Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

Phytotherapeutic Approaches to Metabolic Disorders: Evidence, Mechanisms, and Translational Potential

Muhammad Saad Naeem
Department of Pharmacy, University of Agriculture, Faisalabad, Pakistan
Hira Waheed
Department of Pharmaceutical Chemistry, Government College University Faisalabad, Pakistan
Fatima Rahim
Department of Human Nutrition and Dietetics, Riphah Faculty of Rehabilitation and Allied Health Sciences, Riphah International University, Gulberg Green Campus, Islamabad, Pakistan
Shahmir Ashraf
Scientist at Punjab Agriculture Food and Drug Authority, Pakistan
Aliza Batool
School of Biochemistry and Biotechnology, University of the Punjab, Lahore, Pakistan
alizabatoolm12@gmail.com
Abu Sulman
Department of Pharmacy, University of Agriculture, Faisalabad, Pakistan
abusulmanmalik@gmail.com
Ulfat Ayub
Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan
Dr. Asma Yawar
Department of Nutritional Sciences, Faculty of Science and Technology, Government College Women University Faisalabad, Pakistan
Amel Amir
Department of Human Nutrition and Dietetics, Riphah Faculty of Rehabilitation and Allied Health Sciences, Riphah International University, Gulberg Green Campus, Islamabad, Pakistan
Muneeba sehar
Pharmacist, Beghum Akhtar Rukhsana Memorial Trust Hospital (SAFARI), Bahria Town, Rawalpindi
Muhammad Hashim
House Officer, Ghukri Trust Teaching Hospital, Lahore, Pakistan

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

Author Details

Keywords:

Medicinal plants, Metabolic disorders, Phytochemicals, Diabetes mellitus, Obesity, Cardiovascular disease, Herbal medicine

Received on 18 Feb 2026

Accepted on 27 Mar 2026

Published on 17 Apr 2026

Corresponding E-mails & Authors*:

Aliza Batool

alizabatoolm12@gmail.com,

Abu Sulman

abusulmanmalik@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 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.

1. INTRODUCTION

Metabolism is termed the net result of the biochemical processes that occur in living organisms that maintain all the cellular activities to assist life (Agana et al., 2018). To maintain the daily activities,

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

these processes are organized into 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 metabolism (IEM) are disorders causing due to inactivation or deficiency of a certain enzyme that takes part in the metabolic pathway (El-Hattab, 2015). Most of these inborn errors of metabolism occur due to some autosomal recessive manner of inheritance (Afzal et al., 2025). Individually, they are rare, but collectively, they are common as the 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 (Campeau et al., 2008; Wasim et al., 2023)

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 the next few decades (O'Neill & O'Driscoll, 2015). It is becoming a major issue in the world, especially in resource-limited countries like Africa (Nolan et al., 2017; Ashraf et al., 2025). The current approach to combat metabolic disorders is to provide a good lifestyle and some pharmaceutical drugs that target the specific metabolic pathway involved in nutrient metabolism (Moller, 2001).The metabolic disorders are treated by pharmaceutical drugs, but the pharmaceutical drugs are often very expensive and have poor patient compliance; meanwhile, the patient also suffers from many undesirable adverse effects. There is an urgent requirement of the complimentary approaches and research and development to introduce alternatives for the treatment of metabolic disorders. An alternative approach to treating the metabolic syndrome is the use of medicinal plants. A medicinal plant is defined as any plant or plant preparation that provides health-promoting, therapeutic relief, and has a beneficial effect on health (Sofowora, 1996). The healthcare practitioners now accept that medicinal plants play a vital role in the treatment of metabolic disorders. The use of medicinal plants is not only confined to developing countries but has now become a billion-dollar industry across the world (Gurib-Fakim, 2006; Kanwar et al., 2006)

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

Metabolic disorders can be treated using medicinal plants because of the presence of the pharmacodynamic bioactive agents, which provide a synergistic and additive effect (Rodriguez-Casado, 2016). Most of the pharmaceutical drugs are developed from the medicinal plants based on local communities' knowledge and the extraction methods to isolate the active pharmaceutical ingredient from the plant (Altemimi et al., 2017). A driving factor in the use of medicinal plants is an understanding that medicinal plants are free of toxicity and the adverse effects when compared with the pharmaceutical drugs that are used in the treatment of metabolic disorders (Tabasum & Khare, 2016).

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

2. Medicinal Plants in Modern Therapy

Metabolic disorders are an important concern because disorders like cardiovascular disorders and type 2 diabetes have reached an epidemic level worldwide (Boddu et al., 2025). Metabolic disorders are not like acute diseases, which are caused by pathogens but are very complex disorders that can develop progressively over the years and vary between the organisms of different ages and character (Zakir et al., 2022). Botanicals are important factors for the prevention and 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 a single chemical agent (Figure 1). It is supposed that almost 1200 plants have been discovered that are effective against diabetes.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

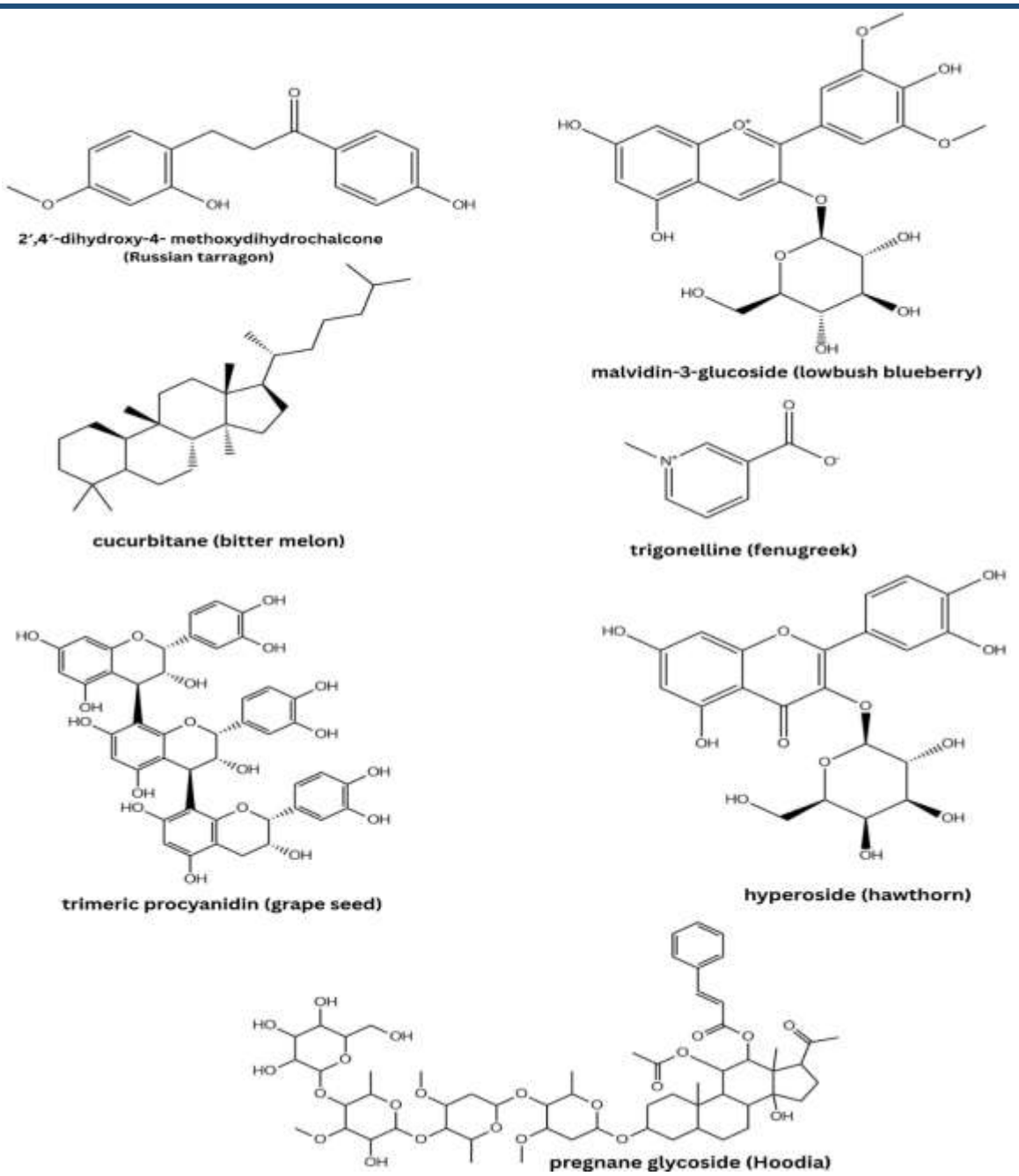

Figure 1: Chemical structures of selected bioactive phytochemicals derived from medicinal plants with potential therapeutic roles in the management of metabolic disorders

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

It is also noted that many of these plants are effective against the risk factors causing metabolic syndrome, including hypercholesterolemia and hypertension (Marles & Farnsworth, 1995). The medicinal plant plays a significant role in the traditional as well as modern healthcare system. The plant preparations have been used for thousands of years and are a source of active pharmaceutical ingredients in 25% of the marketed pharmaceutical products (Newman & Cragg, 2007). Many botanicals in modern medicinal studies are associated with the treatment of metabolic syndrome (Table 1)

Table 1: Selected medicinal plants used in the management of metabolic disorders, along with their plant types, scientific names, and reported therapeutic effects

Plant Name	Plant Type	Scientific Name of Plant	Effect
Bitter melon	Herbaceous vine	Momordica Charantia	Increase insulin sensitivity, decrease glucose, decrease low density lipids,
Lowbush blueberry	Deciduous shrub	Vaccinium angustifolium	Decrease blood pressure, decrease glucose, decrease body weight
Hawthorn	Shrub or a Small Tree	Crataegus monogyna, and	Decrease blood pressure, decrease low density lipids
Cinnamon	Tree	Cinnamomum verum and	Increase insulin sensitivity, decrease glucose level, decrease blood pressure,
Fenugreek	Herb	Trigonella foenum-graecum	Increase insulin sensitivity, decrease glucose level, decrease low density lipids,
Russian tarragon	Herb	Artemisia dracunculus	Increase insulin sensitivity, decrease glucose level.
Hoodia	Shrub	Hoodia gordonii	Decrease body weight

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

2.1 Momordica charantia L. Bitter melon

This plant belongs to Asian origin and is famous for its antidiabetic properties, and has been evaluated in various clinical trials (Leung et al., 2009). The trials' results for the medicinal properties of the bitter melon are inconsistent; however, half of them show positive responses. These inconsistencies resulted from the 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 baseline criterion and undergo a 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 levels when the data was observed (Ahmad et al., 1999). Bitter melon not only has antidiabetic properties, but in various animal models, it is suggested that it has a positive effect on many other complications, like nephropathy (Grover et al., 2001), enteropathy and neuropathy (Grover et al., 2002), cataract development and insulin resistance (Rathi et al., 2002).

2.2 Vaccinium angustifolium Aiton: Lowbush blueberry

This plant has various medicinal properties rich in polyphenols. This plant has very high antioxidant properties, which 4-5 times stronger than those of vitamin C and vitamin E (Shi et al., 2003). The dosage forms prepared from blueberries are believed to lower the blood glucose level in model animals, as seen in depancreatized dogs, and in humans (Ferreira et al., 2024). A compound mainly called myrtillin, which is delphinidine-3-O-glucoside, which is an anthocyanin or red pigment showing hypoglycemic activity in human found in large quantities in blueberries. In 2009, it was seen that an anthocyanin-enriched preparation has been found to be effective as a hypoglycemic agent in diabetic rodent animals, lowering the blood glucose of animals by 51% relative to the control group, when mixed with bio-enhancing agents (Grace et al., 2009).

Vol. 5 No. 2 (2026)
Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

The anthocyanin found in the blueberry shows an anti-obesogenic effect when given with drinking water in diet-induced obese mice. But the effect is not shown when the preparations are given with the mouse food (Prior et al., 2010).

2.3 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 in clinical trials, which is approved by the German Commission E for treatment in patients with stage II heart failure (Pittler et al., 2008). It is suggested that in separate trials, hawthorn was demonstrated to be effective and safe in patients with metabolic disorders who were taking hawthorn therapy as a complementary therapy with other drugs (Walker et al., 2006).

The plant preparations cause lower blood pressure of the body by various mechanisms, including vasodilation of endothelium through eNOS (an enzyme) activation (Brixius et al., 2006), antioxidant activity (Tadić et al., 2008), and ACE inhibition (Lacaille-Dubois et al., 2001). The extract of the Hawthorn exhibits 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 rats (Dehghani et al., 2019).

2.4 Hoodia gordonii: Hoodia

Hoodia is a medicinal plant that is reported to have an anorexic effect. Obesity is the main factor causing metabolic disorders and insulin resistance. Obesity can be controlled by various approaches, like reduction in the caloric intake and increasing the body's energy expenditure (Afzal et al., 2025). Exercise and diet in many cases are not enough and often unsuccessful due to 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 an anorectic compound. It is thought that the compound mode of action acts on hypothalamic

Vol. 5 No. 2 (2026)
Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

modulation (MacLean & Luo, 2004). Scientists have discovered more than 30 glycosides that have been separated from Hoodia extract, showing anorexic properties (Shukla et al., 2009). The property of Hoodia to control obesity is very effective in controlling metabolic disorders and their risk factors. There is an issue in quality control and the safety of the use of botanicals in weight loss products. which causes a big hurdle in the proper beneficial use of the herbal drugs (Graf et al., 2010).

2.5 Trigonella foenum-graecum L.: Fenugreek

The medicinal plant is a leguminous herb. Fenugreek is commonly cultivated in Northern 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 hypocholesterolemic activity of the fenugreek is recorded in animals as well as in humans (Roberts, 2011). The Fenugreek has a high fiber content, which causes a decrease in the rate of gastric emptying and a decrease in sugar level after a meal (Jr et al., 2009)

In clinical trials, the food that contains Fenugreek up to 10% seed powder may increase the glucose tolerance by more than 20% in both diabetic and non-diabetic patients (a total of 6 patients) after 2 weeks of trial (Gopalpura et al., 2007) In a study (number of patients is 24), patients with diabetes were treated with Fenugreek soaked in the hot water 10g/day for 8weeks resulting in a decrease in triglyceride 30%, VLDL cholesterol level 31%, and blood sugar level 25% (Kassaian et al., 2009). The Fenugreek works only when it is given in large volumes because it directly acts on the digestive system (Khorshidian et al., 2016).

2.6 Artemisia dracunculus L.: Russian tarragon

The ethanolic extract of the Russian tarragon exhibits hypoglycemic activity as well as antidiabetic activity (Ribnicky et al., 2006). 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 (Logendra et al., 2006).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

Studies in human as well as in murine muscle cells reported that the Russian tarragon follows the same pathway as the insulin molecule to provide the antidiabetic effect to the body. The pathway that may be disrupted in cases of insulin resistance in many cases (Cefalu, 2009).

A trial study was conducted on 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 the euglycemic clamp (a standard test for insulin sensitivity) in non-diabetic patients. There is an increased 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 improved insulin sensitivity. but the placebo group remains the same. These trials provide evidence of the bioactive compound present in the Russian tarragon with a notable effect in in vitro studies (DeFronzo et al., 1979)

2.7 Cinnamomum cassia: Cinnamon

Cinnamon has been historically used as an anti-diabetic agent, and nowadays many of the cinnamon products are available on the market as dietary supplements that provide maintenance in blood sugar levels in the body. Compounds like polyphenol type A polymer are present in Cinnamon, which exhibit an antidiabetic property mimicking in vitro activity (Anderson et al., 2004). It is also evident that the cinnamon extract improves the insulin signaling tested in the murine diabetic models (Kim et al., 2006). 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 weeks) (Mollazadeh & Hosseinzadeh, 2016; Ziegenfuss et al., 2006). The triglyceride-lowering effect of cinnamon is also seen in the Wistar rat fed a high-fructose diet (Qin et al., 2010). In clinical trials, it is also noted that the serum triglyceride, low-density lipids, and VLDL-cholesterol were all lower with the use of cinnamon in patients (Ranasinghe et al., 2017).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

3. Role of Medicinal Plants in the Treatment of Major Metabolic Disorders

3.1 Obesity

According to the WHO, a person who is overweight has his/her body mass index (BMI) of 25, while an obese person is one who has a BMI equal to or greater than 30 (Obesity and Overweight, n.d.). There has been a wide increase in diseases like obesity in recent years. This is because of the change of diet in people worldwide or due to the adaptation of an inactive lifestyle (Blüher, 2019; Afzal et al., 2025). According to a survey, it is noted that there is a triple increase in obesity between 1989 and 2011. WHO estimated that obesity is the seventh leading cause of mortality in the world. Approximately 2.8 million, a huge number of people died because of obesity and related complications (Obesity and Overweight, n.d.). Obesity can reduce the average life to 7 years after the age of 40 years (Peeters et al., 2003). 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 (Obesity and Overweight, n.d.). It is studies that 21% of the population in South Africa was obese, out of these 21%, there are 57% of the women and 29% are men (Nishida & Mucavele, 2005; van der Merwe & Pepper, 2006).

The main reason for obesity is the uptake of high-density energy foods, and there is less physical activity that is required to consume the calories taken in by food (Romieu et al., 2017). Overweight is associated with complications like cancer, cardiovascular disorders, and diabetes mellitus (Obesity-Linked Diseases (Comorbidities), n.d.). Recommendation is to decrease the body weight by reducing the uptake of free sugar, salts and decreasing consumption of saturated fatty acids. There should be an increase in physical activity of the body, leading towards a healthy lifestyle (Artinian et al., 2010). Only 5-10% of people can maintain their body weight. When people cease therapy or change their physical activity, there is a reversal of the weight loss (Donnelly et al., 2009). The drugs used for weight loss may show any adverse effects (Yanovski & Yanovski, 2014). The herbal drugs can be used as a safe and alternative method for obesity. The herbal drugs may show fewer adverse effects than

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

the pharmaceutical drugs in the body. In this portion of the review (Table 2), some plants are listed that can be used for the treatment of obesity.

Table 2: Medicinal plants used in the treatment of obesity, highlighting their scientific names, plant parts utilized, and mechanisms of action

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

3.2 Cardiovascular Diseases

Cardiovascular diseases (CVDs) is becoming the leading cause of early mortality, and weakness is becoming a major problem in community health (Al Disi et al., 2016). Named as a silent killer, high

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

blood pressure is triggered by various factors, such as genetics or environmental factors, which may contribute to the progression of cardiovascular disease (J. Wang & Xiong, 2012). According to studies the high blood pressure is the leading risk factor causing acute myocardial infarction and causing death in 16.5% of deaths annually around the world (Anwar et al., 2016). A patient is said to be hypertensive if their systolic blood pressure value is greater than or equal to 140 mm of Hg and their diastolic blood pressure is greater than or equal to 90 mm of Hg checked by means of two readings (Hashemi et al., 2017). Most of the pharmaceutical agents are available to treat hypertension, like sympatholytic agents, loop diuretics, calcium channel blockers, angiotensin converting enzyme inhibitors, and vasodilators (Sinha & Agarwal, 2019). These pharmaceutical agents have many side effects like blurred vision, vomiting, kidney failure, muscle cramps, edema, headache, and abnormal heart rate ((PDF) Hypertension and Herbal Plant for Its Treatment, n.d.). Scientists are considering the use of natural and traditional medicines for the treatment of cardiovascular disease because of the fewer adverse effects of the natural products, which can successfully used as alternate therapy for cardiovascular disease (Rastogi et al., 2016). About 70% to 80% of the world population in the developing countries predominantly use natural products for therapeutic purposes due to therapeutic benefits, easy access, and lower cost than pharmaceutical drugs (admin, 2010). Medicinal plants have been trialed for their use in the treatment of metabolic disorders, giving us promising results because many of the pharmaceutical drugs derived from these plants (Shayganni et al., 2016). Many of the medicinal plants available to treat hypertension have different mechanisms of action.

Carum copticum is 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 a decrease in blood pressure and heart rate, while at larger dose cause bradycardia (Boskabady et al., 2014).

Tribulus terrestris acts as an antihypertensive cause decrease in blood pressure. The methanolic extract of the Tribulus terrestris is supposed to act as a vasodilator when given 0.3-15 mg/Kg (Kumar

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

et al., 2015). This plant is used for its diuretic ability, also containing saponins, which prevent the production of H_2O_2 (Sharifi et al., 2003).

Nigella sativa has a component causing decrease in blood pressure. Oral administration of the extract 100-200 mg to a hypertensive male patient for eight weeks recorded a decrease of the systolic blood pressure and diastolic blood pressure of up to 10.6 and 9.6, respectively (Jaarin et al., 2015; Xf et al., 2013). This plant also shows vasorelaxation by means of calcium channel blockage (Kundu et al., 2013).

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 the diastolic blood pressure to 12mm of Hg in a pure hypertensive patient by increasing the antioxidants in the body (Verma et al., 2009).

Daucus carota is used traditionally for hypertensive patients. It regulates the fluid balance, and the juice is full of antioxidants that control the blood vessels by decreasing oxidative stress. It also regulates the blood pressure due to the presence of potassium (Pathophysiology and Risk Factors Related to Hypertension and Its Cure Using Herbal Drugs | Request PDF, n.d.).

Cinnamomum zeylanicum has been noted to reduce blood pressure in various rat models and in people with type 2 diabetes and prediabetes. The extract obtained from the bark causes a decrease in the systolic blood pressure and also reduces the contraction caused by KCl in the endothelium. The methanolic extract is also noted to increase the nitric oxide level (Nyadjeu et al., 2013).

Theobroma cacao is useful in controlling CVDs because of the presence of flavonoid compounds in it, promoting the production of Nitric Oxide, which increases vasodilation and reduces endothelial dysfunction. The daily use of bark of white chocolate can reduce the systolic blood pressure by 5mm of Hg and the diastolic blood pressure by 3mm of Hg (Irondi et al., 2019)

Coriander sativum is used traditionally for the treatment of gastrointestinal issues and cardiovascular disorders because it shows antioxidant activities (Ramkissoon et al., 2013). When the methanolic extract of this plant is used, it is seen that it decreases the systolic blood pressure & diastolic blood pressure by acting as a Ca^{2+} antagonist. It also exhibits a diuretic effect (Wu et al., 2010).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

Allium Sativum acts as a standard medication to treat hypertension; it can decrease the systolic blood pressure by 10 mm of Hg and the 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 (Shouk et al., 2014). A study reveals that garlic is almost 80% effective in treating hypertension in patients. Aged garlic extract can exhibit a more constant drop in blood pressure than the other forms of garlic (H.-P. Wang et al., 2015). The components in the garlic extract inhibit the angiotensin converting enzyme, diminishing the angiotensin-II induced vasoconstriction (Ried et al., 2013).

3.3 Diabetes

A chronic disease that is caused by a disorder affecting the metabolism of protein, fats, and carbohydrates ((PDF) The Search for New Hypoglycemic Agents from Plant, n.d.). It is characterized by an increase in blood sugar. Diabetes is due to a deficiency of insulin or due to its malfunction (Modak et al., 2007; Afzal et al., 2025). Diabetes demands its early diagnosis, change of lifestyle, and proper treatment. Diabetes affects numerous people in the 21st century and is becoming the fifth leading cause of death worldwide (Kazi, 2014). Today, there are many techniques available to treat diabetes, such as insulin therapy, diet therapy, and pharmacotherapy. There are several glucose-lowering drugs available in the market which shows anti diabetic effect by various mechanisms of action. These mechanisms include the increase in the production of insulin by sulfonylureas, by increasing the peripheral absorption of glucose by thiazolidinediones (Bathaie et al., 2012), by reducing the hepatic gluconeogenesis by biguanides, and by delaying the absorption of glucose in the intestine by alpha-glucosidase (Hui et al., 2005). However, many of the treatments have been done for the past three decades, but still, the results of treating diabetes are not perfect. These drugs show many disadvantages like development of resistance, toxicity, and adverse effects. It is seen that in the case of sulfonylureas, 44% of patients lose their effectiveness after 6 years of use. It is also noted that the glucose-lowering drugs cannot be able to control hyperlipidemia (Dey et al., 2002).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

The side effects and the drug interaction with each other should be strictly monitored while using the medicines. Nowadays, many treatments are recommended that consist of the use of medicinal plants (Kooti et al., n.d.). Many plants contain phytochemicals like alkaloids, carotenoids, terpenoids, and flavonoids that show antidiabetic activity (Afrisham et al., 2015). The anti-diabetic treatment, while using the medicinal plants, seems to improve the pancreatic tissue performance causing increased insulin secretion and reducing the absorption of glucose from the intestine (Kooti et al., 2016). Many medicinal plants are available to treat diabetes

Acacia arabica in a study, reveals that the plant shows 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 an 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 the antidiabetic effect. It also improves the plasma glucose level and metabolic disorder causing defects in lipid metabolism (Hegazy et al., 2013).

Achyranthes aspera extract used in STZ-induced 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 (Avvari et al., 2011).

Allium Sativum shows an 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 (Eidi et al., 2006) .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 (Kooti et al., 2016).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

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 (Shinde et al., 2014).

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 (Abdallah & Abdel-Rahman, 2015)

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 (Naquvi et al., 2011).

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 (Eddouks et al., 2005).

4. 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 are used in the preparation of the many allopathic medicines. Natural substance are a key factors to developing new drugs (Heinrich, 2000; A. K. Shakya et al., 2012; WHO (World Health Organization) (2008). Traditional Medicine. Fact Sheet No.134. - References - Scientific Research Publishing, n.d.).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

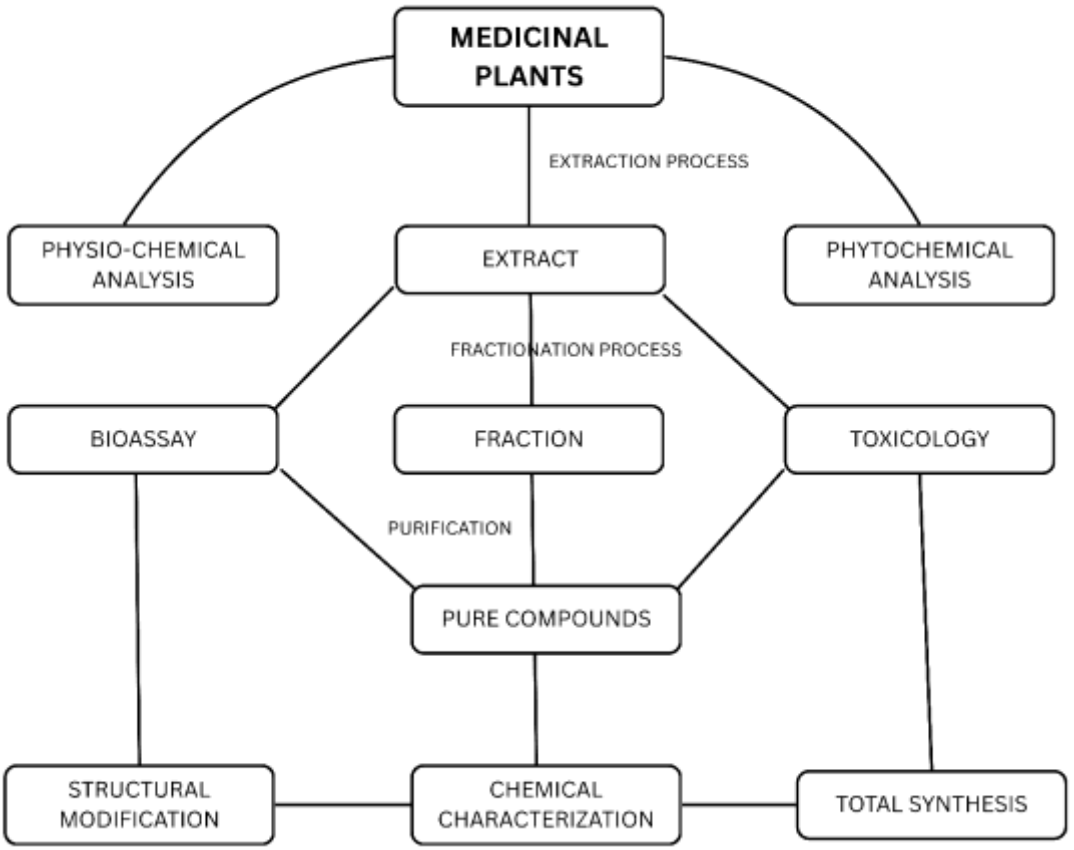

Figure 2: Key steps involved in the development of drugs from medicinal plants, including extraction, isolation, characterization, and clinical evaluation of bioactive compounds

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 (Yadav et al., 2014) (B. Patwardhan, A. D. B. Vaidya and M. Chorghade, "Ayurveda and Natural Products Drug Discovery," Current Science, Vol. 86, No. 6, 2004, Pp. 789-799. - References - Scientific Research Publishing, n.d.). The reason is that the herbal plants can be easily contaminated during growth, processing and collection. It is noted the plants easily adulterated with heavy metal which is a main problem in medicinal

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Naeem et al - 2026

DOI: http://doi.org/10.5281/zenodo.19628697

industry. So, it is necessary to increase the qualitative and quantitative safety of the bioactive compounds for developing new drugs (Clark, 1996; A. Shakya & Correspondence, 2016). 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 (A. Shakya & Correspondence, 2016).

5. 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, 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

Abdallah, H., & Abdel-Rahman, R. (2015). Pharmacological Effects of Ethanol Extract of Artemisia Herba Alba in Streptozotocin-induced Type 1 Diabetes Mellitus in Rats. *Biochemistry & Pharmacology: Open Access*, *04*. https://doi.org/10.4172/2167-0501.1000196

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.19628697

admin. (2010, May 1). *HERBAL REMEDIES FOR TREATMENT OF HYPERTENSION | INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH*. https://ijpsr.com/bft-article/herbal-remedies-for-treatment-of-hypertension/

Afrisham, R., Aberomand, M., Ghaffari, M., Siahpoosh, A., & Jamalan, M. (2015). Inhibitory Effect of Heracleum persicum and Ziziphus jujuba on Activity of Alpha-Amylase. *Journal of Botany*, *2015*, 1–8. https://doi.org/10.1155/2015/824683

Afzal, M. A., Shahzadi, N., Saadat, S., Seemab, R., Tariq, I. S. N., Ashraf, S. R., ... & Kharl, H. A. A. (2025). CRISPR-Cas9 genome-editing technology: A transformative tool for curing human disorders. *Journal of Medical & Health Sciences Review*, *2*(3).

Afzal, M. A., Shahzadi, N., Ahmed, Z., Hyder, A., Saleem, H., Zahra, A., ... & Mukhtar, E. (2025). Breakfast; the most important meal of the day or a myth?. *Biological Times*, 4(2): 20-24.

Afzal, M. A., Habib, A., Ahmed, E., Bukhari, I., & Khan, S. S. (2025). The Importance of Breakfast: Nutritional Significance and Optimal Consumption Patterns. *Biological Times*, 4(6): 7-8.

Afzal, M. A., Noor, M., Shahzadi, N., Saadat, S., Chaudhry, R., & Zafar, M. N. (2025). Case study of a patient with decompensated type 2 diabetes mellitus and multiple comorbidities: implications for personalised care and disease modulation. *Multidisciplinary Surgical Research Annals*, *3*(3), 744-756.

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. https://doi.org/10.21037/atm.2018.12.34

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 Medical Research Council Bulletin*, *25*(1), 11–13.

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. https://doi.org/10.3389/fphar.2015.00323

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

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. https://doi.org/10.3390/plants6040042

Anderson, R. A., Broadhurst, C. L., Polansky, M. M., Schmidt, W. F., Khan, A., Flanagan, V. P., Schoene, N. W., & 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. https://doi.org/10.1021/jf034916b

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, 50. https://doi.org/10.3389/fphar.2016.00050

Artinian, N. T., Fletcher, G. F., Mozaffarian, D., Kris-Etherton, P., Van Horn, L., Lichtenstein, A. H., Kumanyika, S., Kraus, W. E., Fleg, J. L., Redeker, N. S., Meininger, J. C., Banks, J., Stuart-Shor, E. M., Fletcher, B. J., Miller, T. D., Hughes, S., Braun, L. T., Kopin, L. A., Berra, K., … American Heart Association Prevention Committee of the Council on Cardiovascular Nursing. (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. https://doi.org/10.1161/CIR.0b013e3181e8edf1

Ashraf, M. A., Afzal, M. A., Ijaz, M., et al. (2025). Financial impact of nutrition on non-communicable diseases in hospital or other healthcare settings. *Biological Times*, 4(9), 20–21.

Avvari, S., Gnananath, K., G, S., E, R., Puri, R., & S, N. (2011). Anti diabetic Activity of Ethanolic Extract of Achyranthes asperaLeaves in Streptozotocin induced diabetic rats. *Journal of Pharmacy Research*, *4*, 3124–3125.

B. Patwardhan, A. D. B. Vaidya and M. Chorghade, "Ayurveda and Natural Products Drug Discovery," Current Science, Vol. 86, No. 6, 2004, pp. 789-799. - References–Scientific Research Publishing. (n.d.). Retrieved April 9, 2026, from https://www.scirp.org/reference/referencespapers?referenceid=845374

DOI: http://doi.org/10.5281/zenodo.19628697

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*.

Blüher, M. (2019). Obesity: Global epidemiology and pathogenesis. *Nature Reviews. Endocrinology*, *15*(5), 288–298. https://doi.org/10.1038/s41574-019-0176-8

Boddu, S. K., Giannini, C., & Marcovecchio, M. L. (2025). Metabolic disorders in young people around the world. *Diabetologia*, *68*(11), 2374–2385. https://doi.org/10.1007/s00125-025-06450-2

Boskabady, M. H., Alitaneh, S., & Alavinezhad, A. (2014). Carum copticum L.: A herbal medicine with various pharmacological effects. *BioMed Research International*, *2014*, 569087. https://doi.org/10.1155/2014/569087

Brixius, K., Willms, S., Napp, A., Tossios, P., Ladage, D., Bloch, W., Mehlhorn, U., & Schwinger, R. H. G. (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. https://doi.org/10.1007/s10557-006-8723-7

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. https://doi.org/10.1016/j.ymgme.2008.07.001

Cefalu, W. T. (2009). Inflammation, insulin resistance, and type 2 diabetes: Back to the future? *Diabetes*, *58*(2), 307–308. https://doi.org/10.2337/db08-1656

Clark, A. M. (1996). Natural products as a resource for new drugs. *Pharmaceutical Research*, *13*(8), 1133–1144. https://doi.org/10.1023/a:1016091631721

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. https://doi.org/10.1152/ajpendo.1979.237.3.E214

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.19628697

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), 460–468. https://doi.org/10.22038/IJBMS.2019.31964.7678]

Dey, L., Attele, A. S., & Yuan, C.-S. (2002). Alternative therapies for type 2 diabetes. *Alternative Medicine Review: A Journal of Clinical Therapeutic*, *7*(1), 45–58.

Donnelly, J. E., Blair, S. N., Jakicic, J. M., Manore, M. M., Rankin, J. W., Smith, B. K., & American College of Sports Medicine. (2009). American College of Sports Medicine Position Stand. Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine and Science in Sports and Exercise*, *41*(2), 459–471. https://doi.org/10.1249/MSS.0b013e3181949333

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. https://doi.org/10.1016/j.jep.2004.11.030

Eidi, A., Eidi, M., & Esmaeili, E. (2006). Antidiabetic effect of garlic (Allium sativum L.) in normal and streptozotocin-induced diabetic rats. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, *13*(9–10), 624–629. https://doi.org/10.1016/j.phymed.2005.09.010

El-Hattab, A. W. (2015). Inborn errors of metabolism. *Clinics in Perinatology*, *42*(2), 413–439, x. https://doi.org/10.1016/j.clp.2015.02.010

Ferreira, G., Vieira, P., Alves, A., Nunes, S., Preguiça, I., Martins-Marques, T., Ribeiro, T., Girão, H., Figueirinha, A., Salgueiro, L., Pintado, M., Gomes, P., Viana, S., & Reis, F. (2024). Effect of Blueberry Supplementation on a Diet-Induced Rat Model of Prediabetes—Focus on Hepatic Lipid Deposition, Endoplasmic Stress Response and Autophagy. *Nutrients*, *16*(4), 513. https://doi.org/10.3390/nu16040513

Gopalpura, P., 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*. https://doi.org/10.4103/0973-3930.37033

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

Grace, M. H., Ribnicky, D. M., Kuhn, P., Poulev, A., Logendra, S., Yousef, G. G., Raskin, I., & Lila, M. A. (2009). Hypoglycemic activity of a novel anthocyanin-rich formulation from lowbush blueberry, Vaccinium angustifolium Aiton. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, *16*(5), 406–415. https://doi.org/10.1016/j.phymed.2009.02.018

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*, *11*(10), 1107–1115.

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.

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. https://doi.org/10.1016/s0378-8741(01)00246-x

Gurib-Fakim, A. (2006). Medicinal plants: Traditions of yesterday and drugs of tomorrow. *Molecular Aspects of Medicine*, *27*(1), 1–93. https://doi.org/10.1016/j.mam.2005.07.008

Hashemi, V., Dolati, S., Hosseini, A., Gharibi, T., Danaii, S., & Yousefi, M. (2017). Natural killer T cells in Preeclampsia: An updated review. *Biomedicine & Pharmacotherapy = Biomedecine & Pharmacotherapie*, *95*, 412–418. https://doi.org/10.1016/j.biopha.2017.08.077

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 Medical Journal*, *34*(7), 727–733.

Heinrich, M. (2000). Ethnobotany and its role in drug development. *Phytotherapy Research: PTR*, *14*(7), 479–488. https://doi.org/10.1002/1099-1573(200011)14:7%253C479::aid-ptr958%253E3.0.co;2-2

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.19628697

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. https://doi.org/10.1002/dmrr.553

Irondi, E., D., O., S, L., A., B., Olasupo, F., & I., O. (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*.

Jaarin, K., Foong, W. D., Yeoh, M. H., Kamarul, Z. Y. N., Qodriyah, H. M. S., Azman, A., Zuhair, J. S. F., Juliana, A. H., & Kamisah, Y. (2015). Mechanisms of the antihypertensive effects of Nigella sativa oil in L-NAME-induced hypertensive rats. *Clinics*, *70*(11), 751–757. https://doi.org/10.6061/clinics/2015(11)07

Jr, M., Sk, R., W, T., & Jl, S. (2009). Effect of fenugreek fiber on satiety, blood glucose and insulin response and energy intake in obese subjects. *Phytotherapy Research : PTR*, *23*(11). https://doi.org/10.1002/ptr.2795

Kanwar, P., Sharma, N., & Rekha, A. (2006, July 1). *Medicinal plants use in traditional healthcare systems prevalent in western Himalayas*. https://www.semanticscholar.org/paper/Medicinal-plants-use-in-traditional-healthcare-in-Kanwar-Sharma/09c4cd1ca0734f1481050be2c5803a7cbad8919a

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. Internationale Zeitschrift Fur Vitamin- Und Ernahrungsforschung. Journal International De Vitaminologie Et De Nutrition*, *79*(1), 34–39. https://doi.org/10.1024/0300-9831.79.1.34

Kazi, S. (2014). USE OF TRADITIONAL PLANTS IN DIABETES MELLITUS: A REVIEW. *International Journal of Pharmacy*, *4*, 283–289.

Khorshidian, N., Yousefi, M., Arab, M., Mirzaie, A., & Mortazavian, A. (2016). Fenugreek: Potential Applications as a Functional Food and Nutraceutical. *Nutrition and Food Sciences Research*, *3*, 5–16. https://doi.org/10.18869/acadpub.nfsr.3.1.5

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.19628697

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. https://doi.org/10.1016/j.jep.2005.08.059

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

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

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. https://doi.org/10.1016/j.jep.2015.05.021

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. https://doi.org/10.1016/j.bbrc.2013.07.110

Lacaille-Dubois, M. A., Franck, U., & Wagner, H. (2001). Search for potential Angiotensin Converting Enzyme (ACE)-inhibitors from plants. *Phytomedicine*, *8*(1), 47–52. https://doi.org/10.1078/0944-7113-00003

Leung, L., Birtwhistle, R., Kotecha, J., Hannah, S., & Cuthbertson, S. (2009). Anti-diabetic and hypoglycaemic effects of Momordica charantia (bitter melon): A mini review. *The British Journal of Nutrition*, *102*(12), 1703–1708. https://doi.org/10.1017/S0007114509992054

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. https://doi.org/10.1016/j.phytochem.2006.05.015

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.19628697

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. https://doi.org/10.1016/j.brainres.2004.04.041

Marles, R. J., & Farnsworth, N. R. (1995). Antidiabetic plants and their active constituents. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, *2*(2), 137–189. https://doi.org/10.1016/S0944-7113(11)80059-0

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. https://doi.org/10.3164/jcbn.40.163

Mollazadeh, H., & Hosseinzadeh, H. (2016). Cinnamon effects on metabolic syndrome: A review based on its mechanisms. *Iranian Journal of Basic Medical Sciences*, *19*(12), 1258–1270. https://doi.org/10.22038/ijbms.2016.7906

Moller, D. E. (2001). New drug targets for type 2 diabetes and the metabolic syndrome. *Nature*, *414*(6865), 821–827. https://doi.org/10.1038/414821a

Naquvi, K., Ali, M., & Ahamad, J. (2011). Antidiabetic activity of aqueous extract of coriandrum sativum L. fruits in streptozotocin induced rats. *International Journal of Pharmacy and Pharmaceutical Sciences*, *4*, 239–241.

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. https://doi.org/10.1021/np068054v

Nishida, C., & Mucavele, P. (2005). Monitoring the rapidly emerging public health problem of overweight and obesity: The WHO Global Database on Body Mass Index. *SCN News*, *29*.

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. https://doi.org/10.1016/j.pmedr.2017.07.004

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

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*, 27. https://doi.org/10.1186/1472-6882-13-27

Obesity and overweight. (n.d.). Retrieved April 9, 2026, from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Obesity-Linked Diseases (Comorbidities). (n.d.). Retrieved April 9, 2026, from http://ouci.dntb.gov.ua/en/works/7qowzqwl/

O'Neill, S., & O'Driscoll, L. (2015). Metabolic syndrome: A closer look at the growing epidemic and its associated pathologies. *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity*, *16*(1), 1–12. https://doi.org/10.1111/obr.12229

Pathophysiology and Risk Factors related to Hypertension and its cure using Herbal Drugs | Request PDF. (n.d.). Retrieved April 9, 2026, from https://www.researchgate.net/publication/274763042_Pathophysiology_and_Risk_Factors_related_to_Hypertension_and_its_cure_using_Herbal_Drugs

(PDF) Hypertension and herbal plant for its treatment: A review. (n.d.). ResearchGate. Retrieved April 9, 2026, from https://www.researchgate.net/publication/283561041_Hypertension_and_herbal_plant_for_its_treatment_a_review

(PDF) The search for new hypoglycemic agents from plant. (n.d.). Retrieved April 9, 2026, from https://www.researchgate.net/publication/287342895_The_search_for_new_hypoglycemic_agents_from_plant

Peeters, A., Barendregt, J. J., Willekens, F., Mackenbach, J. P., Al Mamun, A., Bonneux, L., & 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. https://doi.org/10.7326/0003-4819-138-1-200301070-00008

Pittler, M. H., Guo, R., & Ernst, E. (2008). Hawthorn extract for treating chronic heart failure. *The Cochrane Database of Systematic Reviews*, *2008*(1), CD005312. https://doi.org/10.1002/14651858.CD005312.pub2

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. https://doi.org/10.1021/jf902852d

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 = Hormon-Und Stoffwechselforschung = Hormones Et Metabolisme*, *42*(3), 187–193. https://doi.org/10.1055/s-0029-1242746

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. https://doi.org/10.1016/S1995-7645(13)60097-8

Ranasinghe, P., Jayawardena, R., Pigera, S., Wathurapatha, W. S., Weeratunga, H. D., Premakumara, G. A. S., Katulanda, P., Constantine, G. R., & 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. https://doi.org/10.1186/s12906-017-2067-7

Rastogi, S., Pandey, M. M., & Rawat, A. K. S. (2016). Traditional herbs: A remedy for cardiovascular disorders. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, *23*(11), 1082–1089. https://doi.org/10.1016/j.phymed.2015.10.012

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

Rathi, S. S., Grover, J. K., Vikrant, V., & Biswas, N. R. (2002). Prevention of experimental diabetic cataract by Indian Ayurvedic plant extracts. *Phytotherapy Research: PTR*, *16*(8), 774–777. https://doi.org/10.1002/ptr.1064

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: International Journal of Phytotherapy and Phytopharmacology*, *13*(8), 550–557. https://doi.org/10.1016/j.phymed.2005.09.007

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. https://doi.org/10.1038/ejcn.2012.178

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. https://doi.org/10.1089/jmf.2011.0002

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. https://doi.org/10.1080/10408398.2012.755149

Romieu, I., Dossus, L., Barquera, S., Blottière, H. M., Franks, P. W., Gunter, M., Hwalla, N., Hursting, S. D., Leitzmann, M., Margetts, B., Nishida, C., Potischman, N., Seidell, J., Stepien, M., Wang, Y., Westerterp, K., Winichagoon, P., Wiseman, M., Willett, W. C., & IARC working group on Energy Balance and Obesity. (2017). Energy balance and obesity: What are the main drivers? *Cancer Causes & Control: CCC*, *28*(3), 247–258. https://doi.org/10.1007/s10552-017-0869-z

Shakya, A., & Correspondence, A. (2016). *Medicinal plants: Future source of new drugs*. https://doi.org/10.13140/RG.2.1.1395.6085

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

Shakya, A. K., Sharma, N., Saxena, M., Shrivastava, S., & Shukla, S. (2012). Evaluation of the antioxidant and hepatoprotective effect of Majoon-e-Dabeed-ul-ward against carbon tetrachloride induced liver injury. *Experimental and Toxicologic Pathology: Official Journal of the Gesellschaft Fur Toxikologische Pathologie*, *64*(7–8), 767–773. https://doi.org/10.1016/j.etp.2011.01.014

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. https://doi.org/10.1016/j.lfs.2003.04.002

Shayganni, E., Bahmani, M., Asgary, S., & Rafieian-Kopaei, M. (2016). Inflammaging and cardiovascular disease: Management by medicinal plants. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, *23*(11), 1119–1126. https://doi.org/10.1016/j.phymed.2015.11.004

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. https://doi.org/10.1089/109662003772519831

Shinde, V. S., Borkar, A. S., & Badwaik, R. T. (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*. https://www.semanticscholar.org/paper/EVALUATION-AND-COMPARATIVE-STUDY-OF-HYPOGLYCEMIC-OF-Shinde-Borkar/e12b81e743ad96b20e47918e6983c357c689e921

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. https://doi.org/10.1016/j.nutres.2013.12.005

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

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. https://doi.org/10.1016/j.phytochem.2009.02.006

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: CJASN*, *14*(5), 757–764. https://doi.org/10.2215/CJN.04330418

Sofowora, A. (1996). Research on medicinal plants and traditional medicine in Africa. *Journal of Alternative and Complementary Medicine*, *2*(3), 365–372. https://doi.org/10.1089/acm.1996.2.365

Tabasum, S., & Khare, S. (2016). *Safety of medicinal plants: An important concern*. 7, P237–P243.

Tadić, V. M., Dobrić, S., Marković, G. M., Dordević, 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. https://doi.org/10.1021/jf801668c

van der Merwe, M.-T., & Pepper, M. S. (2006). Obesity in South Africa. *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity*, *7*(4), 315–322. https://doi.org/10.1111/j.1467-789X.2006.00237.x

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), 503–506.

Walker, A. F., Marakis, G., Simpson, E., Hope, J. L., Robinson, P. A., Hassanein, M., & Simpson, H. C. R. (2006). Hypotensive effects of hawthorn for patients with diabetes taking prescription drugs: A randomised controlled trial. *The British Journal of General Practice: The Journal of the Royal College of General Practitioners*, *56*(527), 437–443.

Wang, H.-P., Yang, J., Qin, L.-Q., & Yang, X.-J. (2015). Effect of garlic on blood pressure: A meta-analysis. *Journal of Clinical Hypertension*, *17*(3), 223–231. https://doi.org/10.1111/jch.12473

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

Naeem et al - 2026
DOI: http://doi.org/10.5281/zenodo.19628697

Wang, J., & Xiong, X. (2012). Control Strategy on Hypertension in Chinese Medicine. *Evidence-Based Complementary and Alternative Medicine : eCAM*, *2012*, 284847. https://doi.org/10.1155/2012/284847

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), e2200318. https://doi.org/10.1002/adbi.202200318

WHO (World Health Organization) (2008). Traditional Medicine. Fact Sheet No.134. - References—Scientific Research Publishing. (n.d.). Retrieved April 9, 2026, from https://www.scirp.org/reference/referencespapers?referenceid=3044210

Wu, T.-T., Tsai, C.-W., Yao, H.-T., Lii, C.-K., Chen, H.-W., Wu, Y.-L., Chen, P.-Y., & 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. https://doi.org/10.1002/jsfa.4023

Xf, L., M, R. M., & K, J. (2013). Nigella sativa and Its Protective Role in Oxidative Stress and Hypertension. *Evidence-Based Complementary and Alternative Medicine : eCAM*, *2013*. https://doi.org/10.1155/2013/120732

Yadav, M., Chatterji, S., Gupta, S. K., & Watal, G. (2014). Preliminary phytochemical screening of six medicinal plants used in traditional medicine. *International Journal of Pharmacy and Pharmaceutical Sciences*, *6*, 539–542.

Yanovski, S. Z., & Yanovski, J. A. (2014). Long-term drug treatment for obesity: A systematic and clinical review. *JAMA*, *311*(1), 74–86. https://doi.org/10.1001/jama.2013.281361

Zakir, F., Mohapatra, S., Farooq, U., Mirza, M., & Iqbal, Z. (2022). *Introduction to metabolic disorders* (pp. 1–20). https://doi.org/10.1016/B978-0-323-99616-7.00001-3

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.19628697

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), 45–53. https://doi.org/10.1186/1550-2783-3-2-45