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An ethanobotanical investigation of cucurbitaceae from South India: A review

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Abstract
Cucurbitaceae crops are cash crops grown as vegetables. The family cucurbitaceae well known medicinal uses the whole plant parts including roots, leaves, fruits and seeds have been extensively studied for their pharmacological activity. A herb is a plant that is valued for flavor, scent, or other qualities. From ancient days to now a day, plant parts used in cooking, as medicines as they were potential and treatment of several diseases and disorders. Main behind of that is medicinal plants is not having any side effects. Fruits of which are widely used in ayurveda and other folk medicines traditionally used for its cardioprotective, cardiotonic, general tonic, diuretic, aphrodisiac, antidote to certain poisons and scorpion strings, alternative purgative, cooling effects. It cures pain, ulcers and fever and used for pectoral cough, asthma and other bronchial disorders-especially syrup prepared from the tender fruits. The fruit is reported to contain the triterepeniode cucurbitacins B, D, G, H and 22-deoxy cucurbitacin. This is an attempt to compile an up-to-date and comprehensive review of that covers its traditional and folk medicinal uses, phytochemistry and pharmacology.

Keywords: Cucurbitaceae, Medicinal uses, Nutrition, Phytochemistry.

1. Introduction
Cucurbitaceae is the largest family of summer vegetable crops, which includes approximately 125 genera and 960 species (Jeffrey, 2005) [1]. Cucurbits represent the major vegetable and fruit crops in the world. Cucurbits family of Cucurbitaceae into 11 tribes under two subfamilies which included Zanonioideae with 60 species under 19 genera and Cucurbitoideae with 740 species under 111 genera (Jeffrey, 2005) [1]. A lot of medicinal potency to the species of the family cucurbitaceae, the most widely cultivated genera are *Cucurbita* L., *Cucumis* L., *Citrullus*., *Colocynthis* Mill, *Lagenaria* L., *Luffa* L., *Coccinia* (wight & Arn.), and *Momordica* L., This family is predominantly tropical, having 90% of the species in three main areas-Africa and Madagascar, Central and South America and Southeast Asia and Malaysia (Jeffrey, 2005) [1]. In India the family represented by 94 species in 31 genera (Renner and Pandey, 2013) [2]. In addition of the wild cucurbits, 25 species of Cucurbitaceae are in cultivation many of these prominently in the export of vegetables. A total of 38 wild and cultivated species belonging to 17 genera were collected and identified in the Eastern Ghats of Peninsular India. Out of 38 species, 30 were used medicinally, 33 were edible, 6 were used as fodder and 2 were found to be poisonous to humans and their domestic animals.
The worldwide harvest of cucumbers, gherkins, squashes and pumpkins were approximately 213 million Mt with 33% growth and watermelon, muskmelon, cantaloupe along with other melons constitute the 126 million Mt with 12% growth in 2010 (Egel and Martyn, 2007; FAOSTAT, 2011) [3,4]. The Karnataka fourth largest producer of horticultural crops in India, Cucurbitaceae crop is grown as major horticultural crop in Mandya, Haveri and Kolar districts in a total area of 5,725 ha with annual production of 8,97,242 t with productivity reaching15.68 t/ha (KSHD, 2010) [5].
Even today almost 80% of the human population in developing countries is belongs on plant resources for healthcare. Indigenous healthcare practices provide low cost alternatives in situation, where modern healthcare services are not available, too expensive and/or ineffective. Documentation of traditional knowledge especially on the medicinal uses of plants has lead to the discovery of many important drugs of the modern day (Dhiman *et al.*, 2012) [6]. Natural products are the basis of many standard drugs used in modern medicine and at least 50 plant derived drugs are developed from ethnobotanical leads. Besides, plants seem to have served as models for drug development (Rahmatullah *et al.*, 2012) [7].

The fruit juice and a leaf tea is employed for diabetes, malaria, colic, sores and wounds, infections, worms and parasites, for measles, hepatitis, and fevers. Constipation, digestion, demulcent, dermatosis, diarrhea, dyspepsia, eczema, emetic, emollient, fever, febrifuge, hemorrhoids, hepatitis, hypoglycemic, inflammation, leprosy, leukemia, malaria, menstrual colic, pain, purgative, rheumatism, scabies, skin, tumor, wound, vaginitis, vermifuge, cancer, food, glucosuria, halitosis, hematuria, polyuria, refrigerant, snakebite, anemia, colitis, dysentery, gonorrhea, appetite stimulant, insecticide, laxative, rage, rhinitis, contraceptive, fat loss, galactagogue, gout, hydrophobia, piles, pneumonia, psoriasis, sore, asthma, headache, scald, sprue, stomachache, cold, cough, hypertension, tonic gallbladder, contusions, lung, measles, suppurative, rheumatoid arthritis and lupus (Kumar *et al*., 2010 ; Murthy *et al.*, 2013) [8, 9]. Cucurbitaceae is used as the medicine for epilepsy, gonorrhea, malaria, measles, smallpox, arthritis, hypertension, kidney, arteriosclerosis, dermatological, herpes, influenza, diabetes, freckle removal and aphrodisiac (Rahman *et al.*, 2008) [10].

1. *Benincasa hispida* (Thunb.) Cogn. (Wax gourd) – The fruit is used as a vegetable. The edible fruits used as the *medicinal* value management of peptic ulcer, hemorrhages from internal organs, asthma, cough, diabetes, diuretic, nutritive, antiperiodic, constipation, heart disease, epilepsy, nervous disorders, tuberculosis colic pain and aphrodisiac. Seeds used for a free radical scavenging, anti-inflammatory, analgesic potential against tapeworm, lumbrici and diuretic. Whole plants are taken for tumour, gonorrhoea, as expectorant and helminthiasis, spermatorrhea, gastritis and infertility. Leaves are taken for constipation, juice of the fruit is massaged for flatulence and stomach ache. Pulp of seeds were dried and taken with warm water for colic pain (Rahmatullah *et al.*, 2012) [7].
2. *Cucumis sativus* L. (Cucumber) – Decoction of the leaf used for the throat infections. The fruit promotes the healthy hair growth, skin problems, sunburn and also curing swelling under the eye. Juice of the fruit softens the skin texture, fruit considered the important weight loss. Seeds are used against in cooling, the intestinal worms and tapeworms. Useful in burning sensation, fever, constipation, diuretic, anthelmintic, renal calculus and bronchitis (Rahman *et al.*, 2008) [10].
3. *Cucumis melo* L. (Muskmelon) – Fruit are tonic, indigestion, sweet, nutritive, cooling, laxative, aphrodisiac, biliousness, flattening, diuretic and aphrodisiac, Seeds are useful in helminthiasis, insanity and general weakness (Rahman *et al.*, 2008) [10].
4. *Cucurbita pepo* L. (Pumpkin) – Leaves decoction reduces fever, cooling, laxative, good for teeth, throat, eyes. Seeds reduced tapeworms and fruit is soften the skin and removes pimple and spots by applying pulp. Seeds diuretic, tonic, bronchitis and used as a treatment for nephritis other urinary system and prostate problems (Shrivastava and Roy, 2013) [11].
5. *Cucurbita maxima* Duchesne ex Lam. (Squash, red gourd pumpkin) – The fruits are sweet, refrigerant, diuretic, anticancer and tonic. The fruits are used in burns, scalds, inflammation and neuralgia, seeds are anthelmintic and nervine tonic, useful nervous weakness, constipation and piles (Khan *et al.*, 2013) [12].
6. *Cucurbita moschata* (Duch. ex Lam.) Duch. (Pumpkin) – Leaves were used in biliousness and burning sensation. The fruit is cooling, laxative, good for teeth, throat, eyes. The seeds were anthelmintic, diuretic, tonic, bronchitis, fever. Good for kidney and brains. Leaves were used as the leafy vegetables (Khan *et al.*, 2013) [12].
7. *Citrullus colocynthis* (Bitter apple) – The whole plant parts like pulp, leaves, seeds and roots used for the medicinal purpose. Ripe fruit rubbed by the people suffering severe headache and arthritis. Fruit is used for diabetes and protecting the cloths from moth in Moroco. Leaves and roots used in painful menstruation, cancer, rheumatoid arthritis, asthma and jaundice. It decoction shows cures of leprosy, antinflammatory activity and diuretic (Shrivastava and Roy, 2013) [11].
8. *Citrullus lanatus* (watermelon) – Fruit contain 90% of water content as cooling, strengthening, diuretic reduce constipation, reduce asthma attack, improves digestion, relives from arthritis, gives immunity and heal wounds. The juice of the fruit acts as antiseptic in typhus fever and purgative. Reduce skin blemishes seeds are rich in protein, magnesium, calcium and protein (Shrivastava and Roy, 2013) [11].
9. *Coccinia grandis* (L.) Voigt. – The all plant parts were used for treatment of diabetes mellitus, hypertension, inflammation, headache, typhoid, sunstroke, coughs, diarrhoea, blood dysentery, vomiting, burns and purification of blood. Juice of the plant parts produce no reduction sugar in blood and used as eye drops. Fruit and leaves used for the treatment of snake-bite, jaundice, stomach pain, oral-lesions, insanity, diabetes, anorexia, asthma, fever, dropsy, catarrh, epilepsy and gonorrhoea. The roots were used for mental diseases, persistent bleeding following menstruation, biliary disorders, spleen disorders, tumors and swelling, goiter and antidote for poison. Fruits are used for diabetes, acne, typhoid, lesions in tounge, with flower it is used for mental disorders, edema, sedative, hypertension, dermatitis, leucorrhea, hematemesis, loss of appetite, baldness, removal of scars, respiratory problems and lung disorder (Rahmatullah *et al.*, 2012) [7].
10. *Momordica charantia* L. (Bitter gourd) – The extract of leaf juice used against the cough, chicken pox, diabetes, helminthiasis, paralysis, severe diarrhea, stomachic, febrifuge, carminative, cooling, exhibit antiviral, arthritis, blood purification and antibiotic properties. Fruit juice is bitter used as medicine against leprosy, fever, sexual disorders, pain, flatulence, diabetics and rheumatism. The extract is also used effective against wound, burns, itching skin as well as anaemia, malaria, cholera and jaundice. A seed from the fruit were antihelminthic and helps to expel intestinal and parasitic worms. Roots are used to stop bleeding in piles, urinary complaints. The medicinal potency of *Momordica* species as anthelmintic, vermifuge, cathartic, hypoglycemic, aphrodisiac, antipyretic and in the treatment of burns, bilious disorders, diabetes, cataract, hypertension, leprosy, jaundice, snake bite and haemorrhoids (Joseph and Antony, 2008; Behera *et al.*, 2011) [13,14].
11. *Momordica cochinchinensis* (Lour.) Spreng.- The leaves and fruit paste is applied externally for ulcer, cancer, malaria, expectorant, liver diseases, edema, itches, constipation, pain, blood purification, colic, dermatitis, lumbago and fracture of bones. Seeds of plant are used in the treatment of ulcers, sores and obstruction of liver and spleen. Roots used in rheumatism with swelling of lower limbs. In Ayurveda, the fruit is considered as tonic, stomachic, stimulant, emetic, antibilous, laxative and

alterative (Kumar *et al.,* 2010) [8].

12. *Luffa cylindrica* M. Roxb (Sponge gourd) – Seeds are used to asthma, sinusitis and fever and stem juice is extracted and used for the treatment of respiratory disorder. Plant is bitter tonic, emetic, diuretic and purgative and useful in asthma, skin diseases and splenic enlargement. Internally for rheumatism, backache, internal hemorrhage and chest pain. The fruits are anthelmentic, carminative, laxative, depurative, emollient, expectorant, tonic useful in fever, syphilis, tumours, bronchitis and leprosy. The vine grown for the fibrous interior of the fruits. Seed is expectorant, demulcent and used in dysentery. Anti-inflammation, anti-fungus, analgesia and sedation, anti-myocardial ischemia, anti-hyper triglyceride, immunostimulation, anti-allergy, anti-asthma and expectorant effects, anti-HIV activity, anti-acute hepatic injury, cardiac stimulation, emetic and cathartic. Fruit is used in cooling, strengthening, aphrodisiac, astringent to the bowels, indigestible, expectorant, diuretic, stomachic, demulcent, productive of loss of appetite and extive of mind, bile and phlegm, purifies the blood, allays thirst, cures biliousness, good for sore eyes, scabies and itches. The seeds are tonic to the brain (Kirtikar and Basu, 1987) [15]. Amarinin from *Luffa amara* inhibits plant cell growth in cell culture, antibacterial and antifungal efficacy against dermatophytes (Devi *et al.,* 2009; Pratap *et al.,* 2012) [16, 17]. Fruits are used against cancer, headache and sinusitis. Seeds were helminthiasis, constipation and abortifacient. Roots were used against the bronchitis, dermatitis, antiemetic, diarrhea and dysentery with mucus (Rahmatullah *et al.,* 2012) [7].
13. *Lagenaria siceraria* (Bottle gourd) – Gourd juice with lime reduces the urinary tract infection. Fight against constipation, leaves juice cure baldness and aid in preventing tooth decay. The leaves of *Lagenaria siceraria* are taken as emetic in the form of decoction this one by adding sugar also used in Jaundice. Leaves are also used as alternative purgative, diuretic and antibilious. Seeds were cooling and used to relieve headache. The leaves contain cucurbitacins B, D, and traces of E. In this present work the hydroalcoholic & aqueous extract of leaves of *Lagenaria siceraria* Mol. were evaluated for its anthelmintic activity against Earthworm and tapeworm (Badmanaban and Patel, 2010) [18]. The fruit is traditionally used as cardiotonic, aphrodisiac and general tonic, livertonic against the liver disorders and pain, anti-inflammatory, expectorant and diuretic agent. Lagenin isolated from the seeds possesses immunoprotective, antitumor, anti-HIV and antiproliferative properties. Fruit revealed the presence of fucosterol, compesterols, flavonoids, cucurbitacins, saponins, polyphenolics, triterpenoids, C-flavone glycosides and ellagitannins (Deshpande *et al.,* 2008) [19].
14. *Luffa actangua* L. Roxb (Ridge gourd) – The fresh leaves used against ringworm, piles, jaundice, tetanus and leprosy. Roots with water useful in the removal of kidney stone, to cure bronchitis, headache and boils. Fruits are used in blood purification, demulcent, diuretic, nutritive and used against the worms. Fruit used against the sunburn and premature graying of hair and seeds used for skin treatment. Roots and seeds for expulsion of worms, treatment to diarrhea and syphilis (Kirtikar and Basu, 1987) [15].
15. *Trichosanthes cucumerina* L. (Snake gourd) – Roots is used to cure bronchitis, headache and boils. Juice of the fruits and leaves useful in congesting liver, headache, purgative, improve apitite, emetic, anthelmintic, anti-inflammatory activity of roots, antidiabetic activity of seeds and cure biliousness. The seeds were cooling, haemagglutinating, expels worms and used for treatment of diarrhea, syphilis activity (Shweta *et al.,* 2012) [20].
16. *Trichosanthes dioica* (Pointed gourd) – Leaves juice is used as the tonic for febrifuge cooling, laxative and used against liver spleen and oedema. Leaves are used for skin treatment. Fruit extract lowers the cholesterol activity and blood sugar. Whole plant shows antimicrobial activity, in treatment of epilepsy, alopecia, skin diseases, diabetes mellitus, antipyretic, diuretic, cardiotonic, cooling, laxative and antiulcer. The used in treating against alcoholism and jaundice activity (Shweta *et al.,* 2012) [20].
17. *Trichosanthes anguina* (Snake gourd) – The root is used as a cure for bronchitis, syphilis, vomiting, headache and boils. The fruit is used as an anthelmintic, antihemorrhagic, antidiarrhoel and anti-inflammatory activity in roots and tubers and antidiabetic activity in seeds. The juice acts stomach disorders as well as gastroprotective actions (Rahman, 2013) [21].
18. *Trichosanthes kirilowii* (Chinese cucumber) – The whole plant parts used in the treatment of jaundice, mumps, diadetes, constipation, cancer and an astringent. The plant leaves and fruits used for treatment of asthma, flatulence, tuberculosis and tropically applied for dermatitis. The seeds showed anti-inflammatory agent, cough medicine and as an expectorant. Shows cytotoxic activity against cancer cells. Anti-tumour activity (Shweta *et al.,* 2012) [20].

Nutrition

1. Cucurbit crops are well known for their nutritive value and health benefits (Table 1). These are consumed either as immature fruits or mature fruits or young shoots and leaves. Cucumber, melon, pumpkin, watermelon and zucchini are rich in minerals, beta carotene, lycopene, lutein and zeaxanthin. Cucurbitaceae crops are sources of carbohydrates and water and their seeds are rich in oil and protein (Rahaman, 2003) [22]. Depending upon the species, virtually all parts of the plant can be used as food, including leaves, shoots, roots, flowers and seeds. Starch can be extracted from the roots, and the seeds are rich source of oils and proteins (Rahaman, 2003; Jacks *et al.,* 1972) [22, 23]. The seeds being rich source of oil and protein are used in the preparation of pickles, curries, salads, pasta and animal feed (Nerson, 2007; Upaganlawar and Balaraman, 2009) [24, 25]. Fruits are eaten when immature (summer squash) or mature (Watermelon). Fruits can be baked (Squash), pickled (Cucumber), candied (Watermelon), or consumed fresh in salads (Cucumber) or dessert (Melon). Seeds are vermifuge against tapeworm. The seeds are of high nutrition producing essential amino acids and important fatty acids (Adebooye, 2009) [26]. The dried Cucurbitaceae fruits are extremely hard with water proof rind, used as multi-purpose containers. Cucurbits are used as ornamentals, sponges, musical instruments and utensils (Ng, 1993) [27]. Luffa sponges were utilized to make scrubbing pots, pans, barbecue grills and tires which were used in household cleaning product. The dried fruits yield spongy substances which are used as a bath sponge. Gourds are used as masks, smoking pipes,

birdhouses, musical instruments, fish net, ornamental purposes such as masks and gourd craft decoration (Bisognin, 2002) [28].

Phytochemical

The seeds considered as the least importance are having a prime role in human nutrition due to encapsulation of innumerable phytochemicals, vitamins, minerals, amino acids and essential fixed oils especially of unsaturated type. Cucurbits are source of secondary metabolites. The Cucurbitacins and triterpenoids impart bitter flavour to many cucurbits and serve as attractants of beetles such as *Diabrotica* (Whitaker and Davis, 1962) [29]. Alkaloids have been reported in *Momordica* and saponins are found in *Cucurbita*, *Citrullus*, *Lagenaria* and *Momordica* (Schultes, 1990) [30]. *M. charantia* fruits consists glycosides, saponins, alkaloids, reducing sugars, resins, phenolic constituents, fixed oil and free acids. *M. Charantia* consists the following chemical constituents those are Alkaloids, charantin, cucurbitacins, momordicins, peptides, polypeptides, proteins, ribosome-inactivating proteins, rosmarinic acid, rubixanthin, spinasterol, steroidal glycosides, stigmasta-diols, stigmasterol, taraxerol, trehalose, trypsin inhibitors, uracil, v-insulin, amino acids-aspartic acid, serine, glutamic acid, thscinne, alanine, g-amino butyric acid. Leaves are nutritious sources of calcium, magnesium, potassium, phosphorus and iron; both the edible fruit and the leaves are great sources of the B vitamins. The abortifacient proteins present in Cucurbitaceae are momorcharin (*M. charantia*), luffaculin (*L. operculata*) and beta-trichosanthin (*T. cucumeroides*). *M. charantia* fruit contains steroids, charantin, momordicosides (G, F1, F2, I, K, L), acyl glucosyl sterols, linolenoyl glucopyranosyl elenosterol, amino acids, fatty acids, and phenolic compounds. The seeds contain galactose-binding lectins, vicine, amino acids, fatty acids, terpenoids, and momordicosides (A, B, C, D and E). The phytochemicals isolated from the whole plant, vines or leaves include saponins, sterols, steroidal glycosides, alkaloids, amino acids and proteins (Kumar *et al.*, 2010; Khulakpam *et al.*, 2015) [8, 31].

Table 1: Nutrient content of edible portion of the Cucurbitaceae vegetables (per 100g of edible portion).

	Unit	Cucumber	Squash	Bittergourd	Pumpkin	Bottlegourd	Ridgegourd
Water	g	95.23	94.76	94.03	91.6	95.54	93.85
Energy	kcal	15	17	17	26	14	20
Protein	g	0.65	1.21	1.00	1.00	0.62	1.20
Total lipid	g	0.11	0.32	0.17	0.1	0.02	0.20
Carbohydrate	g	3.63	3.11	3.7	6.5	3.39	4.35
Fiber, total dietary	g	0.5	1.0	2.8	0.5	0.5	1.1
Sugars, total	g	1.67	2.5	-	2.76	-	2.02
Calcium	mg	16	16	19	21	26	20
Iron	mg	0.28	0.37	0.43	0.8	0.20	0.36
Magnesium	mg	13	18	17	12	11	14
Phosphorus	mg	24	38	31	44	13	32
Potassium	mg	147	216	296	340	150	139
Sodium	mg	2	8	5	1	2	3
Zinc	mg	0.2	0.32	0.8	0.32	0.70	0.07
Vitamin C	mg	2.8	17.9	84.0	9.0	10.1	12.0
Thiamin	mg	0.027	0.045	0.04	0.05	0.029	0.050
Riboflavin	mg	0.033	0.094	0.04	0.11	0.022	0.060
Niacin	mg	0.098	0.451	0.4	0.600	0.320	0.400
Vitamin B-6	mg	0.04	0.163	0.043	0.061	0.04	0.043
Folate, DFE	µg	7	24	72	16	6	7
Vitamin A	IU	105	200	471	8513	16	410
Vitamin E	mg	0.03	0.12	-	1.06	-	0.10
Vitamin K	µg	16.4	4.3	-	1.1	-	0.7
Fatty acids, total saturated	g	0.037	0.084	-	0.052	0.002	0.016
Fatty acids, total monosaturated	g	0.005	0.011	-	0.013	0.004	0.037
Fatty acids, total polysaturated	g	0.032	0.091	-	0.005	0.009	0.087

Source: Rahman *et al.*, 2008; USDA Nutrient Database for Standard, 2010. [10, 32]

Conclusion

This study clearly demonstrated that exhibit antibacterial and anti fungal activity which might be helpful in preventing the progress of various diseases and can be used in alternative system of medicine. Besides folklore medicine also claims its uses especially in cardiac and hepatic diseases, ulcer, etc. Presently there is an increasing interest worldwide in herbal medicines accompanied by increased laboratory investigation into the pharmacological properties of the bioactive ingredients and their ability to treat various diseases. Numerous drugs have entered the international market through exploration of ethnopharmacology and traditional medicine. Although scientific studies have been carried out on a large number of Indian botanicals, a considerably smaller number of marketable drugs or phytochemical entities have entered the evidence-based therapeutics.

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