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A REVIEW ON BITTER GUARD: NATURAL HEALTHY VEGETABLE

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ABSTRACT

Bitter guard provides health reimbursement against various ailments for humanizing the quality of life. It is nutrient dense plant-based food containing flexibility of bioactive compounds such as alkaloids, polypeptide, vitamins and minerals. Owing to being there of bioactive compounds, it has the capacity to fight against different lifestyle associated disorders, e.g. cancer insurgence, diabetes mellitus, abdominal pain, kidney (stone), fever and scabies. Among bioactive moieties, p-insulin is similar to insulin whose subcutaneous injection considerably lower blood glucose levels in diabetic patients. It also contains steroidal saponins called charantin, act a like peptides and certain alkaloids that successfully control sugar level in blood. The beneficial perspectives have been also decorated as they are helpful in regulating blood cholesterol thus protecting the body from cardiovascular disorders like atherosclerosis. Whole fruit, seeds and leaves of bitter guard regulate impaired antioxidant status and suppress fat accumulation. Moreover, curative potential of its bioactive components and their consumption in value added food products are also the publicity of article.

KEYWORDS: Bitter melon, Lifestyle related disorders, Diabetes mellitus, Cancer insurgence, Charantin.

INTRODUCTION

In the field of nutrition, plants and their food have important significance not only for providing basic nutrients but also for avoidance of various maladies. They indeed get better the quality of life throughout the globe.[1] Plant based conventional medicines are also in use since immemorial times, however, their standardizations is essential in order to assess their potential. Epidemiological data portrayed opposite association between their spending and

waning incidence of several ailments. Fruits and vegetables contain array of compounds broadly categorized as photochemical that have thoughtful influence particularly for disease avoidance. The new era witnessed more logical and systematic studies on the subject of these bioactive molecules and results in development of a segregated section i.e. functional and nutraceutical foods. These health promoting commodities are in advance attention of the consumer due to higher suitability and raised level of awareness.[2] These biologically active components are widely disseminated in food such as spices, herbs, tea, fruits & vegetables and show considerable antioxidant activity in vivo & in vitro with significant health penalty. The above mentioned debate is unfinished if we do not look at our lifestyle. Currently, the lifestyle matters a lot in a variety of ways e.g. ease of life, less exciting with lavish/relish delectableness. These all factors cumulatively resulted in diversified eating habits. The metabolic reactions occurring in the body leads to production of some toxic metabolites like free radicals and indeed energy uptake and lack of physical work out further worsen the health status of individuals. The common prevalence of various ailments including coronary hear diseases, diabetes mellitus, cancer insurgence, degenerative disorders, and lack of body inherent defense mechanism are often accredited to the lifestyle changes. The plants and their metabolites offer protections against such maladies if integrated in the diet. They have anticarcinogenic, hypocholesterolimic, hypoglycemic and other beneficial properties. Their consumption is also linked with enhanced immunity to protect against oxidative stress and allied disorders. Some of these phytochemicals dense plants are bitter or astringent in their nature and usually receive less concentration of the consumers and their suitability is limited. However, these plants offer wide range of defense against various ailments. Momordica charantia is one such sample that holds rich phytochemistry and successful agent in dietary regimens to avoid against different maladies. Brief about the bitter melon, it is used as a vegetable in many countries but since time immemorial, it is also used for administration of frequent ailments comprising ulcer, diabetes mellitus and inflammation etc. BM (bitter melon) is innate to subtropical and tropical areas in Asia and some other parts of the globe. It belongs to family cucurbitaceous and in Indian cuisines it is usually prominent as karela. All portions of the BM are edible in nature but regularly grown for the fruit that is bitter of all. As far morphology of the plant is worried, it is herbaceous plant that grows around 5 meters and bears simple/alternate leaves of four to twelve centimeters with 3-7 deeply separate lobes. Bitter melon is comparable to a small cucumber, usually rectangle and oblong in shape and eaten green.[3]

Bitter gourd is packed with pulp and large flat seeds, which immediate a comparatively thin layer of flesh. BM (bitter melon) also rich in various bioactive components containing minerals, alkaloids, vitamins, steroidal saponins, polypeptide and aromatic volatile oil, apart from its usage as vegetable. Bitter melon has capacity to fight next to frequent life styles linked disorders, due to the attendance of bioactive components. In this review, main focus of conversation is progression of bitter melon and its active constituent concerning their health promoting mechanism. The therapeutic perspectives are the limelight of the manuscript. The curative possible of biter melon and its bioactive components demands concentration of the researchers and it is the focus of the article too that bitter melon should be used in value added food products.[4]

Classification of Momordica Charantia

Comman Name	**Karela, Bitter Melon**
Kingdom	Plantae
order	Cucurbitales
Species	M.Charantia
Genus	Momordica
Family	Cucurbitaceous
Division	Magnoliophyta

Chemical Composition

Concerning the nutritional composition, Momordica charantia contains 91.8% water, 0.20% fat, 4.2% carbohydrates and 1.4% fiber. The proteins there in bitter guard seeds are of indeed quality and meet the amino acids supplies/standards laid down by (FAO/WHO/UNU) for preschool children. The proteins are fractionated into albumin, globulin and glutelin that are present in the amounts of 49.3, 29.3, and 3.1%, respectively. The molecular weight of these proteins regularly varies from 45 to 55 kDa. The bitter melon seeds contain nearly 35 to 40% of oil and the fatty acid profile indicates that the seeds contain 3.33% and 36.71% of MUFA (monounsaturated fatty acid) and SFA (saturated fatty acids). The main amount (59.96%) of PUFA (polyunsaturated fatty acids) is found to be here in bitter melon. in the middle of PUFA, α-eleostearic acid (54.26%) is a conjugated linolenic acid and is of significance importance.[5]

The mineral profile of bitter guard seed is little dissimilar as it contains potassium, magnesium, calcium, sodium, and phosphorous in the highest amounts and are more abundant in fruit and leaves. However, seeds are one of the of course best sources of chromium and zinc i.e. amounts of 5.65 and 45.45 mg/100 g, respectively. Bitter melon has

been demanded to comprise glucosides, mineral matters, charantin, steroidal saponin, alkaloids, momordium, carbohydrates and ascorbic acid etc. By using Folin-Ciocalteu reagent, the quantitative examination of entire phenolic compounds shown the occurrence of 42.36 mg GAE/g in bitter gourd. The incidence of Gallic acid in bitter melon as main phenolic acid has been showed by HPLC examination of phenolic content. Many other phenolic components are found to be here in bitter melon extract such as epicatechin, chlorogenic acid, catechin, and gentisic acid and Gallic in bitter acid. The extract of BM has been established as slow rate free fundamental scavenging agents by free fundamental scavenging assay.[6]

Therapeutic Use

The bitter guard is natural product with capacity to defeat or delay the process of aging due to presence of bioactive molecules. A diversity of practical ingredients are found to be present inbitter melon include photochemical components fundamentally terpenoids, glycosides flavonoids, phenolic, alkaloids, charantin and tannins. The plant of Momordica charantia also rich innumerous saponins including nkuguacin, momordicinkaraviloside, momordin, momordicoside and karavilagenin. In one study, the obese rats fed on bitter melon sustained to live at leasta month longer as compared to control. Due to these purposeful components, bitter melon posses wide range of pharmacological performance for instance, antioxidant, antifungal, anti-diabetic, ant obesity, stomachic, anticancer, hypertensive, and blood cholesterol lowering effects.[7]

The diabetes mellitus related complications are right example of life style interrelated disorders. The inactive lifestyle, high eating of dietary energy and obesity are in the midst of diverse causes leading to metabolic syndrome and diabetes mellitus. No doubt, drug used for the management of diabetes mellitus are successful but the side effects related with their use often call for another from conventional medicines. The role of diet and nutritional interventions is being painted in frequent scientific studies and the role of plants and their products are of consequence magnitude. The bitter impression of the under conversation plant is careful to be successful in preventing diabetes mellitus and curing relate Hypoglycemic effect has been formed by the particles which surrounding rigorous ethanol extract of BM (bitter melon). Under high fat fed situations, BM extract supplementation improved the insulin compassion and glucose tolerance. As compared to placebo, the insulin stimulatedIRS-1 tyrosine phosphorylation was also improved moreover; bitter melon can

decrease triglyceride and low-density lipoprotein Momordicoside, an active compound, showed moderate insulin discharge activity. In diabetic rats' body weight and the high level of fasting blood glucose has been enhanced by the administration of BM extracts about 13.33 g pulp per kg body weight/day). Compounds like oleanolic acid 3-Oglucuronide,charantin, polypeptide-p, oleanolic acid 3-O-monodesmoside and momordicinpossessed anti-hyperglycemic action. In pancreatic beta cells, these compounds improve the production of insulin and also encourage the growth and repair of beta cells. In the patients of complications.[8]

Phytochemistry

Water (90%), Protein (1.6 %), Fat (0.2%), Calcium (0.03%), Phosphorous (0.07%), Iron (12 mg in 100gm), Vitamin (6-8%) (Lubhaya, 1984). Fruits contain protein, fat, carbohydrate, mineral matter and moisture. It is rich in vitamins like riboflavin, thiamine, ascorbic acid and as corbegenin, Green fruit contains luteolin. Seeds yield the essential oil. It also contains bitter glycosides, cucurbitacins (Bhattacharjee, 2004). β- Sitosterol-β-D-glucoside and stearic acid isolated from seeds; octacosane, 1-triacontanol, 7-stigmasten3β-ol, 7,25-stigmastadien-3β-ol, 5,25-stigmastadien3β-ol glucoside and a phytospingosine isolated from leaves; two lectins (I,II) differing in amino acid composition and amino terminal sequences, two new triterpene glycosides-momordicosides A and B- isolated from seeds and characterised as 3-O-β-gentiobioside and 3-O-β-D-xylopyranosy (1-4)-[β-D-glucopyranosyl (1-6)]-β-D-glucopyranoside respectively of cucurbit-5- en-3β,22(S),23(R), 24(R), 25-pentaol; momordicoside C,D and E isolated from seeds and characterised as 3-Oβ-gentiobiosides of cucurbit-5-en-3β, 23, 24,25-tetraol, cucurbit-5,24-dien-3β,22,23-triol and 3β-hydroxy23,24,25,26,27-pentanor-20 cucurbit-5-en-22-al respectively; two cytokinins-zeatin and zeatin ribosideisolated from seeds; vicine isolated from seeds; four momordicosides G, F1, F2 and I isolated from immature fruits, of which G and F characterized as 3-O-β-Dallopyranoside.[9]

Pharmacological studies

A number of medicinal properties of the bitter gourd have been studied by various researchers that include antidiabetic, anti-ulcerogenic, anti-viral, antioxidant, anti-tumor, immune-modulatory activities etc. Some imperative pharmacological effects are as follow:

Antidiabetic activity

Hypoglycaemic activity Charantin inaccessible from fruits of M. charantia was hardened for its hypoglycemic activity. In fasting rabbits, it regularly lowered blood sugar within one to four hours and enhanced slowly to the initial level. Charantin was found to be more potent than tol butamide; however, both compounds fashioned the comparable pattern of blood sugar change. The hypoglycaemic action of charantin in depancreatized cats was less, but abolished, indicating a pancreatic as well as extra-pancreatic action.[10]

Anti-viral properties

A variety of extracts of the leaves have established in vitro anti-bacterial activities (Mwambete et al., 2009) against E. coli, Staphylococcus, Pseudomonas, Salmonella, Streptobacillus and Streptococcus. An extract of the entire plant was shown to have antiprotozoal activity.[11]

Antifertility activity

Stepka et al., (1974) have established in vivo antifertility effect of fruit and leaf of bitter melon in female animals.[12]

Anti-ulcer activity

MC has been revealed to have antiulcer activity experimental against two different models of the ulcer. In one study, momordin IC (10mg/kg, p.o.) potentially reserved ethanol-induced gastric mucosal lesions (Ma. Interestingly, MC has been shown to have antiH). Pylori activity, which would also helpfully supply to anti-ulcer activity. In one more study, dried-powdered fruits in filtered honey showed important and dose-dependent antiulcer organic activity aligned with ethanol-induced ulcerogenesis in rats. In adding, ethanol fruits extract also showed important antiulcer activity against HClEtOH induced ulcerogenesis in indomethacin pretreated rats and diethyl dithio carbonate induced ulcer models.[13]

Antihyperlipidemic Activity

Hyperlipidemia is a community problem now a day and connected with diabetes most important amplify morbidity and mortality. Main risk factor of high blood lipid concentration connected with ischemic heart diseases, atherosclerosis and cerebrovascular disease. Momordica charantia considerably showed antihyperlipidemic effect. Metformin, a fraction of Momordica charantia and other fractions such as flavonoids, saponins, tannins, triterpenes and alkaloids effect total cholesterol level in diabetic rats. More freshly, it is described the

dissimilar mechanism of bitter melon and optional that it maintenance injured β-cells thus growing the levels of insulin and its understanding. (It also stimulates the release and synthesis of adiponectin and thyroid hormones and by inhibiting the activity of glucosidase inhibits the absorption of glucoseBM enhances the action of AMPK (adenosine-5-monophosphate kinase) that is associated with fat release from fatty tissues and glucose uptake and thus causing in weight loss. Another study exposed that diabetic rat's treatment with Momordica charantia extract resulted in significant reduction of blood lipid levels. Hepatic production of triglycerides also contributes to the hyperlipidemic effect of HIV-1-protease inhibitors and that contain lipoprotein instead of lipoprotein clearance. The bitter gourd 3% can significantly reduce the cholesterol and the reduce was mediated through improved excretion of fecal lipid emission and their lymphatic transport. In HepG2 cells bitter melon also ameliorate lipid and PI-associated ApoBabnormalities. Along humanizing lipid profiles, phytochemicals also reduce apolipoprotein CIIIand decrease liver secretion of apolipoprotein B (Apo-B). Apo-B protein known aslipoprotein used for the production of LDL. Apo-C-III is a lipoprotein which involves in thesynthesis of LDL and found to be here in VLDL.[14]

Antioxidant And Anti-inflammatory Action

Lipid peroxidation and liver damage may be cause by the production of ammonium free radical.

Enlarged ammonia and urea levels lead to liver damage in ammonium chloride induced rats. Excessive ammonia intake increases commencement of NMDA receptors as well neuronal collapse resulting in oxidative injure due to lipid per oxidation and suppresses the activity of antioxidants. Initiation of ammonium salts either chloride or acetate introduced toxicity of ammonia and oxidative stress resultant in formation of lipid peroxide and free radicals.Oral supervision of bitter melon normalized the levels of TBARS, hydroperoxides, ALT, AST, and GPx and these all are mostly accountable for liver damage and lipid peroxidation. Highest value based on DPPH radical-scavenging activity and ferric dropping power was experiential for leaf extract, while the green fruit extract showed the highest antioxidant Activity on the bases of hydroxyl radical-scavenging activity, β-carotene-linoleatebleachingassay and total antioxidant capacity. Similarly, it was intentional that water as well ethanol extract of bitter melon possesses significant DPPH radical scavenging activity

and iron chelating activity better than Vit. E. while free radical scavenging, xanthane oxidase and antilipidperoxidation activity was lower than that of Vit. E.[15]

Decreased by MAP30 dose-dependently and time-dependently. Lower dose of MAP30 (8.0microg/ml) could decrease the expression of HBsAg and HBeAg Previous studies have shown that extracts of wild bitter melon suppresses lymphocyte proliferation, and macrophageand lymphocyte activity. Traditionally, the wild bitter melon leaves are crushed to obtain the juice for applying on the skin for treating insect bites, bee stings, burns, contact rashes, and wounds. Decoction of its leaves and fruits is drunkas preventative or treatment of stomachache, toothache, liver diseases, diabetes, hypertension and cancer. Furthermore, invivo administration of bitter melon extract decreased PC3 human prostate cancer cell growth subcutaneously in nude mice and this effect was due primarily to the induction of apoptosis, withno significant differences in markers of proliferation or MVD between control and treated animaltumors. The selective introduction of apoptosis in neoplastic cells is also a hallmark of a class ofanti-tumor compounds known as HDAC inhibitors. HDACs, which catalyze the removal ofacetyl groups from the N-terminus of histones, lead to chromatin condensation and transcriptional repression. Altered expression of individual HDACs in tumor samples has beenm reported and several HDAC inhibitors are in clinical trials for cancer therapy. Effects of MCP30on HDAC1 in prostate-derived cell lines were observed because this particular HDAC was beforehand shown to be over spoken in human premalignant and malignant prostate lesions, with the highest amplify in appearance in hormone refractory prostate cancer.[16]

Antimicrobial Activity

A clinical sign of broad-spectrum antimicrobial activity has been delivered by the extract of bittermelon leaf. It has been demonstrated that the whole plant extract uncovered to have antiprotozoal activity and methanol, water and ethanol extract of the BM leaves measured have an antibacterial action against Salmonella, Pseudomonas aeruginosa, E. coli, Bacillus and Streptococcus chain. Similarly, antimicrobial activity of Momrdica was investigated and itwas exposed that Staphylococcus aureus is more often than not affected by essential oil of Momrdica even ata dose of 125 to 500µg/ml while, E.coli and C. albicans both are also sensitive to a level 500µg/ml. It was optional that antibacterial properties of M. charantia oil is related to itshigh trans-nerolidol and conjugated linolenic acids content which was tested before hand.Momordica charantia is a basis of natural products which resulting from plant

with antifungal modifying antiepimastigote activity. A-momorcharin due to its ribosomeinactivating protein (RIP) ability is powerful in inhibiting the fungal and bacterial growth. Their probable against Fusarium solani (IC50 value: 6.23µM), Fusarium oxysporum (IC50 value: 4.15 µM) and Pseudomonas aeruginosa (IC50 value: 0.59 µM) is described Santos et al. Presented further arguments that bitter melon is useful to treat fungal and parasitic diseases e.g. Chagas disease (Causative organism: Trypanosoma cruzi). About 46.06 µg/mL ethanolic extract of BM killed 50%. Though, ≤ 1024 µg/mL was a MIC (minimum inhibitory concentration). Against 25 strains of Candida such as C. guilliermondii, Candida albicans, C. parapsilosis, C. glabrata, C. tropicalis and C. krusei, the antif10 mg/ml has been verified. Through disc diffusion method, a substantial inhibition has been measured. With minimum inhibitory concentration (MIC) value of 500µg/ml the essential oil of plant has been found to prevent Staphylococcus aureus. Momordica charantia also has cytotoxic and antiprotozoal activities. With IC50 value of 0.7 to 7µg/ml bitter melon revealed good antiprotozoal activity against Trypanosome brucei brucei.[17]

Oral administration of leaves showed physically powerful antimalarial activity reduces the levels of parasistemia in plasmodium infected mice. The extract of Momordica charantia leaves has been examined for antimalarial action against Plasmodium falciparum cultured. It was found that P. falciparum growth was inhibited by extract. The IC50 values for Momordica charantia was 68.4µg/mL. Some compounds from bitter melon showed moderate anti-HIV-1 activity with EC (50) values of 8.45 and 25.62 microg/ml, and exerted minimal cytotoxicity. Among the various ribosome-inactivating proteins (RIPs) isolated from bitter melon, MAP30 (Momordica protein of 30 kDa) displayed anti-tumor activity. Adult T-cell leukaemia (ATL) is caused by human T-cell leukaemia virus type I (HTLV-I) infection and is resistant to conventional chemotherapy.[18]

Anti-parasitic (anti- anthelmintic) effect of Bitter Guard

Helminthic infection is a customary problem, which is caused by nematodes, cestodes and trematodes. The main target of helminthes infection is GI system that affects human and livestock's in the world. There are three ways that can professionally treat the infection i.e. medicinal use, lifestyle administration and dietary alteration. As compare to lifestyle organization and dietary modification, trend towards the use of medicine is more. Lifestyle organization and the use of therapeutic diet have attained great interest as compare to medicinal use, since medicines cause a lot of side effects. In these days, as match up to to

other functional foods, bitter gourd careful as an imperative beneficial medicinal food with antithelmintic action and its magnitude is due to the presence of useful ingredients connecting saponins i.e. momordin, momordicoside, momordicin, kuguacin, karavilsodie and karavilagenin. The mechanism behind anthelmintic effect of BM (bitter melon) as well as inhibition of arachidonic acid metabolism, mico nicotinic agonists, oxidative phosphorylation inhibition, increased calcium permeability, acetyl cholinesterase inhibitors and β-tubulin binding. Saponins paralysis the worms and lead their mortality by inhibiting the acetyl cholinesterase.[19] Saponins affect the permeability of the cell membrane of worms and lead disintegration and vacuolization of tegument. Moreover, saponin can aggravate the mucous membrane channel gastrointestinal of worms that interfere with the absorption of food. Alkaloids counting steroidal alkaloid and oligoglycosides have neurotoxic properties, which effect on acetylcholine-stimulated body wall muscle contraction, so act as acetylcholinesterase inhibitors, course worm paralysis. Alkaloids act as an antioxidant and are capable of declining the generation of nitrate which may interfere in homeostasis that is significant for helminthes development. Falconoid compounds counting aliening can inhibit larval growth and inhibit the arachidonic acid metabolism which may lead to the disintegration of neurons in the worm's body and lead to death. Tannins can be potentially acted as anthelmintic effect by plummeting migratory ability and continued existence of newly hatched larvae. They decrease worm burden and caused damage to the digestive tissues and of worms. Moreover, tannins restrain energy production of worms by disengagement the oxidation phosphorylation and bind to glycoprotein on the cuticles of the worms and death.[20]

Wound Healing

The juice of BM (bitter melon) has a healing potential touching psoriasis, scabies and ringworm. Bitter melon juice becomes more efficient with the addition of one teaspoon of lime juice. In the susceptible areas of the world, bitter melon juice used in the inhibition of leprosy. In distinction to an ointment chance iodine, Momordica fruit powder act as an ointment. In rats modeling wound healing probable of fruit powder has been assessed. A significant response has been shown by powder ointment in terms of period of epithelization, wound-contracting ability and wound closure time. Complete ethanolic extract of bitter melon fruits and leaves are very effective in wound healing. Approximately, 1% w/v of the 95% absolute ethanol-50% benzene Momordica fruit extract significantly enhanced the rate of epithelisation and wound closure. The components which are in attendance in the extract

of Momordica fruit are accountable for successful wound healing In bitter melon ribosome inactivating proteins are presents. By inhibiting the synthesis of proteins which promote viral diseases, ribosome inactivating proteins constrain the imitation of viruses. According to laboratory tests the bioactive mechanism which is present in bitter melon can be functional in the managing of HIV infection. Lectins and proteins are insulated from bitter melon have a strong influence on HIV, but these compounds are not well engrossed in patients. In infected people, oral intake of BM will slow the progression of HIV. It has been confirmed by a clinical trial that bitter melon leaf extract provide an immune stimulant belongings against viral infections mainly HIV and has an ability to treat different viral diseases. Frequent compounds such as MAP-30, MRK-29, momorcharin and lectin are isolated from bitter melon; these compounds have a protective effect against viral infections. Varous studies in mice show that, by down-regulating the NF-κB inflammatory pathway, the seeds of BM had a cardio-protective effect. Lectin is an important bioactive component in attendance in bitter melon Lectin act on secondary tissues and lowers the absorption of blood glucose, associated to the effect of insulin in brain. Lectin is a main supplier to the hypoglycemic effect which develops after bitter melon ingestion.[21]

CONCLUSION

Towards the conclusion, it is projected that functional and health sympathetic potential of Momordica charantia wants to be explored for the curb different maladies. Many scientific evidences have come to the fore in hold up of these acclaimed benefits. But still, there is a need to think about the hidden potential of this great blessing of nature. Further more, there is a need to pay honest giving towards the exploration of these bioactive molecules. There has been satisfactory explore conducted on probing the hidden possible of bitter melon against ulcer, viral diseases and various others microbial invasions. It has a great probable to struggle next to various lifestyles associated disorders. In type-1 diabetic's subcutaneous injection of insulin significantly lower the level of glucose and between bioactive moieties, P-insulin is related to that insulin. Apart of the health promoting functions, it may be deemed as well-organized choice in value added food products.

REFERENCES

1. Mandal, S.C. Ethnobotany of the Monpa ethnic group at Arunachal Pradesh, India. Journal of Ethno biology and Ethno medicine, 2011; 31-37.
2. Kumar, M.; and Jain, S. Gastrointestinal toxicity due to bitter bottle gourd (LaGuardia siceraria)--a report of 15 cases. Indian Journal of Gastroenterology, 2011; 233.
3. Ardekani, M.R. Medicinal Plants Used in Iranian Traditional Medicine (ITM) as Contraceptive Agents. Current Trends in Biotechnology and Pharmacy, 2016; 947.
4. Kumar, G.P.; Ilaiyaraja, N. Nutritional, pharmacological and medicinal properties of Momordica charantia. International Journal of Food Sciences and Nutrition, 2015; 75-83.
5. Chen, P.; and Gbur, E. Extraction, fractionation and characterization of bitter melon seed proteins. Journal of Agricultural and Food Chemistry, 2010; 58.
6. Akinwande, A.I.; & Okinawa, O.W. Nutritional and chemical evaluation of Momordica charantia. Journal of Medicinal Plants Research, 2010; 93-94.
7. Perricone, N.V. Niacin-bound chromium increases life span in Zucker Fatty Rats. Inorganic Chemistry, 2011; 105.
8. Chaturvedi, P. Antidiabetic Potentials of Momordica charantia: Multiple Mechanisms behind the Effects. Journal of medicinal food, 2012; 101-107.
9. Mathur, M.; Katariya, P. Antiradical efficiency of 20 selected medicinal plants. Journal of Natural Products, 2011; 122.
10. Chaturvedi, P. Bitter melon. International Journal for Vitamin and Nutrition Research, 2009; 48-50.
11. González-Ortiz, M. Novel nutraceutic therapies for the treatment of metabolic syndrome. World Journal of Diabetes, 2016; 140-145.
12. Hsiang, C.Y. Identification of the bioactive and consensus peptide motif from Momordica charantia insulin receptor-binding protein. Food Chemistry, 2016.
13. Chaturvedi, P. Antiulcer Potentials of Momordica charantia: Multiple Mechanisms behind the Effects. Journal of medicinal food, 2012; 101-107.
14. Park, S.W.; Park, C.Y. Preventive effects of bitter melon (Momordica charantia) against insulin resistance and diabetes are associated with the inhibition of NF-B and JNK pathways in high-fat-fed OLETF rats. Journal of Nutritional Biochemistry, 2015; 116.
15. Subramanian, P. Antioxidant Potential of Momordica charantia in Ammonium Chloride-induced Hyperammonemic Rats. Evid. Based Complement. Alternative medicine, 2012; 140.

16. Yadav, R.B.; Garg, M. Antioxidant activity of various extracts of selected gourd vegetables. Journal of Food Science, 2016; 23-33.
17. T.; D'Arrigo, M.; Germanò, M.P. Chemical composition and antimicrobial activity of Momordica charantia seed essential oil. Fitoterapia, 2008; 123.
18. Macedo, R.O. Model Analytical Development for Physical, Chemical, and Biological Characterization of Momordica charantia Vegetable Drug. Journal of Analytical Methods in Chemistry, 2016; 128.
19. Kappagoda, S.; Singh, U.; Blackburn, B. G. Ant parasitic therapy. Mayo Clinic Proceedings, 2011; 561–83.
20. Rajeswari, v Anthelmintic activity of plants: A review. Research Journal of Photochemistry, 2014; 57–63.
21. Muhammad, N.; Mazlan,. Momordica charantia ointment accelerates diabetic wound healing and enhances transforming growth factor-β expression. Journal of Wound Care, 2014; 404.