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MEDICINAL USE OF AN ANCIENT HERB *MOMORDICA CYMBALARIA*: A REVIEW

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ABSTRACT: *Momordica cymbalaria* (Hook, Fenzl) is a vine of *Momordica* genus found in the Indian states of Karnataka, Madhya Pradesh, Maharashtra, Andhra Pradesh and Tamil Nadu. The medicinal herb also been named *Luffa tuberose* (Roxb) or *Momordica tuberose* (Roxb). *Momordica cymbalaria* is commonly known as Karchikai (Kannada) or Athalakkai (Tamil) or Kasarakayee (Andhra Pradesh) and Kakrol (India). *Momordica cymbalaria* has been used in various Asian traditional medicine systems for a long time. *Momordica* plant parts are characterized by wide diversity of bioactive compounds such as phenolic acids, flavonoids, carotenoids, cucurbitane triterpenoid, and phytosterol. In particular, some of the actual trends of the scientific research are strongly focused on obtaining *in vitro* evidence for the biological efficacy of individual constituents such as triterpenoid, carotenoids and phenolics from different parts of *Momordica* species triterpenoid are the main constituents of Cucurbitaceae family. The potential health benefits of phytochemical found in *Momordica* species have received ample attention in the recent literature, focusing especially on compounds with high diabetes mellitus, cardio protective, ulcer, cancer, and diabetic neuropathy. The herb also has been reported to possess hypoglycaemic, wound healing, infertility, hypolipidemic, hepato-protective, nephro-protective and antioxidant properties. *Momordica cymbalaria* is under threat of extinction. The review focuses on the cultivation, nutritional and chemical composition, as well as medicinal and therapeutic properties of this medicinal plant.

INTRODUCTION: Plants with potential therapeutic values have been used from time immemorial to cure various ailments and infectious diseases. Of late, scientific evidences have been provided on the potential therapeutic agent exhibited by certain traditionally used vegetable extracts. *Momordica* species are vegetable crops, belonging to the family of Cucurbitaceae (referred as cucumber, gourd, melon or pumpkin family), which comprise of medium sized plants that grow abundantly in warmer regions of the world.

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They are well known for the bitter taste due to the presence of phytochemicals and have a wide range of medicinal values [1-3]. A *Momordica* species is an annual or perennial climber that contains about 80 species Raj *et al*., 1993. This is generally found throughout India, Pakistan, Bangladesh, and also extends from Himalayas to Ceylon.

Reported up to an altitude of 1500m in Assam, Garo hills of Meghalaya (Ram *et al*., 2002) and Western Ghats, one of the mega diversity hotspots, hold a rich treasure of diversity, in *Momordica* L., it comprises *M. charantia* var muricata, *M. charantia* var charantia, *M. dioica* and *M. sahyadrica* **(**Joseph and Antony, 2008). The revival of interest in natural drugs started in last decade mainly because of the wide spread belief that green medicine is healthier than synthetic products.

Nowadays, there is manifold increase in medicinal plant based industries. Due to the increase in the interest of medicinal plants throughout the world which are growing at a rate of 7-15% annually, despite the major advances in the modern medicine, the development of new drugs from natural products is still considered important. Medicinal plants as a possible therapeutic measure has become a subject of active scientific investigations.

The *Momordica* species have been used in indigenous knowledge; wild plant foods play a vital role in the complex cultural system of tribal people for reducing various disorders. Research has shown that many edible wild plants are rich in specific constituents, referred as phytochemicals, which may have health promoting effects. Therefore the present review mainly focuses on providing baseline information on exploring nutritional, nutraceutical properties and physiological bioactivities of *Momordica* species on human health.

Biogeography and Botanical Description: Based on the contemporary reasoning *M. cymbalaria* is a climbing annual or perennial herb with slender, scandent, branched, striate stem. The leaves are orbicular-reniform in outline, deeply cordate at the base, obtusely lobed with 5 - 7 lobes. The fruits are 20 - 25 mm long, pyriform with 8 sharp ridges, 24 mm x 15 mm attenuated at the apex and with the base narrowed into the curved peduncle, which is fleshy, dark green and robbed.

The seeds are 4.6 mm long, ovoid shaped, smooth and shiny. Flowers are unisexual; the male flower peduncle is 5-30 mm long, filiform, puberulaus, ebracteate with 2-5 flowers in racemes with a pale yellow corolla and two stamens for each flower. The female flower is solitary on a peduncle of 28 mm length. The roots are woody, and even in the fields for the sake of fruits. However, no regular cultivation is practiced. A limited number of perennial tubers survive in soil and produce single plant in the next season. *M. cymbalaria* has been reported by Nikam *et al*., The Maximum number of indirect regeneration of multiple shoots (9.0 ± 0.5 shoots per explants) was achieved from leaf on MS medium enriched with BA. Large scale shoot formation was achieved by repeated sub culturing of leaf callus on shoot regeneration medium.

Nutritional Values: The *Momordica* species *M. cymbalaria* and *M. charantia* (has acquired a reputation for management of several diseases and disorders. It has passed several animal studies and its clinical trials have been started since many years ago, A. Ghorbani *et al*., 2013 are summarized in **Table 1**. Behera *et al*., [4] and R. Jeyadevi A *et al*., (2012).

TABLE 1: NUTRITIONAL VALUES

Composition	*M. cymbalaria*	*M. charantia*
Moisture %	84.30	83.20
Fibre %	6.42	1.70
Beta Carotene %	0.01	126.00
Protein %	2.15	2.10
Carbohydrate %	12.60	10.60
Energy k cal/100 g	3.00	60.00
Calcium mg/100 g	72.00	23.00
Sodium mg/100 g	40.00	2.40
Potassium mg/100 g	500.00	171.00
Iron mg/100 g	1.70	2.00
Zinc mg/100 g	2.82	0.46
Manganese mg/100 g	0.32	0.08
Copper mg/100 g	0.18	0.19
Phosphorus mg/100 g	0.46	38.00
Vitamin C mg/100 g	290.00	96.00

The calcium content of *M. cymbalaria* is three times higher than that of the *M. charantia*. Calcium is required for the growth of bones and teeth as well as for maintaining normal heart rhythm, blood coagulation, and muscle contraction and also nerve responses. The higher concentration of this nutrient in *M. cymbalaria* may be exploited and used. Iron content in both the species is almost the same. The ascorbic acid content of *M. cymbalaria* two times higher than that of bitter gourd, this is of interest, where there is shortage in Vitamin C consumption. The content of potassium in *M. cymbalaria* is also two times higher than in *M. charantia*. The beta carotene content in *M. cymbalaria* is negligible.

Bioactive Compounds: *Momordica* plant parts are characterized by a wide diversity of bioactive compounds such as phenolic acids, flavonoids, carotenoids cucurbitane triterpenoids, and phytosterol. The potential health benefits of phytochemical found in *Momordica* species have received ample attention in the recent literature, focusing especially on compounds with high antidiabetic, antitumor and antioxidant properties.

In particular, some of the actual trends of the scientific research are strongly focused on obtaining *in vitro* evidence for the biological efficacy of individual constituents such as triterpenoid, carotenoids and phenolics from different parts of *Momordica* species triterpenoids are the main constituents of cucurbitaceae family [5].

They exhibit a broad range of potent biological activities namely hepatoprotective, cytotoxic, anti-inflammatory, cardiovascular, antidiabetic and antiparasitic effects. The terpenoids also referred as isoprenoids which is derived from five carbon isoprene units. The cucurbitacins are a typical group of cucurbitane type triterpenoids found in all plants and belonging to the cucumber family and have been reported as the main chemical constituents of *Momordica* species from different part [6]. *M. cymbalaria*, tubers contain bitter glycosides, beta-sitosterol, steroidal saponin and starch. The seeds contain conjugated fatty acids which was found to be punicic acid.

Outgrowth of Physiological Bioactivities of *Momordica cymbalaria* on Human Health:

***Momordica cymbalaria*:** *M. cymbalaria* fruits were considered as tonic, stomachic, stimulant, laxative and alterative. The fruits are useful in treating gout, rheumatism and sub-acute cases of the spleen and liver disease. It has also been shown to have hypoglycaemic properties in animal studies. The fruits juice and leaf tea of *M. cymbalaria* is employed for diabetes, malaria, colic, sores and wounds, infections, worms and parasites, as an emmenagogue, and for measles, hepatitis, and fevers. Fruit pulp, leaf juice and seeds possess antihelimetic activity.

FIG. 1: *MOMORDICA CYMBALARIA*

Root is astringent, abortifacient, aphrodisiac and also used to treat constipation, indigestion, diabetes, diarrhoea and rheumatism. For the last few decades, the medicinal value of plants has been recognized. The extracts from many plants contain not only minerals and primary metabolites but also a diverse array of secondary metabolites, mostly with antioxidants properties (R. Jeyadevi A *et al.*, 2012). Diabetes poses a major challenge and the economic pressure to the world population, leading to increasing interest in the use of traditional remedies for the treatment of diabetes mellitus. The roots of *M. cymbalaria*, shown antidiabetic activity in presence of an oleanane type triterpenoid saponin in rat insulinoma cell line (RIF-5F), in a study carried out by Koneri *et al*., (2014).

In their study saponin of *M. cymbalaria* (1mg/ml) in rat insulinoma cell line (RIF-5F) pre-exposed and result suggested that the saponin of *M. cymbalaria* possesses potential antidiabetic activity with respect to insulin secretion, quantitative increase in beta cells (75%) which may be attributed to modulation of calcium channel, and beta cell rejuvenation [7].

Whereas other study also revealed potential antidiabetic activity which is carried out by Firdous M *et al*., 2009 in their study type-2 diabetes in BALB/C mice was induced by single I.P injection of Streptozotocin (100mg/kg), 15 min after the I.P. administration of Nicotinamide (240mg/kg). Treatment of type 2 diabetic mice with saponin of *M. cymbalaria* (175mg/kg, p.o./30days) and Metformin (350 mg/kg, p.o./30days) produced a significant fall in blood glucose ($P < 0.001$), cholesterol ($P < 0.001$), triglycerides ($P < 0.001$), and an increase in the serum insulin level ($P < 0.001$), pancreatic islets and beta cells showed an increase in number [8].

Management of optimum blood glucose level through the regulation of insulin is of extreme importance in hyperglycaemic disorders like type 1 and 2 diabetes mellitus. Any agents that increase insulin secretion (in case of type 1 diabetes mellitus) or aids in the peripheral utilization of glucose by sensitization the cells to insulin (in case of type 2 diabetes mellitus) is a claimant to be a drug candidate belonging to the antidiabetic category.

Hypoglycaemic herbs increase insulin secretion, enhance glucose uptake by adipose or muscle tissue, and inhibit glucose absorption from intestine and glucose production from the liver [9].

A triterpenoid saponin of oleanane type was isolated from the roots of *M. cymbalaria* investigated specifically in its ability to increase the uptake of glucose, in a study carried out by Samaddar *et al*., 2015.

In their study, glucose by L6 cell line in the presence of saponin of *M. cymbalaria* was determined by glucose oxidase peroxidase (GOD-POD) method and got significant increased glucose uptake up to 242.75% over control. Diabetic and non diabetic diaphragms also showed increase in glucose uptake in the presence of saponin of *M. cymbalaria* over control and indicates that saponin of *M. cymbalaria* enhances glucose uptake thereby exhibiting hypoglycaemic activity [10]. Diabetic neuropathy is associated with diabetes that is thought to result from micro vascular injury affecting nerve fibres throughout the body.

Diabetes mellitus is the most common cause of diabetes neuropathy. The neuropathic disorder progresses with sensory and autonomic manifestation predominantly. The neuropathies of the peripheral, central and autonomic nervous systems are known to be caused by hyperglycemia, a consequence of the deregulation of glucose in diabetes [11]. Diabetic peripheral neuroprotective effect of methanolic extract of saponin *M. cymbalaria* has been studied by Koneri *et al*., 2014 in male wister rats induced in by injecting streptozotocin 45mg/kg. Rats administered with *M. cymbalaria* showed significant decrease in tail immersion latency time and increase in pain sensitivity when compared to untreated group.

There was improvement in the myelination and degenerative changes of the nerve fibre in both preventive and curative groups, study also revealed that *M. cymbalaria* showed significant decrease in superoxide dismutase, catalase activity, and lipid peroxidation in the nerves and an obvious delay in the progression of neuropathy were evident [12].

Whereas the other study of triterpenoid saponin isolated from *M. cymbalaria* roots shown neuroprotective activity by affecting the polyol pathway in rats, which is carried out by Samaddar *et al*., 2016 in their study *in vivo* the animals were evaluated for various parameters of neuropathy like muscular grip strength and pain sensation tests using hot plate and tail flick methods, and nerve conduction velocity measurement.

In vitro models of diabetic peripheral neuropathy were created by initiating sciatic nerve cultures of rats in 12 well plated. The nerve cultures were then rendered diabetic by exposing them to high glucose. After incubation of 7 days, the tissues were assayed for aldose reductase (AR) and sorbitol dehydrogenase (SDH). The saponin exhibited significant reduction in the AR and SDH activities, reduction in the former being more prominent. Sorbitol accumulation in the nerves was also found to be less as compared to glucose control. Improvement of muscular grip strength, reaction time to pain sensation and nerve conduction velocity was demonstrated by the treated group [13].

Samaddar *et al*., (2016) have studied protective effect of high glucose induced neuropathy in NB-41A3 mouse neuroblastoma cells.

In this work, cells were seeded in a 96-well plate ($5\text{-}10\times10^3$cells/well) and then the cells were high glucose (56mM) mediated neuropathy was induced in NB-41A3 mouse neuroblastoma cells and the neuroprotective activity of the saponin was assessed.

And the results showed a significant reduction in AR activity and intracellular accumulation of sorbitol on saponin treatment. The Na^+K^+ - ATPase activity was found to be restored upon treatment with saponin of *M. cymbalaria* which is beneficial for the proper membrane potential and nerve conduction.

Improvement in Na^+K^+ - ATPase activity was evident with a noteworthy reduction in IL-6, IL 1β and TNF-α production. Pro-inflammatory cytokines *viz.* IL-6, IL-1β and TNF-α was increased considerably by the cells in high glucose as compared to those in a normoglycemic (5.5mM) state [14]. Myocardial damage was induced using ischemia reperfusion (IR). The IR was introduced following no flow global ischemia [15], where sudden

occlusion of physiology salt solution results in immediate biochemical alterations.

The increase in intracellular Na^+ serves to drive Ca^{2+} intracellulary *via* Na^+/Ca^{2+} exchange that results in irreversible damage to myocardium at the end of 15 min global ischemia[16]. Koneri *et al*., (2015) have studied the cardio protective effects of saponin isolated from *M. cymbalaria* was evaluated for global ischemia induced myocardial damage in male wistar rats and hypoxia ischemia induced cardiomyotocytes cell death *in vitro*. *M. cymbalaria* pre treatment reduced myocardial damage by improvement CK-MB and lactate dehydrogenase (LDH).

M. cymbalaria improved the antioxidant defences system in treated animals and considerably reduced the oxidative stress induced by ischemia reperfusion IR. The reduction in oxidative stress was evident from the lipid peroxidation and enzymatic antioxidant activities. Furthermore, the increase in the levels of CK-MB and LDH in the heart tissue homogenate and the decrease of these enzymes in the perfusate was significantly reversed in the treated groups [17].

Natural products have long been used to prevent and treat diseases including cancers and might be good candidates for the development of anticancer drugs. Antiangiogenic and anticancer activity of saponin of *M. cymbalaria* on EAC *in vitro* was examined by Koneri *et al*., (2014). It is reported that carrageenan induced inflammation in air pouch in rats; COX-2 derived PGE2 plays a role in angiogenesis in the developing chronic granulation tissue.

The quantitative analysis of angiogenesis in granulation tissue correlates with the increase in the capillary density. It is concluded that the COX-2 inhibitor saponin of *M. cymbalaria* inhibits angiogenesis in granulation tissue as well as inflammatory response by inhibiting COX-2 in experimental cancers that over express this enzyme, the balance between angiogenic and antiangiogenesis, can be restored, causing tumour necrosis and tumor regression to a small, dormant state.

In this studied of rat air sac model, dexamethasone strongly inhibited the accumulation of pouch fluid, leukocyte infiltration into pouch fluid, and formation of granulation tissue. Saponin of *M. cymbalaria* significantly reduced granulation tissue weight, pouch fluid, dye content. Moreover, the vascular system of CAM is directly accessible to observation and experimentation, and there are no metabolic or hormonal influences. Quantification of vascular changes in the CAM in response to inhibition of angiogenesis was simplified by comparing the image of CAM vessels with or without the administration of the test substances.

The different qualitative changes in the capillaries for each test substances were observed and used to quantify the antiangiogenic effects of roots extract saponin *M. cymbalaria* [18]. Jeevanantham *et al*., 2011 studied reported that the methanolic extract of its aerial parts of *Momordica cymbalaria* given orally to mice at the dose of 100 and 200mg/kg body weight for 14 days caused significant ($P < 0.001$) reduction in body weight, packed volume and viable tumor cell count when compared to the mice if the EAC control group [19].

Several natural plant products, such as phenolics, indoles and flavonoids, saponin, and steroids have been shown to alter the initiation phase of carcinogenesis Kaskurthy RL *et al*., (2015) studies reported that steroidal saponin *M. cymbalaria* was isolated and purified by preparative high performance liquid chromatography. Breast cancer was induced in 50-days old female rats by injecting DMBA (6mg/kg i.v.) in three doses on day 50, 54, and 57. The rats were randomized into 4 groups; control, DMBA, *M. cymbalaria* (100mg/kg), and tamoxifen (6.6 mg/kg) to DMBA breast cancer rats. Mean tumor size and volume, luteinizing hormone, and progesterone with superoxide dismutase, catalase, and glutathione levels increased significantly ($p < 0.001$); serum estradiol, follicle stimulating hormone with lipid peroxidation decreased significantly ($p < 0.001$) in DMBA-induced breast cancer and *vice versa* in *M. cymbalaria* and tamoxifen.

Terminal end buds, terminal ducts, alveolar buds, and lobules decreased significantly ($p < 0.001$) in DMBA- induced breast cancer. Whereas increased significantly in *M. cymbalaria* and tamoxifen. Histological necrosis and haemorrhage along with focal desmoplastic reaction in DMBA- induced

breast cancer; ductile elongation and hyperplasia of both ducts and alveoli were prominent, with increased secretory activity in *M. cymbalaria* group. The results confirmed the chemopreventive effect of *M. cymbalaria*, which may be due to its antiestrogenic, antioxidant activity [20].

Infectious diseases represent a critical problem to health and they are one of the main causes of morbidity and mortality worldwide. During the past several years, there has been an increasing incidence of bacterial and fungal infectious due to a growth in immune comprised population such as organ transplant recipients, cancer and HIV/AIDS patients.

The changing pattern of clinical evaluation and regulatory requirements for merits and demerits of drugs will be highlighted for future challenges and advances in antimicrobial drug development.

Balkhande and Surwase 2013 have studied antimicrobial activity of ethanol and chloroform extracts of the roots of a medicinal plant *M. cymbalaria* was tested against different pathogenic microorganism by agar well diffusion method. The extents of the growth inhibition of bacteria were measured for each extract and most of the selected bacteria exhibited significant growth inhibition zone.

Minimum inhibitory concentration (MIC) and antifungal activity exhibited by root extract against the test organisms by Microtiter plate assay ranged between 1-5mg/ml. Antimicrobial activities of the crude extracts were comparable to those of the standard antibiotic. Antioxidant evaluation of methanolic root extract of *M. cymbalaria* was also carried out using 1, 1-diphenyl-2-picrylhydrazyl radical (DPPH) and results showed the extract of 200mM and 250mM posses moderate scavenging activity with free radical scavenging percentage of 49.80 and 42.30% respectively as compared to standard scavenger ascorbic acid with free radical scavenging percentage of 96% [21].

Whereas the other studied Sajjan *et al*., 2015 extracts of *M. cymbalaria* Fenzl were screened for their *in vitro* antimicrobial activity by agar diffusion method in comparison with standard antibiotics, amipicillin, tetracycline, streptomycin and gentamycin.

The antimicrobial activity of petroleum ether, chloroform, ethanol and aqueous extract of aerial parts of the plant were studied using *Staphylococcus aureus, Klebsiella pneumonia*, *Escherichia coli*, *Pseudomonas aeruginosa* (Clinical isolate, Bacteria) and *Aspergillus niger* (Fungi) as test organisms. All the extracts were effective against all the four microorganisms.

The result reveals that the plant extract has very good inhibitory activity against gram negative organism when compared to standard antibiotics [22].

Many morphological, histological, physiological, and biochemical changes occur in the ovary during the oestrous cycle. During the maturation of preovulatory follicles, ovulation takes place under the combined and balanced influence of ovarian and extra ovarian hormones. Imbalance in these hormones leads to irregularity in the ovarian functions and duration of the oestrous cycle [23 - 25]. Antiovulatory and abortifacient potential in ethanolic extract in rats, in a study carried out by Koneri *et al*., 2006.

In their study, female wistar albino rats with at least three regular oestrous cycles were administered with ethanolic extracts of roots of *M. cymbalaria* at the two doses 250 and 500mg /kg orally for 15 days.

Abortifacient study was done in another set of three groups of animals. Extract at doses of 250 and 500mg /kg were administered orally through gastric gavages from the day 6 to the day 15 of the pregnancy. Animals were lapartomised in 19th day of pregnancy. Highly significant ($P < 0.01$) decrease in the duration of oestrous cycle and metaestrous phase and increase in proestrous phase was seen, but diestrous phase was unchanged in both 250 and 500mg treated groups when compared to untreated group.

Study revealed that ethanolic extract at both doses (250mg and 500mg/kg) showed significant Antiovulatory activity. It is abortifacient at 500mg/kg, but not at 250 mg/kg [26].

Other medicinal out-turn:

TABLE 2: PHARMACOLOGICAL EVALUATION OF *MOMORDICA CYMBALARIA/M. TUBEROSA*

Pharmacological activity	Part of Plant	Extract/ Preparation	Impression
Wound-healing activity	Tuber	Methanol extract	*M. cymbalaria* in methanol extract (10% w/w simple ointment) were applied externally on albino Wister rats by topical route and it showed faster as well as better wound closure and wound contraction. [27]
Antioxidant & Hepatoprotective activity	Tuber	Ethanolic extract	Radical forms covalent bonds with sulfhydryl group of several membrane molecules like reduced glutathione leading to this depletion and causes lipid peroxidation. The lipid peroxidation initiates a cascade of reactions leading to tissue necrosis. The antioxidant property of ethanolic extract of tubers of *M. tuberosa* prevented the formation of trichloromethyl peroxy radical there by reducing tissue damage.[28]
Antiulcer activity	Fruit	Aqueous extract	The reduction in non protein sulfhydryls concentration, gastric content, hemorrhage and ulceration in the ulcer induced Wistar rats suggested that the anti ulcer activity of the aqueous extract to the presence of polyphenolic constituents. [29]
Anticonvulsant activity	Tuber	Ethanolic extract	Ethanolic extract of *M. tuberosa* significantly ($p<0.001$) decreased the duration of tonic clonic seizures and recovery time. The percentage of inhibition was 66%. In PTZ Model the onset of seizures was delayed ($p<0.002$) with low and high doses and the duration of convulsions was reduced effectively ($p<0.001$). [30]

Plausible physiological action of *Momordica cymbalaria*: Antidiabetic activity of *Momordica cymbalaria* may be due to presence of its hypoglycaemic ingredients polypeptide-p, plant insulin, phenolic acids, flavonoids, carotenoids, cucurbitane, triterpenoid, and phytosterol and glycosides improve blood sugar levels by increasing glucose uptake and glycogen synthesis in the liver, muscles, and fat cells. They also improve insulin release from pancreatic beta cells, and repair or promote new growth of insulin secreting beta cells. P-insulin, a polypeptide from the fruits and seeds rapidly decreased and normalized the blood sugar level.

Momordica cymbalaria very promising bioactive compounds, these compounds activate a protein called AMPK, which is well known for regulating fuel metabolism and enabling glucose uptake, processes which are impaired in diabetics. *Momordica cymbalaria* contains a lectin that has insulin-like activity. The insulin-like bioactivity of this lectin is due to its linking together 2 insulin receptors. This lectin lowers blood glucose concentrations by acting on peripheral tissues and, similar to insulin's effects in the brain, suppressing appetite. This lectin is likely a major contributor to the hypoglycaemic effect that develops after eating *Momordica cymbalaria* and why it may be a way of managing adult-onset diabetes. Lectin binding is non-protein specific, and this is likely why *Momordica cymbalaria* has been credited with immunostimulatory activity - by linking receptors that modulate the immune system, thereby stimulating said receptors. *Momordica* also contains insulin like polypeptide, polypeptide-p, which lowers blood sugar levels.

A novel phytochemicals in *Momordica cymbalaria* has pre-clinically demonstrated the ability to inhibit an enzyme named guanylate cyclase. This enzyme is thought to be linked to the pathogenesis and replication of not only psoriasis, but leukaemia and cancer as well. One pre-clinical trial found very limited evidence that *Momordica cymbalaria* might improve immune cell function in animal with cancer. Other phytochemicals that have been documented with cytotoxic activity are a group of ribosome-inactivating proteins.

A chemical analogue of *Momordica cymbalaria* proteins was developed and named MAP-30 and its inventors reported that it was able to inhibit prostate tumor growth. COX-2-derived PGE2 plays

a role in angiogenesis in the developing chronic granulation tissue. COX-2 inhibitor saponin of *Momordica cymbalaria* inhibits angiogenesis in granulation tissue as well as inflammatory response. By inhibiting COX-2 in experimental cancers that over express this enzyme, the balance between angiogenic and anti-angiogenic signals, which control VEGF (vascular endothelial growth factor), expression and angiogenesis, can be restored, causing tumour necrosis and tumour regression to a small, dormant state.

Another method for carcinogen-induced lipid peroxidation in liver and DNA damage in lymphocytes were reduced by following treatment of *Momordica cymbalaria*. The *Momordica* extract was found to significantly active liver enzymes glutathione transferase, glutathione peroxidase and catalase, which showed a depression following exposure to the carcinogen.

The result suggest the preventive role of water soluble constituents of *Momordica cymbalaria* fruit during carcinogenesis, which is mediated possibly by their modulatry effect on enzymes of biotransformation and detoxification system of host. *Momordica cymbalaria* increase the activity of adenosine 5 monophosphate kinase (AMPK), an enzyme that facilitates cellular glucose uptake and fatty acid oxidation. Hypoglycaemic agents in *Momordica cymbalaria* promote efficient oxidation of glucose into fuel, and conversion into starch. (Glycogen or animal starch is stored in the liver and muscle cells). During glucose shortages, fats/fatty acids are used as fuel. Continued demand for energy in the absence or shortage of glucose causes fat cells to release their fat contents to maintain energy balance.

This increased fatty acid oxidation eventually leads to weight loss. Compounds in *Momordica cymbalaria* improve lipid profiles. They reduce liver secretion of apolipoprotein B (Apo B) – the primary lipoprotein of low-density "bad" cholesterol; reduce apolipoprotein C-III expression, the protein found in very-low density cholesterol which turns into LDL/bad cholesterol; and increases the expression of apolipoprotein A-1 (ApoA1) - the major protein component of high density "good" cholesterol. It also lowers cellular triglyceride content. In other in vivo studies, bitter melon fruit and/or seed have been shown to reduce total cholesterol and triglycerisin both the presence and absence of dietary cholesterol. Hyperlipidemia is a known complication of diabetes mellitus and coexists with hyperglycemia and is characterized by increased level of cholesterol, TG and LDL cholesterol, and all the lipid abnormalities associated with diabetes was significantly normalized by treatment with saponin of *Momordica cymbalaria. M. cymbalaria* reported to have of HMG-CoA reductase inhibitory activity by inhibited 3-hydroxy-3-methyl-glutaryl-coenzymeA (HMG-CoA) reductase, the enzyme that catalyzes the conversion of HMG-CoA to mevalonate.

This conversion is an early rate-limiting step in cholesterol biosynthesis. Researchers found that *Momordica cymbalaria* tuber powder, in the form of an ointment (10% w/w dried powder in simple ointment base), showed a statically significant response ($P < 0.01$), in terms of wound contracting ability, wound closure time, period of epithelisation, tensile strength of the wound and regeneration of tissues at wound site.

Activation of α_1-adrenergic receptors on vascular smooth muscles causes' vasoconstriction, which leads to hypertension, the saponin of *M. cymbalaria* reduced the contraction on α_1-adrenergic receptors. It showed that the saponin of *M. cymbalaria* may have antagonistic effect on α_1-adrenergic receptors on vascular smooth muscles and cause the hypotensive effect by reducing the vasoconstriction.

Ovary can be considered an aggregate of three endocrine tissues, the stroma, the follicle and the corpus luteum. The weights of these tissues constitute the net weight of the ovary. During the oestrous cycle the weight of the ovarian tissue increases under the influence of gonadotrophic and steroidal hormones. The decrease in the weight of ovaries of the rats treated with extract indicates a decrease in the activity of the stroma, the follicle, and the corpus luteum in the ovary. This decrease may be due to the non-availability of gonadotrophic or steroidal hormones or both.

Atretic follicles are degenerating preovulatory follicles. The degeneration of preovulatory follicles takes place due to non-availability of steroidal

hormones (essential for their maturation and differentiation), non-availability of local estrogens produced by granulosa cells, or imbalance in endogenous steroid, protein and hormones.

The presence of increased atretic follicles in the rats treated with ethanolic extract, compared with control rats, indicates that the extract promotes the degeneration of preovulatory follicles. Cholesterol is the precursor for the steroidogenesis of ovarian endocrine tissues showed significant increase in ovarian cholesterol in the treated of extract of *Momordica cymbalaria*.

CONCLUSION: Herbal remedies cost less than medicines and are more convenient. The importance of traditional use of medicinal plants has a long history. Ancient people as well as our ancestors were mainly dependent on plants for their recovery against disease. But, the recent tendency to avoid natural sources rather than artificial sources against disease is frustrating. Because continuous reports of antibiotic resistance as well as the side effects of synthetic drugs all over the world are indicating a global health alert. The higher occurrence rate of worldwide diabetes, cancer, obesity, hypertension, and neurodegenerative diseases becomes alarming to all. Huge researches are carried out to find the causes and remedies of them. Therefore, to search for a better alternative than synthetic drug becomes the demand of time.

This paper focused on providing baseline information on exploring nutritional, nutraceutical properties, physiological bioactivities and their possible mechanism of *Momordica cymbalaria* on human health. As it contains significant amount of such as phenolic acids, flavonoids, carotenoids cucurbitane triterpenoid, and phytosterol and these may play pivotal role against several diseases including diabetes mellitus, cardio-protective, ulcer, cancer, and diabetic neuropathy.

This medicinal herb also has been reported to possess hypoglycaemic, wound healing, infertility, hypolipidemic, hepatoprotective, nephroprotective and antioxidant properties.

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CONFLICT OF INTEREST: Certify that we have no conflict of interest in the subject matter.

REFERENCES:

1. Walters TW and Decker DS: Notes on economic plants, Balsam pear (*Momordica charantia*, Cucurbitaceae). Econ. Bot. 1988; 42: 286-288.
2. Miniraj N, Prasanna KP, Peter KV: Bitter gourd *Momordica* spp. In: Kalloo, G., Bergh, B.O., (Eds.), Genetic improvement of vegetable plants. Pergamon Press 1993; 239- 246.
3. Decker-Walters DS: Cucurbits, Sanskrit, and the lndo-Aryas. Econ. Bot. 1999; 53: 98-112.
4. Behera TK, John JK, Bharathi LK *et al*.: *Momordica*. In: Kole C, (Ed.), Wild Crop Relatives: Genomic and Breeding Resources, Vegetables. Springer-Verlag., Berlin Heidelberg 2011; 217-246.
5. Rios JL, Escandell JM and Recio MC: In studies in natural products chemistry. Atta-ur-Rahman, (Ed.), Elsevier: Amsterdam, The Netherlands 2005; 32: 429.
6. Pitiphanpong J, Chitprasert S, Goto M *et al*.: New approach for extraction of charantin from *Momordica charantia* with pressurized liquid extraction. Sep. Purif. Technol 2007; 52: 416-422.
7. Koneri R, Samaddar S and Ramaiah CT: Antidiabetic activity of a triterpenoid saponin isolated from *Momordica cymbalaria* Fenzl Indian Journal of Experimental Biology 2014; 52: 46-52.
8. Firdous M, Koneri R, Sarvaraidu C *et al*.: NIDDM Antidiabetic activity of Saponin of *Momordica cymbalaria* In Streptozotocin - Nicotinamide NIDDM Mice. Journal of Clinical and Diagnostic Research 2009; 3: 1460-1465.
9. Jesada P, Sutawadee C, Motonobu G *et al*.: New approach for extraction of charantin from *Momordica charantia* with pressurized liquid extraction. Sep Purif Technol 2007; 52(3): 416-422.
10. Koneri R, Samaddar S, Bhattarai A and Chandrasekhar KB: *In vitro* glucose uptake activity of an oleanane-type triterpenoid saponin isolated from *Momordica cymbalaria* 2015; 5(5): 2071-2077.
11. Said G: Diabetic Neuropathy - A Review. Nat Rev Neurol 2007; 3(6): 331-40.
12. Koneri RB, Samaddar S, Simi SM and Rao ST: Neuroprotective effect of a triterpenoid saponin isolated from *Momordica cymbalaria* Fenzl in diabetic peripheral neuropathy. Indian J Pharmacol 2014; 46: 76-81.
13. Samaddar S, Balwanth RK, Bhattarai A and Chandrasekhar KB: Oleanane-Type Triterpenoid Saponin of *Momordica cymbalaria* Exhibits Neuroprotective Activity in Diabetic Peripheral Neuropathy by Affecting the Polyol Pathway. Int J Pharm Sci Res 2016; 7(2): 618-25.
14. Samaddar S, Koneri RB, Sah SK and Chandrasekhar KB: Protective effect of saponin of *Momordica cymbalaria* fenzl on high-glucose induced neuropathy in NB-41a3 mouse neuroblastoma cells. Int J Pharm Pharm Sci 2016; 8(4): 229-235.
15. Mouhieddine S, Tresallet N, Boucher F and Leiris JD: Ultra structural basis of free- radical scavenging effect of indapamide in experimental myocardial ischemia and reperfusion. J Cardio Pharmacol 1993; 22: 47-52.
16. Jennings RB, Schaper J and Hill ML: Effect of reperfusion late in the phase of reversible ischemic injury: changes in cell volume, electrolytes, metabolites, and ultra structure. Circul Res 1985; 56: 262-78.

17. Mukumbayi PM, Koneri R and Samaddar S: Cardioprotective effects of saponin *Momordica cymbalaria* in ischemia reperfusion injury. International Journal of Pharmacy Review & Research 2015; 5(4): 385-390.
18. Koneri R, Nagarathna PKM Mubasheera MG and Madhu Mohan M: Antiangiogenic and anticancer activity of saponin of *Momordica cymbalaria*. Int J Basic Clin Pharmacol 2014; 3: 1-9.
19. Jeevanantham P, Vincent S, Balasubramaniam A, Jayalakshmi B *et al*.: Anti Cancer activity of methanolic extract of aerial parts of *Momordica cymbalaria* Hook F. Against Ehrlich Ascites Carcinoma in Mice. J. Pharm. Sci. and Res 2011; 3(8): 1408-1411.
20. Kaskurthy RL, Koneri RB and Samaddar S: Evaluation of anti-tumor activity of *Momordica cymbalaria* fenzyl. Int J Basic Clin Pharmacol 2015; 4: 779-86.
21. Balkhande SV and Surwase BS: antimicrobial activity of tuberous root extracts of *Momordica cymbalaria* Hook. Asian J Pharm Clin Res 2013; 6(1): 201-203.
22. Sajjan S, Chetana SH, Paarakh PM and Vedamurthy AB: Antimicrobial activity of *Momordica cymbalaria* Fenzl aerial parts extracts. Indian Journal of Natural Products and Resources 2010; 1(3): 296-300.
23. Prakash AO and Mathur R: Studies on oestrous cycle of albino rats. Response to *Embelia ribes* extracts. Planta Medica 1979; 36: 131-41.
24. Shivalingappa H, Satyanarayan ND, Purohit MG, Sharanabasappa A and Patil SB: Effect of ethanol extract of *Rivea hypocrateriformis* on the estrous cycle of the rat. J Ethno pharmacol 2002; 82: 11-7.
25. Circosta C, Sanogo R and Occhiuto F: Effects of *Calotropis procera* on oestrous cycle and on oestrogenic functionality in rats. Farmaco 2001; 56: 373-8.
26. Koneri R, Balaraman R and Saraswati CD: Antiovulatory and abortifacient potential of the ethanolic extract of roots of *Momordica cymbalaria* fenzl in rats. Indian J Pharmacol 2006; 38(2): 111-4.
27. Kolluru B, Naik ST, Naik VKM *et al*.: Phytochemical and Wound Healing Activity of Tubers of *Momordica cymbalaria*. Ijppr Human 2016; 7(4): 215-226.
28. Kumar P, Rao DG and Setty RS: Antioxidant and hepatoprotective activity of tubers of *Momordica tuberosa* Cogn against CCl_4 induced liver injury in rats. Indian J Exp Biol 2008; 46: 510-513.
29. Bharathidasan P, Jegadeesan M and Kavimani S: Antiulcer activity of aqueous extract of fruits of *Momordica cymbalaria* Hook F. in Wistar rats. Pharmacogn Res 2010; 2: 1.
30. Vangoori Y, Gadekal M, klnrr D and Ramesh P: Evaluation of anti convulsant activity of ethanolic extract of *Momordica tuberosa* in experimental animals. Int J Pharm Sci 2013; 5(3): 485-487.

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