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MEDICINALS AND CHEMICAL PROPERTIES OF SOME SPECIES OF THE CUCURBITACEAE FAMILY: A REVIEW

Claudia-Sorina LUNGU[1], Costel VÎNĂTORU[2], Bianca MUŞAT[2], Camelia BRATU[2], Florin BURLAN[2], Viorica LAGUNOVSCHI-LUCHIAN[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd, District 1, Bucharest, Romania
[2]Plant Genetic Resources Bank - for Vegetables, Floricultural, Aromatic and Medicinals Plants, 56 Nicolae Bălcescu Blvd, Buzău, Romania

Corresponding author email: claudiasorina03@gmail.com

Abstract

The Cucurbitaceae gourd family consists of more than 900 species.The plants of this family consist of several edible fruits used in medicine or in different food recipes. The other parts of the plants (steam, leaves, flowers and seeds) can be used in the treatment of different symptoms such as headache, rhinits, fever, anemia, inflamations or poisoning. Cucurbits are rich in carotenoids, saponins, phytochemicals and vitamins.Momordica charantia can be used in the treatment of diabetes, ulcers or liver diseases.Cucumis sativus seeds can help to lower the cholesterol, while the fruits can reduce swelling and burns.Cucumis metuliferus is a great source of anti-oxidants protecting the organism of the cellular damaging caused by the oxidative stress, reducing inflammations and preventing heart diseases.Different parts of Luffa cylindrica can be used in treatment of snake bites, chronic bronchitis, nasal swelling and used in China for anthelmintic and stomachic purposes.This review evaluates the current literature about medicinals and chemical properties of some plants of the Cucurbitaceae family in addition to their positive effects on human health.

Key words: *Cucurbitaceae, medicinal properties, homeopathy, antioxidants, chemical properties.*

INTRODUCTION

The Cucurbitaceae family, commonly known as the gourd or squash family is a diverse and significant group of plants that includes around 113 genera and over 900 species, making it one of the largest plant families (Dhiman et al., 2012).

Cucurbitaceae are annual or perennial vines plants with fibrous or tuberous roots and angular stems. The leaves are alternate with solitary tendrils and exstipulate. The plants are monoecious or dioecious, with unisexual, paniculate, racemose or subumbellate flowers (Xu Z., Chang L., 2017).

The Cucurbitaceae family is not only important for it's culinary uses, but also for it's medicinal and chemical properties, studied for their therapeutic potential as antidiabetic, anti-inflamatory , antioxidant effects and purgative properties (Rolnik and Olas, 2020).

One of the chemical component present in Cucurbitaceae family is cucurbitacin, a compound categorized into 12 classes ranging from A to T and more than 200 derivates, known for anti-inflamatory and anticancer properties, and saponin, a sour compound used in treatment of ulcers (Li Y. et al., 2023).

Cucumis sativus is widely used as food, eaten raw, pickled or in salads. It's medicinal properties have been recignized in homeopathy, especially in skin conditions like redness or dilated pores, intoxications, digestive issues and urinary disoders.

Cucumis metuliferus, also known as African horned cucumber or kiwano is used in treating diabetes. The fruit is orange with spiky outer skin and a jelly- like interior with edible seeds, containing antioxidants and hydrating content due to it's high water content. *C. metuliferus* is a close relative of cucumbers and melons in which they may have diverged from a closely

ancestor species. Rich in vitamins like, vitamin C, A and potassium, helps strenghtening the immune system and may reduce chronic disease (Helm and Hemleben, 1997).

Momordica charantia has been used in traditional medicine for managing diabetes, due to it's effects to lower blood sugar levels. The plant contain momordicin, which have the same effect as insulin. The Latin name Momordica means "to bite'', referring to the jagged edges of the leaf, which appear as if they have been bitten (Kumar et al., 2010).

Luffa cylindrica, known as sponge gourd or *Egyptian cucumber* is widely cultivated in tropical or subtropical regions. The fruit can be eaten when is immature as main dish or in salads. When matured, the fibers are used as bath sponge for exfoliation. The water of luffa is used in Japan in lotions for skin irritations (Umehara et al., 2018).

1. MEDICINAL PROPERTIES

1.1. ANTIBACTERIAL ACTIVITY

The seed extraction of *Cucumis sativus* showed high inhibition against *S. aureus*, using the Agar well diffusion method, the seeds possessing potential broad spectrum in antimicrobial activity (Heidari H., 2012).

Cucumis sativus shows high antibacterial and antifungal activity against microorganisms like *S. pyogene*, *E. coli* and *P. aureginosa*, therefore cucumber can be used as an alternative for antibiotics (Balogun et al., na).

Extracts from leaves, fruits and seeds of *L. cylindrica* have been studied for their preventive effects against *Bacillus subtilis*, *Escherichia coli* and *Salmonella typhi*.

The extracts of dried and ash-dry leaves of *Luffa cylindrica* contain bacteriostatic and bactericidal effects against pathogenic bacteria on the skin (Sirisa-Ard et al., 2023).

The extracts from *L. cylindrica* exhibited antimicrobial activity against *Candida albicans* and *Staphylococus aureus*.

1.2. ANTIOXIDANT ACTIVITY

It has been shown through a study from Nigeria the extract of *Cucumis metuliferus* contains volative oils, presenting antioxidant activity with IC50 values, ranging between 537.56-2579.91, the study supporting the use of the *C. metuliferus* in the treatment of diseases (Elisha, 2024).

The combined action of flavonoids, tannins and phenolic acids in *Luffa cylindrica* extracts help to combat the oxidative stress, which arise from an unequal state between the generation of free radicals and the body's capacity to counter act this imbalance may cause damage to the cells, associated with various chronic diseases and cancer (Indurthi & Sarma, 2024).

The University of Malakand, Chakdara, Pakinstan, tested the effects of the microwave against the antioxidants properties of *Momordica charantia*.

The fruits were divided into four portions and then subjected to microwave heating for 5-10 and 15 minutes. One portion of untreated fresh fruit was used as a control (Zeb et al., 2024).

The results showed the microwave heating appears to positively influence the concentration of most of the identified compounds of *Momordica charantia* fruits, excepting for one compound (9-z-lutein) which decreased with prolonged heat exposure.

Aqueous extracts of bitter melon have a considerable hypoglycemic impact and glucosis tolerance.

Ethanolic extracts of cucumber fruit shown hepatoprotective activity against paracetamol induced toxicity in albino rats (Heidari et al., 2012).

1.3. ANTI-DIABETIC

Diabetes mellitus is a global health concern, affecting millions of individuals worldwide. It is characterized by hiperglycemia resulting from insufficient insulin production or insulin resistance (Sethi et al., 2024).

The extract of *C. metuliferus* contains 17 known phytochemical compounds, including ursolic acid. The structure was determinate by IR spectroscopy, mass spectroscopy and 1H NMR. *C. metuliferus* exhibited enzymatic inhibitory activity on key enzymes involved in diabetes (Busuioc, 2023).

The study from Romania demonstrated the activity of hydro-ethanolic extracts of *C. metuliferus* in prevention therapy of diabetes mellitus and compounds identified with a potential use in various disease management.

The fruit ethanol extract of *Cucumis sativus* was used to treat diabetes in rats, the study from Benin-Benin inducating the ethanol extract of the plant can enhance antioxidant defensive

system exposed to the diabetogenic agent, STZ (Osahon et al., 2024).
The smoothie made with cucumber and other fruits (carrots, apples, coconut milk) was effective in lowering blood glucose levels in diabetic rats, making the smoothie suitable for type-2 diabetics (Michael et al., 2024).
Luffa cylindrica leaf and seeds extracts showed results in improving the lipid profile and lower the blood glucose in rats (Abigail L. & Metuaghan E.A., 2019).
The antidiabetic activity of *Luffa cylindrica* seeds protein in rats with diabetes has been studied at the University of Ilorin. Luffa cylindrica seed protein (LSPH) was obtained from LCS protein isolate via pancreatin hydrolysys. The study revealed that LSPH may be explored as potential anti-diabetic agent with little or no safety concern (Arise et al., 2024).
A study by Oguntibeju (2019) proved that charantin-rich extract increase plasma glucose tolerance, suggesting the extract could improve insulin sensivity in patients with diabetes type 2. (Oguntibeju, 2019)
There is no approved cure for diabetes mellitus; therefore, the management and treatment of the disease are the primary courses of action. The treatment of diabetes mellitus is complex and involves a combination of exercises, pharmaco-therapy and nutritional therapy as interventions for successful disease management (Shaikh A.A. et al., 2022).

1.4. ANTI-HIV ACTIVITY

M. charantia extracts inhibit the infection and development of most viruses, including the HIV, the plant root having a moderate anti-HIV activity, while the leaf extract exert immunostimulatory effects against other potential viral diseases or worms infections.
In a hospital in Sri Lanka, the diabetes patients were administrate fruits and leaves of *Momordica charantia* in different forms (cooked, fried, crushed, raw or as juice) with no other plants combined (Niluka et al., 2024). The parts of the plants were dried by sun exposure of shade drying, the majority of the patients consumed fresh plant parts.
The fresh plant parts were consumed by the majority of the patients raw or fried to prevent the loss of bioactive compounds and their biological properties, the study revealing important informations about the antidiabetic plants and their preparation or their form of administration in Sri Lanka.

1.5. ANTI CANCER

The bitter melon have a role in controlling cervical cancer, leukemia and nasopharyngeal carcinoma.
Cucumber peel can aid reducing cramps and potentially contribute to colon health by eliminating toxins, offering potential reassurance in colon cancer (Saira et al., 2024).

1.6. HYPERTENSION ACTIVITY

Cucumis sativus has hypotensive properties, the juice being and effective treatment lowering the blood pressure in pregnant women and cholesterol levels in patients with hypertension (Yanti et al., 2024; Kusrina et al., 2024; Mahruri et al., 2024).
Cucumis sativus can reduce blood pressure and urine protein levels in women childbearing age before hypertension (Kartini & Delano, 2024).
The pulp the *Cucumis sativus* can heal the diabetic wounds. An ointment containing silver nanoparticles was applied on mice to assess it's healing potential. The results demonstrated the wound healed in 15 days, while also exhibiting antibacterial and antioxidant properties (Iqbal et al., 2024).

1.7. TRADITIONAL MEDICINE

The cucurbitacins has been used in traditional Chinese medicine for treating liver diseases, hepatitis and hepatic cancer, inhibiting proli-feration of cancer cells (Li Y. et al., 2023).
A recipe from Burkina Faso is used in the treatment of viral hepatitis B, often associated with *Momordica charantia.*
Momordica charantia, used in the treatment of liver cancer, is associated with a recipe from Burkina Faso, used in the treatment of viral hepatitis B (Zongo et al., 2024). Hepatib tiben is a supplement made from whole plants of *Phyllanthus amarus*, *Cassia nigricans* and leaves of *Balanites aegyptiae.*
The study made in Burkina Faso suggest that aqueous infusions of Hepatib tiben and *M. charantia* could be promising due to their high content of total phenolic compounds.
The Hepatib tiben and *Momordica charantia* can be used combined for the treatment of

advanced chronic viral hepatitis and liver cancer, by traditional health practitioners in Burkina Faso (Traoré K.T. et al) but further studies needs for a better understanding.
The compounds found in L. *cylindrica* peel can reduce pain and swelling, while the water extract can be used to treat sunburnt or reducing the redness.
C. sativus is an ingredient used in lotions or masks to reduce the irritations, treat sunburn and heal blemishies.

1.8. HOMEOPATHIC USES

Some varieties of luffa are used in homeopathic medicine as treatment of seasonal allergic rhinits.
A study in Germany demonstrated the treatment produced a significant decrease in hay fever symptoms, with no significant adverse systemic effects (Weiser M. et al., na).

2.0. CHEMICAL PROPERTIES

Phytochemicals are naturally occurring compounds that are biologically active and highly beneficial on human health. The main phytochemical components present in medicinals plants are flavonoids, terpinoids, tannins, saponins, cardiac glycosides, alkaloids, phytoesterols and phenolics (Figure 1).
Phytochemicals can produce direct or indirect defensive against anti-inflamatory, antimicrobial, antioxidative and anti proliferative properties (Sitobo et al., 2024)
Tannins have the potential to act as biological antioxidants, proton precipitating agents and metal ion chelators (Okonkwo S., 2009).
The presence of saponins contribute to a higher degree of antibacterial activities.

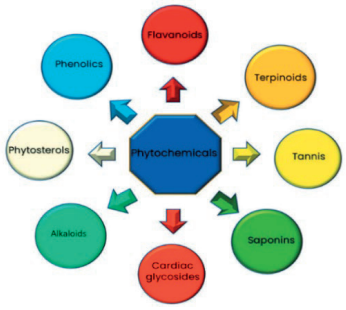

Figure 1.The main phytochemical components present in medicinal plants ((Sitobo et al., 2024; Bansal A. & Priyadarsini C., 2021)

Saponins are found in a variety of plant species through the stems and leaves. The saponins have a sour flavor and is used in the treatment of ulcers or an antibacterial .
The saponins from *Luffa cylindrica* present in the peel and pulp, have desensive role in the plant system against pests and diseases.
Phenols and flavonoids were found in high quantity in *C. sativus* peel, in concentration of 261.73 ± 13.54 for phenols and 261.73 ± 13.54 for flavonoids (Ani et al., 2022).
The phenols and flavonoids play an important role in the prevention of cardiovascular disease and cancer development (Kähköen et al., 1999). These compounds are also important in retaining the oxidative degradation of lipids in food industry, to improve the quality of the food (Wojdyla, 2007).
It has been shown that the ethanol extract of kiwano rind inhibited denaturation of bovine albumin treated with heat in a concentration - dependent manner, exhibiting 47.14% maximum activity (Ani et al., 2022).
The horned melon is more nutritious than cucumber with a higher concentration of vitamins A and C, and zinc. The fruit posses high mineral content particularly potassium, phosphorus, magnesium, calcium, sodium and copper (Muthoni et al., 2024).
Cucumis sativus have higher amount of humidity and protein compared to *C. metuliferus*, while kiwano have higher amount of ash, sugars, polyphenols, flavonoids and tannins (Table 1)
Cucumis metuliferus have less amount of magnesium and calcium compared to *C. sativus* (Table 2).

Table 1.Proximate and phytochemical content of *Cucumis sativus* and *Cucumis metuliferus* (Sambou et al., 2023)

	Cucumis sativus	***Cucumis metuliferus***
Proximate		
Humidity (%)	95.64	93.76
Ash (%)	4.82	7.52
Protein (%)	35.65	27.72
Sugars (%)	430.34	469.99
Phytochemical		
Polyphenols (%)	28.39	49.28
Flavonoids (%)	0.50	0.94
Tannins (%)	22.31	23.30

Table 2. Mineral content of *Cucumis sativus* and *Cucumis metuliferus* (Sambou et al., 2023)

	Cucumis sativus	*Cucumis metuliferus*
Mg (mg/100 g)	43.72	47.87
Ca (mg/100 g)	6.74	21.25
Na (mg/100 g)	19.80	17.02
K (mg/100 g)	214.07	203.90
Fe (mg/100 g)	4.22	1.00

The stem of *Luffa cylindrica* had higher amount of carbohydrate and crude fiber content than the leaf, while the leaf present higher amount of protein and ash than the stem (Sola, 2021).
The proximate and mineral composition of *Luffa cylindrica* leaf and stem are present in the table below (Table 3).

Table 3. The proximate and mineral composition of *Luffa cylindrica* leaf and stem (Sola, 2021)

Parameters	**Leaf**	**Stem**
Moisture	87 ± 0.1	8.17 ± 0.15
Protein	24.47 ± 0.15	11.87 ± 0.15
Ethanol extract	0.73 ± 0.15	0.3 ±0.1
Ash	9.17 ± 0.21	6.77 ± 0.15
Crude fiber	10.57 ± 0.15	18.47 ± 0.15
Carbohydrate	46.37 ± 0.40	54.43 ± 0.42
Ca	180.00 ± 5.00	136.67 ± 7.64
Fe	10.83 ± 0.21	3.70 ± 0.1
Zn	0.4 ± 0.1	0.13 ± 0.06
Mg	73.33 ± 2.89	43.33 ± 2.89
Mn	0.03 ± 0.01	0.02 ± 0.01
K	43.33 ± 2.89	40.00 ± 5.00
Po	14.33 ± 2.89	85.00 ± 5.00

Momordica charantia is a great source of carbohydrates, vitamins and proteins (Table 4), rich in pottasium and B carotene.

CONCLUSIONS

The Cucurbitaceae family have beed used for their antimicrobial, anti-inflammatory and anticancer properties. The cucurbitacins saponins exhibit strong hepatoprotective activities, while the flavonoids and phenolic compounds contribute to their antioxidant and anti-inflammatory effects.
Chemically, these plants are rich in vitamins, minerals and bioactive compound influence the immune functions and help the treating diabetes and different viral diseases. The Cucurbitaceae plants are a great valuable to influence the immune functions and help in treating diabetes and different viral diseases.
The Cucurbitaceae plants are a great valuable source of natural compounds, making them essential in medicinal researches.

Table 4. Proximate and nutrient composition of *Momordica charantia* (Upadhyay, 2015)

Constituents	**Quantity**
Moisture (g/100 g)	83.20
Carbohydrates (g/100 g)	10.60
Proteins (g/100 g)	2.10
Fiber (g/100 g)	1.70
Calcium (mg/100 g)	23.00
Phosphorus (mg/100 g)	38.00
Pottasium (mg/100 g)	171.00
Sodium (mg/100 g)	2.40
Iron (mg/100 g)	2.00
Copper (mg/100 g)	0.19
Manganese(mg/100 g)	0.08
Zinc (mg/100 g)	0.46
B carotene	126.00
Vitamin C	96.00

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