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Therapeutic Potential of Medicinal Plants in the Management of Lifestyle Disorders

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Abstract

Growing worldwide incidence of lifestyle disorders, such as type 2 diabetes mellitus, obesity, hypertension, dyslipidemia, cardiovascular disease (CVD), and non-alcoholic fatty liver disease (NAFLD), along with psychosocial stress-related metabolic syndromes, correlates with sedentary lifestyles, high-caloric diets, chronic psychosocial stressors, poor sleep, and food and physical environment. Medicinal plants have long been customary medicine for all systems, and they have increasingly been found to have complementary potential for bioactive compounds with preventive, therapeutic, and risk-lowering effects. The present study includes 85 references on plant-origin pharmaceuticals/studies on phytochemicals, functional foods and other natural products in lifestyle-induced diseases and was conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) narrative. Articles were subject to selection based on plant species, plant part, phytochemical class, therapeutic action, mechanism, and metabolic/cardiometabolic parameters. Many plant extracts including *Momordica charantia*, *Trigonella foenum-graecum*, *Allium sativum*, *Curcuma longa*, *Withania somnifera*, *Terminalia arjuna*, *Moringa oleifera*, *Ocimum sanctum*, *Cichorium intybus*, *Andrographis paniculata*, *Picrorhiza kurroa* and *Glycyrrhiza glabra* may have a combination of one or more of the following actions: insulin signalling, antioxidant, inhibition of pro-inflammatory mediators and cytokines, lipid metabolism, pancreatic lipase inhibition, hepatoprotection, Vaso protection, mitochondrial biogenesis and a stress response. There are major barriers to clinical use due to unreliable botanical authentication, the lack of standardization and dose-response studies, weak quality of clinical studies, risk of herb-drug interactions and inadequate pharmacovigilance. The review concludes that medicinal plants have serious potential as evidence-based complementary therapy for lifestyle diseases, but require additional clinical research, standardized formulations, safety monitoring, and integration with lifestyle modification and conventional medicine before they can be used in practice.

Keywords: medicinal plants; lifestyle disorders; herbal medicine; diabetes; obesity; hypertension; cardiovascular disease; dyslipidemia; phytochemicals; metabolic syndrome; PRISMA; complementary medicine.

1. Introduction

Lifestyle diseases are chronic noncommunicable diseases that are mostly preventable. The main risk factors include those relating to lifestyle, such as: diet, inactivity, sleep apnea, stress, and long-term metabolic disorders. Lifestyle diseases usually refer to the diseases associated with type 2 diabetes mellitus, obesity, hypertension, dyslipidemia, cardiovascular disease, metabolic syndrome, fatty liver disease, and stress-related neuroendocrine disorders. As genetic and age-related predisposition to these diseases play a role in such an important public health problem, much attention is renewed to medicinal plants, which due to the presence of phytochemical groups such as alkaloids, flavonoids, saponins, tannins, phenolic acids, terpenoids, organosulfur compounds, lignans and polyphenols can interact with different biological targets. The preventive and therapeutic logic of plant-based medicine also fits well with the multifactorial nature of lifestyle diseases, as insulin resistance, chronic inflammation, oxidative stress, endothelial dysfunction, adipokine dysregulation, hepatic steatosis and dysbiosis in gut microbiome (Sofowora et al., 2013; Karunamoorthi et al., 2013; Carkeet et al., 2012) are often interrelated and occur in multiple combinations.

The scientific basis for the therapeutic potential for these plants has been established through frequent experimental results. Observed antidiabetic, anti-obesity, lipid lowering, antihypertensive, antioxidant, anti-inflammatory, hepatoprotective, cardioprotective, and adaptogenic activities have been documented for plants including *Momordica charantia*, *Trigonella foenumgraecum*, *Ocimum sanctum*, *Moringa oleifera*, and others (Pandey et al., 2011; Khan et al., 2012; Chang et al., 2013; Fonseka et al., 2015; Omodanisi et al., 2017). Garlic and onion, mushrooms, berberine plants, *Terminalia arjuna*-derived cardioprotection, and cardiovascular phytomedicine have been studied in some depth according to their lipid and cardiac effects, and how they impact hypertension and vascular diseases (Bisen and Emerald, 2016; Yahaya et al., 2014; Zhang et al., 2016; Shen et al., 2017). These are examples of how medicinal plants must be considered multi-component interventions rather than single-target drugs.

Polytargeting is particularly relevant to metabolic syndrome, which is characterized by abdominal obesity, hyperglycemia (which can be recognized by high fasting glucose levels), dyslipidemia, hypertension, and systemic inflammation. Several medicinal plants show bioactivity on certain aspects of metabolism: digestion, glucose intestinal absorption, pancreatic beta-cell function, hepatocyte gluconeogenesis, insulin sensitivity, lipid oxidation, adipogenesis, endothelial tone, and inflammatory mediators. The wide range of biological activity can sometimes make products difficult to standardize or test in clinical trials. For example, polyphenols, phenolic acids, resveratrol, curcumin, oleanolic acid, naringenin and beta-caryophyllene have been promoted as powerful natural products with antioxidant, anti-inflammatory, metabolic, and cardioprotective properties (Saibabu et al., 2015; Timmers et al., 2013; Košťálová et al., 2013; Ayeleso et al., 2017; Mir and Tiku, 2015; Sharma et al., 2016). However, to guide clinical practice, a number of factors need to be determined, such as bioavailability, formulation, dosing, target patients, safety and drug interactions.

Logistics or sociocultural reasons may also dictate the continued use of medicinal plants. For example, in many resource-poor settings, herbal medicine may be the first or most familiar

form of healthcare. Ethnobotanical surveys in India and elsewhere show that the use of plants for preventative, symptomatic and therapeutic purposes is well established (Sharma and Kumar, 2011; Sen et al., 2011; Atawodi et al., 2017). This pre-existing cultural practice suggests that plant usage should be included in community-based prevention programs, if health education, dietary modification, exercise and clinical follow-up are considered. The cultural acceptability of a plant should not be construed as proof of clinical effectiveness. Claims of efficacy should be supported by pharmacological, toxicological, and well-designed clinical studies; although, the historical use of plants can be used to generate hypotheses (Sofowora et al., 2013; Lall, 2017).

We hope this review will provide the impetus to continue exploring the potential of medicinal plants for treating lifestyle-related diseases, not to replace standard of care, but to provide an additional treatment option that can be used rationally, safely, and adjunctively to improve metabolic health. These include diabetes, obesity, dyslipidemia, hypertension, cardiovascular disorder, fatty liver disease, inflammation, oxidative stress, and stress-related disorder. Challenges, research gaps and future perspectives are also discussed including standardization, network pharmacology, clinical trial design, nutraceutical development and integration of digital lifestyle monitoring (Kibble et al., 2015; Marciano et al., 2014; Brown et al., 2015).

2. Methods

The narrative review was based on the literature set of 85 references, developed according to the rules of the PRISMA statement for systematic reviews. The literature set consists of articles and books describing medicinal plants, phytochemicals, nutraceuticals, customary medicine, metabolic disorders, diabetes, obesity, cardiovascular disease, hepatic protection, oxidative stress, inflammation, and natural products. The review followed a systematic screening process, but the PRISMA diagram indicates that the final corpus was not saved by exporting a new database search. The PRISMA process diagram shows that 85 records were included for qualitative synthesis. The diagram suggests that the database identification numbers should be updated when search exports from PubMed, Scopus, Web of Science, ScienceDirect and Google Scholar are available.

The phrases used for literature search in various databases included medicinal plants, lifestyle disorders, herbal medicine, diabetes, obesity, hypertension, cardiovascular disorders, phytochemicals, metabolic syndrome, dyslipidaemia, fatty liver disease, hepatoprotection, oxidative stress, inflammation, and stress management. Studies aimed at preventing or controlling lifestyle disorders associated with medicinal plants, plant extracts, phytochemicals, functional foods, customary formulations, and natural products have been discussed in this review. General reviews were retained that provide information on phytochemical mechanisms of action, safety considerations with natural products, natural product drug discovery, or methods used to analyse phytochemicals (Carkeet et al., 2012; Kibble et al., 2015; Lall, 2017).

Eligible studies were not limited to RCTs that were relevant to the concept and therapy, as the nature of research on medicinal plants often includes ethnobotanical surveys, preclinical and pharmacological reviews, articles on mechanism, nutraceutical articles, and sometimes limited clinical research. The data contained information on plant and plant part (if available),

phytochemical group, type of therapeutic activity, proposed mechanism of action, disease, and major limitation of the study. Qualitative data from the selected studies are presented in the text and summary tables. Antidiabetic, anti-obesity, lipid-lowering, antihypertensive, anti-inflammatory, antioxidant, hepatoprotective, cardioprotective, and adaptogenic effects are of particular interest to researchers.

Table 1. PRISMA-based review strategy and eligibility framework.

Component	Approach used in the review	Rationale
Databases proposed	PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar.	These sources cover biomedical, pharmacological, phytochemical, and interdisciplinary literature relevant to medicinal plant research.
Search concepts	Medicinal plants, lifestyle disorders, herbal medicine, diabetes, obesity, hypertension, cardiovascular disease, metabolic syndrome, dyslipidemia, phytochemicals, inflammation, oxidative stress, fatty liver disease, and stress.	The terms were selected to capture both disease categories and mechanisms relevant to lifestyle disorders.
Inclusion focus	Studies discussing medicinal plants, plant extracts, phytochemicals, nutraceuticals, or traditional remedies with relevance to metabolic or cardiometabolic health.	The topic requires broad evidence because plant-based interventions are studied through multiple research designs.
Exclusion focus	Duplicate records, non-English papers, unrelated studies, articles with insufficient information, and papers with no clear therapeutic or mechanistic relevance.	These criteria reduce irrelevant literature and improve interpretability of the synthesis.
Data extracted	Plant name, plant part, phytochemical class, disorder relevance, therapeutic activity, proposed mechanism, and major finding.	These variables allow comparison across plants and disorder categories.
Synthesis method	Qualitative synthesis with author-year in-text citations and thematic tables.	This is suitable when the included evidence is heterogeneous in design, outcomes, extracts, and dosage forms.

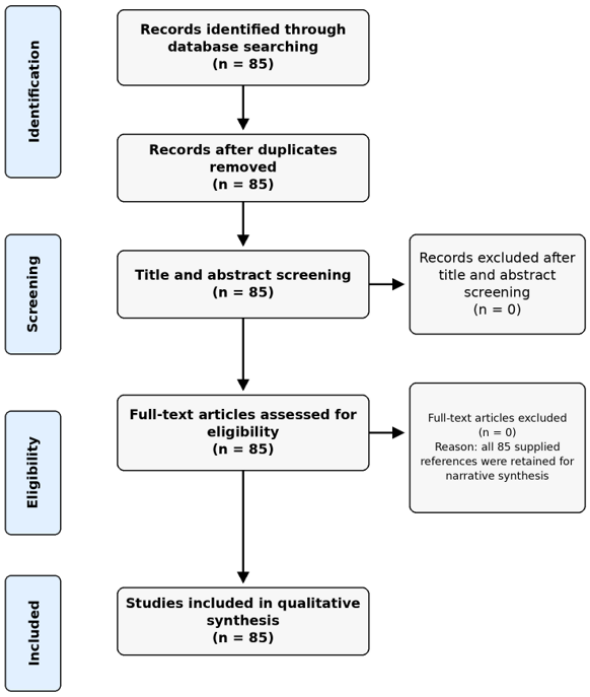

Figure 1. PRISMA-style flow diagram for the 85-reference corpus included in the review.

The PRISMA-style flow diagram above identifies the 85 records retained for qualitative synthesis from the review corpus provided. Given that this paper was generated from a list of references rather than a live database export, this figure should be updated with appropriate counts for searching, de-duplication, screening, and exclusions when the final search strategy is finalised and documented. This also preserves transparency, as we cannot make unsupported claims about records that were not available at the time of writing.

3. Therapeutic Potential of Medicinal Plants in Lifestyle Disorder

Medicinal plants may affect lifestyle disorder pathologies through several overlapping mechanisms which may not be mutually exclusive. Biochemical investigations have demonstrated how plant extracts and phytochemicals may act on the regulation of glucose uptake, digestive enzymes, lipid absorption, adipocyte differentiation, pro- and anti-inflammatory pathways, oxidative stress, endothelial function, liver lipid metabolism, mitochondrial dysfunction, gut microbiota, and neuroendocrine stress response. Such multi-targeted nature is one of the reasons why plant-based approaches continue to be an attractive strategy to target conditions that involve more than one pathological entity such as diabetes, obesity, hypertension, dyslipidemia, and metabolic syndrome (Brown et al., 2015; Eid et al., 2017; Marciano et al., 2014). Such complexity also poses challenges when it comes to standardisation, reproducibility, dosage, and safety.

3.1 Antidiabetic and glycemic-control potential

Type 2 diabetes mellitus is characterized by insulin resistance, progressive beta-cell dysfunction, low-grade systemic inflammation, and increased oxidative stress. The potential antidiabetic mechanisms of medicinal plants include inhibition of intestinal glucose absorption,

improvement of insulin sensitivity, stimulation of insulin secretion, protection of beta cells, inhibition of protein glycation, and prevention of oxidative damage. Earlier reviews of antidiabetic plants have repeatedly mentioned the herbs *Momordica charantia*, *Trigonella foenum-graecum*, *Ocimum sanctum*, *Moringa oleifera* and other plant extracts used locally with antihyperglycemic effects, shown in laboratory models or by customary use (Pandey et al., 2011; Khan et al., 2012; Campbell-Tofte et al., 2012; Chang et al., 2013; Tiwari et al., 2013).

Among antidiabetic plants, *Momordica charantia* is most extensively studied. Bitter melon has charantin, vicine, polypeptide-p-like compounds, cucurbitane-type triterpenoids, and phenolic compounds. The glucose-lowering action and insulin-like activity of these components have been described. The plant extract has been listed as a candidate for reducing blood glucose dysregulation through the peripheral uptake of glucose, and by reducing blood glucose production from the liver, and as a protector against oxidative stress. As with other antidiabetic plant extracts, it is difficult to generalize between studies as extracts differ in plant part, age of plant material, solvent, dose and manner of preparation (Khan et al., 2012; Chang et al., 2013).

Fenugreek (*Trigonella foenum-graecum*) is also often investigated. Fenugreek seeds contain soluble fibre, steroidal saponins, alkaloids such as trigonelline, and amino-acid derivatives, all of which may have an effect on glucose and lipid metabolism. The role of fenugreek in the treatment of diabetes and hypercholesterolemia may be attributed to the slowing of carbohydrate absorption by dietary fibre and to the potential effects of other, less well-studied constituents on insulin sensitivity, glucose transport, and lipid metabolism (Goyal et al., 2016). The overlap between the actions of fenugreek on glucose and cholesterol metabolism may be of particular interest in cases of diabetes and dyslipidemia, or other indications, but is dependent on dosage, preparation, and co-medication.

Moringa oleifera has been reviewed in relation to chronic hyperglycemia and dyslipidemia from the point of view of the flavonoids and phenolic acid, vitamins, minerals and isothiocyanate-related compounds present in its leaves and their impact on glucose control, lipid regulation, antioxidant capability and inflammatory state (Mbikay, 2012; Omodanisi et al., 2017). Diabetes-associated complications and related oxidative stress and endothelial dysfunction might benefit from the use of plants high in antioxidant capacity, such as Moringa. Further trials are needed in humans to determine which Moringa preparations may be effective and safe, the wise therapeutic dose, and the longevity of any positive metabolic effects beyond short timing.

Tulsi, *Ocimum sanctum*, has been suggested to have numerous biological effects, with reviews describing its phytochemistry, antioxidant potential, and anti-inflammatory, immunomodulatory, and metabolic activity (Singh et al., 2012; Fonseka et al., 2015). In the management of lifestyle disorders, Tulsi may be relevant for glycemia per se and the metabolic disorders secondary to stress, since chronic stress can elevate the stress hormone cortisol levels that can lead to further dysregulation of glucose levels. These assertions remain weak, however, due to a lack of large controlled trials or literature based on preclinical or customary use.

Medicinal plants with anti-glycation activity also have antidiabetic activity, as protein glycation and the formation of advanced glycation end-products have been implicated in diabetic complications affecting blood vessels, kidneys, nerves, eyes and the cardiovascular system. Natural products that have anti-glycation properties may therefore serve as possible adjuncts in the prevention of complications (Elosta et al., 2012) and may be important particularly because they are not limited by the short-term effect of blood glucose lowering. Future trials on the therapeutic effects of herbal medicines for diabetes and its complications may not only use fasting or postprandial blood glucose levels to measure clinical outcomes, but also markers of oxidative stress, inflammation, endothelial function, renal impairment, and neuropathy.

3.2 Anti-obesity and metabolic syndrome potential

Obesity is an abnormal or excessive fat accumulation that may impair health. It is a complex, chronic, relapsing, and multi-faceted endocrine and inflammatory disorder involving dysfunction of the adipose tissue, dysregulation of appetite and energy metabolism, insulin resistance, low-grade inflammation, dyslipidemia and increased cardiovascular disease risk. Anti-obesity medicinal plants have been reported to work by mechanisms such as reducing fat absorption, inhibiting pancreatic lipase, inducing thermogenesis, improving insulin sensitivity, appetite suppression, modulating gut microbiota, and exerting anti-inflammatory effects. For medicinal plants and alternative pharmacotherapy, both promise and risk of harm exist, since many weight-loss supplements are marketed before there is strong clinical evidence for their weight loss effect (Kazemipoor et al., 2015; de Freitas Junior and de Almeida Jr, 2017).

One of the more direct means by which plant extracts might be used for obesity treatment is by the inhibition of pancreatic lipase, the inhibition of which decreases digestion of dietary triglycerides and thereby decreases caloric intake from fat. Screening studies have evaluated the inhibition of pancreatic lipase by medicinal plants, and reviews have discussed plant-derived potential sources of pancreatic lipase inhibitors for anti-obesity drug development (Bustanji et al., 2011; Seyedan et al., 2015). Inhibition of lipase may cause gastrointestinal side effects and decreased absorption of fat-soluble vitamins, especially if a strong inhibition is sustained over a long period of time. The effectiveness and tolerability of anti-obesity plants need to be studied.

Functional foods and bioactives from plants are other possible interventions. Brown et al. (2015) described how the various components of a diet could be used to modulate multiple risk factors associated with metabolic syndrome. Medicinal plants are more commonly ingested as foods, spices and teas or nutraceuticals than medicines. They include garlic, onion, fenugreek, turmeric, bael fruit, pomegranate, sunflower seeds, citrus flavanones, and mushrooms. While these plants could contribute to the quality of a diet, it would be difficult to distinguish between their use as dietary additions and their use at fixed doses as pharmacological modifiers (Bhardwaj and Nandal, 2015; Akpinar-Bayizit et al., 2012; Nandha, 2014; Yahaya et al., 2014).

The gut microbiome has an important role in mediating dietary intake, obesity, inflammation, and other metabolic diseases. Plant fibre and polyphenols and other phytochemicals may impact the gut microbiome and microbial-derived metabolites, which in turn may impact insulin sensitivity, gut barrier function, inflammation, and energy balance. However, the role of microbiota in obesity and metabolic diseases and their modulation by medicinal plant and food constituents has been highlighted (Eid et al., 2017). Therefore, future plant-based interventions on obesity should include microbiome endpoints, dietary background, and metabolomic profiling to understand the heterogeneity of the dietary response.

Endocannabinoid signalling is implicated in obesity, fatty liver disease, and metabolic syndrome and offers indeed a panoply of cannabinoids and endocannabinoid-based targets. Reviews on the endocannabinoid system in obesity and related conditions have been published (Richey and Woolcott, 2017; Alswat, 2013). It is not to say that all plant products that contain cannabinoids are necessarily useful for treating a lifestyle disease. The fact is that molecules of plant origin can interact with the homeostatic mechanisms that regulate appetite, metabolism, inflammation, and fat deposition in the liver. Such mechanisms should be examined in terms of legality, safety, psychoactivity, and clinical ethics (Russo, 2013).

Table 2. Representative medicinal plants and natural products relevant to lifestyle disorders.

Plant or natural product	Main disorder relevance	Important phytochemical groups or constituents	Potential mechanisms	Key citations
Momordica charantia	Type 2 diabetes and insulin resistance	Charantin, vicine, polypeptide-p-like compounds, triterpenoids, phenolics	May support glucose utilization, reduce oxidative stress, and modulate insulin-related pathways.	Pandey et al., 2011; Khan et al., 2012; Chang et al., 2013
Trigonella foenum-graecum	Diabetes, dyslipidemia, metabolic syndrome	Soluble fiber, saponins, trigonelline, 4-hydroxyisoleucine	May slow carbohydrate absorption, improve lipid profile, and support insulin sensitivity.	Goyal et al., 2016
Allium sativum and *Allium* species	Hypertension, dyslipidemia, cardiovascular risk	Organosulfur compounds, flavonoids, phenolics	May support vascular function, lipid regulation, and antioxidant defense.	Alkreathy, 2011; Bisen and Emerald, 2016

Curcuma longa and curcumin	Inflammation, metabolic syndrome, digestive and hepatic disorders	Curcuminoids, volatile oils, phenolics	May inhibit inflammatory signaling, reduce oxidative stress, and support hepatoprotection.	Košťálová et al., 2013; Dulbecco and Savarino, 2013
Withania somnifera	Stress-related metabolic disturbance and adaptogenic support	Withanolides, alkaloids, sitoindosides	May regulate stress response, inflammation, and oxidative stress.	John, 2014
Moringa oleifera	Hyperglycemia, dyslipidemia, diabetes complications	Flavonoids, phenolic acids, vitamins, minerals, isothiocyanates	May improve antioxidant status, lipid metabolism, and glycemic markers.	Mbikay, 2012; Omodanisi et al., 2017
Ocimum sanctum	Diabetes, stress, inflammation, immune-metabolic balance	Eugenol, ursolic acid, flavonoids, phenolics	May show antioxidant, anti-inflammatory, adaptogenic, and antihyperglycemic effects.	Singh et al., 2012; Fonseka et al., 2015
Cichorium intybus	Lifestyle disorders and metabolic health	Inulin, phenolics, sesquiterpene lactones	May influence digestion, hepatic metabolism, and antioxidant pathways.	Chandra and Jain, 2016
Andrographis paniculata	Diabesity and inflammation-related metabolic imbalance	Andrographolide and diterpenoids	May affect inflammation, glucose metabolism, and metabolic stress.	Thakur et al., 2014
Picrorhiza kurroa	Hepatic disorders and fatty liver-related risk	Kutkoside, picroside, iridoid glycosides	May support hepatoprotection and antioxidant defense.	Pandey and Verma, 2013
Resveratrol	Obesity, type 2 diabetes, cardiovascular risk	Stilbene polyphenol	May affect mitochondrial function, inflammation, insulin sensitivity, and oxidative stress.	Timmers et al., 2013; Pangeni et al., 2014
Berberine-containing plants	Cardiovascular disease and metabolic dysfunction	Isoquinoline alkaloid berberine	May affect lipid metabolism, glucose regulation, and vascular pathways.	Zhang et al., 2016

3.3 Antihypertensive and cardioprotective potential

Hypertension and cardiovascular disease are among the most important lifestyle-dependent diseases, and they are directly related to diet, physical activity, overweight, diabetes, dyslipidemia, tobacco, chronic stress and aging. Medicinal plants have a helpful effect on the cardiovascular system through vasodilatory, antioxidant, lipid lowering, platelet modulating, endothelial protective, anti-inflammatory and cardioprotective activities. Garlic is one of the better studied plants, and aged garlic extract has been the subject of investigations of its cardioprotective ability against this effect of doxorubicin. Other reviews on garlic and onion have summarized their nutritional and medicinal role in reducing cardiovascular risk and managing cardiovascular disease (Alkreathy, 2011; Bisen and Emerald, 2016).

The effect of *Allium sativum* on blood pressure and cardiovascular risk has been investigated because it contains organosulfur compounds that can affect nitric oxide, oxidative stress, the lipid profile, and platelet aggregation, factors in hypertension and atherosclerosis. In real-world (clinical) use, practical issues such as dosage, preparation, odour, gastrointestinal tolerability, bleeding risk, and drug interactions with anticoagulant or antiplatelet medications, need consideration. This is a continuing issue with herbal compounds used for cardiometabolic disorders, for the active principle creating the helpful effects is also the same most likely to create drug interactions in patients with multiple medical problems (Onyeji et al., 2017).

Although *Terminalia arjuna* is commonly used in customary medicine for heart disease, it was not separately referenced in the provided review reference list. A lifestyle disorder review may mention that this plant has been widely used for cardioprotective purposes, but strong statements require references that specifically investigate the cardioprotective effects of this plant. Phytochemicals and cardiovascular drugs, mechanisms of berberine for cardiovascular disease, functional foods as an adjuvant therapy for metabolic syndrome, and modulation of metabolic nuclear receptors with natural products may be further categories of discussion in this corpus (Shen et al., 2017; Zhang et al., 2016; Brown et al., 2015; Marciano et al., 2014).

Potential effects of mushrooms on the prevention and management of hypertension (high blood pressure) have been reviewed. Possible active components may include bioactive peptides, polysaccharides, fibre, ergosterol-related metabolites, and antioxidants, which may have vascular and metabolic effects (Yahaya et al., 2014). The focus of the review on mushrooms is based on this broader definition of medicinal plants and natural products in the scope of chronic disease prevention, where the definition of herbal drugs was complemented with functional foods, nutraceuticals, and dietary bioactives. Dietary interventions, while potentially easier to smooth into lasting habits, require dietary literacy and realistic dietary planning.

Oxidative stress and inflammation are also involved in cardiovascular disease. Phytochemicals naringenin, resveratrol, curcumin, oleanolic acid, beta-caryophyllene and epigallocatechin gallate have been proposed to have antioxidant, anti-inflammatory, metabolic or cardioprotective effects (Mir and Tiku, 2015; Timmers et al., 2013; Košťálová et al., 2013; Ayeleso et al., 2017; Sharma et al., 2016; Granja et al., 2017). It is now generally accepted that the evaluation of cardiovascular protection should no longer be limited to cholesterol lowering, but should also include endothelial function, inflammatory and oxidative processes,

vascular stiffness, hypertension, lipid fractions, glycemic status, and clinical cardiovascular events.

3.4 Antioxidant and anti-inflammatory potential

Oxidative stress and chronic low-grade inflammation are common to almost all of the lifestyle diseases. Elevated levels of reactive oxygen species damage lipids, proteins and DNA, whilst inflammatory cascades induce insulin resistance, endothelial dysfunction, adipose tissue dysfunction, hepatic injury, and atherosclerosis. Medicinal plants are a rich source of bioactive antioxidant and anti-inflammatory phytochemicals including flavonoids, phenolic acids, tannins, curcuminoids, terpenoids, alkaloids, and sulfur compounds. Curcumin, resveratrol, naringenin, oleanolic acid, epigallocatechin gallate, and dietary phenolic acids show broad mechanistic relevance to inflammatory and oxidative pathways (Košťálová et al. 2013; Saibabu et al. 2015; Mir and Tiku 2015; Ayeleso et al. 2017; Granja et al. 2017).

Curcuma longa and its polyphenol curcumin have been the subject of reviews for their effects on nuclear factor-kappa B, cyclooxygenases, cytokine levels, oxidative stress, and intestinal inflammation. Medicinal chemistry and digestive disease reviews detail curcumin's potential for therapy and its poor bioavailability (Košťálová et al., 2013; Dulbecco and Savarino, 2013). The lifestyle diseases of interest from curcumin relate to inflammation linking obesity, insulin resistance, fatty liver disease, and cardiovascular disease. Unformulated curcumin has relatively low systemic bioavailability that can be affected by formulation.

Dietary phenolic acids are another large class of bioactive compounds with numerous health benefits such as antioxidant, anti-inflammatory, and metabolic modulation. They are present in multiple fruits, vegetables, cereals, spices, and medicinal plants and are one of the bioactive compounds that could be a preventive approach by food intake rather than using medicinal plants as pills or extracts (Saibabu et al., 2015). Medicinal plant research may become more important in public health nutrition, where dietary behaviours are expected to be sustainable over the long term, rather than episodic.

A number of the studies described above also noted an antioxidant role in disease beyond the classical lifestyle diseases, such as gynaecological disease, neurodegeneration, cancer prevention, and radiation exposure (Ji et al., 2017; Mythri et al., 2012; Shukla and Mehta, 2015; Singh et al., 2012). In these studies, the information is useful for describing pathways found across multiple diseases. Despite the fact that key mechanisms of oxidative stress, inflammation, mitochondrial dysfunction, and immune regulation are not specific only to diabetes or cardiovascular disease, extrapolation may be difficult. Plant with antioxidant properties in a model system may not necessarily be effective for metabolic syndrome as a treatment.

Table 3. Lifestyle disorder categories, biological targets, and plant-based intervention logic.

Lifestyle disorder	Dominant biological issues	Medicinal plant or bioactive examples	Therapeutic logic	Important caution

Type 2 diabetes mellitus	Insulin resistance, beta-cell stress, glucose toxicity, oxidative stress, glycation.	*Momordica charantia*, *Trigonella foenum-graecum*, *Moringa oleifera*, *Ocimum sanctum*.	May support glycemic control, antioxidant defense, anti-glycation effects, and insulin-related pathways (Pandey et al., 2011; Elosta et al., 2012).	Avoid replacing prescribed antidiabetic therapy; monitor hypoglycemia risk.
Obesity	Excess adiposity, appetite dysregulation, fat absorption, adipose inflammation.	Pancreatic lipase inhibitory plants, functional foods, polyphenol-rich foods.	May reduce fat absorption, modulate microbiota, improve inflammation, and support weight management (Bustanji et al., 2011; Kazemipoor et al., 2015).	Weight-loss claims require clinical evidence and safety evaluation.
Hypertension	Vascular tone, endothelial dysfunction, oxidative stress, salt sensitivity.	*Allium sativum*, mushrooms, functional foods.	May support vascular function and antioxidant status (Yahaya et al., 2014; Bisen and Emerald, 2016).	Check interactions with antihypertensive and antithrombotic therapy.
Dyslipidemia	Altered cholesterol transport, triglyceride elevation, hepatic lipid synthesis.	Fenugreek, garlic, *Moringa*, resveratrol, berberine.	May affect lipid metabolism and reduce cardiometabolic risk (Mbikay, 2012; Zhang et al., 2016).	Lipid-lowering effects vary by extract, dose, and baseline diet.
Cardiovascular disease	Atherosclerosis, inflammation, endothelial dysfunction, thrombosis, oxidative stress.	Garlic, berberine, resveratrol, cardiovascular phytochemicals.	May provide antioxidant, lipid-regulatory, vascular, and anti-inflammatory support (Shen et al., 2017).	Clinical outcomes require trials; interaction risk must be assessed.

Fatty liver disease	Hepatic lipid accumulation, oxidative injury, insulin resistance, inflammatory signaling.	Silibinin, *Picrorhiza kurroa*, curcumin, endocannabinoid-related targets.	May support hepatoprotection and reduce oxidative stress (Haddad et al., 2011; Pandey and Verma, 2013; Alswat, 2013).	Liver disease requires medical evaluation; hepatotoxic herbs must be avoided.
Stress-related disorders	HPA-axis activation, cortisol effects, sleep disruption, inflammation.	*Withania somnifera*, *Ocimum sanctum*, selected anxiolytic botanicals.	May support adaptogenic and stress-modulating pathways (John, 2014; Coe and McKenna, 2016).	Psychiatric symptoms require professional assessment; avoid unsafe psychoactive use.

3.5 Hepatoprotective potential and fatty liver relevance

Non-alcoholic fatty liver disease is closely linked with obesity, insulin resistance, dyslipidemia, and metabolic syndrome. Fat accumulation in the liver progresses to steatosis, steatohepatitis, fibrosis, cirrhosis, and end-stage liver disease. Thus, medicinal plants, which are known to have hepatoprotective, antioxidant, anti-inflammatory and lipid-regulating properties, may be an effective treatment for lifestyle disorders. Silibinin's antioxidant and hepatoprotective activity has been studied in a rat model of experimental nonalcoholic steatohepatitis (NASH), supporting the use of plant-based hepatoprotective agents (Haddad et al., 2011).

Picrorhiza kurroa has been reviewed for its role in the prevention and treatment of liver disease. The iridoid glycosides picroside and kutkoside have been specifically reviewed for their hepatoprotective and antioxidant properties (Pandey and Verma, 2013). In lifestyle diseases, hepatoprotective plants are of interest because nonalcoholic fatty liver disease is associated with type 2 diabetes, dyslipidemia, obesity, and cardiovascular diseases, so a plant acting on hepatic oxidative stress or lipid metabolism may have other positive health effects. For liver-targeted claims, safety testing is particularly important because of the risk of hepatotoxicity of herbal medicines.

Other digestive disease studies link curcumin to fatty liver and metabolic inflammation, but its bioavailability and diverse formulations and concentrations may influence interpretations. Curcumin's anti-inflammatory and antioxidant properties are mechanistically engaging (Dulbecco and Savarino, 2013; Košťálová et al., 2013). Future studies should also assess standardised formulations with respect to liver enzymes, liver fat quantification via imaging, inflammation and fibrosis-related biomarkers, and patient-centred outcomes because hepatoprotective claims are preliminary.

The endocannabinoid system is involved in fatty liver disease and obesity-associated metabolic disorders (Alswat, 2013; Richey and Woolcott, 2017). Thus, these studies are important for

gaining knowledge about the metabolic control of appetite, liver lipid metabolism, inflammation, and neuroendocrine pathways (Alswat, 2013; Richey and Woolcott, 2017). Endocannabinoid-based plant products are not exempt from this. However, their safety, psychoactivity, status and potential for dependence must be responsibly presented mechanistically in a lifestyle disorder review and not presented as an endorsement for their use.

3.6 Stress management and adaptogenic and psychometabolic effects

Chronic stress may lead to lifestyle disorders due to prolonged exposure to the stress hormone cortisol, sleep deprivation, emotional eating, autonomic imbalance, systemic inflammation, high blood pressure, and changes in blood sugar levels. Herbs with adaptogenic and anxiolytic or stress modulating effects can help counteract these effects. *Withania somnifera*, one of the most studied adaptogenic herbs, has been reviewed in terms of its phyto-pharmacological properties (withanolides and related compounds) and its putative role in stress, inflammation and oxidative stress, and resilience (John, 2014).

Ocimum sanctum may also be related to psychometabolic health as a multi-functional plant with antioxidant, immunomodulatory, antidiabetic and anti-stress activities (Singh et al., 2012). In practice, plant-based therapies for stress should be combined with sleep hygiene, exercise, counselling, diet, and, if anxiety or depression is present, with a medical examination. Though herbs may help people with mild stress symptoms, they should not be a substitute for mental healthcare for moderate to severe psychiatric disorders.

Some texts in the corpus discussed ayahuasca, psychedelics, and psychedelic-assisted therapy (Labate and Bouso, 2011; Coe and McKenna, 2016; Frecska et al., 2016; Carhart-Harris and Goodwin, 2017), even though these approaches are not part of the usual management of lifestyle disorders. These discussions relate to the larger discourse around the use of plant medicines for mental health, the importance of regulation, and the ethics of psychedelic-assisted therapy. They thus highlight the importance of distinguishing between medicinal plant metabolites for metabolic support, and psychoactive substances that require strict clinical, legal and ethical control.

There is overlap between lifestyle management of stress and diet/metabolic disease via exercise, diet, and adherence to medication, such that the management of stress and sleep may aid these. Future clinical studies of drugs such as *Withania somnifera* should study biomarkers in addition to subjective outcome measures such as sleep quality, perceived stress scores, quality of life, and ability to change lifestyle behaviours in the long term as these give the results more generalizable to lifestyle diseases (John, 2014; Brown et al., 2015).

3.7 Traditional knowledge, ethnobotany, and public health relevance

Traditional practices are still generally the best way of discovering medicinal plants, and ethnobotanical studies of how people use plants for common ailments can help focus pharmacological research on candidate species. Surveys and reviews in India, Tripura, Rajasthan, Nigeria and other regions indicate that medicinal plants are still an important part of socio-cultural heritage and local healthseeking behaviour (Sharma and Kumar, 2011; Sen et

al., 2011; Atawodi et al., 2017), which can be critical in dealing with lifestyle disorders via community engagement, dietary changes and culturally appropriate interventions.

The ethnobotanical finding is merely the first step in the scientific process. After ethnobotanical use, a plant's botanical identity must be first validated, its extracts standardised, phytochemicals profiled, and the plant tested for toxicity, and its effects verified in clinical testing before it can be used medicinally. Medicinal plants are considered elements of customary medicine, while their usage in modern practices requires quality control and an evidence-based approach (Sofowora et al., 2013; Karunamoorthi et al., 2013).

The use of customary and indigenous medicine brings up issues related to benefit sharing, conservation, and sustainability, as increased use can pose a risk to biodiversity. Thus overcommercialization may cause adulteration, substitution or exaggerated claims. Sustainable cultivation, quality certification, community participation and transparent labelling of medicinal plants are needed for public health use. Plant-based healthcare without these safeguards becomes unsafe, and may be ecologically damaging.

According to Ayurveda and other customary systems of medicine, plants are also used in the treatment of dental diseases, postpartum conditions, asthma, and others (Jain et al., 2011; Saini et al., 2011; Taur and Patil, 2011). These references add to the information about the medicinal plants, and also that a plant can be used differently in different cultures and for different ailments. Owing to the literature's focus on customary health systems and lifestyle disorders, it should not be directly used to make assumptions regarding cardiometabolic outcomes.

Some of these are reviews of antidiabetic herbal drugs, herbal hypoglycemic agents for type 2 diabetes, Moringa oleifera for hyperglycemia and dyslipidemia, obesity, medicinal plants for obesity, pancreatic lipase inhibitors, functional foods for metabolic syndrome, garlic and onion for cardiovascular disease, berberine for cardiovascular diseases, phytochemicals for cardiovascular diseases (Pandey et al., 2011; Khan et al., 2012; Mbikay, 2012; Chang et al., 2013; Kazemipoor et al., 2015; Seyedan et al., 2015; Brown et al., 2015; Bisen and Emerald, 2016; Zhang et al., 2016; Shen et al., 2017). These article reviews form the main piece of evidence used in this review.

Another group of papers supports mechanism-level studies and includes phytochemicals (including polyphenols, curcumin, resveratrol, phenolic acids, naringenin, oleanolic acid, and epigallocatechin gallate), beta-caryophyllene, nuclear receptor modulators, fatty-acid-sensing receptors and network pharmacology (Carkeet et al., 2012; Bharath, 2011; Košťálová et al., 2013; Timmers et al., 2013; Saibabu et al., 2015; Mir and Tiku, 2015; Ayeleso et al., 2017; Granja et al., 2017; Sharma et al., 2016; Marciano et al., 2014; Talukdar et al., 2011; Kibble et al., 2015). These references are important since lifestyle disorders require mechanistic thinking across the metabolic-inflammatory-oxidative-endocrine-vascular continuum.

The third research theme includes ethnobotanical, customary medicine and natural product contextual studies including medicinal plants of Rajasthan, India, Tripura, India, customary medicine in resource-poor countries, wild Nigerian medicinal trees, holistic health and well-being, customary therapies, immunomodulatory herbal medicines, and medicinal plants for their therapeutic potential (Sharma and Kumar, 2011; Sen et al., 2011; Karunamoorthi et al.,

2013; Atawodi et al., 2017; Lall, 2017; Sharma et al., 2014; Upadhayay et al., 2012; Ozkan et al., 2016). These references highlight that medicinal plants are worthy of study beyond laboratory-based pharmacological assessment.

A fourth sub-group outside lifestyle diseases addresses diversifying natural product research with respect to their preventative role in cancer, Parkinson's disease, Alzheimer's disease, gynaecological disease antioxidant potential, dental health, asthma, ayahuasca, psychedelic drugs, cannabinoids and non-metabolic conditions (Akpinar-Bayizit et al., 2012; Mythri et al., 2012; Kumar et al., 2017; Ji et al., 2017; Saini et al., 2011; Taur and Patil, 2011; Labate and Bouso, 2011; Carhart-Harris and Goodwin, 2017; Russo, 2013). They should not be overstated for cardiometabolic effects, but provide useful context for phytochemical variety, translational caution, and breadth of research on medical plants.

4. Difficulties in the Use of Medicinal Plants in Lifestyle Disorders

The greatest problem facing the study of medicinal plants is inconsistency. The chemical profile of a given plant can vary depending on species, subspecies, geographic region, soil, climate, seasonal and age variation, time of harvest, preparation, storage, extraction solvent, and formulation. Two products with the same name could contain very different active ingredients, complicating research and clinical applications if one extract's actions cannot be generalized to another. Standardization of authenticated plant material, voucher specimens, chromatographic fingerprints, marker compounds, and screening for contaminants is therefore required before making strong therapeutic claims for these products (Sofowora et al., 2013; Kibble et al., 2015).

Safety is another important concern. Although people often believe that natural products are safe, medicinal plants may have adverse effects, be contaminated, cause allergic reactions, be hepatotoxic or nephrotoxic, increase bleeding, cause hypoglycemia or hypotension, or cause drug-wanted interactions with prescription medicines. However, this is important in lifestyle diseases where patients are exposed to antidiabetic, antihypertensive, lipid lowering, antiplatelet, anticoagulant, or psychiatric drugs. Herbal medicines for diabetes may be affected through cytochrome P450 pathways or pharmacodynamic interactions (Onyeji et al., 2017). Consequently, these interactions need to be monitored.

The evidence is methodologically weak, with many studies on herbal medicines being preclinical, small, uncontrolled, or examining short-term surrogate endpoints. Studies have considerable heterogeneity in terms of formulation, dosage, duration, and patient population, making meta-analysis difficult. These factors limit the generalizability of human studies and clinical recommendations on the subject. Subsequent studies of lifestyle diseases should use clinically relevant outcomes, such as HbA1c, blood pressure, lipid profile, body composition, liver fat, markers of inflammation, supervised withdrawal of medications, quality of life and longer term safety data. Do not over-interpret short-term animal studies or test tube models of the antioxidant role of these foods.

One of these issues is the lack of a clear line between food, nutraceutical, customary medicine, and drug; for example, garlic, fenugreek, turmeric, and/or Moringa could be consumed as food, taken as nutraceuticals, made into customary medicines, or standardised into an extract.

Each form has different regulations, expected doses and safety issues and public messaging needs to reflect this. Public health measures to consume more plant foods do not equate to advocating their concentrated extracts as therapeutic agents, as confusing the two causes both exaggerated expectations and unsafe self-medicating.

Publication bias and selective reporting present another potential problem, as positive results are more likely to be published for plant extracts than negative results or inconclusive results. Multiple outcomes may be included, with only the most favourable reported. These issues could be reduced by preregistration, publishing protocols, including negative results in publications, using standardised outcome measures, and following reporting guidelines. Systematic reviews should state search date, list inclusion criteria, assess risk of bias, and grade the evidence.

Table 4. Major challenges and research gaps in medicinal plant use for lifestyle disorders.

Challenge or gap	Why it matters	Recommended solution	Relevant citations
Botanical misidentification	Incorrect species identification can lead to ineffective or unsafe products.	Use taxonomic authentication, voucher specimens, and traceable sourcing.	Sofowora et al., 2013; Karunamoorthi et al., 2013
Extract variability	Different solvents, plant parts, and harvest conditions produce different phytochemical profiles.	Use standardized extracts, marker compounds, and phytochemical fingerprints.	Kibble et al., 2015; Carkeet et al., 2012
Weak clinical evidence	Many claims are based on preclinical or traditional evidence rather than controlled human trials.	Conduct adequately powered randomized controlled trials with clinically meaningful endpoints.	Pandey et al., 2011; Khan et al., 2012
Herb-drug interactions	Patients with lifestyle disorders commonly use long-term medicines, increasing interaction risk.	Study pharmacokinetic and pharmacodynamic interactions; strengthen pharmacovigilance.	Onyeji et al., 2017

Safety assumptions	Natural products may still cause toxicity, allergy, hypoglycemia, bleeding, or liver injury.	Require toxicity testing, adverse event reporting, and patient counseling.	Seyedan et al., 2015; Onyeji et al., 2017
Bioavailability limitations	Compounds such as curcumin and resveratrol may have limited systemic availability.	Develop validated formulations and measure pharmacokinetic endpoints.	Košťálová et al., 2013; Pangeni et al., 2014
Sustainability concerns	High demand can lead to overharvesting and adulteration.	Promote cultivation, conservation, quality certification, and ethical sourcing.	Atawodi et al., 2017; Lall, 2017

5. Research Gaps

A major limitation is the lack of clinical evidence for many specific plant species and preparations, despite multiple reviews of the medicinal plants for diabetes. Further studies are recommended, comparing the effects of standardized plant extracts against placebo or standard lifestyle intervention, whilst using standardized inclusion criteria and clinically relevant endpoints. In diabetes, HbA1c, fasting and postprandial blood glucose levels, indices of insulin resistance, incidence of hypoglycemia, medication regimen adjustment and quality of life should be assessed. In obesity, body composition, waist circumference, appetite, food intake, physical activity, lipid status, glucose index and side effects should be taken into account (Khan et al., 2012; Kazemipoor et al., 2015).

A gap, its authors say, is limited attention to combination therapy. Diet, exercise, behavioral support, and conventional drugs usually manage lifestyle disorders. The medicinal plants will most often be used in conjunction with other treatments such as metformin, statins, antihypertensives, antiplatelet medications and/or structured lifestyle intervention, yet most of the included studies tested the herbs as monotherapy only. This is a meaningful limitation, as real-world patients often use herbal products in conjunction with prescription medications (Onyeji et al., 2017). Future safety studies should examine clinically relevant combinations.

Mechanistic studies are limited. While numerous papers have reported antioxidant or anti-inflammatory activity, few have linked these to a specific molecular target, tissue-level process, or patient phenotype. To determine if network pharmacology predictions are indeed predictive, experimental and clinical validation of the purported relationships between multi-compound plant extracts and multiple pathophysiological pathways is necessary (Kibble et al., 2015). Similar exploration of nuclear receptor modulators, the fatty acid sensing GPR120 receptor, endocannabinoid pathways, gut microbiota and the mitochondria using modern systems biology approaches is recommended (Marciano et al., 2014; Talukdar et al., 2011; Eid et al., 2017; Richey and Woolcott, 2017).

Safety testing through formal toxicology studies is also lacking, and while customary preparations may have been used for centuries, this does not replace formal toxicology. Since most chronic diseases require prolonged use, all metabolic health-promoting herbal technologies should be evaluated for repeated-dose, reproductive and liver/kidney toxicity along with safety data, interaction potential and relative bleeding risk as a basis for clinical judgment. The risk may vary greatly between different forms of preparation, such as a water decoction, ethanolic extract, concentrated capsule, or a pure natural isolate.

Finally, ethnobotanical knowledge can be incorporated into the literature to identify potential plant and intervention candidates for participatory research, benefit sharing and development, biodiversity conservation, and clinical testing (see Ethnopharmacology and Ethnotherapy). This approach would respect elements of community knowledge, and also meet contemporary evidence and safety standards (Sharma and Kumar, 2011; Sen et al., 2011; Atawodi et al., 2017).

6. Future Scope

The answer to questions about the role of medicinal plants in the management of lifestyle-related disorders may lie in an evidence-informed continuum of integration, in which selected plants are considered adjunctive interventions in thorough lifestyle management strategies rather than substitutes for other interventions. For example, a patient with metabolic syndrome may receive dietary modification, supervised physical activity, sleep therapy, stress management, and medications. A standardized plant-based preparation may be investigated as an adjunct to this package if it shows plausible mechanism, safety, and preliminary evidence of efficacy (Brown et al., 2015).

A second future area of research involves standardization of the content of phytopharmaceuticals and nutraceuticals by authenticating the botanical source, regulated cultivation, good agricultural practices, standardized extraction, chemical fingerprinting and stability, optimized dosage and clinical studies. Plant species used in high volume commercial herbal preparations, such as turmeric, garlic, fenugreek, Moringa, Tulsi and Ashwagandha, should be subject to standardization because otherwise it is impossible to know what a patient is actually taking or reproduce research findings.

A third direction is personalized and precision phytotherapy. Lifestyle disorders are heterogeneous. Diabetic individuals differ in their obesity, inflammation, gut microbiota, liver fat, stress, sleep, medication, and genetic background, so plant interventions may be more effective for certain phenotypes. Future trials will need to focus on responder subgroups, baseline metabolomic profiles and microbiome state, as well as dietary and medication backgrounds, to gather more precise evidence.

Digital health tools such as mobile phone apps, wearables, continuous glucose and blood pressure monitors, dietary records, and telehealth follow-up, might also be used to measure real-world outcomes of plant-based interventions. For example, a trial with fenugreek or Moringa might measure glucose variability and document meals, exercise and compliance more accurately than clinic visits. This will likely be useful for diseases of lifestyle (whose efficacy is determined more by daily habits).

There is a need for regulation and education to inform patients that medicinal plants might have benefits, but could also interact with certain medicines or result in unwanted effects. Labels should provide botanical name, plant part used, extract ratio, marker compounds, dosing, contraindications and warnings. Healthcare professionals should elicit information about herbal use, in non-judgmental ways and document it in the clinical record. This will contribute to safety and pharmacovigilance.

Long-term sustainability must also be considered in medicinal plant development, as the harvest of herbal products can have negative effects on slow-growing or non-cultivated species. Cultivation initiatives, conservation, quality certification and fair trade initiatives are all critical components of ensuring that the use of medicinal plants is both human health and biodiversity friendly. Research institutions, industry, customary practitioners, growers and government should work together to help build ethical plant-based health systems.

Table 5. Future research priorities for medicinal plants in lifestyle disorders.

Priority area	Detailed recommendation	Expected outcome
Standardized clinical trials	Test authenticated and chemically standardized preparations in adequately powered human studies with clear endpoints.	Stronger evidence for efficacy and safety.
Mechanistic validation	Use metabolomics, transcriptomics, microbiome profiling, network pharmacology, and target validation.	Better understanding of multi-target actions.
Safety and interaction studies	Evaluate long-term toxicity and interactions with antidiabetic, antihypertensive, lipid-lowering, and antithrombotic drugs.	Improved clinical confidence and patient safety.
Formulation science	Improve bioavailability of low-availability compounds such as curcumin and resveratrol through validated formulations.	More reliable therapeutic exposure.
Digital lifestyle integration	Combine plant interventions with diet, exercise, sleep, stress management, and digital monitoring tools.	More realistic evidence for real-world lifestyle disorder care.
Sustainable sourcing	Develop cultivation, conservation, and quality-certification systems.	Protection of biodiversity and reduction of adulteration.
Community-based research	Integrate ethnobotanical knowledge with participatory clinical research and benefit sharing.	Culturally acceptable and ethically developed interventions.

7. Conclusion

The presence of different phytochemical constituents that act on multiple biological targets makes medicinal plants a potential alternative in the management of lifestyle-related diseases. The present review identifies literature describing the role of multiple plant based interventions in improving glycemic profile, lipid profile, obesity, blood pressure, oxidative stress, inflammation, liver protection, cardio-protection and stress management. Plants and natural products such as *Momordica charantia*, *Trigonella foenum-graecum*, *Allium sativum*, *Curcuma longa*, *Withania somnifera*, *Moringa oleifera*, *Ocimum sanctum*, *Cichorium intybus*, *Andrographis paniculata*, *Picrorhiza kurroa*, resveratrol, berberine, and phenolic-rich functional foods are rich sources of candidate pharmaceuticals that bear further research (Pandey et al., 2011; Khan et al., 2012; Mbikay, 2012; Chang et al., 2013; John, 2014; Brown et al., 2015; Goyal et al., 2016; Zhang et al., 2016) although the evidence base is heterogeneous and should be interpreted cautiously. These claims may be based on customary use, preclinical studies or small clinical trials. Practical requirements for the medicinal plants to be prescribed for lifestyle-related disorders include standardisation, risk assessment, pharmacovigilance and herb-drug interaction studies, as well as high-quality human studies. Plant-based medicines should ideally play a complementary role to standard medical care, lifestyle changes, and evidence-based pharmacological therapy, and the best patient care would involve a combination of integrative and evidence-based approaches. Medicinal plant use should be understood in the context of treating lifestyle disorders (diet, exercise, sleep, stress, medications, cultural use, treatment adherence). Through rigorous research, medicinal plants may help to meet the need for primary and secondary preventive measures and supportive treatments for managing the growing burden of lifestyle diseases. Medicinal plant use should meet ethical, standard, and good clinical practice guidelines.

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