aqueous extracts of Cucumis sativus have proper efficacy on wound healing. Herbal paste preparation showed significant ($P<0.05$) improvement on maturation, wound contraction and epithelialisation.[19]

Antacid & Carminative activity: Swapnil Sharma et al was investigate with the aqueous extract fruit pulp of C. sativa significantly neutralized acid and showed resistance against change in pH and also illustrate good carminative potential. The extract of C. sativa, has shown to possess significant carminative and antacid property.[25]

Activity against ulcerative colitis: Patil et alwas descrives after an authentic investigation with the aqueous extract of Cucumis sativus Linn. The Fruit in ulcerative colitis in laboratory animals. In this investigation, the aqueous extract of C. sativus L. selected for screening against experimentally

induced bowel disease. The extract of C. sativa, has shown to possess significant property against ulcerative colitis.[19]

Hypoglycemic and Hypolipidemic: Ethanolic extracts of some fruits of Cucurbitaceae family such as Cucumis sativus (cucumber), Lagenaria siceraria (white pumpkin), Luffa acutangula (ridge gourd), Benincasa hispida (ash gourd), Citrullus lanatus (sweet melon) and Cucarbita maxima(pumpkin) have been studied for their hypoglycemic effects on alloxan induced diabetic rats (AIDRs). Screening results suggested that among the tested fruits the hypoglycemic potency follows: cucumber > white pumpkin > ridge gourd. These three fruit-extracts were further investigated for their hypoglycemic, hypolipidemic and glycogenesis effects. Cucumber, white pumpkin and ridge gourd extracts reduced blood glucose level by 67, 65 and 51%, respectively at 12 hours after single intraperitoneal injection; while reduced the low density lipoprotein (LDL) level to 13, 28 and 86%, respectively in AIDRs. The maximum reduction 87% was observed by cucumber extract. Cucumber, white pumpkin and ridge gourd extracts reduced total cholesterol level to 29, 15 and 38%, respectively comparing with the diabetic control group. Here the maximum reduction of 85% was observed by white pumpkin extract. Cucumber, white pumpkin and ridge gourd also reduced triglyceride levels to 72, 68 and 80%, respectively. Maximum reduction of 32% was observed by white pumpkin. Significant improvement of glycogenesis was also observed by ridge gourd extracts in AIDRs.[24]

CONCLUSION

India is richly endowed with a wide variety of plants having medicinal value. The term "herbal drugs" denotes plants or plant parts that have been converted into phytopharmaceuticals by means of simple processes involving harvesting, drying, and storage .The plant processing encompasses drying, mechanical disruption, and solvent extraction such as aqueous or organic solvent, e.g., ethanol, and will influence the final quality of the herbal product. Analytical procedures can be used to determine the active constituents that are present in herbal substances. Herbal medicine uses are based on historical medicinal practices. Historical practices determine the way herbal medicines are formulated and used. In some cases e.g. China, there are well-defined procedures that are well documented in pharmacopoeias dating back nearly 2000 years and other monographs.

Cucumis sativus widely used in Ayurveda, Siddha, Chinese medicine etc. The vast study done on the plant proved that the plant has many important Phytoconstituents like Glycosides, flavones, terpinoids, phytosterol, saponins and anolignan B, Tannins, ellargic acid, glucose, fructose. These compounds were found to be responsible for many of the pharmacological activities such as antibacterial, antifungal, antidiabetic, Cytotoxic , Antacid & Carminative activity , Hepatoprotective activity, Wound healing activities. Further the plant is used in the treatment of gastric ulcer, constipation, general debility, piles. Hence, this plant provides a significant role in the prevention and treatment of a disease. Further evaluation needs to be carried out in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of the mankind.

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