Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Role of Medicinal Plants in the Management of Metabolic Disorders: Mechanisms, Efficacy, and Therapeutic Prospects

Muhammad Saad Naeem
Department of Pharmacy, Faculty of Health & Pharmaceutical Sciences, University of Agriculture, Faisalabad
Sadais Ahmed
Department of Pharmacy, Mirpur University of Science and Technology, Mirpur Azad Jammu & Kashmir
Abu Sulman
Department of Pharmacy, Faculty of Health & Pharmaceutical Sciences, University of Agriculture, Faisalabad
Samreen Usman
Margalla College of Pharmacy, Margalla Institute of health Sciences, Rawalpindi
Muhammad Akmal Farooq
Department of Pharmacy, Faculty of Health & Pharmaceutical Sciences, University of Agriculture, Faisalabad
Muhammad Talha
National Institute of Food Science & Technology, University of Agriculture, Faisalabad
Ayesha Awan
Riphah Institute of Pharmaceutical Sciences, Riphah International University, Islamabad
Zunaira Afzal
Department of Pharmacy, Faculty of Health & Pharmaceutical Sciences, University of Agriculture, Faisalabad
Muzammil Zaman Khan
Department of Pharmacy, Faculty of Health & Pharmaceutical Sciences, University of Agriculture, Faisalabad
Anam Hanif
Department of Pharmacy, Faculty of Health & Pharmaceutical Sciences, University of Agriculture, Faisalabad
Hafiz Aamir Ali Kharl*
Riphah Institute of Pharmaceutical Sciences, Riphah International University, Islamabad Email: aamirkharl43@gmail.com

ABSTRACT

Sedentary lifestyles, dietary habits, and genetic factors have led to metabolic disorders such as diabetes mellitus, obesity, and cardiovascular diseases becoming major global health concerns. The conventional pharmacotherapies, while effective, often come with significant limitations of high cost, adverse effects, and poor patient compliance. Medicinal plants provide a feasible alternative that is safer and more economical due to their diverse bioactive phytochemicals that act synergistically to produce

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

therapeutic benefits. This review highlights the pharmacological potential of medicinal plants in the management of metabolic disorders with an emphasis on mechanisms of action, efficacy, and clinical relevance. Key botanicals, including *Momordica charantia, Vaccinium angustifolium, Crataegus laevigata, Hoodia gordonii, Trigonella foenum-graecum, Artemisia dracunculus*, and *Cinnamomum cassia*, have exhibited significant roles in enhancing insulin sensitivity, reducing hyperglycemia, modulating lipid metabolism, and controlling hypertension. Additionally, *Allium sativum, Coriandrum sativum,* and *Tribulus terrestris* are some of the plants that possess cardioprotective and antihypertensive activities. Despite encouraging preclinical and clinical results, standardization, quality control, and toxicity studies still pose challenges for herbal products. Further scientific validation and integration of traditional knowledge with modern pharmacology will be required to fully realize the therapeutic potential of medicinal plants in metabolic disorders.

Keywords: Medicinal Plants, Metabolic Disorders, Phytochemicals, Diabetes Mellitus, Obesity, Cardiovascular Disease, Herbal Medicine

Introduction

Metabolism is termed as net result of the biochemical processes that occur in the living organisms that maintain all the cellular activities to assist life [1]. To maintain the daily activities these processes are organized to their specific metabolic pathways. These pathways depend upon the specific enzymes and their substrates to ensure the smooth functioning of the cell. Inborn errors of the metabolism (IEM) are the disorders causing due to inactivation or deficiency of the certain enzyme that took part in the metabolic pathway [2]. Most of this Inborn error of metabolism have occurred due to some autosomal recessive manners by inheritance. individually they are rare but collectively they are common as overall incident ratio is more than 1:1000. According to data by the IEM it detected that newborn screening is up to 1 in 3,234 [3] [4].

There is an increase in the prevalence of metabolic syndrome. These are the cluster of metabolic disorders. According to the IDF (International Diabetes Federation) 25% of the global population, especially adults, have metabolic syndrome, and the prevalence is estimated to increase in next few decades [5]. It is becoming a major issue in the world especially in resource limited countries like Africa [6]. The current approach is to combat with metabolic disorders is to provide a good life style and some pharmaceutical drugs that target the specific metabolic pathway which involves in the nutrient's metabolism [7].The metabolic disorders are treated by the pharmaceutical drugs but the pharmaceutical drugs are often very expensive and having a poor patient compliance meanwhile the patient also suffers from many undesirable adverse effects .There is a urgent requirement of the complimentary approaches and the research and development to introduce the alternatives for the treatment of the metabolic disorders. An alternative approach to treat the metabolic syndrome is the use of medicinal plants. A medicinal plant is defined as any plant or the plant preparations that provide health-promoting, therapeutic relief and have beneficial effect on health [8]. The healthcare practitioners now accept that the medicinal plants play a vital role in the treatment of the metabolic disorder. The use of medicinal plants is not only confined

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

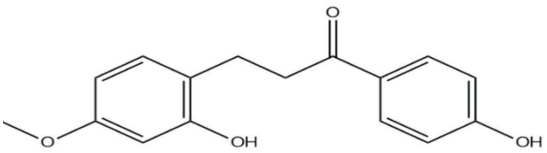
to developing countries but now become a billion-dollar industry across the world [9][10].

Metabolic disorders can be treated using medicinal plants because of the presence of the pharmacodynamic bioactive agents which provide synergistic and additive effect [11]. Most of the pharmaceutical drugs are developed from the medicinal pant based on local communities 'knowledge and the extraction methods to isolate the active pharmaceutical ingredient from the plant [12]. A driving factor in the use of medicinal plant is an understanding the medicinal plant are free of toxicity and the adverse effects when compared with the pharmaceutical drugs that used in the treatment of the metabolic disorder [13].

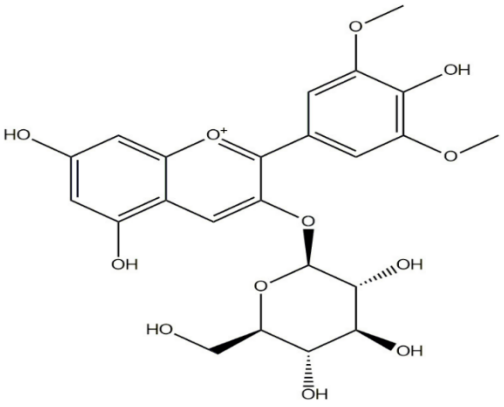
It is necessary to communicate with healthcare professionals and medicinal scientists to aware the advantages of the medicinal plants in the treatment of the disorders. Because the medicinal plants are safely accessible, a good alternative, affordable and affordable in treatment of the metabolic disorders In this review we discuss the importance of the medicinal plants and the phytochemicals extracted from plants used in the different regions in the treatment and the prevention of metabolic disorders such as cardiovascular disease, obesity and diabetes mellitus.

Medicinal Plants in Modern Therapy

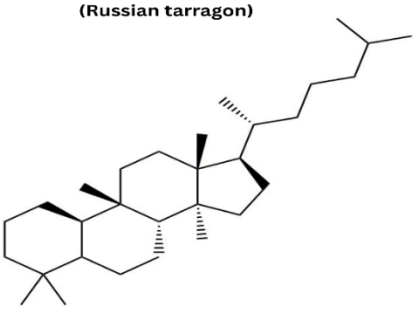
Metabolic disorders are an important concern because disorders like cardiovascular disorders and type 2 diabetes have reached an epidemic limit worldwide [14]. Metabolic disorders are not like acute diseases which are caused by pathogens but are very complex disorders which can develop progressively over the years and vary between the organisms of age and character [15]. Botanicals are important factors for the prevention and the treatment of metabolic disorders because they contain a wide variety of biologically active compounds. These biologically active compounds have various mechanisms of action that accelerate each other and provide synergistic effects to become more efficacious than the use of single chemical agent (Figure 1). It is supposed that almost 1200 plants have been discovered which are effective against diabetes.



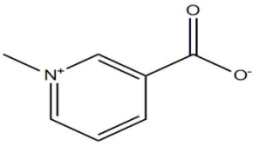
2′,4′-dihydroxy-4- methoxydihydrochalcone
(Russian tarragon)



malvidin-3-glucoside (lowbush blueberry)



cucurbitane (bitter melon)



trigonelline (fenugreek)

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

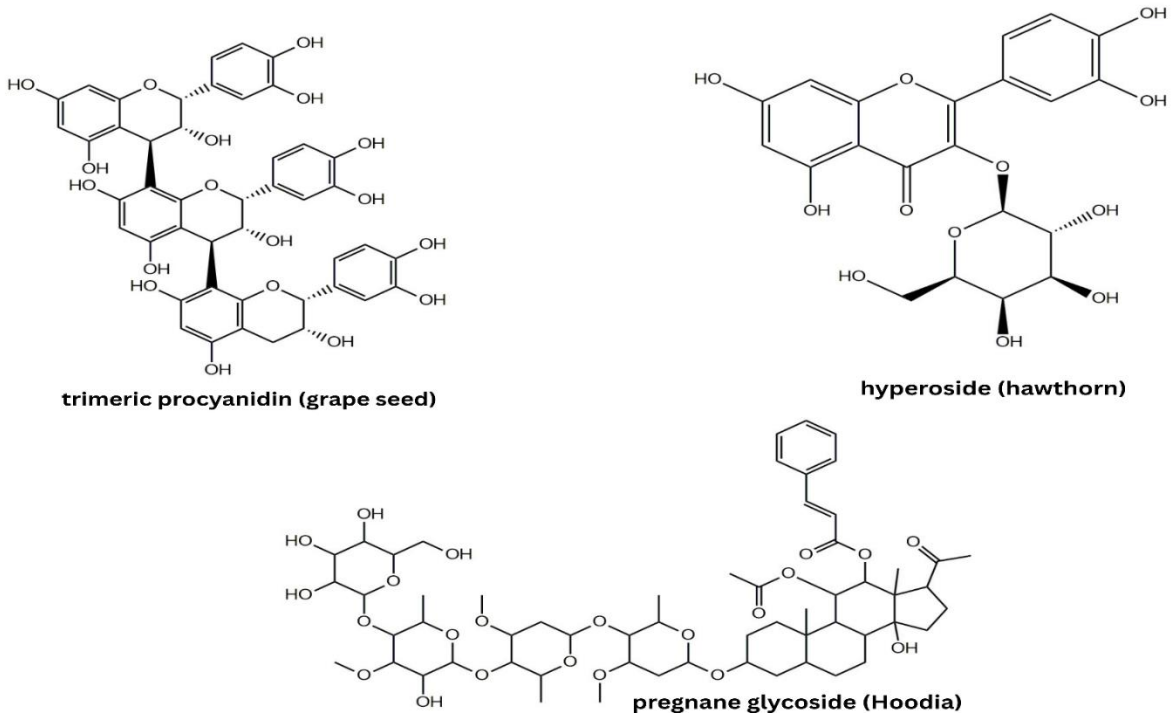


Figure 1. Active constituents present in medicinal plants

It is also noted that many of these plants are effective against the risk factors causing metabolic syndrome including hypercholesteremia and hypertension [16]. The medicinal plant plays a significant role in the traditional as well as modern healthcare system. The plants preparations have been used for thousands of years and are a source of active pharmaceutical ingredients in 25% of the marketed pharmaceutical products [17].

There are many botanicals in modern medicinal studies that are associated with the treatment of metabolic syndrome (Table 1).

Table 1. Medicinal Plants used for treating Metabolic Syndrome

Plant Name	**Plant Type**	**Scientific Name of Plant**	**Effect**	**Reference**
Bitter melon	Herbaceous vine	*Momordica Charantia*	Increase insulin sensitivity, decrease glucose, decrease low density lipids, decrease triglyceride	[18-22]
Lowbush blueberry	Deciduous shrub	*Vaccinium angustifolium*	Decrease blood pressure, decrease glucose, decrease body weight	[23-26]

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Hawthorn	Shrub or a Small Tree	*Crataegus monogyna, and Crataegus*	Decrease blood pressure, decrease low density lipids	[27-32]
Cinnamon	Tree	*Cinnamomum verum and Cinnamomum cassia*	Increase insulin sensitivity, decrease glucose level, decrease blood pressure, decrease triglyceride level	[45-50]
Fenugreek	Herb	*Trigonella foenum-graecum*	Increase insulin sensitivity, decrease glucose level, decrease low density lipids, decrease triglyceride.	[36-40]
Russian tarragon	Herb	*Artemisia dracunculus*	Increase insulin sensitivity, decrease glucose level.	[41-44]
Hoodia	Shrub	*Hoodia gordonii*	Decrease body weight	[33-35]

***Momordica charantia* L. Bitter melon**

This plant belongs to Asian origin and is famous for his antidiabetic properties and has been evaluated in various clinical trials [18]. The trials result for medicinal properties of the bitter melon is inconsistent, however half of them show positive responses. These inconsistencies resulted due to improper design of the trials and improper botanical preparations tested. The largest trials are with bitter melons conducted on 100 patients with type 2 diabetes who have a base line criterion and undergoes washout period of oral medication for 3 days. The patients undergo overnight fasting before consuming the drink which is made of freshly prepared bitter melon fruit. The result was seen as a mean reduction of 18% in fasting as well as after meal blood sugar level when the data was observed [19].

Bitter melon is not only having antidiabetic properties because in Various animal models it is suggested that it has positive effect in many other complications like nephropathy [20] enteropathy and neuropathy [21] cataract development and insulin resistance [22]

***Vaccinium angustifolium Aiton:* Lowbush blueberry**

This plant has various medicinal properties rich in polyphenols. This plant has a very high antioxidant properties which 4-5 time stronger that that of Vitamin C and Vitamin E [23]. The dosage forms prepared from blueberry are believed to lower the blood glucose level in model animals also seen in depancreatized dogs also in humans [24]. A compound mainly called myrtillin which is delphinidine-3-O-glucoside, which is an anthocyanin or red pigment showing hypoglycemic activity in human found large quantity in blue berries. In 2009 it is seen that a anthocyanin enrich

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

preparation has been found to be effective as hypoglycemic effect in diabetic rodent animals lowering blood glucose of animal by 51% relative to control group, when mixed with bio enhancing agents [25].
The anthocyanin found in the blueberry shows anti-obesogenic effect when given with drinking water in dietary-induce obese mice. But the effect is not shown when the preparations are given with the mouse food [26].

Crataegus laevigata: **Hawthorn**
The Hawthorn is recognized worldwide in eastern as well as in western medicine. The flowers, leaves and fruits are used in the treatment of cardiac failure. The hawthorn is successfully applied on the clinical trials that it is approved by the German Commission E for treatment in patients with stage II heart failure [27]. It is suggested that in separate trials, hawthorn was demonstrated to be effective and safe in the patients with metabolic disorders that taking hawthorn therapy as a complementary therapy with other drugs [28].
The plant preparations causing lower blood pressure of the body by various mechanisms including vasodilation of endothelium through eNOS (an enzyme) activation [29], antioxidant activity [30] and ACE inhibition [31]. The extract of the Hawthorn exhibit action on lipids It is suggested that it has a positive effect on dyslipidemia by preventing the increase of low-density lipids, triglyceride and VLDL-cholesterol level hyperlipidemic rat [32].

Hoodia gordonii: **Hoodia**
Hoodia is a medicinal plant which is reported to having an anorexic effect .Obesity is the main factor causing the metabolic disorders and the insulin resistance .The obesity can be controlled by various approaches like reduction in the caloric uptake also by increasing the energy expenditure of the body .Exercise and dirt in many cases are not enough and often unsuccessful as a poor compliance. Hoodia is now widely marketed as an appetite-suppressant and found in many dietary components. Pregnane glycoside a steroidal component which is extracted from the Hoodia and evident as a anorectic compound. It is thought that the compound mode of action is acting on hypothalamic modulation [33]. Scientists have discovered more than 30 glycosides which have been separated from Hoodia extract showing anorexic property [34]. The property of the Hoodia to control obesity is very effective against the control of the metabolic disorders and their risk factors. There is an issue in quality control, and the safety of the botanicals use in weight loss products. which cause a big hurdle in the proper beneficial use of the herbal drugs.[35]

Trigonella foenum-graecum **L.: Fenugreek**
The medicinal plant is a leguminous herb. Fenugreek is commonly cultivated in Northen Africa and India. Its seed is used worldwide as a spice in cooking ingredients. The seed contains a good amount of fiber and protein. This makes it a good hypoglycemic as well as hypocholesterolemia agent. The hypoglycemic and hypocholesterolemia activity of the fenugreek is recorder in animals as well as in human [36]. The Fenugreek has a high fiber content which causes the decrease the rate of gastric emptying and decrease sugar level after meal.[37]

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

In clinical trials the food which contain Fenugreek up to 10% seed powder may increase the glucose tolerance more than 20% in both diabetic and non-diabetic patients (total number of patients are 6) after 2 weeks of trial [38] In a study (number of patients are 24) patients with diabetes were treated with the Fenugreek soaked in the hot water 10g/day for 8weeks resulting in the decrease in triglyceride 30% ,VLDL cholesterol level 31% and blood sugar level 25% [39]. The Fenugreek works only when it is given in large volume because it directly acts on the digestive system [40]

Artemisia dracunculus L.: **Russian tarragon**

The ethanolic extract of the Russian tarragon is exhibited a hypoglycemic activity as well as antidiabetic activity [41]. The bioactivity fractionation of the extract causes the separation of the 6 compounds including 6-demethoxy-capillarison, davidigenin, 4,5-di-O-caffeolquinic acid, and4′-dihydroxy-4-methoxydihydrochalcone [42].

Studies in the human as well as in murine muscle cells reported that the Russian tarragon follow the same pathway as the insulin molecule to provide the antidiabetic effect to the body. The pathway which may be disrupted in case of the insulin resistance in many cases [43]

A trial study was conducted in the people to evaluate the clinical effect of the Russian tarragon. In this study the Russian tarragon 6g/day is given to the insulin resistance using euglycemic clamp (a standard test for insulin sensitivity) in non-diabetic patient. There is a increase concentration of the three bioactive compounds in the blood plasma that were detected sakuranetin, chalcone and Davidigenin examined through liquid chromatography -mass spectrometry. It is noted that the patient with the Russian tarragon has been improved insulin sensitivity. but the placebo group remains the same. These trials provide the evident of the bioactive compound present in the Russian tarragon with notable effect in invitro studies has been seemed [44]

Cinnamomum cassia: **Cinnamon**

Cinnamon has been evident historically used as anti-diabetic agent and now a days many of the cinnamon products are available on market as dietary supplements that provide maintenance in blood sugar level in body. Compounds like polyphenol type A polymer are present in Cinnamon which exhibit a antidiabetic property in mimetic in vitro activity [45]. It is also evident that the cinnamon extract also improves the insulin signaling tested in the murine diabetic models [46]

It is demonstrated that cinnamon has a positive effect on other metabolic disorders in addition to its antidiabetic property. The antihypertensive activity of cinnamon has been seen in both hypertensive rats and in patients with metabolic syndrome (22 men &women are treated with cinnamon 500-mg daily for 12 week) [47][48]

The triglyceride lowering effect of cinnamon is also seen in the Wistar rat fed a high-fructose diet [49] In clinical trials it is also noted that the serum triglyceride, Low density lipids, VLDL-cholesterol were all lower with the use of the cinnamon in patients [50]

Role of Medicinal Plants in the Treatment of Major Metabolic Disorders

Obesity

According to WHO, a person who is overweight has his/her body mass index (BMI)

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

is over or equal to 25 means while an obese person is one who has BMI equal or greater than 30 [51]. There has been a wide increase in diseases like obesity in recent years. This is because of the change of diet in the people worldwide or due to the adaptation of inactive lifestyle [52]. According to a survey it is noted that there is a tripled increase in obesity between 1989 to 2011. WHO estimated that obesity is the seventh leading cause of mortality in the world. Approximately 2.8 million, a huge number of people who died because of the obesity and related complications [51] Obesity can reduce the average life to 7 years after the age of 40 years [53]. In 2016 a statistic showed that there are 650 million people in the world who are obese and there are 1.9 billion people who are overweight [51]. It is studies that 21% of the population in the South Africa was obese out of these 21% there are 57% of the women and 29% are the men [54][55].

The main reason for obesity is the uptake of high dense energy foods and there is less physical activity that is required to consume the calories taken by food [56]. Overweight is associated with complications like cancer, cardiovascular disorders and diabetes mellitus [57]. Recommendation is to decrease the body weight by reducing uptake of free sugar, salts and decreasing consumption of the saturated fatty acids. There should be increase in physical activity of the body leading towards a healthy lifestyle [58]. Only 5-10% of people able to maintain their body weight when people cease therapy or change their physical activity, there is a reversal of the weight loss. [59]. The drugs used for the weight loss may shows any adverse effects [60]. The herbal drugs can be used as a safe and alternative method for the obesity. The herbal drugs may show less adverse effects than the pharmaceuticals drugs in the body. In this portion of review (table 2) some plant are listed which can be used for the treatment of obesity.

Table 2. Medicinal plants used for the treatment of obesity

PLANT NAME	**SCIENTIFIC NAME**	**PART USE**	**ACTION**
Fennel	*Foeniculum vulgare Mill*	Seed	Reduce oxidative stress, inhibit serotonin uptake
Gimena	*Gymnema sylvestre*	Leaves	Inhibit fatty acid accumulation and glucose absorption
Kalahari cactus	*Hoodia gordonii*	Stem	Suppress appetite, target adipose tissue
Cape Aloe	*Aloe ferox*	Leaves	Reduce water retension
Aloe vera	*Aloe vera Mille*	Leaves	Increase metabolism of carbohydrates. Reduce glucose intolerance
Marijuana	*Cannabis sativa L.*	Leaves	Increase metabolic rate, reduce energy storage

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

Moringa	*Moringa Oleifera Lam*	Leaves	Reduce body weight, decrease cholesterol
David root	*Cissampelos capensis L.f.*	Root	Increase body energy

Cardiovascular disease

Cardiovascular disease (CVDs) is becoming the leading cause of early mortality and weakness is becoming a major problem in community health [61]. Named as silent killer high blood pressure is triggered by a various factors like genetics or environmental factors may contribute to the progression of the cardiovascular disease [62]. According to studies the high blood pressure is the leading risk factor causing acute myocardial infarction and causing death in 16.5% of death annually around the world [63]. A patient is said to be hypertensive if it has systolic blood pressure value is greater than or equal to 140 mm of Hg and diastolic blood pressure is greater than or equal to 90 mm of Hg checked by means of two readings [64]. Mant of the pharmaceutical agents are available to treat hypertension like sympatholytic agents, loop diuretics, calcium channel blockers, angiotensin converting enzyme inhibitors and vasodilators [65]. These pharmaceutical agents have many side effects like blurred vision, vomiting, kidney failure, muscle cramp, edema, headache and abnormal heart rate [66]. Scientists are considering the use of natural and traditional medicines for the treatment of cardiovascular disease because of the less adverse effects of the natural products it can successfully use as alternate therapy for cardiovascular disease [67]. About 70% to 80% of the world population in the developing countries predominantly use the natural products for therapeutic purposes due to therapeutic benefits, easy access and lower cost than pharmaceutical drugs [68]. Medicinal plants have been trialed for their use in the treatment of the metabolic disorders giving us promising results because many the pharmaceuticals' drugs derived from these plants.[69]. Many of the medicinal plants available to treat hypertension having different mechanisms of action

Carum copticum noted to block the calcium channels which has a beneficial effect on regulating heartbeat and blood pressure. The methanolic extract of the *Carum copticum* 1-30 mg/Kg is believed to cause decrease of blood pressure and heart rate while at larger dose cause bradycardia [70]

Tribulus terrestris act as antihypertensive cause decrease in blood pressure. The methanolic extract of the *Tribulus terrestris* is supposed to be acted as vasodilator when given 0.3-15 mg/Kg [71]. This plant is used for its diuretic ability, also containing saponins which prevent the production of the H_2O_2 [72].

Nigella sativa has component causing decrease in blood pressure. Oral administration of the extract 100-200 mg to a hypertensive male patient for eight weeks recorded as decrease of the systolic blood pressure and diastolic blood pressure up to 10.6 and 9.6 respectively [73][74]. This plant also shows vasorelaxation by means of calcium channel blockage [75].

Elettaria cardamomum is noted to have antihypertensive activity the powder of fruit (3g) is shown to reduce the systolic blood pressure to 19 mm of Hg and diastolic

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

blood pressure to 12mm of Hg in a pure hypertensive patient by increasing the antioxidants in body [76]

Daucus carota is used traditionally for hypertensive patients. It regulates the fluid balance, and the juice is full of antioxidants which control the blood vessels by decreasing the oxidative stress. It also regulates the blood pressure due to existence of potassium [77]

Cinnamomum zeylanicum has noted to reduce the blood pressure in various rat models and in people with type 2 diabetes and prediabetes patients. The extract obtained from the bark cause decrease in the systolic blood pressure also reduce the contraction caused by KCl in endothelium. The methanolic extract also noted to increase the nitric oxide level [78].

Theobroma cacao is useful in controlling CVDs because of the presence of flavonoids compounds in them promoting the production of Nitric Oxide which increases the vasodilation and reducing endothelial dysfunction. The daily use of bark of white chocolate can reduce the systolic blood pressure by 5mm of Hg and diastolic blood pressure by 3mm of Hg [79]

Coriander sativum is used traditionally for the treatment of gastrointestinal issues and cardiovascular disorders because it shows antioxidant activities [80]. When the methanolic extract of this plant is been used it is seen that it decreases the systolic blood pressure & diastolic blood pressure by acting as Ca^{2+} antagonist. It also exhibits diuretic effect [81].

Allium Sativum acts as like a standard medication to treat hypertension it can decrease the systolic blood pressure by 10 mm of Hg and diastolic blood pressure by 8 mm of Hg. This herb is particularly very beneficial, having various effects like anti-cancer activity, anti-inflammatory activity, anti-hypercholesteremic activity and anti-cancer activity [82]. A study reveals that garlic is almost 80% effective in treating hypertension in patients. Aged garlic extract can exhibit a constant drop in blood pressure than the other forms of garlic [83]. The components in the garlic extract inhibit the angiotensin converting enzyme diminished the angiotensin-II induced vasoconstriction [84]

Diabetes

A chronic disease which is caused by the disorder in the metabolism of protein fats and carbohydrates [85][86]. It is characterized by the increase in blood sugar after taking a meal. Diabetes is due to the deficiency of insulin or due to its malfunction [86]. Diabetes demands its early diagnosis, change of lifestyle and proper treatment. Diabetes effect numerous people in 21st century and becoming the fifth leading cause of the death worldwide [87]. Today there are many techniques available to treat diabetes like insulin therapy, diet therapy and pharmacotherapy. There are several glucose lowering drugs are available in the market which shows ani diabetic effect by various mechanism of action. These mechanisms include the increase in the production of insulin by sulfonylureas, by increasing the peripheral absorption of glucose by thiazolidinediones [88] by reducing the hepatic gluconeogenesis by biguanides, by delaying in the absorption of the glucose in the intestine by alpha glucosidase [89]. However, many of the treatments have been done for past three decades but still the result of treating diabetes is not perfect. These drugs show many

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

disadvantages like development of the resistance, toxicity and adverse effects. It is seen that in case of sulfonylureas 44% of the patient lose its effectiveness after 6 years of use. It is also notes that the glucose lowering drugs cannot be able to control hyperlipidemia [90]. The side effects and the drug interaction with each other should be strictly monitored while using the medicines. Now a days many treatments are recommended that consist of the use of medicinal plants [91]. Many plants contain phytochemicals like alkaloids, carotenoids, terpenoids and flavonoids show antidiabetic activity [92]. The anti-diabetic treatment while using the medicinal plants seen to improve the pancreatic tissue performance causes increase insulin secretion and reduces the absorption of glucose from intestine.[93]. Mant medicinal plants are available to treat diabetes

Acacia arabica in a study reveal that the pant show antidiabetic property when given orally 200 mg/Kg as bark extract to streptozotocin (STZ) induced diabetic rats for over 21 days. It seems that there is a increase in the insulin level in the serum of the rat. In addition, the insulin resistance is decreasing. The plant contains many flavonoids, tannins, and polyphenols. The presence of the compounds shows antioxidant property is an explanation of antidiabetic effect. It also improves the plasma glucose level and metabolic disorder causing defects in lipid metabolism [94].

Achyranthes aspera extract used in STZ-induce rats shows that there is a significant reduction in the blood glucose level. It is suggested that it may be due to the decrease in glucose absorption from the intestine [95].

Allium Sativum shows anti diabetic effect when ethanolic extract is given to STZ-induced diabetic rat. After the 14 days of oral administration of the extract of this plant showed a decrease in the serum glucose level, cholesterol triglycerides, creatinine, uric acid and urea While comparing the activity of the garlic extract and 600 mg/Kg of glipalamide showed that the plant extract showed more promising effect than the glipalamide [96] .In other study shows that the administration of the ethanolic extract or juice in the STZ-induced diabetic rat causes increase insulin secretion from pancreatic cells. Daily dose of the plant extract reduces the plasma glucose level [93].

Aloe barbadensis Miller is used as traditional medicinal plant for various complications. The study of the ethanolic extract of this plant in STZ-induce diabetic rats for 42 days shows that there is a significant reduction in the blood glucose level. The anti-diabetic effect of this plant extract can be compared with the standard drugs available in market like metformin [97].

Artemisia herba aqueous extract derived from the aerial part of the plant .For 2–4-week administration in diabetic rat cause decrease in the blood glucose level this plant shows hypoliposis which can prevent weight loss in diabetic animals [98]

Coriandrum sativum shows antidiabetic activity when the extract is given to STZ-induced rat. Doses of 500 and 250 mg/Kg cause in the significant decrease in the blood glucose level in experimental group as comparison with the control group. However, it is noted that dose of 500 mg/kg shows maximal effect to rats [99].

Lepidium sativum seed extract has been studied in STZ-induced diabetic rats. Administration of daily dose or 15 doses daily of the extract 20 mg/Kg the blood glucose level significantly decreases. After following 15 doses daily for 2 weeks it is estimated that the basal concentration of insulin return to its normal state [100]

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Challenges in developing Herbal drug

The development of drugs from botanical source starting with the isolation, characterization of the plant active components and purification The herbal drugs are believed to be more effective having less adverse effect and affordable for the patient than that of the allopathic medicines. These herbal medicines include herbal extracts, herbal preparations and herbal products. These drugs contain different part of the plants and other materials as active constituents. It has been well recorded that the plants is used in the preparation of the many allopathic medicines. Natural substance are a key factors to developing new drugs [101-103]. Figure 2 describes the key steps to development of new drugs from plant.

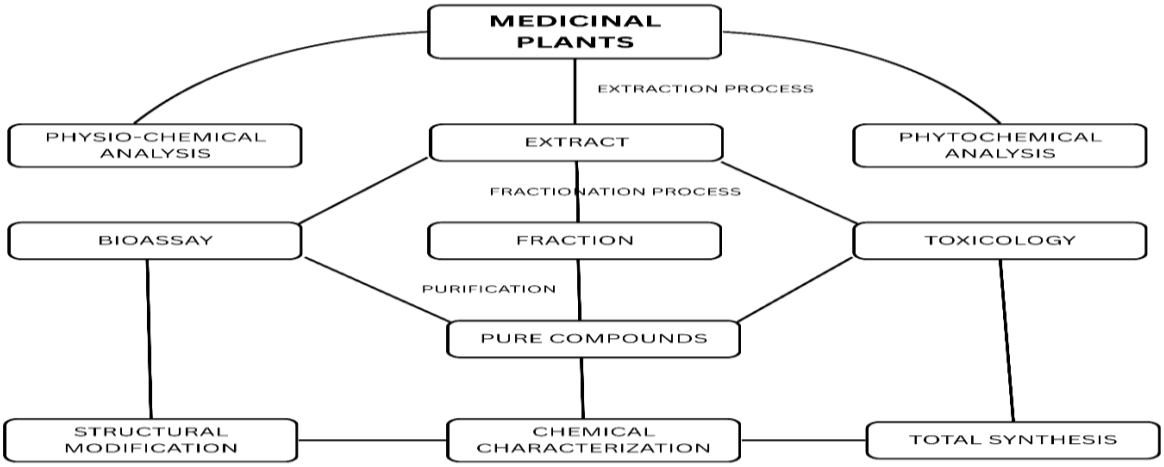


Figure 2 Key steps to development of new drugs from plant [108].

Despite this success in the past two to three decades future development of drugs from plants faces many challenges. The herbal sources are questioned based on the quality and the standardization of the raw material is acting as major issue in the herbal industry [104] [105]. The reason is that the herbal plants can be easily contaminated during growth, processing and collection. It is noted the plants easily adulterated with the heavy metal which is a main problem in medicinal industry. So, it is necessary to increase the qualitative and quantitative safety of the bioactive compounds for developing new drugs [106][107]. There are many compounds are derived from plants are studied successfully by the scientists and the investigators and no doubt that pants are very effective against the management of the metabolic disorders [108].

Conclusion

Medicinal plants have immense potential in the prevention and treatment of metabolic disorders due to their wide range of bioactive compounds and multifaceted mechanisms of action. Many studies have illustrated their efficacy in improving glucose and lipid metabolism, reducing oxidative stress, and regulating cardiovascular functions with fewer adverse effects as compared to synthetic drugs. However, despite their therapeutic promise, several limitations hinder their clinical application,

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

including variability in plant composition, lack of standardized extraction methods, and insufficient regulatory oversight. In order to realize their full potential, rigorous pharmacological, toxicological, and clinical investigations will be necessary to establish efficacy, safety, and reproducibility. Closer collaboration among traditional medicine practitioners, pharmacologists, and healthcare providers will facilitate the rational development of plant-based therapeutics. When appropriately validated and standardized, medicinal plants could make a considerable contribution to the management of the global burden of metabolic disorders and provide a sound basis for future drug discovery.

References

Agana, M., Frueh, J., Kamboj, M., Patel, D. R., & Kanungo, S. (2018). Common metabolic disorder (inborn errors of metabolism) concerns in primary care practice. Annals of translational medicine, 6(24), 469.

El-Hattab, A. W. (2015). Inborn errors of metabolism. Clinics in perinatology, 42(2), 413-439.

Campeau, P. M., Scriver, C. R., & Mitchell, J. J. (2008). A 25-year longitudinal analysis of treatment efficacy in inborn errors of metabolism. Molecular genetics and metabolism, 95(1-2), 11-16.

Wasim, M., Khan, H. N., Ayesha, H., & Awan, F. R. (2023). Need and challenges in establishing newborn screening programs for inherited metabolic disorders in developing countries. Advanced Biology, 7(7), 2200318.

O'neill, S. (2015). O'Driscol Ll. Metabolic syndrome: a closer look at the growing epidemic and its associated pathologies. Obes Rev, 16, 1-12.

Nolan, P. B., Carrick-Ranson, G., Stinear, J. W., Reading, S. A., & Dalleck, L. C. (2017). Prevalence of metabolic syndrome and metabolic syndrome components in young adults: A pooled analysis. Preventive medicine reports, 7, 211-215.

Moller, D. E. (2001). New drug targets for type 2 diabetes and the metabolic syndrome. Nature, 414(6865), 821-827.

Sofowora, A. (1996). Research on medicinal plants and traditional medicine in Africa. The Journal of Alternative and Complementary Medicine, 2(3), 365-372.

Gurib-Fakim, A. (2006). Medicinal plants: traditions of yesterday and drugs of tomorrow. Molecular aspects of Medicine, 27(1), 1-93.

Kanwar, P., Sharma, N., & Rekha, A. (2006). Medicinal plants use in traditional healthcare systems prevalent in Western Himalayas. Indian Journal of traditional knowledge, 5(3), 300-309.

Rodriguez-Casado, A. (2016). The health potential of fruits and vegetables phytochemicals: notable examples. Critical reviews in food science and nutrition, 56(7), 1097-1107.

Altemimi, A., Lakhssassi, N., Baharlouei, A., Watson, D. G., & Lightfoot, D. A. (2017). Phytochemicals: Extraction, isolation, and identification of bioactive compounds from plant extracts. Plants, 6(4), 42.

Tabasum, S., & Khare, S. (2016). Safety of medicinal plants: An important concern. Int. J. Pharm. Biol. Sci, 7, 237-243.

Online ISSN 3007-3197
Print ISSN 3007-3189

Boddu, S. K., Giannini, C., & Marcovecchio, M. L. (2025). Metabolic disorders in young people around the world. Diabetologia, 1-12.

Zakir, F., Mohapatra, S., Farooq, U., Mirza, M. A., & Iqbal, Z. (2022). Introduction to metabolic disorders. In Drug delivery systems for metabolic disorders (pp. 1-20). Academic Press.

Marles, R. J., & Farnsworth, N. R. (1995). Antidiabetic plants and their active constituents. Phytomedicine, 2(2), 137-189.

Newman, D. J., & Cragg, G. M. (2007). Natural products as sources of new drugs over the last 25 years. Journal of natural products, 70(3), 461-477.

Leung, L., Birtwhistle, R., Kotecha, J., Hannah, S., & Cuthbertson, S. (2009). Anti-diabetic and hypoglycaemic effects of Momordica charantia (bitter melon): a mini review. British Journal of Nutrition, 102(12), 1703-1708.

Ahmad, N., Hassan, M. R., Halder, H., & Bennoor, K. S. (1999). Effect of Momordica charantia (Karolla) extracts on fasting and postprandial serum glucose levels in NIDDM patients. Bangladesh Med. Res. Counc. Bull.

Grover, J. K., Vats, V., Rathi, S. S., & Dawar, R. (2001). Traditional Indian anti-diabetic plants attenuate progression of renal damage in streptozotocin induced diabetic mice. Journal of Ethnopharmacology, 76(3), 233-238.

Grover, J. K., Rathi, S. S., & Vats, V. (2002). Amelioration of experimental diabetic neuropathy and gastropathy in rats following oral administration of plant (Eugenia jambolana, Mucuna pruriens and Tinospora cordifolia) extracts. Indian Journal of Experimental Biology, 40(3), 273-276.

Rathi, S. S., Grover, J. K., Vikrant, V., & Biswas, N. R. (2002). Prevention of experimental diabetic cataract by Indian Ayurvedic plant extracts. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 16(8), 774-777.

Shi, J., Yu, J., Pohorly, J. E., & Kakuda, Y. (2003). Polyphenolics in grape seeds—biochemistry and functionality. Journal of medicinal food, 6(4), 291-299.

Ferreira, G. D. C. R. (2022). Effect of blueberry juice supplementation in a rat model of prediabetes: control diets and molecular mechanisms (Master's thesis, Universidade de Coimbra (Portugal)).

Grace, M. H., Ribnicky, D. M., Kuhn, P., Poulev, A., Logendra, S., Yousef, G. G., ... & Lila, M. A. (2009). Hypoglycemic activity of a novel anthocyanin-rich formulation from lowbush blueberry, Vaccinium angustifolium Aiton. Phytomedicine, 16(5), 406-415.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 11 (2025)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Prior, R. L., E. Wilkes, S., R. Rogers, T., Khanal, R. C., Wu, X., & Howard, L. R. (2010). Purified blueberry anthocyanins and blueberry juice alter development of obesity in mice fed an obesogenic high-fat diet. Journal of agricultural and food chemistry, 58(7), 3970-3976.

Pittler, M. H., Guo, R., & Ernst, E. (2008). Hawthorn extract for treating chronic heart failure. The Cochrane database of systematic reviews, (1), CD005312-CD005312.

Walker, A. F., Marakis, G., Simpson, E., Hope, J. L., Robinson, P. A., Hassanein, M., & Simpson, H. C. (2006). Hypotensive effects of hawthorn for patients with diabetes taking prescription drugs: a randomised controlled trial. The British Journal of General Practice, 56(527), 437.

Brixius, K., Willms, S., Napp, A., Tossios, P., Ladage, D., Bloch, W., ... & Schwinger, R. H. (2006). Crataegus special extract WS® 1442 induces an endothelium-dependent, NO-mediated vasorelaxation via eNOS-phosphorylation at serine 1177. Cardiovascular drugs and therapy, 20(3), 177-184.

Tadić, V. M., Dobrić, S., Marković, G. M., Đorđević, S. M., Arsić, I. A., Menković, N. R., & Stević, T. (2008). Anti-inflammatory, gastroprotective, free-radical-scavenging, and antimicrobial activities of hawthorn berries ethanol extract. Journal of agricultural and food chemistry, 56(17), 7700-7709.

Lacaille-Dubois, M. A., Franck, U., & Wagner, H. (2001). Search for potential angiotensin converting enzyme (ACE)-inhibitors from plants. Phytomedicine, 8(1), 47-52.

Dehghani, S., Mehri, S., & Hosseinzadeh, H. (2019). The effects of Crataegus pinnatifida (Chinese hawthorn) on metabolic syndrome: A review. Iranian journal of basic medical sciences, 22(5), 460.

MacLean, D. B., & Luo, L. G. (2004). Increased ATP content/production in the hypothalamus may be a signal for energy-sensing of satiety: studies of the anorectic mechanism of a plant steroidal glycoside. Brain research, 1020(1-2), 1-11.

Shukla, Y. J., Pawar, R. S., Ding, Y., Li, X. C., Ferreira, D., & Khan, I. A. (2009). Pregnane glycosides from Hoodia gordonii. Phytochemistry, 70(5), 675-683.

Graf, B. L., Raskin, I., Cefalu, W. T., & Ribnicky, D. M. (2010). Plant-derived therapeutics for the treatment of metabolic syndrome. Current opinion in investigational drugs (London, England : 2000), 11(10), 1107–1115.

Online ISSN 3007-3197
Print ISSN 3007-3189

Roberts, K. T. (2011). The potential of fenugreek (Trigonella foenum-graecum) as a functional food and nutraceutical and its effects on glycemia and lipidemia. Journal of medicinal food, 14(12), 1485-1489.

Mathern, J. R., Raatz, S. K., Thomas, W., & Slavin, J. L. (2009). Effect of fenugreek fiber on satiety, blood glucose and insulin response and energy intake in obese subjects. Phytotherapy research, 23(11), 1543-1548.

Gopalpura, P. B., Jayanthi, C., & Dubey, S. (2007). Effect of Trigonella foenum-graecum seeds on the glycemic index of food: A clinical evaluation. International Journal of Diabetes in Developing Countries, 27(2).

Kassaian, N., Azadbakht, L., Forghani, B., & Amini, M. (2009). Effect of fenugreek seeds on blood glucose and lipid profiles in type 2 diabetic patients. International Journal for Vitamin and Nutrition Research, 79(1), 34-39.

Khorshidian, N., Yousefi Asli, M., Arab, M., Adeli Mirzaie, A., & Mortazavian, A. M. (2016). Fenugreek: potential applications as a functional food and nutraceutical. Nutrition and food in health and disease, 3(1), 5-16.

Ribnicky, D. M., Poulev, A., Watford, M., Cefalu, W. T., & Raskin, I. (2006). Antihyperglycemic activity of Tarralin™, an ethanolic extract of Artemisia dracunculus L. Phytomedicine, 13(8), 550-557.

Logendra, S., Ribnicky, D. M., Yang, H., Poulev, A., Ma, J., Kennelly, E. J., & Raskin, I. (2006). Bioassay-guided isolation of aldose reductase inhibitors from Artemisia dracunculus. Phytochemistry, 67(14), 1539-1546.

Cefalu, W. T. (2009). Inflammation, insulin resistance, and type 2 diabetes: back to the future?. Diabetes, 58(2), 307.

DeFronzo, R. A., Tobin, J. D., & Andres, R. (1979). Glucose clamp technique: a method for quantifying insulin secretion and resistance. American Journal of Physiology-Endocrinology and Metabolism, 237(3), E214.

Anderson, R. A., Broadhurst, C. L., Polansky, M. M., Schmidt, W. F., Khan, A., Flanagan, V. P., ... & Graves, D. J. (2004). Isolation and characterization of polyphenol type-A polymers from cinnamon with insulin-like biological activity. Journal of agricultural and food chemistry, 52(1), 65-70.

Kim, S. H., Hyun, S. H., & Choung, S. Y. (2006). Anti-diabetic effect of cinnamon extract on blood glucose in db/db mice. Journal of ethnopharmacology, 104(1-2), 119-123.

Online ISSN 3007-3197
Print ISSN 3007-3189

Mollazadeh, H., & Hosseinzadeh, H. (2016). Cinnamon effects on metabolic syndrome: a review based on its mechanisms. Iranian journal of basic medical sciences, 19(12), 1258.

Ziegenfuss, T. N., Hofheins, J. E., Mendel, R. W., Landis, J., & Anderson, R. A. (2006). Effects of a water-soluble cinnamon extract on body composition and features of the metabolic syndrome in pre-diabetic men and women. Journal of the International Society of Sports Nutrition, 3(2), 45.

Qin, B., Polansky, M. M., & Anderson, R. A. (2010). Cinnamon extract regulates plasma levels of adipose-derived factors and expression of multiple genes related to carbohydrate metabolism and lipogenesis in adipose tissue of fructose-fed rats. Hormone and Metabolic Research, 42(03), 187-193.

Ranasinghe, P., Jayawardena, R., Pigera, S., Wathurapatha, W. S., Weeratunga, H. D., Premakumara, G. S., ... & Galappaththy, P. (2017). Evaluation of pharmacodynamic properties and safety of Cinnamomum zeylanicum (Ceylon cinnamon) in healthy adults: a phase I clinical trial. BMC Complementary and Alternative Medicine, 17(1), 550.

WHO World Health Organization: Obesity. Available online: **https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight** (accessed on November 02, 2025)

Blüher, M. (2019). Obesity: global epidemiology and pathogenesis. Nature reviews endocrinology, 15(5), 288-298.

Peeters, A., Barendregt, J. J., Willekens, F., Mackenbach, J. P., Mamun, A. A., Bonneux, L., & for NEDCOM, the Netherlands Epidemiology and Demography Compression of Morbidity Research Group*. (2003). Obesity in adulthood and its consequences for life expectancy: a life-table analysis. Annals of internal medicine, 138(1), 24-32.

Nishida, C., & Mucavele, P. (2004). Monitoring the rapidly emerging public health problem of overweight and obesity: the WHO global database on body mass index.

Van Der Merwe, M. T., & Pepper, M. S. (2006). Obesity in South Africa. Obesity reviews, 7(4), 315-322.

Romieu, I., Dossus, L., Barquera, S., Blottière, H. M., Franks, P. W., Gunter, M., ... & IARC Working Group on Energy Balance and Obesity. (2017). Energy balance and obesity: what are the main drivers?. Cancer causes & control, 28(3), 247-258.

Online ISSN 3007-3197
Print ISSN 3007-3189

Al-Abed, A. A. A. A. (2021). Obesity-Linked Diseases (Comorbidities). In Obesity and its Impact on Health (pp. 97-116). Singapore: Springer Singapore.

Artinian, N. T., Fletcher, G. F., Mozaffarian, D., Kris-Etherton, P., Van Horn, L., Lichtenstein, A. H., ... & Burke, L. E. (2010). Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults: a scientific statement from the American Heart Association. Circulation, 122(4), 406-441.

Donnelly, J. E., Blair, S. N., Jakicic, J. M., Manore, M. M., Rankin, J. W., & Smith, B. K. (2009). Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. Medicine & Science in Sports & Exercise, 41(2), 459-471.

Yanovski, S. Z., & Yanovski, J. A. (2014). Long-term drug treatment for obesity: a systematic and clinical review. Jama, 311(1), 74-86.

Al Disi, S. S., Anwar, M. A., & Eid, A. H. (2016). Anti-hypertensive herbs and their mechanisms of action: part I. Frontiers in pharmacology, 6, 323.

Wang, J., & Xiong, X. (2012). Control strategy on hypertension in Chinese medicine. Evidence-Based Complementary and Alternative Medicine, 2012(1), 284847.

Anwar, M. A., Al Disi, S. S., & Eid, A. H. (2016). Anti-hypertensive herbs and their mechanisms of action: part II. Frontiers in pharmacology, 7, 172328.

Hashemi, V., Dolati, S., Hosseini, A., Gharibi, T., Danaii, S., & Yousefi, M. (2017). Natural killer T cells in Preeclampsia: An updated review. Biomedicine & Pharmacotherapy, 95, 412-418.

Sinha, A. D., & Agarwal, R. (2019). Clinical pharmacology of antihypertensive therapy for the treatment of hypertension in CKD. Clinical Journal of the American Society of Nephrology, 14(5), 757-764.

Singh, P., Mishra, A., Singh, P., Goswami, S., Singh, A., & Tiwari, K. D. (2015). Hypertension and herbal plant for its treatment: a review. Indian Journal of Research in Pharmacy and Biotechnology, 3(5), 358.

Rastogi, S., Pandey, M. M., & Rawat, A. K. S. (2016). Traditional herbs: a remedy for cardiovascular disorders. Phytomedicine, 23(11), 1082-1089.

Agrawal, M., Nandini, D., Sharma, V., & Chauhan, N. S. (2010). Herbal remedies for treatment of hypertension. Int J Pharm Sci Res, 1(5), 1-21.

Online ISSN 3007-3197
Print ISSN 3007-3189

Shayganni, E., Bahmani, M., Asgary, S., & Rafieian-Kopaei, M. (2016). Inflammaging and cardiovascular disease: Management by medicinal plants. Phytomedicine, 23(11), 1119-1126.

Boskabady, M. H., Alitaneh, S., & Alavinezhad, A. (2014). Carum copticum L.: a herbal medicine with various pharmacological effects. BioMed research international, 2014(1), 569087.

Kumar, K., Sharma, Y. P., Manhas, R. K., & Bhatia, H. (2015). Ethnomedicinal plants of Shankaracharya Hill, Srinagar, J&K, India. Journal of ethnopharmacology, 170, 255-274.

Sharifi, A. M., Darabi, R., & Akbarloo, N. (2003). Study of antihypertensive mechanism of Tribulus terrestris in 2K1C hypertensive rats: role of tissue ACE activity. Life sciences, 73(23), 2963-2971.

Leong, X. F., Rais Mustafa, M., & Jaarin, K. (2013). Nigella sativa and its protective role in oxidative stress and hypertension. Evidence-Based Complementary and Alternative Medicine, 2013(1), 120732.

Jaarin, K., Foong, W. D., Yeoh, M. H., Kamarul, Z. Y. N., Qodriyah, H. M. S., Azman, A., ... & Kamisah, Y. (2015). Mechanisms of the antihypertensive effects of Nigella sativa oil in L-NAME-induced hypertensive rats. Clinics, 70, 751-757.

Kundu, J. K., Liu, L., Shin, J. W., & Surh, Y. J. (2013). Thymoquinone inhibits phorbol ester-induced activation of NF-κB and expression of COX-2, and induces expression of cytoprotective enzymes in mouse skin in vivo. Biochemical and biophysical research communications, 438(4), 721-727.

Verma, S. K., Jain, V., & Katewa, S. S. (2009). Blood pressure lowering, fibrinolysis enhancing and antioxidant activities of cardamom (Elettaria cardamomum). Indian journal of biochemistry & biophysics, 46(6), 503.

Kaur, R., & Khanna, N. (2012). Pathophysiology and risk factors related to hypertension and its cure using herbal drugs. Spatula DD, 2(4), 245-56.

Nyadjeu, P., Nguelefack-Mbuyo, E. P., Atsamo, A. D., Nguelefack, T. B., Dongmo, A. B., & Kamanyi, A. (2013). Acute and chronic antihypertensive effects of Cinnamomum zeylanicum stem bark methanol extract in L-NAME-induced hypertensive rats. BMC complementary and alternative medicine, 13(1), 27.

Irondi, A. E., Olawuyi, A. D., Lawal, B. S., Boligon, A. A., Olasupo, F., & Olalekan, S. I. (2019). Comparative inhibitory effects of cocoa bean and cocoa pod husk extracts on enzymes associated with hyperuricemia and hypertension in vitro. International Food Research Journal, 26(2).

Online ISSN 3007-3197
Print ISSN 3007-3189

Ramkissoon, J. S., Mahomoodally, M. F., Ahmed, N., & Subratty, A. H. (2013). Antioxidant and anti–glycation activities correlates with phenolic composition of tropical medicinal herbs. Asian Pacific journal of tropical medicine, 6(7), 561-569.

Wu, T. T., Tsai, C. W., Yao, H. T., Lii, C. K., Chen, H. W., Wu, Y. L., ... & Liu, K. L. (2010). Suppressive effects of extracts from the aerial part of Coriandrum sativum L. on LPS-induced inflammatory responses in murine RAW 264.7 macrophages. Journal of the Science of Food and Agriculture, 90(11), 1846-1854.

Shouk, R., Abdou, A., Shetty, K., Sarkar, D., & Eid, A. H. (2014). Mechanisms underlying the antihypertensive effects of garlic bioactives. Nutrition research, 34(2), 106-115.

Wang, H. P., Yang, J., Qin, L. Q., & Yang, X. J. (2015). Effect of garlic on blood pressure: A meta-analysis. The Journal of Clinical Hypertension, 17(3), 223-231.

Ried, K., Frank, O. R., & Stocks, N. P. (2013). Aged garlic extract reduces blood pressure in hypertensives: a dose–response trial. European Journal of Clinical Nutrition, 67(1), 64-70.

Osadebe, P. O., Odoh, E. U., & Uzor, P. F. (2014). The search for new hypoglycemic agents from plants. Afr J Pharm Pharmacol, 8(11), 292-303.

Modak, M., Dixit, P., Londhe, J., Ghaskadbi, S., & Devasagayam, T. P. A. (2007). Indian herbs and herbal drugs used for the treatment of diabetes. Journal of clinical biochemistry and nutrition, 40(3), 163-173.

Kazi, S. (2014). Use of traditional plants in diabetes mellitus. Int J Pharm, 4(4), 283-9.

Bathaie, S. Z., Mokarizade, N., & Shirali, S. (2012). An overview of the mechanisms of plant ingredients in the treatment of diabetes mellitus. Journal of Medicinal Plants, 11(44), 1-24.

Hui, H., Zhao, X., & Perfetti, R. (2005). Structure and function studies of glucagon-like peptide-1 (GLP-1): the designing of a novel pharmacological agent for the treatment of diabetes. Diabetes/metabolism research and reviews, 21(4), 313-331.

Dey, L., Attele, A. S., & Yuan, C. S. (2002). Alternative therapies for type 2 diabetes. Alternative medicine review, 7(1), 45-58.

Online ISSN 3007-3197
Print ISSN 3007-3189

Kooti, W., Moradi, M., Ali-Akbari, S., Sharafi-Ahvazi, N., Asadi-Samani, M., & Ashtary-Larky, D. (2015). Therapeutic and pharmacological potential of Foeniculum vulgare Mill: a review. Journal of HerbMed Pharmacology, 4(1), 1-9.

Afrisham, R., Aberomand, M., Ghaffari, M. A., Siahpoosh, A., & Jamalan, M. (2015). Inhibitory Effect of Heracleum persicum and Ziziphus jujuba on Activity of Alpha-Amylase. Journal of Botany, 2015(1), 824683.

Kooti, W., Farokhipour, M., Asadzadeh, Z., Ashtary-Larky, D., & Asadi-Samani, M. (2016). The role of medicinal plants in the treatment of diabetes: a systematic review. Electronic physician, 8(1), 1832–1842. https://doi.org/10.19082/1832

Hegazy, G. A., Alnoury, A. M., & Gad, H. G. (2013). The role of Acacia Arabica extract as an antidiabetic, antihyperlipidemic, and antioxidant in streptozotocin-induced diabetic rats. Saudi Med J, 34(7), 727-33.

Kumar, A., Gnananath, K., Gande, S., Goud, E., Rajesh, P., & Nagarjuna, S. (2011). Anti-diabetic Activity of Ethanolic Extract of Achyranthes aspera Leaves in Streptozotocin induced diabetic rats. Journal of Pharmacy Research, 4(7), 3124-5.

Eidi, A., Eidi, M., & Esmaeili, E. (2006). Antidiabetic effect of garlic (Allium sativum L.) in normal and streptozotocin-induced diabetic rats. Phytomedicine, 13(9-10), 624-629.

Shinde, V., Borkar, A., & Badwaik, R. (2014). Evaluation and comparative study of hypoglycemic activity of aloe Barbadensis Miller with oral hypoglycemic drugs (glibenclamide and metformin) in rats. International Journal of Medical and Pharmaceutical Sciences, 4(6), 31-6.

Abdallah, H. M., Abdel-Rahman, R. F., Jaleel, G. A. A., El-Kader, H. A. M. A., & El-Marasy, S. A. (2015). Pharmacological effects of ethanol extract of Artemisia herba alba in streptozotocin-induced type 1 diabetes mellitus in rats. Biochem Pharmacol (Los Angel), 4(196), 2167-0501.

Naquvi, K. J., Ali, M. O. H. D., & Ahmad, J. (2004). Antidiabetic activity of aqueous extract of Coriandrum sativum L. fruits in streptozotocin induced rats. Indian J Exp Biol, 42(9), 909-12.

Eddouks, M., Maghrani, M., Zeggwagh, N. A., & Michel, J. B. (2005). Study of the hypoglycaemic activity of Lepidium sativum L. aqueous extract in normal and diabetic rats. Journal of ethnopharmacology, 97(2), 391-395.

World Health Organization. (2008). Media centre: Traditional medicine. Fact sheet, (134).

Heinrich, M. (2000). Ethnobotany and its role in drug development. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 14(7), 479-488.

Shakya, A. K., Sharma, N., Saxena, M., Shrivastava, S., & Shukla, S. (2012). Evaluation of the antioxidant and hepatoprotective effect of Majoon-e-

Online ISSN 3007-3197
Print ISSN 3007-3189

Dabeed-ul-ward against carbon tetrachloride induced liver injury. Experimental and toxicologic pathology, 64(7-8), 767-773.

Yadav, M., Chatterji, S., Gupta, S. K., & Watal, G. (2014). Preliminary phytochemical screening of six medicinal plants used in traditional medicine. Int J Pharm Pharm Sci, 6(5), 539-42.

Patwardhan, B., Vaidya, A. D., & Chorghade, M. (2004). Ayurveda and natural products drug discovery. Current science, 789-799.

Shakya, A. K. (2016). Medicinal plants: Future source of new drugs. International journal of herbal medicine, 4(4), 59-64.

Clark, A. M. (1996). Natural products as a resource for new drugs. Pharmaceutical research, 13(8), 1133-1141.

Shakya, A. K. (2016). Medicinal plants: Future source of new drugs. International journal of herbal medicine, 4(4), 59-64.