

Review Article**A Review on Biological Attributes of *Momordica charantia*****Zermina Khalid¹, Syeda Mona Hassan¹, Shahzad Sharif Mughal^{1, *}, Syed Khurram Hassan², Huma Hassan³**¹Department of Chemistry, Lahore Garrison University, Lahore, Pakistan²Institute of Quality and Technology Management, University of the Punjab, Lahore, Pakistan³Department of Chemical Engineering, NFC Institute of Engineering and Fertilizer Research, Faisalabad, Pakistan**Email address:**

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To cite this article:Zermina Khalid, Syeda Mona Hassan, Shahzad Sharif Mughal, Syed Khurram Hassan, Huma Hassan. A Review on Biological Attributes of *Momordica charantia*. *Advances in Bioscience and Bioengineering*. Vol. 9, No. 1, 2021, pp. 8-12. doi: 10.11648/j.abb.20210901.12**Received:** June 22, 2020; **Accepted:** November 2, 2020; **Published:** March 26, 2021

Abstract: *Momordica charantia* is an herbal climber grown in tropical and subtropical regions, belonging to the *Cucurbitaceae* family. *M. charantia* can be used as a remedy against various diseases from ancient times. It has been used in various Asian traditional medicines for the treatment of cholera, bronchitis, anemia, blood diseases, ulcer, diarrhea, dysentery, gonorrhoea, rheumatism, gout, worms, colic, disease of liver and spleen, cancer and diabetes etc. The main constituents of *M. charantia* are triterpene, protein, steroid, alkaloid, inorganic, lipid, and phenolic compounds, which are responsible for biological and pharmacological activities including anti-diabetic, anti-cancerous and anti-tumorous, anti-microbial, anti-viral, anti-helminthic, antimalarial, anti-ulcerative and immunomodulatory. Combination of its Ayurvedic properties i.e. Gunna, Rasa and Virya (Dry, pungent, light, bitter and hot) makes it the real nature's wonder. Hence the present study is planned to evaluate the biological characteristics like antioxidant and antimicrobial properties of *M. charantia*. These activities will be assessed by using different assays viz. total phenolics, total flavonols and scavenging assay for 1,1-diphenyl-2-picrylhydrazyl (DPPH). The antimicrobial activity will be evaluated by disc diffusion method.**Keywords:** *Momordica charantia* Linn, General Description, Medicinal Properties

1. Introduction

Momordica charantia is generally known as bitter melon and is a subtropical or tropical climber belonging to the *Cucurbitaceae* family. It is generally found in Malaysia, India, China and steamy Africa. All parts of the plant are very bitter, as is comprised of a bitter complex called *momordicin* that causes a stomachic effect [1, 2]. Bitter melon has been used as a folk remedy to treat toothache, dysmenorrhoea, psoriasis, jaundice, emmenagogue, diabetes, diarrhea, scabies, leucorrhoea, gout, kidney stone, eczema, galactagogue, furuncle, pneumonia and rheumatism [3]. *M. charantia* possesses anti-leukemic, antiviral, antitumor, antidiabetic [4, 5], antibacterial, anthelmintic [6], antimutagenic, hypoglycemic effect, [7], anti-ulcer, antioxidant [8], olesterolemic, hypotriglyceridemic, hypotensive, insecticidal and immunostimulant attributes [5]. Food dishes

of *M. charantia* are not famous in the Western world because of its taste [7]. Although the dissimilar parts of the plant *M. charantia* (Karela) have been used as food and drug but the fruit is the most vital part. Depending on the ripeness stages, *M. charantia* seed has been found as an ample source of protein (28-30%) and oil (18.1-37.6%) [9]. Former surveys have presented that the leaves and fruits of *M. charantia* are also rich in phenolics and showed a great antioxidant potential. Fresh *M. charantia* is also used as an alimentary food, as it contains: 0.9% protein, 20 kJ energy per 100 g, 0.1% lipid, 93.8% water, 3.3% dietary fiber, 0.6% ash, and a minor quantity, 0.05%, of vitamin C [8].

2. Taxonomy

2.1. Taxonomy of *M. Charantia*

Nation: Plantae
 Union: Magnoliophyta
 Period: Magnoliopsida
 Order: *Cucurbitales*
 Family: *Cucurbitaceae*
 Type: *Momordica*
 Class: *M. charantia*

Communal Name is Bittergourd, Karle. [10] *M. Charantia* is a herbal plant having length of 10 meter. The plant has modest leaves which are 4-5 cm in width having 3-7 profoundly separated lobes. The plant has oblong fruit with a particular waxy exterior. The inner part of the fruit is hollow, containing white core and seeds [11]. *M. charantia* is an annual to perennial monoecious climbing herb. It may be either hairless or somewhat hairy. There is a cardinal taproot, from the top of which the stems spread to climb over any accessible support [12]. The nutritional value is less due to low levels of carbohydrates and proteins, as compared to other member of *Cucurbitaceae* with high nutritional value, due to the iron, phosphorus and ascorbic acid content [13]. *M. charantia* grown in Thailand could be divided into two types; one type has cylindrical and larger fruit, known as Mara-chin or Chinese bitter melon. The other one has pear-shaped and smaller fruit, typically called Mara-Khee-Nok or thai bitter melon [14]. *M. Charantia* is a flowering plant in the *Cucurbitaceae* family. Fruit are mostly spindle or ellipsoid in shape and warty or ridged, dehiscent unevenly as a 3 valved fleshy capsule [10].

M. charantia invented on the Indian subcontinent, and was presented into China in the 14th century. Known by different native names in the subtropics and tropics regions but they are universally identified acetyl by their specific botanical name. [7]

It is also composed of charantin, cycloartenols, cucurbitanes, cucurbitacins, cryptoxanthin, elaeostearic acids, diosgenin, erythrodiol, galacturonic acids, goyasaponins, goyaglycosides, hydroxytryptamines, momordenol, gypsogenin, gentisic acid, linolenic acid, lanosterol, guanylatecyclase inhibitors, linoleic acid, karounidiols, momorcharasides, *momorcharins*, *momordin*, *momordicili*, lauric acid, *momordicinin*, *momordicosides*, multiflorenol, *momordolo*, oleanolic acid, myristic acid, oleic acid, nerolidol, oxalic acid, petroselinic acid, peptides, proteins, polypeptides, rubixanthin, steroidal glycosides, ribosome-inactivating proteins, stigmaterol, rosmarinic acid, stigmasta-diols, spinasterol, trehalose, taraxerol, zeatin, uracil, vaccine, verbascoside, v-insulin, trypsin inhibitors, zeaxanthin, zeatinriboside, vicine, glutamic acid, Amino acids-aspartic acid, thscinne, zeinoxanthin, serine, b-sitosterol-d-glucoside, elasterol, pipercolic acid, citrulline, alanine, ascorbigen, g-amino butyric acid, lutein, pipercolic acid, lycopene and flavochrome [10].

2.2. Pharmacological Attributes

Alcoholic method of the idea of medicinal foods was

drawn from the study that foods are not proposed to fulfill hunger and only deliver vital macro- and micronutrients to the body. But also to provide it with bioactive ingredients that help to decline nutrition-related diseases and ensure physical well-being [16]. Medicinal properties include antimicrobial, anti-mutagenic, anti-cancerous, antihelminthic, antitumorous, abortifacient, anti-fertility, anti-diabetic [5].

2.3. Anti-Diabetic Properties

There are various herbal medicines that have been used to treat diabetes in Asia and other growing nations. *M. charantia* is used for the treating diabetes related condition among the native population of South America, Asia, East Africa and India [17]. Diabetes mellitus is the one of the five significant causes of death. It is a syndrome of disorderly metabolic rate, generally due to a permutation of heritable and environmental causes, resulting in abnormally high blood sugar levels. Etiologically, it is due to absolute or relative lack of insulin, the inattentiveness of insulin or both [18]. *M. charantia* is one of the vital plants that have been investigated systematically for the treatment of diabetes. Current scientific indication of the biological function of *M. charantia*, it is one of the best promising plants against diabetes. Traditional uses of *M. charantia* in India discovered that it is one of the important plant for lowering blood glucose levels in patients with diabetes. [19]

It is also reported that oral management of fresh fruit juice (dose, 6 c.c. /kg. body wt.) lowered the blood sugar level. Oral management of alcoholic extracts of the plant to certain diabetic patients did not produce any hypoglycemic action. [10] P-Insulin, a polypeptide from the seeds and fruits quickly decreased and regulated the blood sugar level. *M. charantia* can be used to lesser blood sugar levels in an animal model of diabetes. Alcohol extracted charantin from *M. charantia* comprises of mixed steroids, and it enhanced that glucose acceptance to a degree similar to the oral hypoglycemic agent, tolbutamide [20]. Alternative compound, polypeptide found in fruits and seeds of bitter melon is comparable to insulin in composition. So it can be of a great benefit in therapy of type 1 diabetes. Third compound is alkaloids which have been famous to have a blood sugar lowering effect. Compounds known as oleanolic acid glycosides have been found to enlarge glucose tolerance in type 2 diabetes [21].

Hence, in the current study the aqueous extracts of *M. charantia* fruits, were estimated for the potential anti hyperlipidemic and antidiabetic effect on streptozotocin-induced diabetic rats and compared with the result with glibenclamide, a standard antidiabetic medicine [22]. The hypoglycemic probable mechanisms in *M. charantia* have been recognized as glycosides, triterpenes, polysaccharides, saponins, alkaloids, steroids and proteins. While numerous fresh chemicals were isolated from *M. charantia* and useful for examining their antidiabetic mechanisms. The mixture of these hypoglycemic chemicals such as charantins or saponins appeared to present a meaningfully advanced bioactivity. For example, the hypoglycemic chemicals of *M. charantia* are confirmed as a combination of steroidal saponins known as

alkaloids and *charantins* [8] and mice have shown significant lowering of blood glucose levels [23].

3. Anti-Oxidant Properties

M. charantia have medicinal value and great antioxidant properties due in part to phenols, terpenes, isoflavones, flavonoids, glucosinolates and anthraquinones [23]. Studies have reported that phenolics have powerful antioxidant and free radical-scavenging actions. All plant of *M. charantia* (flesh, aril and seeds) has been shown to a good font of phenolic compounds This one of the best study verified that the flesh, aril and seeds totally possess very high antioxidant potential [24]. Secondary metabolites and antioxidants play a key role in stopping disease due to oxidative anxiety, which indications to collapse of cell membranes and numerous pathological diseases [25]. Antioxidants are naturally present in the spices and herbs and thus play a vital role in the chemoprevention of diseases and aging [26]. Many nutritional phytochemicals, particularly phenolic compounds, have demonstrated antioxidant characteristics in various disease states such as diabetes, liver disease, cardiovascular disease and cancer. Consequently, the profitable development of plants as roots of antioxidants for nutritional and health purposes are of great interest worldwide [27].

3.1. Antimicrobial Property

Many infectious diseases have been cured with antimicrobial agents continues to present problems in modern-day medicine. As numerous studies display a significant increase in the incidence of bacterial resistance to some antibiotics. Consequently, there is a necessity to search for new infection-fighting stratagems to control microbial infections [28]. Jigsaw *et al.* (2008) reported that leaves of *M. charantia*, possess strong antimicrobial potential against *E. coli* (gram-ve), *S. aureus* (gram+ve) and *C. albicans* strains. *M. charantia* has also been evolved to possess antiviral activity against Epstein Barr, Herpes and HIV viruses. [29] In vivo study, extract of leave from plant part showed the ability to increase resistance against common viral infections of humans and animals. By increasing interferon production and ordinary killer cell activity as well as providing an immune-stimulant [30].

3.2. Anticancer Property

M. charantia is rich in numerous organically active chemicals including proteins, triterpenes, and steroids. Triterpenes of *M. charantia* has the capability to inhibit the enzyme guanylatecyclase might be responsible to cause psoriasis. In addition, guanylatecyclase is one of the important enzymes, essential to suppress the development of leukemia to possess and other cancer cells. In adding triterpenes, proteins like *momordin*, alpha- and beta *momorcharin* and *cucurbitacin B* were also investigated anticancerous properties. The *momordin* also showed to have anticancer action against Hodgkin's lymphoma in vivo. Moreover, in

vivo studies have revealed the antitumor and cytostatic activity of *M. charantia*. It is reported that water extract clogged the development of rat prostate carcinoma [10]. *M. charantia* seed extract also possess anti-leukemic potential on human severe myelogenous leukemia cells [31]. Many investigations have reported that action of *M. charantia* related products induces apoptosis and cell cycle capture without disturbing usual cell growth [32]. Fang *et al.*, (2012) also reported the antitumor potential of crude extract of *M. charantia* against prostate cancer in vitros & vivos studies [2].

3.3. Antimutagenic Property

M. charantia has been reported to have antimutagenic properties which are attributed to the presence of exact acylglucosyl sterols [33]. One of the greatest ways to reduce the effect of carcinogens and mutagens is to recognize the antimutagens /anticlastogens (materials which suppress the procedure of mutagenesis by acting directly on the mechanism of cell) and desmutagens (some materials which how to destroy or inactivate, wholly or partly the mutagens, thereby affecting less cell population) in our diets and growing their use. Previous studies indicated immunopotentiating and antistress activity of *M. charantia*. *M. charantia* can be used as neutraceutical, possessing nongenotoxic activity. Sumanth and Chowdary (2010) carried out in vivo mouse bone marrow micronucleus test and chromosomal aberration to investigate the antimutagenic action of *M. charantia* by controlling the genetic mutilation convinced by cyclophosphamide [34]. The potentiation of anti-viral and antimutagenic activity of bitter melon has been correlated with the presence of specific acylglucosylsterols and *Momordica* anti-HIV protein (MAP protein), respectively. Studies showed that bitter melon extract is nonmutagenic by using Ames test and the alkaline single cell gel electrophoresis assay [35]. So, Medicinal plants possess biological potential [36].

4. Conclusion

M. charantia is a potential herbal plant which is used as medicine and vegetable. It is a high-quality root of different essential biochemical's medically like, alkaloid, steroid, protein, triterpene, and phenolic which are liable for its pharmacological also biological activities include antioxidant, anti-diabetic, anti-tumorous and anti-cancerous, anti-ulcerative, antimicrobial, antimalarial, anti-viral, anti-fertility, immunomodulatory and anti-helmintic etc. On the basis of all these properties *M. charantia* can be use as a good source of medicinal, nutritional and pesticidal agent. *Momordica charantia* is a member of the cucurbitacea family and is mostly taken as vegetable in India as is incredibly cheap and available throughout the year. This is generally referred to as Karela. According to Dhanasekar *et al.*, observed that after oral administration of aqueous extract of the *Momordica charantia* seeds in the glucose and streptozotocin condition, our previous experimental findings were strongly encouraged. In the Indian medicine method many parts of this plant were used for many diseases, aside from diabetes. They determined

whether tissue lipid peroxides and enzymatic antioxidant caused by Streptozotocin (STZ) diabetic rats are impaired by aqueous extract of Momordica charantia (MCSE1 and MCSE2) plants. Alfi Khatib et al., demonstrate that phenolics from *M. Charantia* possessed potential anti-inflammatory, anticarcinogenic, anti-mutagenic, antitumor activities.

It was demonstrated that catechin and catechin gallate green tea antioxidant activation includes the interaction of gallic acid with epicatechin or epigallocatechin through a three-position esterification of Aglycons and glycones. Several phenolic group hydroxyle are joined to flavonoid rings, and a hydroxyle hydrate or another functional group of flavonoids is added in the glycosylation method. The mechanism of glycosylation makes flavonoids more sensitive to free radicals. Flavones, isoflavones and dihydroxyflavones are commonly found in the group of 7 hydroxyls; flavonols and dihydro flavonols in the three- or seven hydroxyls and anthocyanidins in the 3- or 5-hydroxyls.

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