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Review On Aesculapian Uses And Herbal Properties Of Capsicum Annum

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Abstract: - Capsicum annuum is a species of the plant genus Capsicum native to southern North America and northern South America, belonging to family, Solanaceae, is commonly consumed all over the world as spices. It is commonly known as red pepper in English and mirchi in Hindi. Historically, it has been known to possess medicinal properties like anti-inflammatory, Analgesic,Antipyretic, Hypoglycaemic. Anti- microbial activity and stomachic. C. annuum have highest proportion of capsaicin in placental tissue as one of the important chemical constituents

Key words: - Capsicum annuum , Christmas pepper , Antipyretic, Anti-microbial activity

Introduction: -

The genus name Capsicum is derived from a Greek-based derivative of the Latin word capto, meaning "to grasp, to seize," in reference to the heat or pungency of the species' fruit, but it has also been speculated to derive from the Latin word capsa, "box," referring to the shape of the fruit in typical species forms (1). Although the species name annuum implies "annual" (derived from the Latin annus, "year"), the plant is not an annual but rather frost delicate(2) In the absence of winter frosts, it can survive several seasons and mature into a huge, shrubby perennial herb(3).

Common names containing the word "pepper" are the result of a mistake among Europeans participating in the Columbian Exchange. They mistakenly assumed the spicy fruits were a type of black pepper plant, which also produces spicy fruit. However, these two plants are not closely related (4). The common English names for Capsicum annuum fruit vary depending on locale and cultivar. The larger, sweeter cultivars are known as "capsicum" in Australia and New Zealand(5) In the United Kingdom and Ireland, plant cultivars are often referenced in terms of "sweet" or "hot/chilli" peppers, with individual cultivars rarely provided (6). In Canada and the United States, cultivars are commonly referred to as "bell", "jalapeño", "cayenne", or "bird's"(7).

Capsicum annuum, or red pepper, is a member of the Solanaceae family (8). Red pepper contains a variety of plants with popular names such as chili pepper, tabasco pepper, African chilies, cayenne pepper, paprika (9), and Christmas pepper (10).

Red peppers originated in South America and are utilized for both medicinal and (9).

In addition to being used as a food additive, capsicum fruits have been used in traditional medicine to treat cough, toothache, sore throat, parasitic infections, rheumatism, and wound healing (9). They have also been used as an antiseptic, counterirritant, appetite stimulator (11), antioxidant, and immunomodulator (12). Chilies have other effects, including antibacterial and anticancer properties (11).

Red pepper is used as a medication to treat atonic dyspepsia and flatulence (11) by enhancing motility in the gastric antrum, duodenum, proximal jejunum, and colon (12). It may also enhance parietal, pepsin, and bile acid secretions (13). Chilies have been shown to protect against gastrointestinal ailments (14), including dyspepsia (12), loss of appetite, gastroesophageal reflux disease, and gastric ulcers (12), through a variety of mechanisms, including reducing food transition time through the gastrointestinal tract and anti-Helico pylori effects. Furthermore, the plant's leaves exhibit antioxidant properties (15).

Synonyms: -

Capsicum annuum Capsicum annuum var. acuminatum Fingerh., Capsicum annuum var. aviculare (Dierb.) D'Arcy & Eschbaugh, Capsicum annuum var. conoides (Mill.) Irish, Capsicum annuum var. cordiforme Edwall, Capsicum annuum var. fasciculatum (Sturtev.) Irish, Capsicum annuum var. grossum (Willd.) Sendtn., Capsicum annuum var. longum (DC.) Sendtn., Capsicum cerasiforme Mill., Capsicum cerasiforme Willd., Capsicum conoides Roem. & Schult, Capsicum cordiforme Mill, Capsicum frutescens var. cerasiforme (Mill.) L.H.Bailey, Capsicum frutescens var. conoides (Mill.) L.H.Bailey, Capsicum frutescens var. fasciculatum (Sturtev.) L.H.Bailey, Capsicum frutescens var. grossum (Mill.) L. H. Bailey, Capsicum frutescens var. longum (Sendtn.) L. H. Bailey, Capsicum grossum L., Capsicum indicum auct., Capsicum indicum var. aviculare Dierb., Capsicum indicum var. conoideum (Mill.) Dierb., Capsicum indicum subsp. elaeocarpon Dierb., Capsicum indicum var. ribesium Dierb., Capsicum longum DC., Capsicum petenense Standl (16-18).

Common names: -

Capsicum annuum

Afrikaan: Rissie

Albanian: Spece,Speci

Amharic: Yafrank Karya

Arabic: Fulful, Fulful Akhdar, Fulful Baladi, Fulful Ahhmar, Fulful Halou, Fulaifilah Halwa

Armenian: Garmir Bghbegh, Karmir Pghpegh

Azeri: Ístiot, Qirmizi BibƏr

Austria: Paprika

Ayurvedic: Raktamaricha, Lankaa, Katuviraa

Basque: Piperrautsa

Brazil: Pimant, Pimentậo

Breton: Pimant Dous

Belgium: Peper

Bulgarian: Cherven Piper, Piperka

Catalan: Pebrotera

Chinese: Chiao-Tzu, Ching Chiao

English: Chilli, Red Pepper

Farisi: Paprika

French: Piment Annuel, Gros Piment, Piment Doux

German: Cayennepfeffer, Chile, Chili, Chilli

Greek: Pipera, Piperia

Hungarian: Bell Paprika,Csemegepaprika

India: Molar Gujaarati, Degi Mirch, Deshi Mirch

Indonesia:Cabai, Cabe, Cabe Manis

Italian: Peperone, Pepperoncini, Pepperoncino

Japanese: Bansho, Bapurika, Peppaa

Malaysia: Cabai, Chili, Cili

Russian: Perets Krasnyj, Perets Zelenyi

Spanish: Aji, Chile, Chile Jalapento

Turkish: Biber, Kirmizi Biber, Pul Biber Filfil-e-Ahmar, Filfl-e-Surkh, Surkh Mirch.

Siddha: Milagay and Unani: Mirch [51,55].

Capsicum fructescens

Ayurvedic: Katuviraa

Bengali: Gachmirch

English: Bird Chilli

Gujrati: Mirchi

Hindi: Lalmirch

Kannada: Menashinakai

Malyalam: Chabbai

Marathi: Mirchi

Sanskrit: Katuvira

Siddhal: Musi Milagay

Sinhalese: Miris

Tamil: Mullagay

Telugu: Mirapakai

Unani: Surkh Mirch

Urdu: Mirch (16-20).

Traditional uses: -

Capsicum is a tropical and an important agricultural crop and one of the popular vegetables, not only because of its economic value, but also for the combination of color, taste and nutritional values of its fruit (21-22). The interest in the consumption of capsicum is, to a large extent due to its content of bioactive compounds and their importance as dietary antioxidants. Peppers were used fresh, dried, fermented, or as an oleoresin extract. It has both nutritional and nutraceutical importance (23). Capsicum was used as a colourant, flavourant, and/or as a source of pungency. The main source of pungency in peppers is the chemical group of alkaloid compounds called capsaicinoids (CAPS), which are produced in the fruit. Capsaicin ($C_{18}H_{27}NO_3$), trans-8- methyl-N-vanillyl-6-nonenamide), is the most abundant CAPS, followed by dihydrocapsaicin, with minor amounts of nordihydrocapsaicin, homocapsaicin, homodihydrocapsaicin, and others. Capsaicin is a white crystalline, fat-soluble compound formed from homovanillic acid that is insoluble in water, odourless, and tasteless (24). The red colour of mature pepper fruits is due to several related carotenoid pigments, including capsanthin, capsorubin, cryptoxanthin, and zeaxanthin, which are present as fatty acid esters. The most important pigments are capsanthin and its isomer capsorubin, which make up to 30–60% and 6–18% respectively, of the total carotenoids in the fruit (25). It is also important for its flavor in many products in addition to its color. Dried chilli is also valued for its contribution to flavor in chilli sauces and chilli powders. The flavoring principle is associated with volatile aromatic compounds and color. As a general rule, when the color of paprika or chilli powder fades, the flavor also disappears (23). Both volatile and non-volatile substances contribute to its use as flavoring agent (26).

Capsicum annuum was used traditionally to treat toothache. The fruits are used to stimulate gastric activities and increase blood circulation. It is also a stimulant, carminative, and used locally for neuralgia and for rheumatism. Uterine pain associated with childbirth is treated with soup containing the fruit. The Commission E approved

Capsicum annuum for painful muscle spasms in areas of shoulder, arm and spines. Preparations are used to treat arthritis, neuralgia, lumbago and chilblains (27, 28-29). Capsicum frutescens was also used traditionally as an external therapy in painful muscle spasms in areas of shoulder, arm and spine; for treating arthritis, neuralgia, lumbago and chilblains. In addition, it also used for the treatment of diabetes, blood pressure [high/ low], bronchitis, burning feet, to increase circulation, relieve rheumatic pain, treat mouth sores and infected wounds, reduce blood clots, and aid digestion by stimulating saliva and gastric juice flow (30,31).

Parts used medicinally: fruits.

Physicochemical properties Capsicum annuum contained total ash 9.27 %, acid insoluble ash 0.74%, water soluble ash 1.49% , loss on drying 8.90%, total alcoholic-soluble extractive value 3.54% and total water-soluble extractive value 9.32% (32). The physicochemical properties of Capsicum annuum (Sweet pepper) and Capsicum annuum (Bell pepper) oils were: refractive index 1.439 ± 0.01 and 1.428 ± 0.00, specific gravity 0.802 ± 0.01 and 0.751 ± 0.01 (g/cm3) , acid value 0.785 ± 0.01 and 1.346 ± 0.10 (mg/g), iodine value 27.920 ± 0.20 and 17.770 ± 0.11 (mg/g) , saponification number (mg/g) 138.250 ± 0.23 and 147.263 ± 0.02 and unsaponifiable matter (mg/g) 1.780 ± 0.11 and 1.890 ± 0.04. While, physicochemical properties of C. frutescens (Bird eye chilli) and C. frutescens (Bird pepper) oils were: refractive index 1.428 ± 0.00 and 1.451 ± 0.01, specific gravity (g/cm3) 0.765 ± 0.01 and 0.830 ± 0.01, acid value 1.122 ± 0.10 and 2.693 ± 0.11(mg/g), iodine value 25.380 ± 0.22 and 22.842 ± 0.10 (mg/g), saponification number (mg/g) 117.81 ± 0.30 and 187.935 ± 0.21 and unsaponifiable matter (mg/g) 1.473 ± 0.05 and 2.400 ± 0.05 (33).

Pharmacological effects of C. annuum: -

Antimicrobial effects:-

The butanol extract of Capsicum annuum fruit showed high antimicrobial activity against all the tested pathogens while other extracts showed comparatively moderate activity. The ethanol extract (100 mg/ml) of Capsicum annuum showed high antimicrobial activity against Micrococcus sp (20 mm), Bacillus (10 mm), E. Coli (17 mm), Pseudomonas sp (16mm) and Citrobacter sp(15 mm). The chloroform extract of Capsicum annuum showed less antimicrobial activity against all the tested pathogens (34)

Antibacterial activity of Capsicum annuum was evaluated against pathogenic strains isolated from the urinary tract (2 Klebsiella pneumoniae, 2 Pseudomonas aeruginosa and 2 E.coli). The different concentrations of the plant extracts showed antibacterial activity at 5 and 10mg/ml against the tested microorganisms (35).

Insecticidal and anthelmintic effects:

The insecticidal activities of red pepper (Capsicum annuum L.) fruit powder were investigated against Rhyzopertha dominica and Sitophilus granaries. This powder was mixed with 20g wheat grains as direct admixtures at different rates viz, 0, 0.5, 0.85, 1.5, 3 and 5% (w/w) to assess for mortality and reduction of Fl progeny. The results revealed that red pepper in low concentrations did not cause complete mortality on two insects after 14 days. It caused complete reduction in Fl progeny of S. granarius and R. dominica at highest tested dosages (36).

The insecticidal activity of different concentrations of methanol extract of fruits and leaves of C. frutescens was investigated against 2nd and 3rd instar larvae of A. aegypti. The mortality of the larvae was found to be concentration dependent. Among larvae, 2nd instar larvae were shown to be more sensitive than 3rd instar larvae. The fruit extract has shown more killing effect than leaf extract (37).

Antioxidant effect:

Antioxidant compounds and their antioxidant activity in 4 different colored (green, yellow, orange, and red) sweet bell peppers (Capsicum annuum L.) were investigated. The free radical scavenging abilities of peppers determined by the 2, 2~-diphenyl-1- picrylhydrazyl (DPPH) method. Antioxidants present in the (Capsicum annuum L.) appeared beneficial and can protect the food or body from oxidative damage induced by free radicals and reactive oxygen (23).

Carotenoids extracted from dried Capsicum annuum were evaluated for their antioxidant activities. Guajillo pepper carotenoid extracts exhibited good antioxidant activity and had the best scavenging capacity for the DPPH+ cation (24.2%) (38).

Cytotoxic effects:

Four types of chili (Capsicum annuum) extracts, categorized according to color (green and red), and size (small and large) were studied in Hep-G2 cells. Red small (RS) chili had an LC50 value of 0.378 ± 0.029 mg/ml compared to green big (GB) 1.034 ± 0.061 mg/ml and green small (GS) 1.070 ± 0.21 mg/ml. Red big (RB) was not cytotoxic. Capsaicin content was highest in RS and produced a greater percentage of sub-G1 cells ($6.47 \pm 1.8\%$) after 24 h exposure compared to GS ($2.96 \pm 1.3\%$) and control ($1.29 \pm 0.8\%$). G2/M phase was reduced by GS compared to RS and control cells. RS at the LC50 concentration contained 1.6 times the amount of pure capsaicin LC50 to achieve the same effect of capsaicin alone. GS and GB capsaicin content at the LC50 value was lower (0.2 and 0.66, respectively) compared to the amount of capsaicin to achieve a similar reduction in cell growth (39).

Capsicum annuum L. var. angulosum Mill. extracts showed relatively higher cytotoxic activity against two human oral tumor cell lines (HSC-2, HSG) than against normal human gingival fibroblasts (HGF), suggesting a tumor-specific cytotoxic activity (40).

Anti-inflammatory effect:

Topical preparations of capsaicinoids are widely used for musculoskeletal disorders as a complementary therapy. The potential effects of both topical capsaicinoids-containing patch and local subcutaneous capsaicin application on the anti-inflammatory action of NSAID were examined. Carrageenan-induced paw oedema of rats was used as the inflammation model. Topical capsaicinoids-containing patch application or local capsaicin injection (2, 10, 20 μg/paw) alone did not cause any effect on oedema volume and weight. However, the combination of diclofenac with topical capsaicinoidscontaining patch significantly increased the effectiveness of diclofenac on inflammation. Evans blue content of the paws that represents plasma extravasation was decreased by capsaicinoids-containing patch with and without diclofenac (41).

The anti-inflammatory activity of Capsicum annuum was assessed by inhibiting Soyal lipoxygenase (LOX) enzyme. The results showed higher % of LOX inhibition by green capsicum (46.12 %) followed by yellow (44.09 %) and red capsicum (32.18 %) (42).

Cardiovascular effects:

Capsicum annuum contained an anticoagulant that helps prevent the blood clots that can cause heart attacks (23).

Natural α-amylase and α-glucosidase inhibitors from food-grade plants offer an attractive strategy to control postprandial hyperglycemia for type 2 diabetes management. Concurrently associated macrovascular complication of hypertension can be managed by similar extracts by inhibition of angiotensin I-converting enzyme (ACE). Nine types of pepper (Capsicum annuum) were investigated for inhibitory activity against α-amylase and α-glucosidase and angiotensin I-converting enzyme (ACE) inhibitors. Several pepper extracts had

high αglucosidase inhibitory activity, which was not correlated to total phenolic content and free radical scavenginglinked antioxidant activity. Select extracts such as Green pepper and Long hot pepper had less or no inhibitory effect on the α-amylase activity. Among various water extracts of Red pepper had the highest ACE inhibitory activity (43).

An in-vitro thrombolytic model was used to check the clot lysis effect of Capsicum frutescens. A combination of honey and Capsicum frutescens was also investigated along with streptokinase as a positive control and water as a negative control. By using an in vitro thrombolytic model Capsicum frutescens and a combination of honey and Capsicum frutescens showed 57.40% and 44.54% clot lysis effect respectively (44) .

Anti-obesity effect:-

The anti-obesity effects of water extracts of seven Capsicum annuum L. varieties, Putgochu (Pca), Oyee gochu (Oca), Kwari putgochu (Kca), Green pepper (Gca), Yellow paprika (Yca), Red paprika (Rca) and Cheongyang gochu (Cca), were examined through the evaluation of lipoprotein lipase (LPL) mRNA expression level in 3T3-L1 cells (mouse pre-adipocytes). After capsaicin elimination by chloroform defatting, freezedried powder of Cca was treated to 3T3-L1 cells and antiobesity effects were examined by determining the LPL mRNA level using the RT-PCR method. Of the primary fractions, only proven fractions underwent secondary and tertiary re-fractionating to determine anti-obesity effects. From seven different Capsicum annuum, there was a significant decrease of the LPL mRNA expression level of 50.9% in Cca treatment compared to the control group. A significant decrease of the LPL mRNA expression level was shown in primary fractions (Fr) 5 (36.2% decrease) and 6 (30.5% decrease) of the Cca water extracts. Due to the impurities checked by UPLC chromatography, Fr 5 and 6 were re-fractionated to determine the LPL mRNA expression level. Treatment of Fr 6-6 (35.8% decrease) and Fr 5-6 (35.3% decrease) showed a significant decrease in the LPL mRNA expression level. When analyzed using UPLC, major compounds of Fr 6-6 and Fr 5-6 were very similar. Subsequently, Fr 6-6 and Fr 5-6 were re-fractionated to isolate the major peak for structure elucidation. Treatment of Fr 5-6-1 (26.6% decrease) and Fr 6-6-1 (29.7% decrease) showed a significant decrease in the LPL mRNA expression level (45).

Adverse effects and toxicity: -

A rabbit skin irritation test of C. annuum fruit extract at 0.1% to 1.0% produced no irritation but caused neoplastic changes in the liver and intestinal tumours were observed in rats fed red chili powder at 80 mg/kg per day for 30 days. High doses administered over extended period of time can cause chronic gastritis, kidney damage, liver damage and neurotoxic effects (46-47).

Inhalational exposure to capsaicinoids in pepper sprays damaged rat bronchial, tracheal, nasal, alveolar cells and causing acute inflammations (48).

Acute myocardial infarction was recorded in 40 years old man admitted to emergency department with complains of chest pain and dyspnea after exposure the pepper gas that sprayed to environment during a social event (49).

Capsicum annuum should not be used during pregnancy and lactation, in people with hypersensitivity and in children. The plant should not be used on open wounds or abrasions, or near the eyes (50).

Interactions were reported with concomitant administration of Capsicum annuum with aspirin and salicylic compounds. It also decreased the actions of α-adrenergic blockers, clonidine and methyldopa (46,50-51)

Dose :-

Capsicum annuum 30-60 mg of powder of fruits (52).

Liquid extract is prepared by percolating 100 gm of the plant extract with 60 mg of ethanol, to be used as an antirheumatic. External daily dose of semi solid preparations containing maximum of 50 mg of capsaicin in 100 gm neutral base is also used as an antirheumatic and applied to the affected area not more than 3 or 4 times daily (53).

Conslusion:-

The review highlights Capsicum annuum as a promising medicinal plant with diverse pharmacological properties that can be used in a variety of medical applications due to their effectiveness and safety.
Capsicum can be applied topically to alleviate pain caused by osteoarthritis, shingles, rheumatoid arthritis, postherpetic neuralgia, trigeminal neuralgia, diabetic neuropathy, fibromyalgia, and back pain. Others have used capsicum to relieve muscle spasms and as a gargle for laryngitis.

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