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Review

Pharmacologically Active Phytomolecules Isolated from Traditional Antidiabetic Plants and Their Therapeutic Role for the Management of Diabetes Mellitus

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Abstract: Diabetes mellitus is a chronic complication that affects people of all ages. The increased prevalence of diabetes worldwide has led to the development of several synthetic drugs to tackle this health problem. Such drugs, although effective as antihyperglycemic agents, are accompanied by various side effects, costly, and inaccessible to the majority of people living in underdeveloped countries. Medicinal plants have been used traditionally throughout the ages to treat various ailments due to their availability and safe nature. Medicinal plants are a rich source of phytochemicals that possess several health benefits. As diabetes continues to become prevalent, health care practitioners are considering plant-based medicines as a potential source of antidiabetic drugs due to their high potency and fewer side effects. To better understand the mechanism of action of medicinal plants, their active phytoconstituents are being isolated and investigated thoroughly. In this review article, we have focused on pharmacologically active phytomolecules isolated from medicinal plants presenting antidiabetic activity and the role they play in the treatment and management of diabetes. These natural compounds may represent as good candidates for a novel therapeutic approach and/or effective and alternative therapies for diabetes.

Keywords: medicinal plants; traditional medicine; phytoconstituents; diabetes; pharmacology

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1. Introduction

Diabetes mellitus is one of the most common endocrine metabolic disorders characterized by chronic hyperglycemia caused by varying degrees of insulin resistance, deficiency in insulin secretion, or both [1]. Nearly 10.5% of the worldwide population is affected by diabetes, with its prevalence increasing at an alarming rate. According to data collected from the International Diabetes Federation (IDF), about 783.2 million people are estimated to be diagnosed with diabetes by 2045 [2]. Diabetes mellitus can be classified into two major categories: Type 1 and Type 2 diabetes, where Type 2 diabetes accounts for about 90% of all cases. Type 1 diabetes, previously known as insulin-dependent diabetes, is an autoimmune disorder that occurs due to the destruction of the pancreatic beta cells leading to significantly reduced secretion of insulin [3]. It is a non-hereditary genetic condition that mainly affects the juvenile under thirty years of age. Type 2 diabetes, also known as non-insulin-dependent diabetes, is the most common form of diabetes, with its prevalence rapidly rising worldwide [4]. It is a hereditary condition caused as a result of insulin resistance, insufficient insulin secretion, or a combination of both, largely affecting an older population than Type 1 diabetes [5]. Both forms of diabetes alter carbohydrate, protein, and fat metabolism. The effect of insulin resistance leads to high blood sugar levels

by hindering the uptake and efficient use of glucose by most cells of the body [6]. The progression of the disease is accompanied by tissue or vascular damage resulting in severe complications, including retinopathy, diabetic neuropathy, nephropathy, cardiovascular, pulmonary, cerebral, and peripheral vascular diseases, ulcers, and thyroid gland disorders, leading to serious morbidity and mortality [1,7–9]. Available therapies currently in use for the treatment and management of diabetes include insulin and several oral hypoglycemic agents such as metformin, sulfonylureas, α-glucosidase inhibitors, meglitinide analogues, thiazolidinediones, DPP-IV inhibitors, SGLT-2 inhibitors, and GLP-1 mimetics. However, these drugs, intended to boost insulin sensitivity and increase insulin secretion together with the reduction in circulatory plasma glucose levels by increasing glucose excretion or uptake in adipose tissue, are usually associated with many side effects. These include, among others, weight gain, hypoglycemia, gastrointestinal tract disturbances, liver injury, renal failure, hypersensitivity reactions, flatulence, diarrhea, and abdominal bloating [1,10,11]. In addition, these drugs have been known to have other major disadvantages, including drug resistance, and there is also a lack of therapies to prevent the long-term complications of the disease.

The complications associated with insulin and oral antidiabetic agents, together with limited drug tolerability, adverse effects, and cost, have accelerated the search for alternative medicines with better efficacy, potency, and fewer side effects [12]. Interestingly, there has been an increase in popularity surrounding drug discovery research into natural antidiabetic agents, especially those derived from medicinal plants, which could enhance β-cell function and treat diabetes-associated complications with fewer adverse side effects [13].

Herbal medicines contain a diversity of phytochemicals and have been traditionally used for treating a wide variety of diseases. They are considered to be naturally safe and efficacious with fewer side effects [12]. The control and management of diabetes using herbal drugs have proven to be more advantageous over synthetic medicines due to their accessibility, reduced cost, lesser complications, and lower side effects. Herbal medicines act via different mechanisms aiming at reducing insulin resistance, increasing insulin secretion, protecting pancreatic beta cells, and thereby lowering circulating blood glucose levels [14].

Throughout the years, thousands of plant species have been used for their medicinal uses as integrative medicines for various diseases, of which more than 800 plants have been reported to exhibit antidiabetic effects [15]. Such plants have been examined for their use in the treatment of the different types of diabetes and could be potential sources for new natural antidiabetic drug discovery research [16]. A number of medicinal plants used traditionally for their antidiabetic activity are currently under investigation to be formulated commercially as modern drugs. This is particularly the case in developing countries where the cost of allopathic medicine is high, and the traditional use of plants to treat diabetes is common practice [15]. Traditional natural medicines are extensively prescribed in Asian countries (e.g., China, India, Bangladesh, Pakistan, Sri Lanka, Thailand, Nepal, Bhutan, Japan, and others) [17]. Among the medicinal plants possessing hypoglycemic effects, the most common ones used as remedies for diabetes include *Acacia arabica*, *Aegle marmelos*, *Allium cepa*, *Allium sativum*, *Aloe vera*, *Annona squamosa*, *Azadirachta indica*, *Berberis vulgaris*, *Camellia sinensis*, *Capsicum frutescens*, *Cassia alata*, *Cinnamomum zeylanicum*, *Eucalyptus globulus*, *Eugenia jambolana*, *Helicteres isora*, *Momordica charantia*, *Panax ginseng*, *Punica granatum*, *Swertia chirayita*, *Trigonella foenum-graecum*, and others [15,16,18,19]. The antidiabetic activity of these plants is thought to be mediated via various mechanisms, including the stimulation of insulin secretion from pancreatic β-cells, increasing insulin binding to receptors, reduction in insulin resistance, and improving glucose tolerance. Other modes of action include enhancing glucose metabolism, improving β-cell mass and function, and increasing plasma insulin, thus decreasing circulating blood glucose levels [20–23]. In addition to being used to treat diabetes, these plants have also been traditionally employed to treat other conditions such as ulcers, wounds, inflammation, infections, diarrhea, dysentery, malaria, rheumatism, hypertension, obesity, pneumonia,

and kidney diseases [12,19,24–26]. The main objective of this review is to explore the traditional plant-based therapies and/or their phytoconstituents available for the treatment of diabetes. These could provide the basis for the discovery of new antidiabetic drugs with fewer side effects and stronger efficacy than currently available medicines.

2. Methods

A literature search was carried out via Google Scholar, ScienceDirect, Scopus, and PubMed databases to accumulate data for this review article using the keywords "Diabetes mellitus," "Medicinal Plants," "Traditional medicine," "Antidiabetic phytochemicals," and "Plant-based antidiabetic therapy." The data search was not restricted to a specific time period; however, around 98% of the gathered data were published between 2000 and 2022, and only 2% were published before 2000. Our data collection began in early January until late May 2022. More than 700 papers were found relevant to our study, and after performing a primary screening, around 400 papers were selected to be critically examined. An overview of the key findings has been presented in this current review.

3. Ethnomedicines and Their Scope in the Modern World

Ethnomedicine is a traditional health care practice followed by indigenous people concerned with human health. It is the origin of all other traditional medical systems, including Ayurveda, Siddha, Unani, Nature Cure, as well as modern medicine [27]. Knowledge of plants presenting therapeutic properties has been passed on by experimenting through trials and errors from one generation to the next for more than hundreds of years. Ethnomedicines are highly prevalent in the rural and native communities of several developing countries [28]. According to information collected from the World Health Organization, about 80% of the global population relies upon traditional remedies [29]. Medicinal plants have always been recognized as a major source of raw materials for both conventional and traditional medicines [30]. In India, the poor and rural residents are dependent upon natural herbal remedies since they are easily obtainable to them. Indeed, plant-based medicines are the sole source of medical management for people living in remote areas. In countries such as Russia, Africa, and a few European countries, ethnomedicines are being studied by various botanists, anthropologists, folklorists, and medical scientists [27]. The inability for people to access adequate healthcare, alongside financial restrictions, has resulted in the under-provision of modern health care for a majority of the people in underdeveloped countries. [31]. Numerous folk remedies are recorded as being effective in treating various diseases (such as digestive tract disorders, skin diseases, renal and liver diseases, malaria, ulcers, heart diseases, pneumonia, diabetes, and many others), and thus, even developed countries have also considered utilizing these medicines [32].

4. Plant-Based Medicine versus Synthetic Medicine

Many drugs that are currently available have been derived directly or indirectly from natural sources such as medicinal plants and animals [33,34]. Plant-derived natural products have played and continue to play a prominent role in drug discovery and development programs. The increase in the number of herbal drug manufacturing companies, linked to the current increase in interest and demand for herbal medicines, can be largely expanded because of the toxicity and numerous adverse effects of allopathic medicines [35]. The convenience of accessibility, availability, inexpensiveness, and relatively low risks of side effects, have caused plant-based medicines to be an important alternative source of existing therapies, especially in rural and/or developing regions [33]. Plant-based medicines also provide a rich source of biologically active compounds that possess pharmacological activity with minimal undesirable effects [33].

Over the centuries, plant-based medicines have been widely used to treat the ailments of local communities of many developing countries that have easy access to these sources. Densely populated countries, such as China and India, have especially contributed to the advancement of sophisticated traditional medical systems such as acupuncture, ayurvedic

medicine, and herbal medicine [36]. Many factors should be considered when selecting the appropriate medications for the management and treatment of diabetes. This includes efficacy, adverse effects, cost, and potential to contribute to weight gain, risks associated with hypoglycemia, comorbidities, and patient compliance. Even though oral antihyperglycemic agents can lower plasma glucose levels by improving insulin secretion or reducing insulin resistance, they are associated with many other adverse effects. Metformin, the mainstay of treatment in type 2 diabetes, has a high safety profile, yet it is still associated with mild side effects such as low risks of hypoglycemia and gastrointestinal tract disturbances (nausea, diarrhea, dyspepsia). Previous studies have shown that continuous use of metformin may result in vitamin B12 and folic acid deficiency in humans [37]. DPP-IV inhibitors such as sitagliptin, saxagliptin, and linagliptin, have been found to cause headaches, nasopharyngitis, and upper respiratory tract infections [38]. The most common adverse effect of sulphonylureas such as glimepiride and gliclazide is hypoglycemia. These drugs are also associated with minor side effects such as weight gain, nausea, headaches, drowsiness, and hypersensitivity reactions. The most serious complication of insulin injections is hypoglycemia. Insulin may also cause weight gain or loss, dizziness, confusion, and sweating [38]. In contrast to synthetic drugs, plant-based medicines do not interrupt the body's natural healing process; instead, they accelerate the recovery process by strengthening the healing process, ultimately leading to a steady recovery. Alongside their ability to help the body recover to a healthy status, herbal medicines are also known for boosting the immune system. The use of highly effective herbal medicines showing fewer side effects and a strong immune system together with a healthy lifestyle promotes better body metabolism with increased nutritional absorption from the diet [35]. Whether they have insulinotropic, insulin-mimetic, or any other antihyperglycemic effects, medicinal plants are considered safer and more effective alternatives to synthetic antidiabetic drugs [39].

5. Pharmacological Activity of Plant-Based Medicines

Although knowledge of many plant-based therapies has been transmitted through generations, only a few of these have started to come to the fore recently. However, there is still some uncertainty regarding their pharmacological activity as well as their acute/chronic side effects due to such medicines being broadly underreported [40]. Few plants have proven to be efficacious for which they were intended, whilst some were not strongly therapeutically effective and/or sufficient scientific data were lacking to support their expected effects [41]. The increase in the widespread use of plant-based therapies has led to an urgent need for a detailed scientific examination of the chemicals responsible for pharmacological activity. Indeed, such a study of the pharmacological properties and phytoconstituents of plant-based medicines may lead to the discovery of new pharmacological characteristics previously unknown or used in traditional medicine [42]. Herbal medicines have been suggested to exert their mechanism of action by concurrently targeting multiple physiological processes via interactions between different biochemicals and cellular proteins [43].

Herbal medications may be able to alter the biological systems from disease to a healthy state by causing the interactions between multi-component and multi-target. Because of the therapeutic properties of the phytomolecules, a lower dosage may be used, resulting in less toxicity and adverse effects. [43]. The antidiabetic activity of medicinal plants is dependent upon the phytochemicals that act through multiple pathways, such as cAMP: which stimulates insulin secretion without affecting the K_{ATP} channel [44]; PI3K: which facilitates glucose uptake by the translocation of the glucose transporter in skeletal muscles, adipose tissue, or liver [45]; AMPK: The activation of 5′-adenosine monophosphate-activated protein kinase pathway improves insulin sensitivity by limiting lipolysis and lipogenesis, and AMPK also enhances glucose uptake in skeletal muscles by translocating GLUT4-containing intracellular vesicles across the plasma membrane [46,47]. For example, phlorizin obtained from the bark of apple and pear trees increases glucose excretion in urine by decreasing glucose reabsorption in the kidneys via the inhibition of SGLT and thus, lowers plasma

glucose concentration [48]. Some of the phytomolecules have the potential to regenerate and protect pancreatic beta cells from destruction by reducing the glucose load [49], inhibiting α-amylase and α-glucosidase activity, inducing glucose uptake in 3T3L1 cells [50,51], inhibiting aldose reductase enzyme activity, glycogen metabolizing enzymes, exerting hepato-pancreatic protective activity, inhibiting glucose-6-phosphate and DPP-IV, reducing lactic dehydrogenase, γ-glutamyl transpeptidase, glycosylated hemoglobin levels, and inhibiting glycogenolysis and gluconeogenesis in the liver [20,52]. As an example, a summary of the different pathways involved in the antidiabetic activity of flavonoids is illustrated in Figure 1. A summary of antidiabetic medicinal plants and their pharmacological actions has been shown in Table 1.

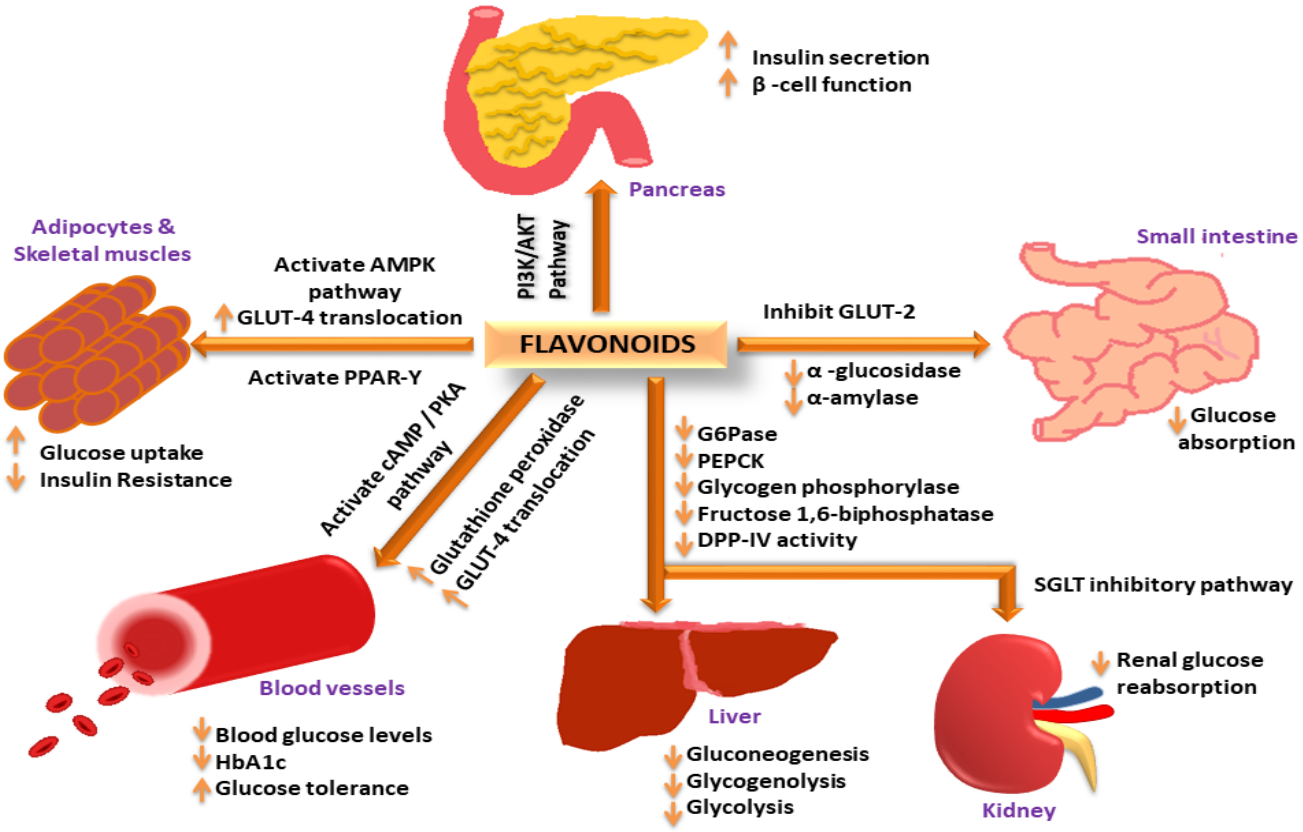


Figure 1. Flavonoids exerting antidiabetic activity via different mechanistic pathways: Flavonoids increase insulin secretion and improve β-cell function via the PI3K/AKT signaling pathway; increase GLUT-4 translocation through AMPK activation to increase glucose uptake in adipose tissues and skeletal muscles; activate PPAR-γ expression to decrease insulin resistance; activate cAMP/PKA pathway to reduce blood glucose levels and improve glucose tolerance; increase glutathione peroxidase activity to reduce HbA1c levels; decrease G-6-Pase, PEPCK, glycogen phosphorylase, fructose 1,6-biphosphatase and DPP-IV activity in liver to decrease gluconeogenesis, glycogenolysis, and glycoslysis; inhibit SGLT pathway in kidney to decrease renal glucose reabsorption; inhibit GLUT-2, α-amylase and α-glucosidase activity to decrease glucose absorption in the small intestine.

Table 1. Traditional uses and pharmacological effects of antidiabetic medicinal plants.

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
1. *Abrus precatorius*	Leaves, seeds	Diabetes, wounds, fever, cough, cold, tetanus	Improves β-cell function, inhibits α-amylase and α-glucosidase activity	[53,54]
2. *Acacia arabica*	Bark, roots	Diabetes, astringent, diarrhea, parasitic worms, diuretic, liver tonic	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and glucose tolerance	[24,55]
3. *Acacia catechu*	Bark	Diabetes, asthma, bronchitis, diarrhea, obesity, dysentery, skin diseases	Lowers blood glucose levels, increases insulin secretion	[56–58]
4. *Aegle marmelos*	Leaves	Diabetes, dysentery, inflammation, ulcer, diarrhea, asthma	Lowers blood glucose levels, increases insulin secretion, glucose uptake and metabolism, inhibits aldose reductase and DPP-IV enzyme activity	[56,59,60]
5. *Aframomum melegueta*	Fruit, leaves	Diabetes, cough, diarrhea, stomach ache, leprosy, hypertension, measles	Lowers plasma glucose levels, inhibits α-amylase and α-glucosidase activity	[61,62]
6. *Ageratum conyzoides*	Leaves	Diabetes, fever, rheumatism, cardiovascular diseases, malaria, wounds, spasms	Lowers blood glucose levels, improves β-cell function, increases insulin secretion	[63,64]
7. *Albizia lebbeck*	Bark, pods	Diabetes, asthma, diarrhea, infections, dysentery, inflammation	Lowers blood glucose levels, increases insulin secretion, enhances glucose uptake	[56,65,66]
8. *Albizia adianthifolia*	Bark, leaves	Diabetes, eye problems, hemorrhoids, skin diseases, wounds, malaria diarrhea, indigestion	Lowers blood glucose levels, improves glucose tolerance	[16,67]
9. *Allium cepa*	Bulb	Diabetes, bronchitis, hypertension, skin infections, swelling, lower cholesterol level	Increases insulin secretion and insulin sensitivity, improves glucose uptake	[68,69]
10. *Allium sativum*	Bulb	Diabetes, fever, hypertension, rheumatism, dysentery, bronchitis, intestinal worms	Increases insulin secretion and insulin sensitivity to cells	[70,71]
11. *Aloe vera*	Leaves	Diabetes, constipation, infections, ulcer, dysentery, piles, rheumatoid arthritis	Lowers blood glucose levels, increases insulin secretion, reduces insulin resistance, improves glucose tolerance	[72,73]
12. *Anacradium occidentale*	Leaves, stem bark	Diabetes, fever, hypertension, rheumatism, toothache, piles, dysentery	Lowers blood glucose levels, reduces oxidative stress, decreases total cholesterol and triglyceride levels	[74–76]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
13. *Anemarrhena asphodeloides*	Rhizome	Diabetes, fever, cough, inflammation, infections, night sweats, dementia	Lowers blood glucose levels, increases insulin sensitivity, improves glucose uptake	[77,78]
14. *Annona salzmannii*	Leaves, bark	Diabetes, inflammation, tumors	Lowers blood glucose levels, improves β-cell function, increases insulin secretion	[79,80]
15. *Annona squamosa*	Leaves	Diabetes, wounds, inflammation, hypertension, malaria, insect bites	Lowers blood glucose levels, increases insulin secretion, improves glucose tolerance and β-cell function	[10,81]
16. *Anogeissus latifolia*	Bark	Diabetes, diarrhea, hemorrhoids, dysentery, snake bites, stomach disorders, skin diseases, leprosy	Decreases blood glucose levels, improves β-cell function, increases insulin secretion, inhibits DPP-IV enzyme activity	[56,82,83]
17. *Arachis hypogaea*	Seeds	Diabetes, inflammation, heart diseases, coagulation, rheumatism, hypertension, Alzheimer's disease	Increases insulin secretion and insulin sensitivity, improves glucose tolerance	[84–86]
18. *Artemisia absinthium*	Rhizome	Diabetes, wounds, indigestion, gastritis, anemia, hepatitis, cardiovascular diseases, gall bladder disorders	Increases insulin sensitivity, improves glucose uptake, enhances GLUT-4 translocation	[87–89]
19. *Artocarpus heterophyllus*	Leaves, rhizome	Diabetes, diarrhea, malaria, wounds, anemia, inflammation	Lowers blood glucose levels, decreases glycosylated hemoglobin levels	[78,90]
20. *Asparagus racemosus*	Roots	Diabetes, constipation, ulcers, stomach disorders, cough, inflammation	Increases insulin secretion and action, improves β-cell function, inhibits carbohydrate digestion and absorption	[91–94]
21. *Atractylodes japonica*	Rhizome	Diabetes, rheumatism, gastrointestinal diseases, influenza, night blindness, diuretic, stomachic	Lowers blood glucose levels, reduces insulin resistance, improves glucose uptake	[95,96]
22. *Azadirachta indica*	Leaves	Diabetes, malaria skin diseases, infections, cardiovascular diseases, intestinal worms	Lowers blood glucose levels, increases insulin secretion, improves pancreatic β-cell function, inhibits α-amylase and α-glucosidase activity, enhances glucose uptake	[56,97,98]
23. *Balanites aegyptiaca*	Fruit	Diabetes, wounds, asthma, malaria, diarrhea, hemorrhoids, fever, infections	Increases insulin secretion, improves glucose uptake, inhibits α-glucosidase activity	[99,100]
24. *Berberis vulgaris*	Root, bark	Diabetes, eye infections, piles, wounds, snake bites, hemorrhoids, dysentery	Reduces blood glucose levels, increases insulin secretion	[101,102]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
25. *Bidens pilosa*	Root	Diabetes, wounds, hepatitis, diarrhea, urinary tract infections, cold, glandular sclerosis	Increases plasma insulin, improves glucose tolerance, protects or prevents islet degeneration	[103,104]
26. *Bougainvillea spectabilis*	Flowers, leaves	Diabetes, inflammation, ulcers, sore throat, infections, contraceptive	Regenerates β-cell function, increases plasma insulin levels, reduces intestinal glucosidase activity	[105,106]
27. *Brassica juncea*	Leaves, seeds	Diabetes, arthritis, rheumatism, back pain, coughs, paralysis	Increases insulin secretion and glucose utilization	[16,107]
28. *Bridelia ferruginea*	Leaves, stem bark	Diabetes, headache, arthritis, fever, inflammation	Lowers blood glucose levels, inhibits α-amylase and α-glucosidase activity	[108,109]
29. *Bunium persicum*	Seeds	Diabetes, diarrhea, gastrointestinal disorders, inflammation, obesity, asthma	Lowers blood glucose levels, improves glucose uptake and utilization	[56,110,111]
30. *Caesalpinia decapetala*	Leaves	Diabetes, indigestion, flatulence, stomach aches, constipation, fever	Lowers blood glucose levels, protects pancreatic beta cells, decreases oxidative stress	[112,113]
31. *Calendula officinalis*	Leaves, bark	Diabetes, fever, infections, wounds, menstrual irregularity, poor eyesight, inflammation, ulcers	Lowers blood glucose levels, increases plasma insulin levels	[114,115]
32. *Camellia sinensis*	Leaves	Diabetes, heart diseases, diuretic, astringent, stimulant, flatulence	Increases insulin secretion and action, inhibit insulin glycation, DPP-IV enzyme, and α-amylase activity, improves glucose tolerance	[116,117]
33. *Capsicum frutescens*	Whole plant	Diabetes, gastrointestinal disorders, toothache, pain, muscle spasms, fever, infections	Increases insulin secretion and insulin sensitivity, improves glucose uptake	[118,119]
34. *Carica papaya*	Fruit, leaves	Diabetes, gastrointestinal disorders, dengue, malaria, nerve pains, insomnia, constipation	Lowers blood glucose levels, increases insulin secretion, suppresses glucagon secretion	[120,121]
35. *Cassia alata*	Leaves, seeds	Diabetes, skin diseases, rheumatism, constipation, ringworm, infections, inflammation	Lowers blood glucose levels, inhibits α-glucosidase activity	[122,123]
36. *Cassia fistula*	Stalk	Diabetes, wounds, constipation, piles, skin diseases, asthma, liver diseases, rheumatism, leprosy	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and utilization	[56,124–127]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
37. *Catharanthus roseus*	Leaves, roots	Diabetes, hypertension, menstrual irregularity, cancer, wounds, muscle pain	Lowers blood glucose levels, increases insulin sensitivity, improves glucose uptake and utilization	[128–130]
38. *Cecropia obtusifolia*	Root bark	Diabetes, asthma, bronchitis, heart diseases, inflammation, wounds, hypertension	Lowers blood glucose levels, decreases glycosylated hemoglobin levels	[78,131]
39. *Cichorium intybus*	Bark, leaves	Diabetes, constipation, wounds, liver diseases	Increases insulin secretion and insulin sensitivity, improves glucose uptake	[78,132]
40. *Cinnamomum zeylanicum*	Bark	Diabetes, common cold, flu, gastrointestinal disorders, bacterial infections, headache, stomach pain	Increases plasma insulin levels, increases insulin sensitivity, inhibits α-amylase activity	[133,134]
41. *Citrus limon*	Fruit	Diabetes, hypertension, infections, scurvy, sore throat, rheumatism	Lowers plasma glucose levels, inhibits α-amylase activity	[135,136]
42. *Citrus x aurantium*	Fruit	Diabetes, insomnia, indigestion, constipation, heartburn, nausea, cardiovascular diseases	Lowers blood glucose levels, increases insulin secretion	[137,138]
43. *Cola nitida*	Seeds	Diabetes, dysentery, fatigue, CNS stimulant, morning sickness, migraine, indigestion, wounds	Lowers blood glucose levels, increases serum insulin levels	[139,140]
44. *Coptis chinensis*	Rhizome	Diabetes, sore throat, whooping cough, dysentery, neurodegenerative diseases	Lowers blood glucose levels, increases insulin sensitivity, improves glucose uptake	[141,142]
45. *Cornus officinalis*	Fruit, seeds	Diabetes, pain, inflammation, cardiovascular diseases, liver, and kidney diseases	Lowers blood glucose levels, increases insulin secretion, inhibits α-glucosidase activity, increases GLUT-4 expression	[143,144]
46. *Curcuma longa*	Rhizome	Diabetes, gastric, inflammation, infections, cough, pain, liver diseases	Lowers blood glucose levels, inhibits α-amylase and α-glucosidase activity, increases insulin secretion, improves peripheral glucose uptake, reduces insulin resistance	[78,145,146]
47. *Cudrania cochinchinensis*	Bark, roots	Diabetes, hepatitis, scabies, bruises, gonorrhea, jaundice, rheumatism	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and utilization, inhibits DPP-IV enzyme and α-glucosidase activity	[56,147,148]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
48. *Cyamopsis tetragonoloba*	Fruit	Diabetes, night blindness, arthritis, sprains, constipation, asthma, liver diseases, obesity	Increases insulin secretion, protects pancreatic beta cells, decreases glycosylated hemoglobin levels	[149,150]
49. *Dalbergia sissoo*	Bark	Diabetes, stomach disorders, dysentery, skin diseases, syphilis, nausea, gonorrhea	Lowers blood glucose levels, reduces serum triglyceride and cholesterol levels	[56,151,152]
50. *Eriobotrya japonica*	Leaves, seeds	Diabetes, bronchitis, inflammation, cough	Lowers blood glucose levels, reduces insulin resistance, improves glucose tolerance	[153,154]
51. *Eucalyptus citriodora*	Leaves	Diabetes, fever, pain, sinusitis, bronchitis, asthma, chronic rhinitis,	Increases insulin secretion, improves glucose uptake, inhibits insulin glycation and DPP-IV enzyme activity, decreases starch digestion	[155,156]
52. *Eucalyptus globulus*	Leaves	Diabetes, cough, cold, wounds, fungal infections, fever, sore throat, pain	Increases insulin secretion, improves glucose uptake	[157,158]
53. *Euclea undulata*	Root, bark	Diabetes, cough, chest pain, diarrhea, headache, toothache	Lowers blood glucose levels, inhibits α-glucosidase activity	[78,159]
54. *Eugenia jambolana*	Seeds	Diabetes, skin ulcers, gastritis, constipation, sore throat, liver, and kidney diseases	Lowers blood glucose levels, improves pancreatic β-cell function, increases insulin secretion, inhibits sucrase and maltase activity, improves glucose uptake and metabolism	[56,160,161]
55. *Euphorbia hirta*	Leaves	Diabetes, respiratory diseases, diarrhea, jaundice, tumors, gonorrhea	Increases insulin release from beta cells, inhibits α-glucosidase activity	[162,163]
56. *Ficus benghalensis*	Bark, leaves	Diabetes, hypertension, dysentery, diarrhea, pain, ulcers, asthma	Decrease carbohydrate digestion and absorption, lowers blood glucose levels	[164,165]
57. *Garcinia kola*	Seeds	Diabetes, diarrhea, food poisoning, bacterial infections, cough, liver diseases	Inhibits α-amylase activity, decreases glycosylated hemoglobin levels	[166,167]
58. *Glycine max*	Seeds	Diabetes, cardiovascular diseases, obesity, cancer	Reduces insulin resistance, improves glucose tolerance	[168,169]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
59. *Glycyrrhiza glabra*	Roots	Diabetes, epilepsy, respiratory diseases, paralysis, jaundice, rheumatism	Lowers blood glucose levels, increases insulin secretion	[56,170]
60. *Gymnema sylvestre*	Leaves	Diabetes, asthma, bronchitis, constipation, jaundice, dyspepsia, hemorrhoids, obesity	Lowers blood glucose levels, regenerates beta cells, increases insulin secretion, improves glucose tolerance	[171,172]
61. *Harungana madagascariensis*	Leaves	Diabetes, cancer, hernia, hypertension, jaundice, malaria, yellow fever	Lowers blood glucose levels, inhibits α-amylase activity	[16,173]
62. *Helicteres isora*	Roots	Diabetes, diarrhea, snake bites, gastrointestinal disorders, spasms	Lowers blood glucose levels, improves glucose uptake	[174,175]
63. *Heritiera fomes*	Bark	Diabetes, diarrhea, constipation, dysentery, dermatitis, scabies, goiter	Decreases carbohydrate digestion and glucose absorption, lowers blood glucose levels, increases insulin secretion, improves glucose tolerance, inhibits DPP-IV enzyme activity	[26,51,176]
64. *Hibiscus esculentus*	Roots, seeds	Diabetes, gastric irritations, inflammatory diseases, wounds, and boils	Lowers blood glucose levels, improves β-cell function, increases insulin secretion	[177,178]
65. *Hibiscus rosa-sinensis*	Leaves	Diabetes, cough, diarrhea, dysentery, pain, contraceptive	Reduces glucose absorption, lowers blood glucose levels, increases insulin secretion and hepatic glucose utilization, improves glucose tolerance, inhibits DPP-IV activity	[179,180]
66. *Jatropha curcas*	Leaves	Diabetes, fever, bacterial and fungal infections, jaundice, muscle pain	Lowers fasting blood glucose levels, improves glucose uptake and utilization	[181,182]
67. *Lantana camara*	Leaves	Diabetes, asthma, malaria, chicken pox, hypertension, measles	Lowers elevated blood glucose levels, improves glucose tolerance	[183,184]
68. *Linum usitatissimum*	Seeds	Diabetes, diarrhea, gastrointestinal infections, asthma, bronchitis, atherosclerosis	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and metabolism	[56,185]
69. *Mangifera indica*	Leaves, seeds	Diabetes, constipation, piles, dysentery, asthma, anemia, hypertension, hemorrhage,	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake, inhibits α-glucosidase and DPP-IV activity	[56,186,187]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
70. *Momordica charantia*	Leaves, seeds	Diabetes, malaria, hypertension, scabies, liver diseases, obesity, ulcers, measles	Lowers blood glucose levels, increases insulin secretion and glucose uptake, improves glucose tolerance, decreases gluconeogenesis, inhibits α-glucosidase activity	[56,134,188]
71. *Moringa oleifera*	Leaves	Diabetes, asthma, enlarged liver, bacterial infections, eye problems, piles, influenza, diuretic	Reduces glucose absorption, lowers blood glucose levels, improves glucose uptake, inhibits α-amylase activity	[189,190]
72. *Murraya koenigii*	Leaves	Diabetes, piles, dysentery, itching, bruises, inflammation	Lowers blood glucose levels, inhibits α-amylase and α-glucosidase activity	[78,191]
73. *Musa sapientum*	Flowers	Diabetes, dysentery, ulcers, hypertension, pain, inflammation, snake bites	Lowers blood glucose levels, increases insulin secretion, decreases glucosylated hemoglobin levels	[192,193]
74. *Nigella sativa*	Seeds	Diabetes, hypertension, gastrointestinal disorders, back pain, paralysis, heart diseases, bacterial infections, malaria	Decreases carbohydrate digestion and absorption, lowers blood glucose levels, increases insulin secretion and sensitivity, improves glucose uptake and utilization	[194,195]
75. *Ocimum basicllicum*	Leaves	Diabetes, headaches, constipation, coughs, kidney diseases, warts	Inhibits α-amylase and α-glucosidase activity, reduces oxidative stress, inhibits glycogenolysis	[196–198]
76. *Ocimum sanctum*	Leaves	Diabetes, ringworm, skin diseases, dysentery, dyspepsia, bronchitis, asthma	Increases insulin secretion, improves glucose uptake and utilization	[149,199]
77. *Olea europaea*	Leaves	Diabetes, constipation, urinary tract infections, asthma, hypertension, intestinal diseases	Lowers blood glucose levels, increases antioxidant activity	[200,201]
78. *Panax ginseng*	Roots	Diabetes, insomnia, anorexia, confusion, hemorrhage	Improves peripheral insulin action, increases insulin sensitivity, decreases carbohydrate absorption	[202,203]
79. *Panda oleosa*	Stem bark	Diabetes, HIV/AIDS, wounds, rheumatism, intestinal parasites	Lowers blood glucose levels, improves glucose tolerance	[16,204]
80. *Phaseolus vulgaris*	Seeds	Diabetes, hypertension, obesity, blood cancer	Reduces insulin resistance, inhibits α-amylase and DPP-IV enzyme activity	[149,205]
81. *Phyllanthus amarus*	Leaves	Diabetes, spleen, liver and kidney diseases, gonorrhea, stomach problems	Lowers blood glucose levels, increases insulin secretion, improves insulin sensitivity	[206,207]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
82. *Plantago ovata*	Husk	Diabetes, constipation, diarrhea, hypercholesterolemia, hypertension, hemorrhoids	Improves glucose tolerance, decreases carbohydrate digestion and glucose absorption	[208,209]
83. *Pterocarpus marsupium*	Bark	Diabetes, dysentery, cough, diarrhea, skin diseases, wounds, ulcer	Improves pancreatic β-cell function, increases insulin secretion, improves glucose uptake	[149,210,211]
84. *Punica granatum*	Flowers	Diabetes, urinary tract infections, arthritis, sore throat, skin diseases, anemia	Improves β-cell function, increases insulin secretion	[210,212,213]
85. *Rehmannia glutinosa*	Roots	Diabetes, anemia, obesity, kidney diseases, osteoporosis	Improves pancreatic β-cell function, increases insulin secretion, improves glucose uptake, decreases oxidative stress	[214,215]
86. *Santalum album*	Bark	Diabetes, jaundice, diarrhea, dysentery, liver tonic, inflammation, hypertension	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and utilization	[56,216]
87. *Selaginella bryopteris*	Leaves	Diabetes, fever, epilepsy, constipation, colitis, cancer, urinary tract infections	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and utilization	[56,217]
88. *Sesamum indicum*	Seeds	Diabetes, constipation, hypertension, high cholesterol, athlete's foot	Inhibits α-amylase and α-glucosidase activity, exerts antioxidant activity	[56,218,219]
89. *Solanum nigrum*	Leaves	Diabetes, pneumonia, toothache, stomach ache, fever, tumor, tonsilitis	Lowers blood glucose levels, increases insulin secretion, decreases gluconeogenesis, increases glycogenesis	[220,221]
90. *Spirulina platensis*	Whole plant	Diabetes, hypercholesterolemia, atherosclerosis, obesity	Lowers blood glucose levels, increases insulin secretion, improves glucose tolerance, inhibits DPP-IV activity	[222,223]
91. *Swertia chirayita*	Bark, leaves	Diabetes, malaria, hypertension, epilepsy, liver diseases, weight loss	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and metabolism, inhibits α-amylase and α-glucosidase	[56,224]
92. *Tamarindus indica*	Seeds	Diabetes, diarrhea, dysentery, constipation, abdominal pain, wounds, malaria	Lowers blood glucose levels, increases insulin secretion	[56,225]
93. *Terminalia arjuna*	Bark	Diabetes, cardiotonic, anemia, viral infections, venereal diseases, ulcers	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and utilization	[56,226]

Table 1. *Cont.*

Medicinal Plants	Parts	Traditional Uses	Pharmacological Effects	References
94. *Terminalia chebula*	Fruit	Diabetes, fever, astringent, constipation, dementia	Improves β-cell function, increases insulin secretion, reduces glycosylated hemoglobin levels	[227,228]
95. *Tinospora cordifolia*	Leaves, roots, stem	Diabetes, dysentery, diarrhea, snake bites, asthma, fever, jaundice	Increases insulin secretion, inhibits gluconeogenesis, increases insulin sensitivity	[149,229]
96. *Trigonella foenum-graecum*	Seeds	Diabetes, bronchitis, pneumonia, indigestion, dysentery, high cholesterol	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and utilization	[56,134,230,231]
97. *Urtica dioica*	Leaves	Diabetes, cardiovascular diseases, anemia, rhinitis, arthritis, gout, wounds	Increases insulin sensitivity, improves glucose tolerance	[232,233]
98. *Vernonia amygdalina*	Leaves	Diabetes, gastrointestinal disorders, amoebic dysentery, malaria, helminth infections	Lowers elevated blood glucose levels, inhibits gluconeogenesis and glycogenolysis	[234,235]
99. *Withania coagulans*	Fruit	Diabetes, insomnia, impotence, nervous exhaustion, asthma, liver diseases	Lowers blood glucose levels, improves glucose tolerance	[56,236]
100. *Zingiber officinale*	Rhizome	Diabetes, nausea, high cholesterol, heartburn, indigestion, diarrhea, asthma	Lowers fasting blood glucose levels, increases insulin secretion	[119,237]

6. Phytochemicals and Their Impact on Diabetes

Plants are the primary source of biologically active compounds that may ultimately lead to the discovery and development of potential new drugs [238]. Plants produce both primary and secondary metabolites. Carbohydrates, proteins, and lipids are considered primary metabolites, necessary for the growth and development of plants and involved in essential metabolic pathways, such as photosynthesis and glycolysis. Secondary metabolites are not required for the growth and development of plants; rather, they are responsible for interactions between plant species and the environment and have highly specific functions in plants [239].

Over 13,000 secondary metabolites have been purified and isolated from medicinal plants. These phytochemicals can be categorized into various chemical classes such as alkaloids, flavonoids, terpenoids, phenolics, tannins, saponins, xanthones, and glycosides [78]. Many of these phytochemicals are known to exhibit medicinal properties, including antidiabetic activity [78]. Several phytochemicals isolated from various plant species have been scientifically validated for their contribution to treating and managing diabetes by exerting antihyperglycemic activity and reducing the complications associated with diabetes [171]. For example, the flavonoid rutin, present in the leaves of numerous plants, including *Annona squamosa* and *Azadirachta indica* (neem), has been reported to possess many beneficial effects such as anti-inflammatory, anti-cancer, anti-allergic, antiviral, and antioxidative properties [240]. Rutin-containing plants have also been shown to protect against heart disease, hepatotoxicity, and diabetes mellitus [240]. Rutin exerts its antidiabetic effect by lowering plasma glucose, improving the function of pancreatic β-cells, and enhancing glucose tolerance [10]. Two other flavonoids found in the leaves of *Annona squamosa*, namely quercetin and isoquercetin, have also been reported to possess antihyperglycemic activity by inhibiting α-glucosidase and lowering blood glucose levels [241]. Alongside rutin and quercetin, the tetranortriterpenoid meliacinolin, isolated from the leaves of *A. indica*, has been found to inhibit α-glucosidase and α-amylase in Type 2 diabetic mice [98]. Nimbidin, extracted from neem seeds, is another phytochemical exhibiting hypoglycemic properties [98]. Quercetin, allicin, allyl-propyl disulfide, cysteine sulfoxide, and S-allyl cysteine sulfoxide from *Allium sativum* (garlic) have been reported to stimulate insulin secretion from pancreatic β-cells, increase insulin sensitivity to target cells, and prevent insulin activation triggered by the liver [71]. Alliin, from garlic, has been reported to mimic the function of glibenclamide and insulin [71]. Epigallocatechin-3-gallate, epigallocatechin, epicatechin-3-gallate, and epicatechin present in *Camellia sinensis* (tea) leaves can also lower plasma glucose levels by improving β-cell function, increasing insulin secretion, and enhancing glucose metabolism [117]. These phytomolecules may exert their antidiabetic activity in multiple manners, most commonly by being insulinotropic, insulin-mimetic, and by improving β-cell function, increasing insulin sensitivity, improving glucose tolerance and metabolism, as well as inhibiting various enzyme activities. A summary of antidiabetic medicinal plants and their phytochemicals with potential antidiabetic effects is provided in Table 2. The chemical structures of the antidiabetic phytoconstituents of medicinal plants are given in Table 3.

Table 2. Phytoconstituents of antidiabetic medicinal plants and their pharmacological effects.

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
1.	*Abrus precatorius*	Leaves, seeds	Luteolin, lupenone, 24-methylene cycloartenol	Maintains blood glucose levels, promotes insulin secretion, prevents oxidative stress, inhibits inflammation in pancreatic tissues	[16,242,243]
2.	*Acacia arabica*	Bark, roots	Quercetin, kaempferol, catechin	Lowers blood glucose levels, increases insulin secretion, reduces insulin resistance, improves glucose tolerance, reduces oxidative stress	[24,244]
3.	*Acacia catechu*	Bark	Catechin, epicatechin, catechu tannic acid, gallocatechin, kaempferol	Lowers blood glucose levels, increases plasma insulin levels, reduces insulin resistance, and improves glucose uptake, inhibits α-amylase and α-glucosidase activity	[24,244–247]
4.	*Aegle marmelos*	Leaves	Rutin, β-sitosterol, aegelinosides A and B, aegeline, marmelosin	Lowers plasma glucose levels, reduces insulin resistance, decreases glycosylated hemoglobin levels, inhibits α-glucosidase activity, improves β-cell function	[248–252]
5.	*Aframomum melegueta*	Fruit, leaves	6-paradol, 6-shogaol, 6-gingerol, oleanolic acid	Decreases blood glucose and cholesterol levels, improve glucose tolerance and utilization, inhibits lipid synthesis by adipocytes	[16,253–255]
6.	*Ageratum conyzoides*	Leaves	Kaempferol, precocene II	Lowers blood glucose levels, increases plasma insulin levels, improves glucose uptake	[16,256]
7.	*Albizia lebbeck*	Bark, pods	Lupeol, oleanolic acid, docosanoic acid, β-sitosterol, catechin, friedelin	Decreases blood glucose and glycosylated hemoglobin levels, reduces nitric oxide, increases insulin levels, activates GLUT2 and GLUT4	[244,250,255,257–259]
8.	*Albizia adianthifolia*	Bark, leaves	β-caryophyllene, viridiflorol	Lowers blood glucose levels, increases insulin secretion and sensitivity, reduces glucose absorption, triglyceride, and cholesterol levels	[67,260]
9.	*Allium cepa*	Bulb	Alliin, quercetin, S-methyl cysteine sulfoxide	Reduces fasting glucose levels, increases insulin secretion and sensitivity, decreases triglyceride levels	[16,261,262]
10.	*Allium sativum*	Bulb	Allicin, alliin, diallyl disulfide, quercetin, allyl propyl disulfide	Lowers blood glucose levels, increases insulin secretion and sensitivity, decreases cholesterol and triglyceride levels	[71,261–263]
11.	*Aloe vera*	Leaves	Lophenol, aloin, aloetic acid, emodin, glucomannan	Lowers blood glucose levels, increases insulin secretion, improves glucose tolerance, prevents oxidative stress	[16,264–266]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
12.	*Anacradium occidentale*	Leaves, stem bark	Anacardic acid, lectin	Delays glucose absorption, reduces oxidative stress, inhibits α-glucosidase activity	[16,267]
13.	*Anemarrhena asphodeloides*	Rhizome	Mangiferin, neomangiferin, sarsasapogenin	Reduces fasting blood glucose levels, improves glucose tolerance, reduces cholesterol and triglyceride levels, improves diabetic complications	[78,268–270]
14.	*Annona salzmannii*	Leaves, bark	α-copaene, β-caryophyllene, δ-cadinene	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake, reduces glucose absorption, cholesterol, and triglyceride levels	[80,260]
15.	*Annona squamosa*	Leaves	Rutin, quercetin, isoquercetin	Lowers blood glucose levels, increases insulin secretion, improves glucose tolerance, reduces glycosylated hemoglobin levels	[10,249,262,271]
16.	*Anogeissus latifolia*	Bark	Ellagic acid, β-sitosterol, 3,4,3-tri-*O*-methylellagic acid	Lowers plasma glucose and glycosylated hemoglobin levels, increases insulin levels, improves β-cell function	[250,272,273]
17.	*Arachis hypogaea*	Seeds	Resveratrol, catechin, rutin, quercetin	Lowers blood glucose levels, increases insulin secretion and glucose uptake, reduces oxidative stress, inhibits α-amylase and α-glucosidase activity	[244,249,262,274]
18.	*Artemisia absinthium*	Rhizome	α and β thujones, thujyl alcohol, azulene, cadinene	Lowers blood glucose levels, activates adenosine monophosphate-activated protein kinase, increases insulin sensitivity	[16,275,276]
19.	*Artocarpus heterophyllus*	Leaves, rhizome	Chrysin, silymarin, isoquercetin	Lowers blood glucose levels, improves β-cell function and glucose tolerance, increases insulin sensitivity, inhibits Pro-inflammatory cytokines	[78,271,277,278]
20.	*Asparagus racemosus*	Roots	Asparagamine, asparagine, kaempferol, quercetin	Lowers blood glucose levels, increases insulin secretion, improves glucose uptake and tolerance	[93,256,262]
21.	*Atractylodes japonica*	Rhizome	Atractans A, B, C, atractylenolide III	Lowers blood glucose levels, decreases insulin resistance	[95,96,279]
22.	*Azadirachta indica*	Leaves	Azadirachtin, nimbin, rutin, quercetin, campestrol	Lowers blood glucose levels, improves β-cell function, increases insulin secretion, reduces cholesterol and triglyceride levels	[97,98,249,280]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
23.	*Balanites aegyptiaca*	Fruit, seeds	Balantin 1, 2, diosgenin, 3,4,6-tri-*O*-methyl-D-glucose, triethylphosphine	Increases serum insulin and c-peptide levels, increases glucose metabolism, decreases gluconeogenesis	[16,281]
24.	*Berberis vulgaris*	Root bark	Berberine, berbamine	Increases insulin secretion, improves insulin sensitivity, inhibits α-glucosidase and aldose reductase activity	[102,282,283]
25.	*Bidens pilosa*	Roots	Cytopiloyne, apigenin, luteolin, kaempferol, quercetin	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin expression and secretion from beta cells, stimulates glucose metabolism, increases insulin sensitivity to cells	[16,242,284–286]
26.	*Bougainvillea spectabilis*	Flowers, leaves	Pinitol, quercetin, β-sitosterol	Lowers fasting blood glucose and glycosylated hemoglobin levels, increases insulin secretion, improves insulin sensitivity	[16,250,262,287]
27.	*Brassica juncea*	Leaves, seeds	Cinnamic acid, kaempferol, aniline	Lowers blood glucose levels, increases insulin secretion and glucose uptake, improves glucose tolerance	[16,256,288]
28.	*Bridelia ferruginea*	Leaves, stem bark	Epigallocatechin, epigallocatechin gallate	Lowers blood glucose levels, improves glucose tolerance, enhances insulin secretion, decreases gluconeogenesis	[16,289,290]
29.	*Bunium persicum*	Seeds	Linoleic acid, palmitic acid, kaempferol, camphene, linalool	Lowers blood glucose levels, increases insulin levels in blood, improves insulin sensitivity, enhances glucose uptake and tolerance	[256,291–294]
30.	*Caesalpinia decapetala*	Leaves	Quercitrin, kaempferol, astragalin, apigenin-7-rhamnoside	Decreases fasting blood glucose levels, increases insulin levels in blood, enhances antioxidant activity, improves glucose uptake, decreases nitric oxide	[16,256,295,296]
31.	*Calendula officinalis*	Leaves, bark	Caffeic acid, quercetin, esculetin	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, reduces diabetic oxidative stress, increases GLUT4 expression in adipocytes, improves glucose utilization	[16,262,297,298]
32.	*Camellia sinensis*	Leaves	Rutin, quercitrin	Lowers blood glucose levels, improves β-cell function, increases insulin secretion, improves glucose tolerance	[117,249,295]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
33.	*Capsicum frutescens*	Whole plant	Capsaicin, β-carotene	Lowers blood glucose levels, increases insulin levels, improves glucose tolerance, inhibits pro-inflammatory cytokines	[119,299,300]
34.	*Carica papaya*	Fruit, leaves	Chlorogenic acid, coumarin compounds	Lowers blood glucose levels, stimulates insulin secretion, increases insulin sensitivity, inhibits α-amylase, α-glucosidase, glucose-6-phosphatase, and aldose reductase activity	[16,301,302]
35.	*Cassia alata*	Leaves, seeds	Emodin, kaempferol, β-sitosterol	Lowers blood glucose levels, increases insulin secretion, enhances insulin sensitivity, inhibits phosphoenolpyruvate, carboxykinase, glucose-6-phosphatase activity	[16,250,256,266]
36.	*Cassia fistula*	Stalk	Lupeol, kaempferol, catechin, epicatechin	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin levels, reduces nitric oxide, improves glucose tolerance	[244,246,257,303]
37.	*Catharanthus roseus*	Leaves, roots	Gallic acid, chlorogenic acid, vindoline I	Lowers blood glucose levels, stimulates insulin secretion, improves glucose tolerance, decreases pro-inflammatory cytokines	[16,301,304,305]
38.	*Cecropia obtusifolia*	Root, bark	Isoorientin, stigmast-4-en-3-one, chlorogenic acid, β-sitosterol	Reduces blood glucose levels, improves insulin sensitivity, enhances glucose uptake, decreases cholesterol and triglyceride levels, inhibits glucose-6-phosphatase and hepatic glucose, improves glucose tolerance	[78,306,307]
39.	*Cichorium intybus*	Bark, leaves	Chlorogenic acid, chicoric acid, gallic acid, kaempferol, quercetin, β-sitosterol	Lowers blood glucose levels, stimulates insulin release, improves insulin sensitivity, inhibits α-amylase, α-glucosidase, glucose-6-phosphatase activity, prevents oxidative stress	[22,78,132,301,308]
40.	*Cinnamomum zeylanicum*	Bark	Cinnamaldehyde, eugenol	Decreases blood glucose levels, reduces insulin resistance, inhibits α-glucosidase activity and formation of advanced glycated end products, inhibits sugar binding to albumin	[134,309,310]
41.	*Citrus limon*	Fruit	Diosmin, hesperetin	Lowers blood glucose levels, increases insulin secretion, enhances glucose utilization, stimulates β-endorphine secretion from adrenal glands, inhibits gluconeogenesis	[16,311,312]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
42.	*Citrus x aurantium*	Fruit	Naringin, naringenin, epigallocatechin-3-gallate	Decreases blood glucose levels, increases insulin secretion, improves glucose tolerance, increases GLUT4 translocation in skeletal muscles, decreases gluconeogenesis	[16,289,290,313]
43.	*Cola nitida*	Seeds	D-catechin, L-epicatechin, naringenin, apigenin	Lowers blood glucose levels, increases insulin sensitivity, decreases oxidative stress, inhibits α-amylase and α-glucosidase activity	[16,244,246]
44.	*Coptis chinensis*	Rhizome	Berberine, jatrorrhizine	Lowers blood glucose levels, enhances aerobic glycolysis, inhibits gluconeogenesis, increases insulin secretion and insulin sensitivity	[33,282,314]
45.	*Cornus officinalis*	Fruit, seeds	Gymnemagenin, gymnemic acid, ursolic acid	Lowers fasting blood glucose levels, increases insulin secretion, improves glucose uptake and tolerance, inhibits protein glycation	[143,279,315,316]
46.	*Curcuma longa*	Rhizome	Curcumin, turmerin	Decreases fasting blood glucose, glycosylated hemoglobin, triglyceride, and cholesterol levels, inhibits α-amylase, α-glucosidase activity, and diabetic inflammatory processes	[78,317,318]
47.	*Cudrania cochinchinensis*	Bark, roots	Kaempferol, vanillin, β-sitosterol	Lowers blood glucose levels, increases insulin levels, decreases serum advanced glycation end products, improves glucose uptake, reduces insulin resistance	[250,256,319,320]
48.	*Cyamopsis tetragonoloba*	Fruit	Quercetin, kaempferol, gallic acid	Lowers plasma glucose levels, increases insulin secretion, improves glucose tolerance, decreases triglyceride levels	[16,256,262,304]
49.	*Dalbergia sissoo*	Bark	Biochanin A, tectorigenin, rhamnoglucoside, dalbergin, dalbergichromene	Lowers blood glucose levels, improves insulin sensitivity and glucose tolerance, reduces insulin resistance	[321–323]
50.	*Eriobotrya japonica*	Leaves, seeds	Cinchonain-Ib, timosaponin, chlorogenic acid, epicatechin	Lowers blood glucose, total cholesterol, and triglyceride levels, enhances insulin secretion and sensitivity, improves glucose tolerance	[246,279,301,324,325]
51.	*Eucalyptus citriodora*	Leaves	Betulinic acid, gallic acid, quercitrin, isoquercitrin, rhodomyrtosone E	Lowers blood glucose levels, increases insulin secretion and sensitivity, improves glucose tolerance and antioxidant activity, decreases triglyceride levels,	[155,295,304,326]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
52.	*Eucalyptus globulus*	Leaves	Eucalyptol, rutin, sesquiterpene	Lowers blood glucose levels, improves β-cell function, increases insulin secretion, reduces oxidative stress	[157,249,327]
53.	*Euclea undulata*	Rootbark	Botulin, lupeol, epicatechin	Decreases serum glucose, increases insulin levels, improves insulin sensitivity, decreases glycosylated hemoglobin levels	[78,246,257]
54.	*Eugenia jambolana*	Seeds	Ellagic acid, gallic acid, chlorogenic acid	Lowers blood glucose levels, increases insulin sensitivity, improves β-cell function, improves glucose tolerance, inhibits α-amylase, α-glucosidase, and glucose-6-phosphatase activity	[11,272,301,304]
55.	*Euphorbia hirta*	Leaves	Quercetin, kaempferol, gallic acid	Lowers blood glucose levels, increases insulin secretion, improves glucose tolerance, decreases triglyceride levels, enhances glucose uptake	[162,256,262,304]
56.	*Ficus benghalensis*	Bark, leaves	Rutin, gallic acid, leucopelargonidin-3-*O*-α-rhamnopyranoside, lupeol, α-amyrin acetate	Decreases blood glucose levels, improve glucose tolerance and β-cell function, increases insulin secretion,	[249,328–330]
57.	*Garcinia kola*	Seeds	Kolaviron, ascorbic acid	Decreases blood glucose level, stimulates insulin secretion, improves glucose utilization, inhibits glucose-6-phosphatase, exhibits free radical scavenging activity	[16,331,332]
58.	*Glycine max*	Seeds	Kaempferol, soyasaponin, genistein, β-sitosterol	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin levels in blood, decreases insulin resistance, improves glucose uptake, inhibits glucose absorption	[16,250,256]
59.	*Glycyrrhiza glabra*	Roots	Glycyrrhizin, glycyrrhetinic acid, isoliquiritin	Lowers postprandial rise in blood glucose levels, decreases glycosylated hemoglobin levels	[333–335]
60.	*Gymnema sylvestre*	Leaves	Gymnemoside A,B,C,D,E,F, quercitol, lupeol, gymnemic acid	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, inhibits glucose absorption in the small intestine	[149,257,315,336]
61.	*Harungana madagascariensis*	Leaves	Harunganin, lupeol, betulinic acid, quercetin, β-sitosterol	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, decreases insulin resistance, prevents diabetic nephropathy	[16,250,257,262,337,338]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
62.	*Helicteres isora*	Roots	Gallic acid, vanillin, *p*-coumaric acid	Lowers blood glucose levels, increases insulin levels in blood, decreases triglyceride levels, reduces serum advanced glycation end products concentration, improves glucose tolerance	[175,304,319,339]
63.	*Heritiera fomes*	Bark	Stigmasterol, β-sitosterol, epicatechin, procyanidins, proanthocyanidins, quercitrin	Decreases blood glucose and glycosylated hemoglobin levels, increases insulin levels, reduces insulin resistance, improves glucose uptake	[26,176,250,340]
64.	*Hibiscus esculentus*	Roots, seeds	Isoquercitrin, quercetin-3-*O*-gentiobioside	Decreases serum glucose levels, increases insulin secretion, improves glucose tolerance	[16,341]
65.	*Hibiscus rosa-sinensis*	Leaves	Quercetin, cyanidin, thiamine, ascorbic acid, niacin	Decreases blood glucose concentration, increases insulin synthesis and secretion, reduces oxidative stress, improves endothelial functions, and reduces complications of type 2 diabetes mellitus	[179,262,342,343]
66.	*Jatropha curcas*	Leaves	Rhoifolin, isoorientin, isoquercitrin	Decreases plasma glucose, cholesterol, and triglyceride levels, stimulates glucose uptake, inhibits DPP-IV activity	[241,306]
67.	*Lantana camara*	Leaves	Lantanoside, ferulic acid, oleanolic acid, caffeic acid	Lowers blood glucose levels, increases insulin secretion, improves glucose utilization, reduces oxidative stress	[255,297,344]
68.	*Linum usitatissimum*	Seeds	Caffeic acid, *p*-coumaric acid, ferulic acid	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, reduces diabetic oxidative stress, enhances antioxidant activity	[297,339,344,345]
69.	*Mangifera indica*	Leaves, seeds	Mangiferin, gallic acid, kaempferol, curcumin	Lowers fasting blood glucose levels, improves glucose tolerance, increases insulin secretion, reduces triglyceride and cholesterol levels, inhibits oxidative stress and diabetic inflammatory processes	[16,256,269,304,317]
70.	*Momordica charantia*	Leaves, seeds	Charantin, vicine, momordicine II, oleanolic acid	Lowers blood glucose levels, stimulates insulin release, inhibits glucose-6-phosphatase and glucose transport in intestines	[22,134,255,336]
71.	*Moringa oleifera*	Leaves	Quercetin, kaempferol, vanillin, chlorogenic acid	Lowers plasma glucose levels, increases insulin secretion, improves glucose tolerance, decreases the concentration of serum advanced glycation end products	[16,22,189,256,319]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
72.	*Murraya koenigii*	Leaves	Mahanimbine, isomahanine, ascorbic acid, kaempferol, quercetin	Lowers blood glucose levels, reduces triglyceride levels, inhibits α-amylase and α-glucosidase activity, increases insulin secretion, improves glucose tolerance	[78,191,346]
73.	*Musa sapientum*	Flowers	Rutin, delphinidin, syringin	Lowers blood glucose levels, increases insulin secretion, reduces reactive oxygen species generation, prevents high glucose-induced cell proliferation	[16,249,347]
74.	*Nigella sativa*	Seeds	Thymoquinone, thymol, α-pinene, oleic acid, linoleic acid	Lowers blood glucose, glycosylated hemoglobin, total cholesterol, and triglyceride levels, promotes insulin secretion, reduces insulin resistance, decreases oxidative stress	[291,348–350]
75.	*Ocimum basicllicum*	Leaves	Linalool, linolen, eugenol, geraniol	Lowers blood glucose levels, improves glucose uptake, inhibits advanced glycation end products generation and α-glucosidase activity	[196,197,310,351]
76.	*Ocimum sanctum*	Leaves	Eugenol, carvacrol, β-sitosterol, linalool	Lowers blood glucose levels, increases insulin secretion, decreases carbohydrate digestion and absorption, inhibits α-glucosidase activity, reduces insulin resistance	[149,248,250,310]
77.	*Olea europaea*	Leaves	Oleuropein, oleanolic acid, luteolin	Maintains blood glucose levels, promotes insulin secretion, improves insulin sensitivity, reduces oxidative stress, inhibits gluconeogenesis	[16,242,255,352]
78.	*Panax ginseng*	Roots	Ginsenoside Rb2, Rg2	Regenerates pancreatic beta cells, increases glucose uptake, reduces insulin resistance, and improves insulin sensitivity	[248,279,353]
79.	*Panda oleosa*	Stem bark	Ginsenoside Rb2, protapananadiol/triol	Increases glucose uptake, reduces insulin resistance, and improves insulin sensitivity	[204,353]
80.	*Phaseolus vulgaris*	Seeds	Hydroxycinnamic acid, rutin, quercetin, orientin, petunidin, catechin	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, improves glucose tolerance, reduces oxidative stress	[16,149,244,249,262]
81.	*Phyllanthus amarus*	Leaves	Oleanolic acid, ursolic acid	Lowers blood glucose levels, increases insulin secretion, improves glucose tolerance, inhibits oxidative stress-induced hepatic insulin resistance, inhibits gluconeogenesis	[16,255,316]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
82.	*Plantago ovata*	Husk	Kaempferol, catechin, myricetin, pinocembrin	Lowers blood glucose levels, increases insulin secretion, reduces insulin resistance, inhibits α-amylase and α-glucosidase activity	[208,244,256,354]
83.	*Pterocarpus marsupium*	Bark	Epicatechin, marsupin, carsupin, marsupol	Lowers blood glucose levels, improves insulin sensitivity, enhances insulin release, improves glucose uptake	[149,246]
84.	*Punica granatum*	Flowers	Gallic acid, rutin, nictoflorin	Lowers blood glucose levels, improves β-cell function, increases insulin secretion, improves glucose tolerance, decreases triglyceride levels	[16,249,304]
85.	*Rehmannia glutinosa*	Roots	Catalpol, rehmannioside	Lowers blood glucose levels, prevents diabetic complications, promotes glucose utilization and glycogen synthesis, reduces oxidative stress	[214,279]
86.	*Santalum album*	Bark	Spirosantalol, α-santalene, α-santalol, β-santalol, α-bergamotol	Lowers blood glucose and glycosylated hemoglobin levels, decreases total cholesterol and triglyceride levels	[355]
87.	*Selaginella bryopteris*	Leaves	Gallic acid, rutin	Decreases plasma glucose and glycosylated hemoglobin levels, improves glucose tolerance, decreases triglyceride levels, inhibits inflammatory cytokines	[249,304,356]
88.	*Sesamum indicum*	Seeds	Pinoresinol, sesamin, sesaminol	Lowers fasting blood glucose and glycosylated hemoglobin levels, inhibits α-glucosidase activity	[16,357,358]
89.	*Solanum nigrum*	Leaves	Gallic acid, catechin, epicatechin, rutin, naringenin	Lowers blood glucose levels, improves β-cell function and glucose tolerance, increases insulin secretion, reduces insulin resistance, inhibits α-amylase and α-glucosidase activity	[220,244,246,249,304,313]
90.	*Spirulina platensis*	Whole plant	*p*-coumaric acid, catechin, β-carotene	Lowers blood glucose levels, increases insulin levels, reduces insulin resistance, inhibits α-amylase and α-glucosidase activity, reduces oxidative stress and pro-inflammatory biomarkers	[222,244,300,339]
91.	*Swertia chirayita*	Bark, leaves	Swerchirin, mangiferin, swertiamarin, amarogentin	Lowers blood glucose levels, promotes insulin release, inhibits glucosidase and glucuronidase activity	[30,268,269,336]

Table 2. *Cont.*

	Medicinal Plants	Parts	Phytoconstituents	Pharmacological Effects	References
92.	*Tamarindus indica*	Seeds	Apigenin, naringenin, catechin, epictaechin, taxifolin	Lowers blood glucose levels, increases insulin secretion, inhibits α-amylase and α-glucosidase activity, improves glucose tolerance, increases insulin sensitivity	[244,246,313,359]
93.	*Terminalia arjuna*	Bark	Arjungenin, arjunolone, ellagic acid, derivatives of arjunic acid	Lowers blood glucose levels, increases insulin sensitivity, decreases free radical damage	[29,360]
94.	*Terminalia chebula*	Fruit	Chebulagic acid, gallic acid, ellagic acid, tannic acid	Lowers blood glucose levels, improve glucose tolerance and lipid metabolism, stimulates glucose transport, decreases triglyceride levels	[245,304,360–362]
95.	*Tinospora cordifolia*	Leaves, roots, stem	Tinosporaside, berberine, syringin	Lowers plasma glucose levels, stimulates insulin synthesis and secretion, decreases triglyceride levels, improves insulin sensitivity, inhibits gluconeogenesis	[149,282,363]
96.	*Trigonella foenum-graecum*	Seeds	Galactomannan, diosgenin, coumarin	Decreases blood glucose levels, stimulates insulin release, inhibits α-glucosidase and aldose reductase activity, increases insulin sensitivity	[16,302,364,365]
97.	*Urtica dioica*	Leaves	Quercetin, quercitrin, rutin	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, reduces insulin resistance, improves antioxidant activity	[16,249,262,295]
98.	*Vernonia amygdalina*	Leaves	Sobrerol, vernoamyoside E, luteolin, vitamin E	Lowers blood glucose and glycosylated hemoglobin levels, increases insulin secretion, enhances insulin sensitivity, reduces oxidative stress	[16,235,242,366,367]
99.	*Withania coagulans*	Fruit	Withanolides, withacoagulin, withanosides, withaferin A	Lowers blood glucose levels, exhibits free radical scavenging activity, inhibits DPP-IV activity	[368,369]
100.	*Zingiber officinale*	Rhizome	Gingerol, 6-paradol, 6-shogaol, camphene	Lowers blood glucose levels, increases insulin levels, improves glucose tolerance and utilization, decreases cholesterol levels	[16,253,254,293]

Table 3. Antidiabetic phytoconstituents of medicinal plants and their chemical structures.

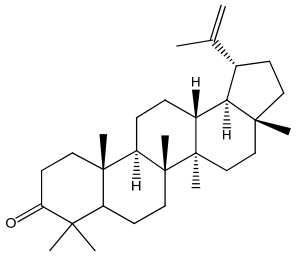
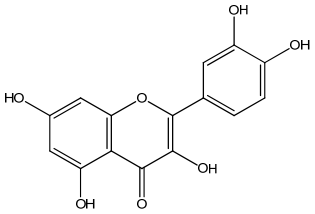
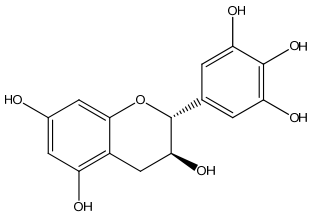
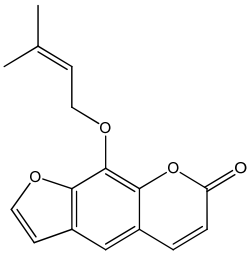
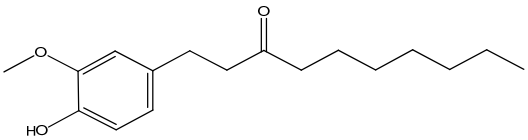
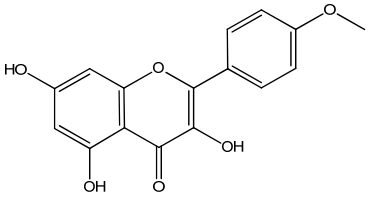
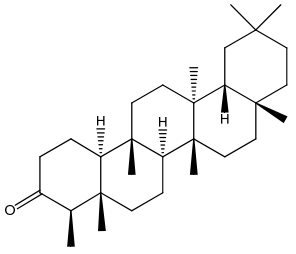
	Medicinal Plants	Phytoconstituents	Chemical Structure
1.	*Abrus precatorius*	Lupenone	
2.	*Acacia arabica*	Quercetin	
3.	*Acacia catechu*	Gallocatechin	
4.	*Aegle marmelos*	Marmelosin	
5.	*Aframomum melegueta*	6-paradol	
6.	*Ageratum conyzoides*	Kaempferol	
7.	*Albizia lebbeck*	Friedelin	

Table 3. *Cont.*

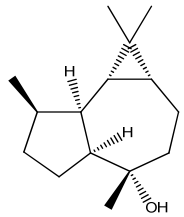
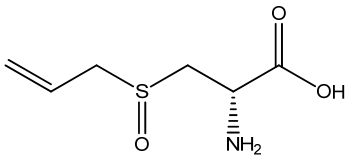
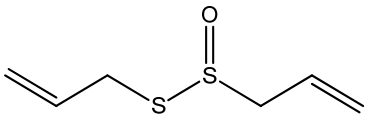
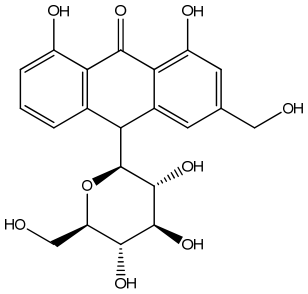
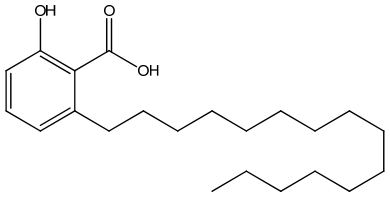
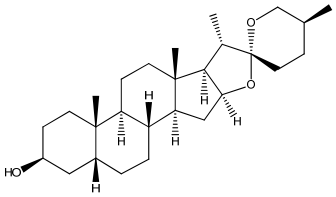
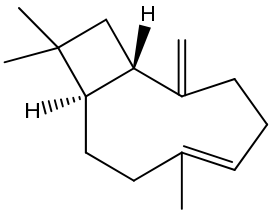
	Medicinal Plants	Phytoconstituents	Chemical Structure
8.	*Albizia adianthifolia*	Viridiflorol	
9.	*Allium cepa*	Alliin	
10.	*Allium sativum*	Allicin	
11.	*Aloe vera*	Aloin	
12.	*Anacradium occidentale*	Anacardic acid	
13.	*Anemarrhena asphodeloides*	Sarsasapogenin	
14.	*Annona salzmannii*	β-caryophyllene	

Table 3. *Cont.*

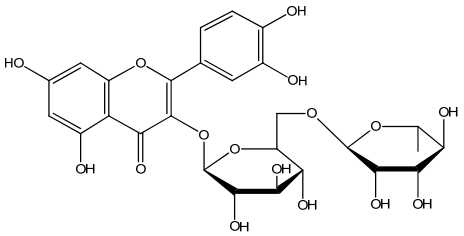
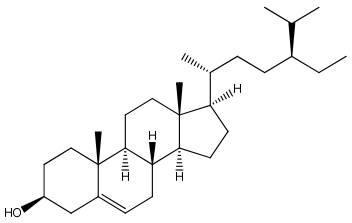
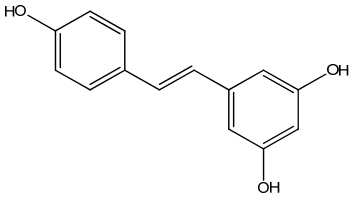
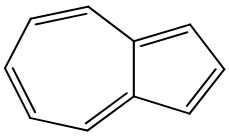
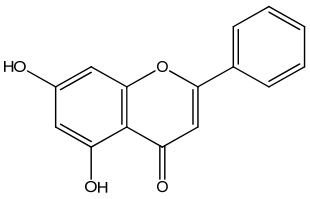
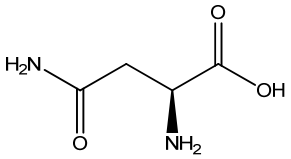
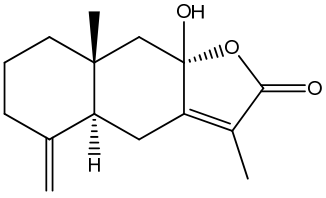
	Medicinal Plants	Phytoconstituents	Chemical Structure
15.	*Annona squamosa*	Rutin	
16.	*Anogeissus latifolia*	β-sitosterol	
17.	*Arachis hypogaea*	Resveratrol	
18.	*Artemisia absinthium*	Azulene	
19.	*Artocarpus heterophyllus*	Chrysin	
20.	*Asparagus racemosus*	Asparagine	
21.	*Atractylodes japonica*	Atractylenolide III	

Table 3. *Cont.*

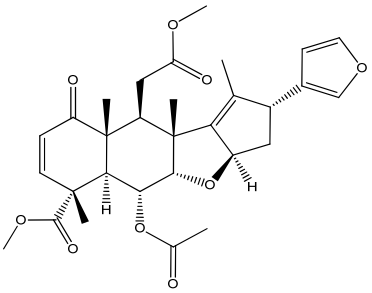
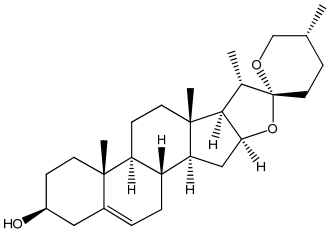
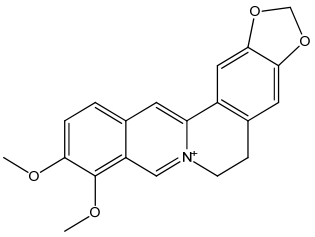
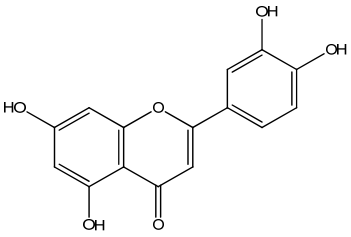
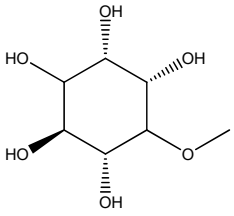
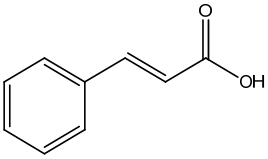
	Medicinal Plants	Phytoconstituents	Chemical Structure
22.	*Azadirachta indica*	Nimbin	
23.	*Balanites aegyptiaca*	Diosgenin	
24.	*Berberis vulgaris*	Berberine	
25.	*Bidens pilosa*	Luteolin	
26.	*Bougainvillea spectabilis*	Pinitol	
27.	*Brassica juncea*	Cinnamic acid	

Table 3. *Cont.*

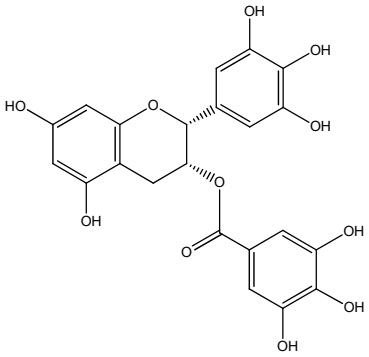
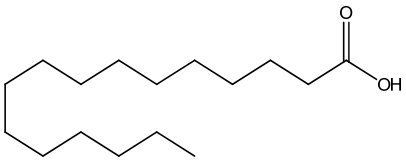
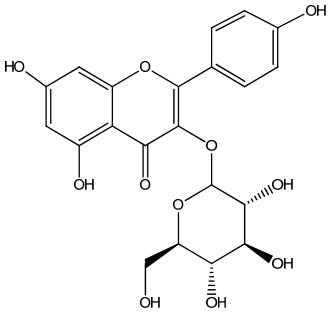
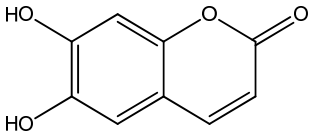
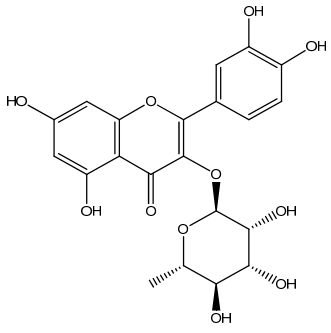
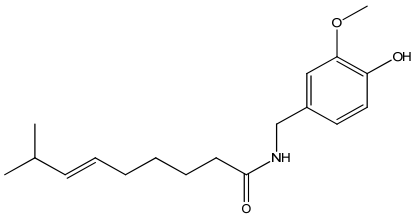
	Medicinal Plants	Phytoconstituents	Chemical Structure
28.	*Bridelia ferruginea*	Epigallocatechin gallate	
29.	*Bunium persicum*	Palmitic acid	
30.	*Caesalpinia decapetala*	Astragalin	
31.	*Calendula officinalis*	Esculetin	
32.	*Camellia sinensis*	Quercitrin	
33.	*Capsicum frutescens*	Capsaicin	

Table 3. *Cont.*

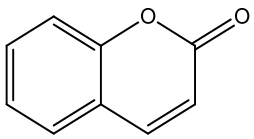
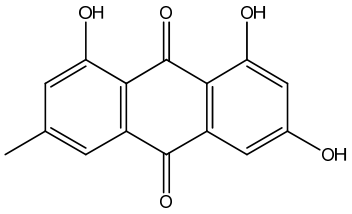
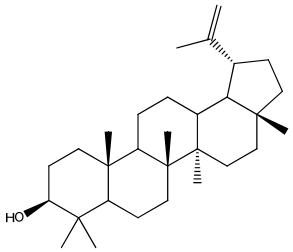
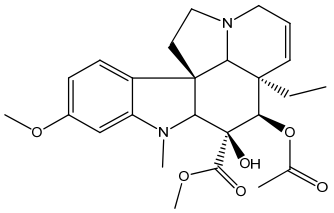
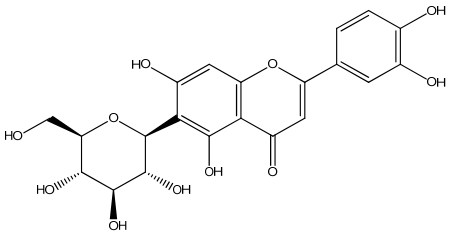
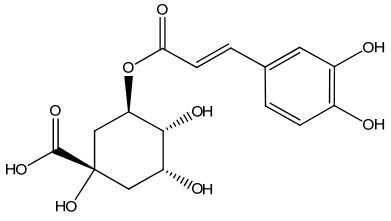
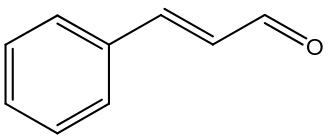
	Medicinal Plants	Phytoconstituents	Chemical Structure
34.	*Carica papaya*	Coumarin	
35.	*Cassia alata*	Emodin	
36.	*Cassia fistula*	Lupeol	
37.	*Catharanthus roseus*	Vindoline	
38.	*Cecropia obtusifolia*	Isoorientin	
39.	*Cichorium intybus*	Chlorogenic acid	
40.	*Cinnamomum zeylanicum*	Cinnamaldehyde	

Table 3. *Cont.*

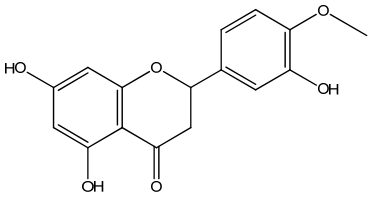
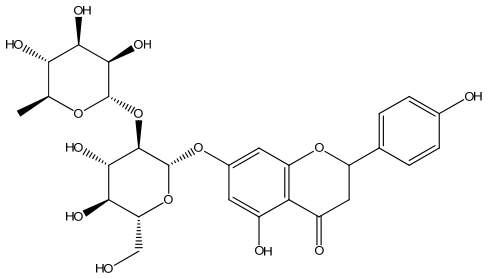
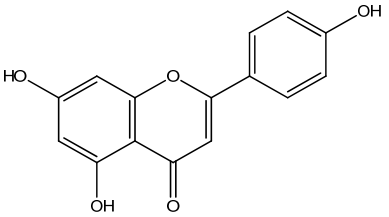
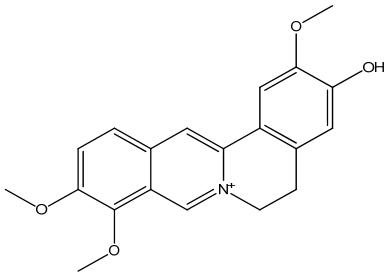
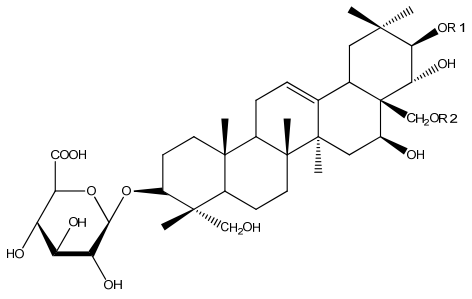
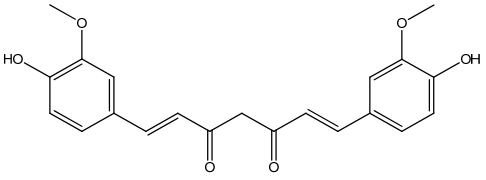
	Medicinal Plants	Phytoconstituents	Chemical Structure
41.	*Citrus limon*	Hesperetin	
42.	*Citrus x aurantium*	Naringin	
43.	*Cola nitida*	Apigenin	
44.	*Coptis chinensis*	Jatrorrhizine	
45.	*Cornus officinalis*	Gymnemic acid	
46.	*Curcuma longa*	Curcumin	

Table 3. *Cont.*

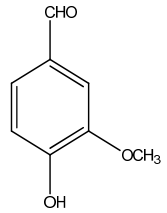
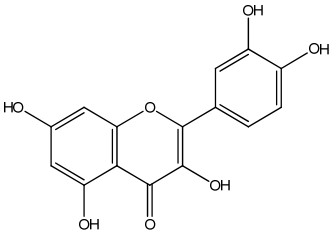
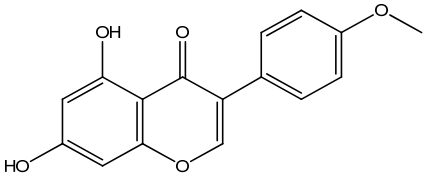
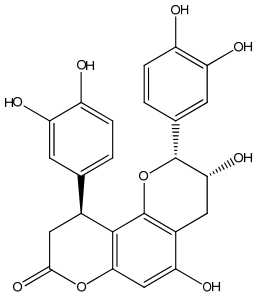
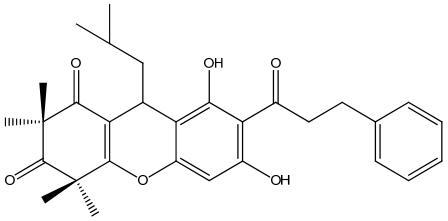
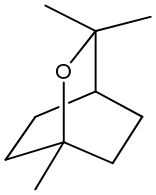
	Medicinal Plants	Phytoconstituents	Chemical Structure
47.	*Cudrania cochinchinensis*	Vanillin	
48.	*Cyamopsis tetragonoloba*	Quercetin	
49.	*Dalbergia sissoo*	Biochanin A	
50.	*Eriobotrya japonica*	Cinchonain ib	
51.	*Eucalyptus citriodora*	Rhodomyrtosone E	
52.	*Eucalyptus globulus*	Eucalyptol	

Table 3. *Cont.*

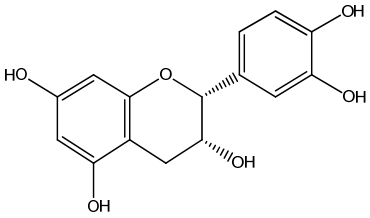
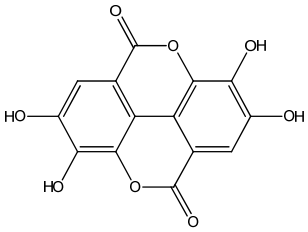
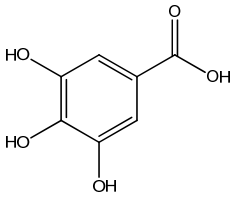
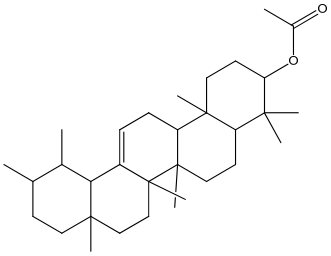
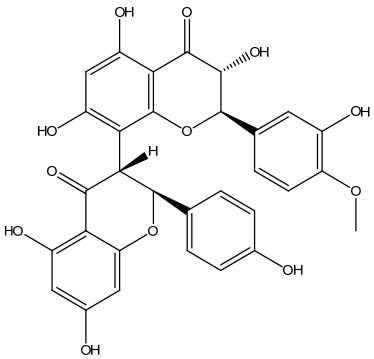
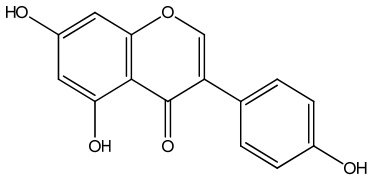
	Medicinal Plants	Phytoconstituents	Chemical Structure
53.	*Euclea undulata*	Epicatechin	
54.	*Eugenia jambolana*	Ellagic acid	
55.	*Euphorbia hirta*	Gallic acid	
56.	*Ficus benghalensis*	α-amyrin acetate	
57.	*Garcinia kola*	Kolaviron	
58.	*Glycine max*	Genistein	

Table 3. *Cont.*

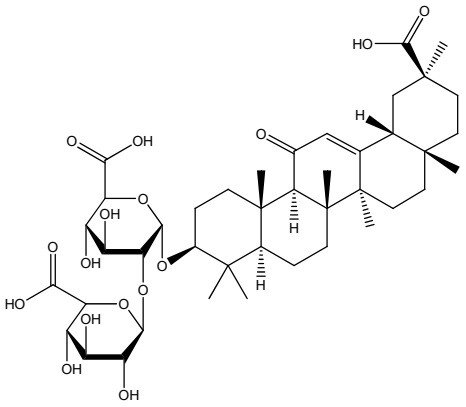
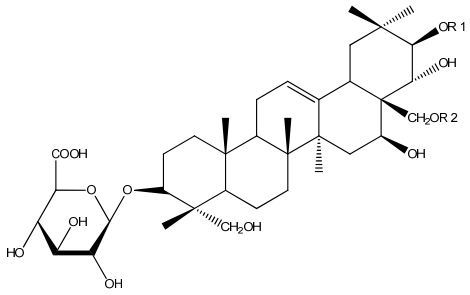
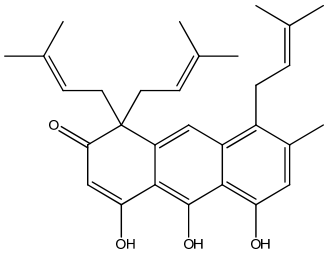
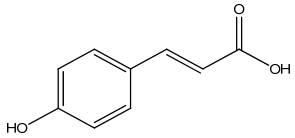
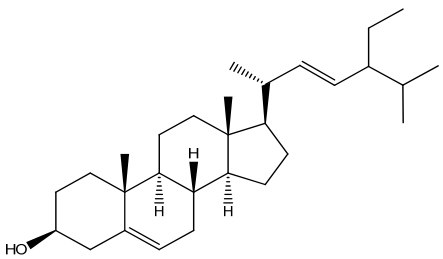
	Medicinal Plants	Phytoconstituents	Chemical Structure
59.	*Glycyrrhiza glabra*	Glycyrrhizin	
60.	*Gymnema sylvestre*	Gymnemic acid	
61.	*Harungana madagascariensis*	Harunganin	
62.	*Helicteres isora*	*p*-coumaric acid	
63.	*Heritiera fomes*	Stigmasterol	

Table 3. *Cont.*

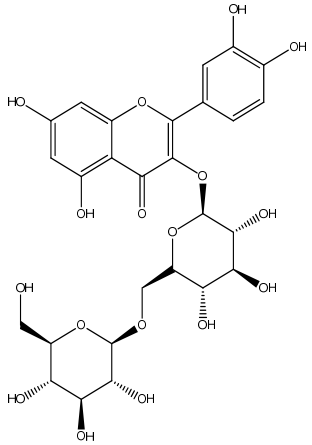
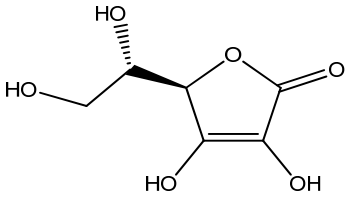
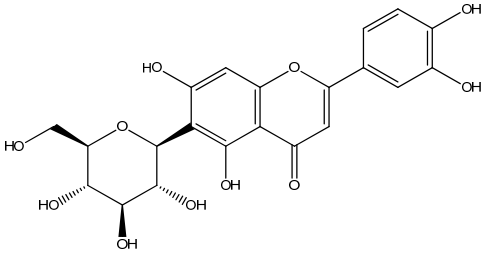
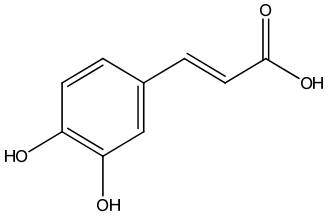
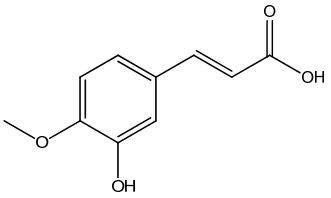
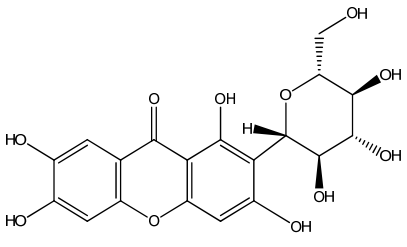
Medicinal Plants	Phytoconstituents	Chemical Structure
64. *Hibiscus esculentus*	Quercetin-3-*O*-gentiobioside	
65. *Hibiscus rosa-sinensis*	Ascorbic acid	
66. *Jatropha curcas*	Isoorientin	
67. *Lantana camara*	Caffeic acid	
68. *Linum usitatissimum*	Ferulic acid	
69. *Mangifera indica*	Mangiferin	

Table 3. *Cont.*

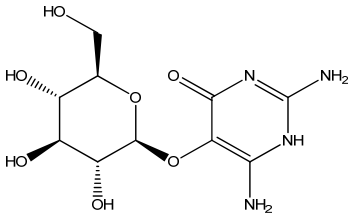
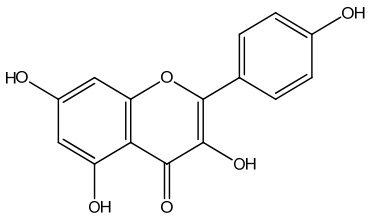
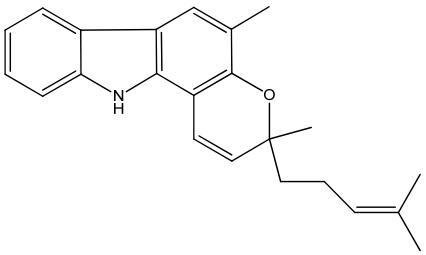
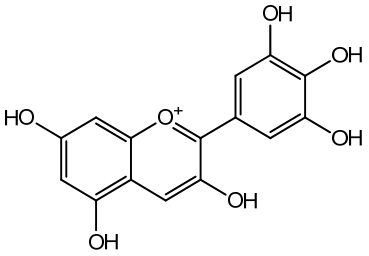
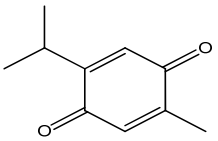
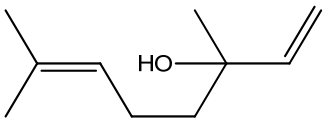
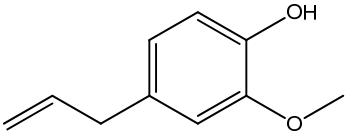
	Medicinal Plants	Phytoconstituents	Chemical Structure
70.	*Momordica charantia*	Vicine	
71.	*Moringa oleifera*	Kaempferol	
72.	*Murraya koenigii*	Mahanimbine	
73.	*Musa sapientum*	Delphinidin	
74.	*Nigella sativa*	Thymoquinone	
75.	*Ocimum basicllicum*	Linalool	
76.	*Ocimum sanctum*	Eugenol	

Table 3. *Cont.*

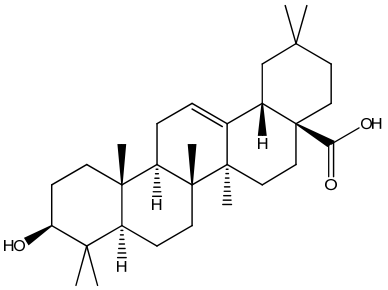
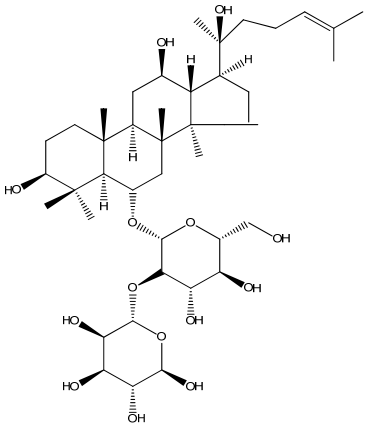
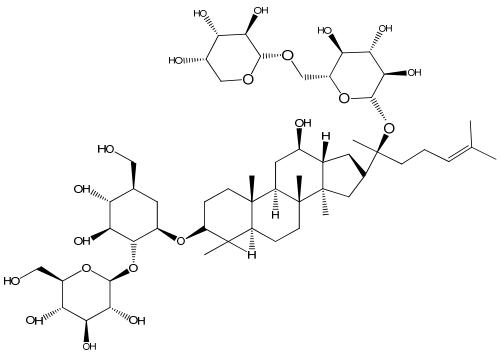
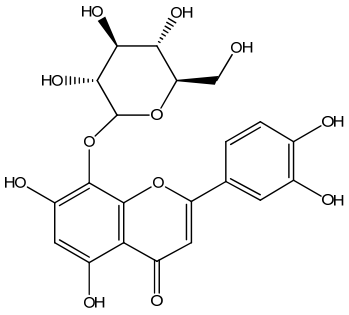
	Medicinal Plants	Phytoconstituents	Chemical Structure
77.	*Olea europaea*	Oleanolic acid	
78.	*Panax ginseng*	Ginsenoside Rg2	
79.	*Panda oleosa*	Ginsenoside Rb2	
80.	*Phaseolus vulgaris*	Orientin	

Table 3. *Cont.*

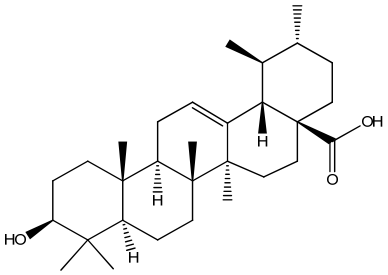
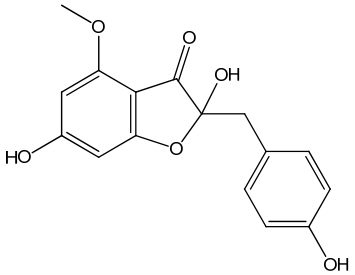
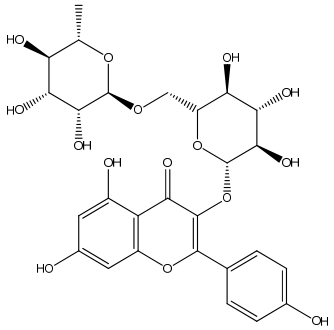
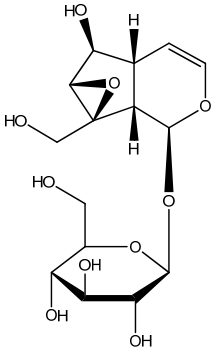
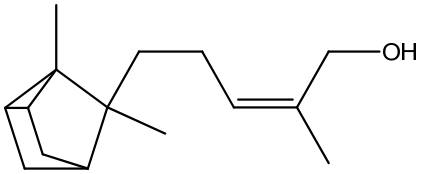
	Medicinal Plants	Phytoconstituents	Chemical Structure
81.	*Phyllanthus amarus*	Ursolic acid	
83.	*Pterocarpus marsupium*	Marsupin	
84.	*Punica granatum*	Nictoflorin	
85.	*Rehmannia glutinosa*	Catalpol	
86.	*Santalum album*	β-santalol	

Table 3. *Cont.*

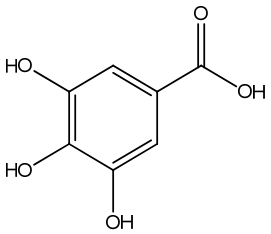
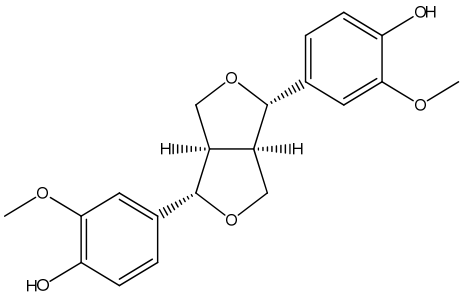
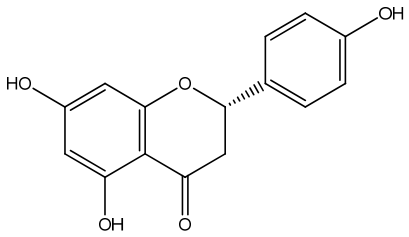
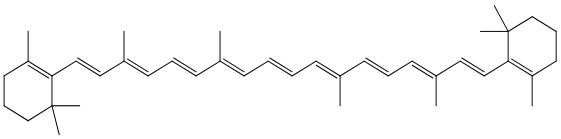
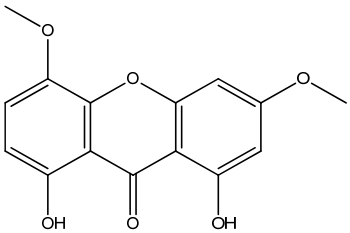
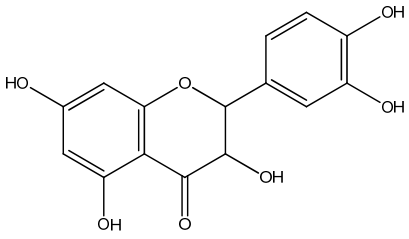
	Medicinal Plants	Phytoconstituents	Chemical Structure
87.	*Selaginella bryopteris*	Gallic acid	
88.	*Sesamum indicum*	Pinoresinol	
89.	*Solanum nigrum*	Naringenin	
90.	*Spirulina platensis*	β-carotene	
91.	*Swertia chirayita*	Swerchirin	
92.	*Tamarindus indica*	Taxifolin	

Table 3. *Cont.*

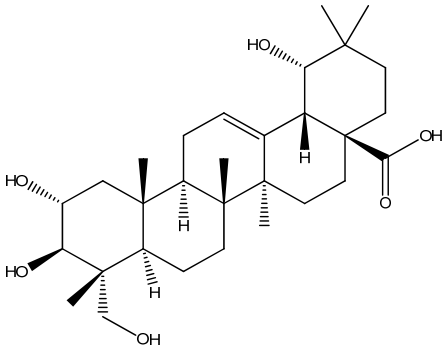
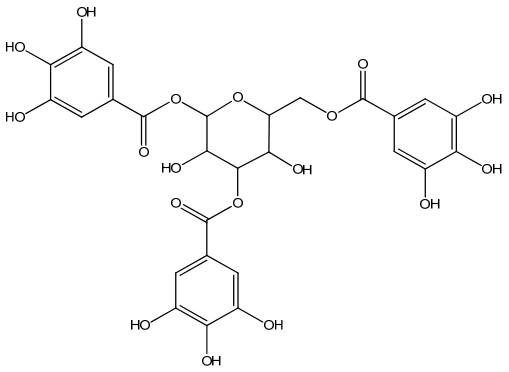
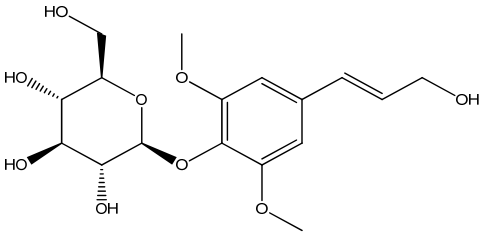
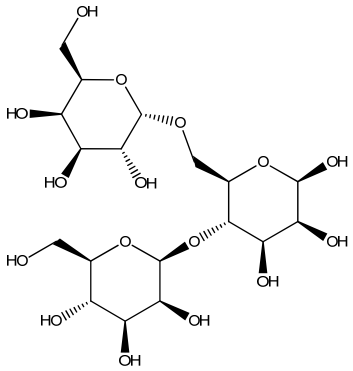
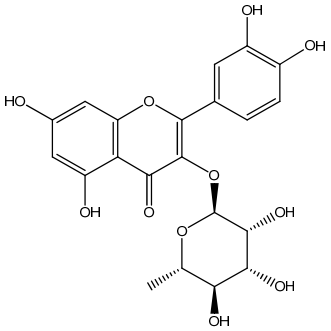
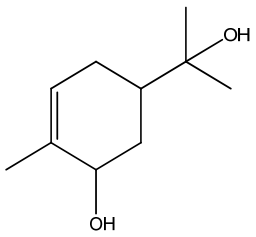
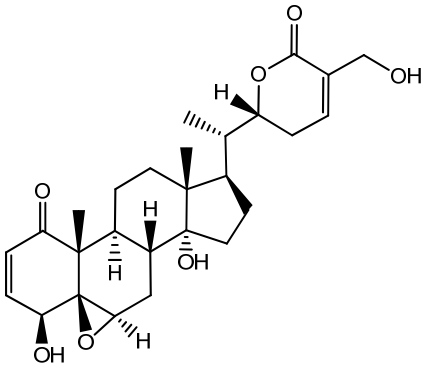
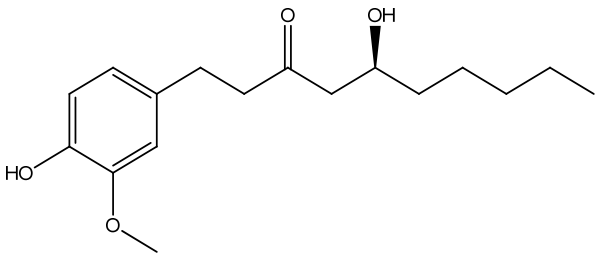
Medicinal Plants	Phytoconstituents	Chemical Structure
93. *Terminalia arjuna*	Arjungenin	
94. *Terminalia chebula*	Tannic acid	
95. *Tinospora cordifolia*	Syringin	
96. *Trigonella foenum-graecum*	Galactomannan	

Table 3. *Cont.*

Medicinal Plants	Phytoconstituents	Chemical Structure
97. *Urtica dioica*	Quercitrin	
98. *Vernonia amygdalina*	Sobrerol	
99. *Withania coagulans*	Withaferin A	
100. *Zingiber officinale*	Gingerol	

7. Plant-Based Drug Formulations Available on the Market and Their Role in Diabetes

For the past few decades, there has been an increasingly growing trend in many European countries to develop and sell plant-based medicines [370]. The latter are known as herbal formulations or phytomedicines. These preparations have been standardized and confirmed for their safety profile and effectiveness in the treatment of various diseases. Similar to any other allopathic medicine, herbal formulations can also be prepared as diverse formulations such as tablets, capsules, elixirs, suspensions, solutions, emulsions, and powders [371]. Phytomedicines can either be single herb- or polyherbal formulations [35]. Several phytomedicines have been marketed worldwide for the control and management of diabetes. These include Antibetic, Diabetics, Diabetica, Diabet, Diasol, Diabecon, Diasulin, Dia-Care, Diabecure, Diabeta, Diabeta Plus, Dianex, Diashis, GlucoCare, GlycoNase,

Glyoherb, Karmin Plus, SugarMax, and Sugar Loss [35,372]. These products comprise a combination of individual constituents from several antidiabetic plants. Many of these preparations are sold with directions about diet, rest, and physical activities to enhance their effectiveness [35,372].

8. The Future of Plant-Based Antidiabetic Medicines

Nearly 75% of the globally used herbal medicines have been developed based on traditional medicine practitioners [24]. Medicinal plants will continue to be used for their natural safety and potency in many remedies, as well as cosmetics, perfumes, and in the food and beverages industry [373]. Biologically active components derived from traditional medicinal plants have yielded several clinically used drugs and still play a key role in the discovery of new medicines. Thus, it is reasonable to assume that plants used in folk medicine can be used as a potential source for the discovery of new drugs to treat diabetes. The most frequently recommended synthetic drug, metformin, has blood glucose-lowering properties in Type 2 diabetes and the search for many such drugs persists [370]. Moreover, any plant-derived antidiabetic drug with a novel mode of action compared to existing antidiabetic agents has a high potential to be used in clinics [374]. Although the use of plant-based medicines is widespread in developing countries, recently, developed countries have also shown interest in using herbal drugs and therapies. With the rise in the incidence of diabetes mellitus, the demand for plant-based antidiabetic medicines is increasing worldwide. It is expected that countries such as China, India, and Japan, which have an abundance of medicinal plant species and are the greatest exporters of medicinal plants worldwide, will be the most sought [375]. More studies are required regarding the pharmacokinetics/pharmacodynamics of different phytoconstituents in laboratory animals and in clinical use to establish the benefits and mode(s) of action of these compounds in the treatment and management of diabetes. Extensive investigations into the pharmacology, toxicology, metabolism, and tissue distribution of medicinal plants and their phytomolecules are necessary for the development of new potent antidiabetic drugs [376].

9. Conclusions

Diabetes mellitus has risen as a major public health crisis, particularly in underdeveloped countries. Thus, recent research efforts have been centered on the discovery of new natural sources of antidiabetic therapies for the treatment and management of diabetes. As traditional medicinal plants with antidiabetic activity may be considered potential candidates for diabetes management in the long run, they are being extensively researched for novel targets, mechanisms of action, and routes of administration. Plant-based antidiabetic medicines are inexpensive, readily available, and hold low risks of side effects. This makes them promising new antidiabetic agents. With the progression of medicinal plant-based research, scientists and physicians have started to develop newer classes of antidiabetic drugs based on the pharmacology of the phytochemicals isolated from these plants. However, more studies are required for in-depth investigation of these newly discovered antidiabetic drugs at the molecular, therapeutic, and physiological levels in order to control and manage diabetes mellitus worldwide.

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Abbreviations

AMPK	5′ adenosine monophosphate-activated protein kinase
cAMP	cyclic Adenosine monophosphate
DPP-IV	Dipeptidyl peptidase-4
G6Pase	Glucose-6-phosphatase
GLP-1	Glucagon-like peptide-1
GLUT-2	Glucose transporter-2
GLUT-4	Glucose transporter-4
HbA1c	Hemoglobin A1c
IDF	International Diabetes Federation
K_{ATP}	Adenosine triphosphate-sensitive potassium channel
PEPCK	Phosphoenolpyruvate carboxykinase
PI3K/AKT	Phosphoinositide 3-kinase/protein kinase B
PKA	Protein kinase A
PPAR-γ	Peroxisome proliferator-activated receptor-γ
SGLT	Sodium–glucose linked transporter

References

1. Bastaki, S. Diabetes mellitus and its treatment. *Int. J. Diabetes Metab.* **2005**, *13*, 111–134. [CrossRef]
2. Sun, H.; Saeedi, P.; Karuranga, S.; Pinkepank, M.; Ogurtsova, K.; Duncan, B.B.; Stein, C.; Basit, A.; Chan, J.C.; Mbanya, J.C. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res. Clin. Pract.* **2022**, *183*, 109119. [CrossRef] [PubMed]
3. Katsarou, A.; Gudbjörnsdottir, S.; Rawshani, A.; Dabelea, D.; Bonifacio, E.; Anderson, B.J.; Jacobsen, L.M.; Schatz, D.A.; Lernmark, Å. Type 1 diabetes mellitus. *Nat. Rev. Dis. Primers* **2017**, *3*, 17016. [CrossRef] [PubMed]
4. Ohlson, L.-O.; Larsson, B.; Björntorp, P.; Eriksson, H.; Svärdsudd, K.; Welin, L.; Tibblin, G.; Wilhelmsen, L. Risk factors for type 2 (non-insulin-dependent) diabetes mellitus. Thirteen and one-half years of follow-up of the participants in a study of Swedish men born in 1913. *Diabetologia* **1988**, *31*, 798–805. [CrossRef]
5. DeFronzo, R.A.; Ferrannini, E.; Groop, L.; Henry, R.R.; Herman, W.H.; Holst, J.J.; Hu, F.B.; Kahn, C.R.; Raz, I.; Shulman, G.I. Type 2 diabetes mellitus. *Nat. Rev. Dis. Primers* **2015**, *1*, 15019. [CrossRef] [PubMed]
6. Hall, J.E.; Guyton, A.C. Insulin, Glucagon, and Diabetes Mellitus. In *Guyton and Hall Textbook of Medical Physiology*, 13th ed.; Elsevier: Philadelphia, PA, USA, 2017; pp. 983–999.
7. Nowakowska, M.; Zghebi, S.S.; Ashcroft, D.M.; Buchan, I.; Chew-Graham, C.; Holt, T.; Mallen, C.; Van Marwijk, H.; Peek, N.; Perera-Salazar, R. The comorbidity burden of type 2 diabetes mellitus: Patterns, clusters and predictions from a large English primary care cohort. *BMC Med.* **2019**, *17*, 145. [CrossRef] [PubMed]
8. Nathan, D.M. Long-term complications of diabetes mellitus. *N. Engl. J. Med.* **1993**, *328*, 1676–1685. [CrossRef]
9. Ansari, P.; Hannan, J.M.A.; Azam, S.; Jakaria, M. Challenges in Diabetic Micro-Complication Management: Focus on Diabetic Neuropathy. *Int. J. Transl. Med.* **2021**, *1*, 175–186. [CrossRef]
10. Ansari, P.; Flatt, P.R.; Harriott, P.; Abdel-Wahab, Y.H.A. Evaluation of the antidiabetic and Insulin Releasing Effects of *A. squamosa*, Including Isolation and Characterization of Active Phytochemicals. *Plants* **2020**, *9*, 1348. [CrossRef]
11. Patel, D.; Prasad, S.K.; Kumar, R.; Hemalatha, S. An overview on antidiabetic medicinal plants having insulin mimetic property. *Asian Pac. J. Trop. Biomed.* **2012**, *2*, 320–330. [CrossRef]
12. Gaonkar, V.P.; Hullatti, K. Indian Traditional medicinal plants as a source of potent Anti-diabetic agents: A Review. *J. Diabetes Metab. Disord.* **2020**, *19*, 1895–1908. [CrossRef] [PubMed]
13. Oh, Y.S. Plant-derived compounds targeting pancreatic beta cells for the treatment of diabetes. *Evid.-Based Complementary Altern. Med.* **2015**, *2015*, 629863. [CrossRef] [PubMed]
14. Jeeva, S.; Anlin Sheebha, Y. A review of antidiabetic potential of ethnomedicinal plants. *Med. Aromat. Plants* **2014**, *3*, 1–8.
15. Arumugam, G.; Manjula, P.; Paari, N. A review: Anti diabetic medicinal plants used for diabetes mellitus. *J. Acute Dis.* **2013**, *2*, 196–200. [CrossRef]
16. Kasali, F.M.; Kadima, J.N.; Peter, E.L.; Mtewa, A.G.; Ajayi, C.O.; Tusiimire, J.; Tolo, C.U.; Ogwang, P.E.; Weisheit, A.; Agaba, A.G. Antidiabetic Medicinal Plants Used in Democratic Republic of Congo: A Critical Review of Ethnopharmacology and Bioactivity Data. *Front. Pharmacol.* **2021**, *12*, 757090. [CrossRef]
17. Dar, R.A.; Shahnawaz, M.; Qazi, P.H. General overview of medicinal plants: A review. *J. Phytopharm.* **2017**, *6*, 349–351. [CrossRef]

18. Moradi, B.; Abbaszadeh, S.; Shahsavari, S.; Alizadeh, M.; Beyranvand, F. The most useful medicinal herbs to treat diabetes. *Biomed. Res. Ther.* **2018**, *5*, 2538–2551. [CrossRef]
19. Rizvi, S.I.; Mishra, N. Traditional Indian medicines used for the management of diabetes mellitus. *J. Diabetes Res.* **2013**, *2013*, 712092. [CrossRef]
20. Oyagbemi, A.; Salihu, M.; Oguntibeju, O.; Esterhuyse, A.; Farombi, E. Some selected medicinal plants with antidiabetic potentials. Antioxidant, Antidiabetic agents and Human Health. In *Antioxidant-Antidiabetic Agents and Human Health*; Intech: London, UK, 2014; Volume 4, pp. 95–113.
21. Kooti, W.; Farokhipour, M.; Asadzadeh, Z.; Ashtary-Larky, D.; Asadi-Samani, M. The role of medicinal plants in the treatment of diabetes: A systematic review. *Electron. Physician* **2016**, *8*, 1832–1842. [CrossRef]
22. Alam, S.; Sarker, M.M.R.; Sultana, T.N.; Chowdhury, M.N.R.; Rashid, M.A.; Chaity, N.I.; Zhao, C.; Xiao, J.; Hafez, E.E.; Khan, S.A. Antidiabetic Phytochemicals from Medicinal Plants: Prospective Candidates for New Drug Discovery and Development. *Front. Endocrinol.* **2022**, *13*, 800714. [CrossRef]
23. Rafe, M.R. A review of five traditionally used anti-diabetic plants of Bangladesh and their pharmacological activities. *Asian Pac. J. Trop. Med.* **2017**, *10*, 933–939. [CrossRef] [PubMed]
24. Ansari, P.; Flatt, P.R.; Harriott, P.; Hannan, J.M.A.; Abdel-Wahab, Y.H.A. Identification of Multiple Pancreatic and Extra-Pancreatic Pathways Underlying the Glucose-Lowering Actions of *Acacia arabica* Bark in Type-2 Diabetes and Isolation of Active Phytoconstituents. *Plants* **2021**, *10*, 1190. [CrossRef] [PubMed]
25. Wanjohi, B.K.; Sudoi, V.; Njenga, E.W.; Kipkore, W.K. An ethnobotanical study of traditional knowledge and uses of medicinal wild plants among the Marakwet Community in Kenya. *Evid.-Based Complementary Altern. Med.* **2020**, *2020*, 3208634. [CrossRef] [PubMed]
26. Ansari, P.; Azam, S.; Seidel, V.; Abdel-Wahab, Y.H.A. In vitro and in vivo antihyperglycemic activity of the ethanol extract of *Heritiera fomes* bark and characterization of pharmacologically active phytomolecules. *J. Pharm. Pharmacol.* **2022**, *74*, 415–425. [CrossRef]
27. Vedavathy, S. Scope and importance of traditional medicine. *Indian J. Tradit. Knowl.* **2003**, *2*, 236–239.
28. Ghosh, A. Herbal folk remedies of Bankura and Medinipur districts, West Bengal. *Indian J. Tradit. Knowl.* **2003**, *2*, 393–396.
29. Morshed, M.A.; Haque, A.; Rokeya, B.; Ali, L. Anti-hyperglycemic and lipid lowering effect of *Terminalia arjuna* Bark extract on Streptozotocin induced Type-2 Diabetic Model Rats. *Int. J. Pharm. Pharm. Sci.* **2011**, *3*, 450–454.
30. Dey, P.; Singh, J.; Suluvoy, J.K.; Dilip, K.J.; Nayak, J. Utilization of *Swertia chirayita* Plant Extracts for Management of Diabetes and Associated Disorders: Present Status, Future Prospects and Limitations. *Nat. Prod. Bioprospecting* **2020**, *10*, 431–443. [CrossRef]
31. Vaidya, A.; Vaidya, R.A. Ancient Insights and Modern Discoveries in the Process of Aging-An Overview. *Indian J. Med. Sci.* **1997**, *51*, 349–363.
32. Soren, A.D.; Soren, P.; Jamir, W. Traditional Herbal Medicines—How safe are they? In *PARISAR (The Scope)*; Sonowal, A., Ed.; Purbayon Publication: Assam, India, 2020; pp. 132–138.
33. Salehi, B.; Ata, A.; V Anil Kumar, N.; Sharopov, F.; Ramírez-Alarcón, K.; Ruiz-Ortega, A.; Abdulmajid Ayatollahi, S.; Valere Tsouh Fokou, P.; Kobarfard, F.; Amiruddin Zakaria, Z. Antidiabetic potential of medicinal plants and their active components. *Biomolecules* **2019**, *9*, 551. [CrossRef]
34. Coulter-Parkhill, A.; McClean, S.; Gault, V.A.; Irwin, N. Therapeutic Potential of Peptides Derived from Animal Venoms: Current Views and Emerging Drugs for Diabetes. *Clin. Med. Insights: Endocrinol. Diabetes* **2021**, *14*, 117955142110060. [CrossRef]
35. Kaur, M.; Valecha, V. Diabetes and antidiabetic herbal formulations: An alternative to Allopathy. *Eur. J. Med.* **2014**, *6*, 226–240. [CrossRef]
36. Vlachogianni, T.; Loridas, S.; Fiotakis, K.; Valavanidis, A. From the Traditional Medicine to the Modern Era of Synthetic Pharmaceuticals. *Pharmakeftiki* **2014**, *26*, 16–30.
37. Fogelman, Y.; Kitai, E.; Blumberg, G.; Golan-Cohen, A.; Rapoport, M.; Carmeli, E. Vitamin B12 screening in metformin-treated diabetics in primary care: Were elderly patients less likely to be tested? *Aging Clin. Exp. Res.* **2017**, *29*, 135–139. [CrossRef] [PubMed]
38. Chaudhury, A.; Duvoor, C.; Reddy Dendi, V.S.; Kraleti, S.; Chada, A.; Ravilla, R.; Marco, A.; Shekhawat, N.S.; Montales, M.T.; Kuriakose, K. Clinical review of antidiabetic drugs: Implications for type 2 diabetes mellitus management. *Front. Endocrinol.* **2017**, *8*, 6. [CrossRef]
39. Balekari, U.; Veeresham, C. Insulinotropic agents from medicinal plants. *J. Pharm. Sci. Emerg. Drugs* **2013**, *1*, 2. [CrossRef]
40. Walji, R.; Boon, H.; Barnes, J.; Austin, Z.; Baker, G.R.; Welsh, S. Adverse event reporting for herbal medicines: A result of market forces. *Healthc. Policy* **2009**, *4*, 77. [CrossRef]
41. Bachtel, N.; Israni-Winger, K. Focus: Plant-based Medicine and Pharmacology: Introduction. *Yale J. Biol. Med.* **2020**, *93*, 227.
42. Subramoniam, A. Present scenario, challenges and future perspectives in plant based medicine development. *Ann. Phytomed.* **2014**, *3*, 31–36.
43. Gu, J.; Chen, L.; Yuan, G.; Xu, X. A drug-target network-based approach to evaluate the efficacy of medicinal plants for type II diabetes mellitus. *Evid.-Based Complementary Altern. Med.* **2013**, *2013*, 203614. [CrossRef]
44. Seino, S. Cell signalling in insulin secretion: The molecular targets of ATP, cAMP and sulfonylurea. *Diabetologia* **2012**, *55*, 2096–2108. [CrossRef] [PubMed]

45. Świderska, E.; Strycharz, J.; Wróblewski, A.; Szemraj, J.; Drzewoski, J.; Śliwińska, A. Role of PI3K/AKT pathway in insulin-mediated glucose uptake. In *Blood Glucose Levels*; Szablewski, L., Ed.; IntechOpen: London, UK, 2018; Volume 1, pp. 1–18.
46. Dutta, D.; Kalra, S.; Sharma, M. Adenosine monophosphate-activated protein kinase-based classification of diabetes pharmacotherapy. *J. Postgrad. Med.* **2017**, *63*, 114–121. [CrossRef] [PubMed]
47. Habegger, K.M.; Hoffman, N.J.; Ridenour, C.M.; Brozinick, J.T.; Elmendorf, J.S. AMPK enhances insulin-stimulated GLUT4 regulation via lowering membrane cholesterol. *Endocrinology* **2012**, *153*, 2130–2141. [CrossRef] [PubMed]
48. Cai, Q.; Li, B.; Yu, F.; Lu, W.; Zhang, Z.; Yin, M.; Gao, H. Investigation of the protective effects of phlorizin on diabetic cardiomyopathy in db/db mice by quantitative proteomics. *J. Diabetes Res.* **2013**, *2013*, 263845. [CrossRef] [PubMed]
49. Hosseini, A.; Shafiee-Nick, R.; Ghorbani, A. Pancreatic beta cell protection/regeneration with phytotherapy. *Braz. J. Pharm. Sci.* **2015**, *51*, 1–16. [CrossRef]
50. Oyedemi, S.O.; Oyedemi, B.O.; Ijeh, I.I.; Ohanyerem, P.E.; Coopoosamy, R.M.; Aiyegoro, O.A. Alpha-amylase inhibition and antioxidative capacity of some antidiabetic plants used by the traditional healers in Southeastern Nigeria. *Sci. World J.* **2017**, *2017*, 3592491. [CrossRef] [PubMed]
51. Ansari, P.; Flatt, P.R.; Harriott, P.; Abdel-Wahab, Y.H.A. Insulin secretory and antidiabetic actions of *Heritiera fomes* bark together with isolation of active phytomolecules. *PLoS ONE* **2022**, *17*, e0264632. [CrossRef]
52. Kaushal, S.; Dev, D.; Prasad, D.; Sharma, R.; Hira, S. Antidiabetic Potential of Herbal Plants. *J. Drug Deliv. Ther.* **2019**, *9*, 1085–1093. [CrossRef]
53. Garaniya, N.; Bapodra, A. Ethno botanical and Phytophrmacological potential of *Abrus precatorius* L.: A review. *Asian Pac. J. Trop. Biomed.* **2014**, *4*, S27–S34. [CrossRef]
54. Boye, A.; Barku, V.Y.A.; Acheampong, D.O.; Ofori, E.G. *Abrus precatorius* Leaf Extract Reverses Alloxan/Nicotinamide-Induced Diabetes Mellitus in Rats through Hormonal (Insulin, GLP-1, and Glucagon) and Enzymatic (α-Amylase/α-Glucosidase) Modulation. *BioMed Res. Int.* **2021**, *2021*, 9920826. [CrossRef]
55. Rajvaidhya, S.; Nagori, B.; Singh, G.; Dubey, B.; Desai, P.; Jain, S. A review on *Acacia arabica*-an Indian medicinal plant. *Int. J. Pharm. Sci. Res.* **2012**, *3*, 1995–2005.
56. Ansari, P.; Hannon-Fletcher, M.P.; Flatt, P.R.; Abdel-Wahab, Y.H.A. Effects of 22 traditional anti-diabetic medicinal plants on DPP-IV enzyme activity and glucose homeostasis in high-fat fed obese diabetic rats. *Biosci. Rep.* **2021**, *41*, BSR20203824. [CrossRef] [PubMed]
57. Sunil, M.; Sunitha, V.; Radhakrishnan, E.; Jyothis, M. Immunomodulatory activities of *Acacia catechu*, a traditional thirst quencher of South India. *J. Ayurveda Integr. Med.* **2019**, *10*, 185–191. [CrossRef]
58. Ikarashi, N.; Toda, T.; Okaniwa, T.; Ito, K.; Ochiai, W.; Sugiyama, K. Anti-obesity and anti-diabetic effects of *acacia* polyphenol in obese diabetic KKAy mice fed high-fat diet. *Evid.-Based Complementary Altern. Med.* **2011**, *2011*, 952031. [CrossRef] [PubMed]
59. Ansari, P.; Afroz, N.; Jalil, S.; Azad, S.B.; Mustakim, M.G.; Anwar, S.; Haque, S.N.; Hossain, S.M.; Tony, R.R.; Hannan, J.M.A. Anti-hyperglycemic activity of *Aegle marmelos* (L.) corr. is partly mediated by increased insulin secretion, α-amylase inhibition, and retardation of glucose absorption. *J. Pediatric Endocrinol. Metab.* **2017**, *30*, 37–47. [CrossRef]
60. Sankeshi, V.; Kumar, P.A.; Naik, R.R.; Sridhar, G.; Kumar, M.P.; Gopal, V.H.; Raju, T.N. Inhibition of aldose reductase by *Aegle marmelos* and its protective role in diabetic cataract. *J. Ethnopharmacol.* **2013**, *149*, 215–221. [CrossRef]
61. Dzoyem, J.; McGaw, L.; Kuete, V.; Bakowsky, U. Anti-inflammatory and anti-nociceptive activities of African medicinal spices and vegetables. In *Medicinal Spices and Vegetables from Africa*, 1st ed.; Kuete, V., Ed.; Academic Press: Cambridge, MA, USA, 2017; pp. 239–270, ISBN 9780128092866.
62. Mohammed, A.; Gbonjubola, V.A.; Koorbanally, N.A.; Islam, M.S. Inhibition of key enzymes linked to type 2 diabetes by compounds isolated from *Aframomum melegueta* fruit. *Pharm. Biol.* **2017**, *55*, 1010–1016. [CrossRef] [PubMed]
63. Ming, L.C. Ageratum conyzoides: A tropical source of medicinal and agricultural products. In *Perspectives on New Crops and New Uses*; Janick, J., Ed.; ASHS Press: Alexandria, VA, USA, 1999; pp. 469–473.
64. Agbafor, K.; Onuohah, S.; Ominyi, M.; Orinya, O.; Ezeani, N.; Alum, E. Antidiabetic, Hypolipidemic and Antiathrogenic Properties of Leaf Extracts of *Ageratum conyzoides* in Streptozotocin-Induced diabetic rats. *Int. J. Curr. Microbiol. Appl. Sci.* **2015**, *4*, 816–824.
65. Patel, P.A.; Parikh, M.P.; Johari, S.; Gandhi, T.R. Antihyperglycemic activity of *Albizzia lebbeck* bark extract in streptozotocin-nicotinamide induced type II diabetes mellitus rats. *Ayu* **2015**, *36*, 335. [CrossRef]
66. Verma, S.; Vashishth, E.; Singh, R.; Kumari, A.; Meena, A.; Pant, P.; Bhuyan, G.; Padhi, M. A review on parts of *Albizia lebbeck* (L.) Benth. used as ayurvedic drugs. *Res. J. Pharm. Technol.* **2013**, *6*, 1307–1313.
67. Maroyi, A. *Albizia Adianthifolia*: Botany, Medicinal Uses, Phytochemistry, and Pharmacological Properties. *Sci. World J.* **2018**, *2018*, 7463584. [CrossRef] [PubMed]
68. Kumar, K.S.; Debjit, B.; Pankaj, T. *Allium cepa*: A traditional medicinal herb and its health benefits. *J. Chem. Pharm. Res.* **2010**, *2*, 283–291.
69. Kianian, F.; Marefati, N.; Boskabady, M.; Ghasemi, S.Z.; Boskabady, M.H. Pharmacological Properties of *Allium cepa*, Preclinical and Clinical Evidences; A Review. *Iran. J. Pharm. Res.* **2021**, *20*, 107. [CrossRef] [PubMed]
70. Mbaveng, A.T. Allium sativum. In *Medicinal Spices and Vegetables from Africa*, 1st ed.; Kuete, V., Ed.; Academic Press: Cambridge, MA, USA, 2017; pp. 363–377, ISBN 9780128094419.

71. El-Saber Batiha, G.; Magdy Beshbishy, A.; Wasef, L.G.; Elewa, Y.H.; Al-Sagan, A.A.; El-Hack, A.; Mohamed, E.; Taha, A.E.; Abd-Elhakim, Y.M.; Prasad Devkota, H. Chemical constituents and pharmacological activities of garlic (*Allium sativum* L.): A review. *Nutrients* **2020**, *12*, 872. [CrossRef]
72. Adams, K.; Eliot, T.; Gerald, A. Extent of Use of *Aloe vera* Locally Extracted Products for Management of Ailments in Communities of Kitagata Sub-county in Sheema District, Western Uganda. *Int. J. Sci. Basic Appl. Res.* **2014**, *15*, 1–15.
73. Kim, K.; Kim, H.; Kwon, J.; Lee, S.; Kong, H.; Im, S.-A.; Lee, Y.-H.; Lee, Y.-R.; Oh, S.-T.; Jo, T.H. Hypoglycemic and hypolipidemic effects of processed *Aloe vera* gel in a mouse model of non-insulin-dependent diabetes mellitus. *Phytomedicine* **2009**, *16*, 856–863. [CrossRef] [PubMed]
74. Chan, E.; Baba, S.; Chan, H.T.; Kainuma, M.; Inoue, T.; Wong, S.K. Ulam herbs: A review on the medicinal properties of *Anacardium occidentale* and *Barringtonia racemosa*. *J. Appl. Pharm. Sci.* **2017**, *7*, 241–247. [CrossRef]
75. Iyare, G.; Omorodion, N.; Erameh, T.; Achukwu, P.; Ogochukwu, A. The effects of *Anacardium occidentale* leaves extract on histology of selected organs of Wistar rats. *MOJ Biol. Med.* **2017**, *2*, 216–221.
76. Olatunji, L.A.; Okwusidi, J.I.; Soladoye, A.O. Antidiabetic effect of *Anacardium occidentale.* Stem-bark in fructose-diabetic rats. *Pharm. Biol.* **2005**, *43*, 589–593. [CrossRef]
77. Piwowar, A.; Rembiałkowska, N.; Rorbach-Dolata, A.; Garbiec, A.; Ślusarczyk, S.; Dobosz, A.; Długosz, A.; Marchewka, Z.; Matkowski, A.; Saczko, J. *Anemarrhenae asphodeloides* rhizoma Extract Enriched in Mangiferin Protects PC12 Cells against a Neurotoxic Agent-3-Nitropropionic Acid. *Int. J. Mol. Sci.* **2020**, *21*, 2510. [CrossRef]
78. Singh, R.; Arif, T.; Khan, I.; Sharma, P. Phytochemicals in antidiabetic drug discovery. *J. Biomed. Ther. Sci.* **2014**, *1*, 1–33.
79. Costa, E.V.; Dutra, L.M.; de Jesus, H.C.R.; de Lima Nogueira, P.C.; de Souza Moraes, V.R.; Salvador, M.J.; de Holanda Cavalcanti, S.C.; dos Santos, R.L.C.; do Nacimento Prata, A.P. Chemical composition and antioxidant, antimicrobial, and larvicidal activities of the essential oils of *Annona salzmannii* and *A. pickelii* (Annonaceae). *Nat. Prod. Commun.* **2011**, *6*, 908–912. [CrossRef]
80. Cascaes, M.M.; Carneiro, O.d.S.; Nascimento, L.D.d.; de Moraes, Â.A.B.; de Oliveira, M.S.; Cruz, J.N.; Guilhon, G.M.S.P.; Andrade, E.H.d.A. Essential Oils from Annonaceae Species from Brazil: A Systematic Review of Their Phytochemistry, and Biological Activities. *Int. J. Mol. Sci.* **2021**, *22*, 12140. [CrossRef] [PubMed]
81. Ma, C.; Chen, Y.; Chen, J.; Li, X.; Chen, Y. A review on *Annona squamosa* L.: Phytochemicals and biological activities. *Am. J. Chin. Med.* **2017**, *45*, 933–964. [CrossRef]
82. Patil, U.; Gaikwad, D. Ethno-pharmacological review of a herbal drug: *Anogeissus latifolia*. *Int. J. Pharma Sci. Res.* **2011**, *2*, 41–43.
83. Ramachandran, S.; Naveen, K.R.; Rajinikanth, B.; Akbar, M.; Rajasekaran, A. Antidiabetic, antihyperlipidemic and in vivo antioxidant potential of aqueous extract of *Anogeissus latifolia* bark in type 2 diabetic rats. *Asian Pac. J. Trop. Dis.* **2012**, *2*, S596–S602. [CrossRef]
84. Patel, J.K.; Sharma, M.K. Origin, Bioactivities and Therapeutic uses of *Arachis hypogaea* (Peanut/Fabaceae). *Plant Cell Biotechnol. Mol. Biol.* **2019**, *20*, 1172–1179.
85. Akter, F.; Jahan, N.; Sultana, N. Effect of Peanut (*Arachis hypogaea* L.) on Fasting Blood Glucose and HbA1c in Alloxan Induced Diabetic Male Rats. *J. Bangladesh Soc. Physiol.* **2014**, *9*, 48–53. [CrossRef]
86. Karra, G.; Nadenla, R.; Kiran, R.S.; Srilatha, K.; Mamatha, P.; Rao, V.U. An overview on *Arachis hypogaea* plant. *Int. J. Pharm. Sci. Res.* **2013**, *4*, 4508–4518.
87. Batiha, G.E.-S.; Olatunde, A.; El-Mleeh, A.; Hetta, H.F.; Al-Rejaie, S.; Alghamdi, S.; Zahoor, M.; Magdy Beshbishy, A.; Murata, T.; Zaragoza-Bastida, A. Bioactive Compounds, Pharmacological Actions, and Pharmacokinetics of Wormwood (*Artemisia absinthium*). *Antibiotics* **2020**, *9*, 353. [CrossRef]
88. Daradka, H.M.; Abas, M.M.; Mohammad, M.A.; Jaffar, M.M. Antidiabetic effect of *Artemisia absinthium* extracts on alloxan-induced diabetic rats. *Comp. Clin. Pathol.* **2014**, *23*, 1733–1742. [CrossRef]
89. Hausner, E.A.; Poppenga, R.H. Hazards Associated with the Use of Herbal and Other Natural Products. In *Small Animal Toxicology*, 3rd ed.; Elsevier Inc.: Amsterdam, The Netherlands, 2012; pp. 335–356. [CrossRef]
90. Jagtap, U.; Bapat, V. *Artocarpus*: A review of its traditional uses, phytochemistry and pharmacology. *J. Ethnopharmacol.* **2010**, *129*, 142–166. [CrossRef] [PubMed]
91. Hannan, J.M.A.; Ali, L.; Khaleque, J.; Akhter, M.; Flatt, P.R.; Abdel-Wahab, Y.H.A. Antihyperglycaemic activity of *Asparagus racemosus* roots is partly mediated by inhibition of carbohydrate digestion and absorption, and enhancement of cellular insulin action. *Br. J. Nutr.* **2012**, *107*, 1316–1323. [CrossRef] [PubMed]
92. Goyal, R.; Singh, J.; Lal, H. *Asparagus racemosus*—An update. *Indian J. Med. Sci.* **2003**, *57*, 408–414.
93. Marikani, K. Antidiabetic and antihyperlipidemic activities of *Asparagus racemosus* in alloxan induced diabetic rats. *J. Pharm. Res.* **2012**, *5*, 2469–2472.
94. Hannan, J.M.A.; Marenah, L.; Ali, L.; Rokeya, B.; Flatt, P.R.; Abdel-Wahab, Y.H.A. Insulin secretory actions of extracts of *Asparagus racemosus* root in perfused pancreas, isolated islets and clonal pancreatic β-cells. *J. Endocrinol.* **2007**, *192*, 159–168. [CrossRef]
95. Lee, D.H.; Han, J.M.; Yang, W.M. The effects of *Atractylodes japonica* Koidz. on type 2 diabetic rats. *J. Korean Med.* **2015**, *36*, 75–85. [CrossRef]
96. Zhang, W.-J.; Zhao, Z.-Y.; Chang, L.-K.; Cao, Y.; Wang, S.; Kang, C.-Z.; Wang, H.-Y.; Zhou, L.; Huang, L.-Q.; Guo, L.-P. *Atractylodis* Rhizoma: A review of its traditional uses, phytochemistry, pharmacology, toxicology and quality control. *J. Ethnopharmacol.* **2021**, *266*, 113415. [CrossRef]

97. Alzohairy, M.A. Therapeutics role of *Azadirachta indica* (Neem) and Their Active Constituents in Diseases Prevention and Treatment. *Evid.-Based Complementary Altern. Med.* **2016**, *2016*, 7382506. [CrossRef]
98. Yarmohammadi, F.; Mehri, S.; Najafi, N.; Amoli, S.S.; Hosseinzadeh, H. The protective effect of *Azadirachta indica* (neem) against metabolic syndrome: A review. *Iran. J. Basic Med. Sci.* **2021**, *24*, 280–292. [CrossRef]
99. Chothani, D.L.; Vaghasiya, H. A review on *Balanites aegyptiaca* Del (desert date): Phytochemical constituents, traditional uses, and pharmacological activity. *Pharmacogn. Rev.* **2011**, *5*, 55. [CrossRef] [PubMed]
100. Ezzat, S.M.; Abdel Motaal, A.; El Awdan, S.A.W. In vitro and in vivo antidiabetic potential of extracts and a furostanol saponin from *Balanites aegyptiaca*. *Pharm. Biol.* **2017**, *55*, 1931–1936. [CrossRef] [PubMed]
101. Rahimi-Madiseh, M.; Lorigoini, Z.; Zamani-Gharaghoshi, H.; Rafieian-Kopaei, M. *Berberis vulgaris*: Specifications and traditional uses. *Iran. J. Basic Med. Sci.* **2017**, *20*, 569. [CrossRef]
102. Meliani, N.; Dib, M.E.A.; Allali, H.; Tabti, B. Hypoglycaemic effect of *Berberis vulgaris* L. in normal and streptozotocin-induced diabetic rats. *Asian Pac. J. Trop. Biomed.* **2011**, *1*, 468–471. [CrossRef]
103. Xuan, T.D.; Khanh, T.D. Chemistry and pharmacology of *Bidens pilosa*: An overview. *J. Pharm. Investig.* **2016**, *46*, 91–132. [CrossRef]
104. Yang, W.C. Botanical, pharmacological, phytochemical, and toxicological aspects of the antidiabetic plant *Bidens pilosa* L. *Evid.-Based Complementary Altern. Med.* **2014**, *2014*, 698617. [CrossRef]
105. Ghogar, A.; Jiraungkoorskul, K.; Jiraungkoorskul, W. Paper Flower, *Bougainvillea spectabilis*: Update properties of traditional medicinal plant. *J. Nat. Remedies* **2016**, *16*, 82–87. [CrossRef]
106. Ghogar, A.; Jiraungkoorskul, W. Antifertility effect of *Bougainvillea spectabilis* or paper flower. *Pharmacogn. Rev.* **2017**, *11*, 19. [CrossRef]
107. Kumar, V.; Thakur, A.K.; Barothia, N.D.; Chatterjee, S.S. Therapeutic potentials of *Brassica juncea*: An overview. *CellMed* **2011**, *1*, 2.1–2.16. [CrossRef]
108. Mahomoodally, M.F.; Jugreet, S.; Sinan, K.I.; Zengin, G.; Ak, G.; Ceylan, R.; Jekő, J.; Cziáky, Z.; Angelini, P.; Angeles Flores, G. Pharmacological Potential and Chemical Characterization of *Bridelia ferruginea* Benth.—A Native Tropical African Medicinal Plant. *Antibiotics* **2021**, *10*, 223. [CrossRef]
109. Olajide, O.A.; Aderogba, M.A.; Okorji, U.P.; Fiebich, B.L. *Bridelia ferruginea* produces antineuroinflammatory activity through inhibition of nuclear factor-kappa B and p38 MAPK signalling. *Evid.-Based Complementary Altern. Med.* **2012**, *2012*, 546873. [CrossRef] [PubMed]
110. Giancarlo, S.; Rosa, L.M.; Nadjafi, F.; Francesco, M. Hypoglycaemic activity of two spices extracts: *Rhus coriaria* L. and *Bunium persicum* Boiss. *Nat. Prod. Res.* **2006**, *20*, 882–886. [CrossRef] [PubMed]
111. Seri, A.; Khorsand, M.; Rezaei, Z.; Hamedi, A.; Takhshid, M.A. Inhibitory effect of *Bunium persicum* hydroalcoholic extract on glucose-induced albumin glycation, oxidation, and aggregation in vitro. *Iran. J. Med. Sci.* **2017**, *42*, 369. [PubMed]
112. Hussain, L.; Qadir, M.I.; ur Rehman, S. Antihyperglycemic and hypolipidemic potential of *Caesalpinia decapetala* in alloxan-induced diabetic rabbits. *Bangladesh J. Pharmacol.* **2014**, *9*, 529–532. [CrossRef]
113. Parveen, A.; Akash, M.S.H.; Rehman, K.; Mahmood, Q.; Qadir, M.I. Analgesic, anti-inflammatory and anti-pyretic activities of *Caesalpinia decapetala*. *Bioimpacts* **2014**, *4*, 43. [CrossRef]
114. Arora, D.; Rani, A.; Sharma, A. A review on phytochemistry and ethnopharmacological aspects of genus *Calendula*. *Pharmacogn. Rev.* **2013**, *7*, 179. [CrossRef]
115. Athaiban, M.A. Effect of *Calendula officinalis* Extract against Streptozotocin Induced Diabetes in Male Rats. *Int. J. Pharm. Phytopharm. Res.* **2018**, *8*, 22–28.
116. Chopade, V.; Phatak, A.; Upaganlawar, A.; Tankar, A. Green tea (*Camellia sinensis*): Chemistry, Traditional, Medicinal uses and its Pharmacological activities-a review. *Pharmacogn. Rev.* **2008**, *2*, 157–162.
117. Ansari, P.; Flatt, P.R.; Harriott, P.; Abdel-Wahab, Y.H.A. Anti-hyperglycaemic and insulin-releasing effects of *Camellia sinensis* leaves and isolation and characterisation of active compounds. *Br. J. Nutr.* **2021**, *126*, 1149–1163. [CrossRef]
118. Batiha, G.E.-S.; Alqahtani, A.; Ojo, O.A.; Shaheen, H.M.; Wasef, L.; Elzeiny, M.; Ismail, M.; Shalaby, M.; Murata, T.; Zaragoza-Bastida, A. Biological Properties, Bioactive Constituents, and Pharmacokinetics of Some *Capsicum* spp. and Capsaicinoids. *Int. J. Mol. Sci.* **2020**, *21*, 5179. [CrossRef]
119. Manukumar, H.; Shiva Kumar, J.; Chandrasekhar, B.; Raghava, S.; Umesha, S. Evidences for diabetes and insulin mimetic activity of medicinal plants: Present status and future prospects. *Crit. Rev. Food Sci. Nutr.* **2017**, *57*, 2712–2729. [CrossRef] [PubMed]
120. Aravind, G.; Bhowmik, D.; Duraivel, S.; Harish, G. Traditional and medicinal uses of *Carica papaya*. *J. Med. Plants Stud.* **2013**, *1*, 7–15.
121. Solikhah, T.I.; Setiawan, B.; Ismukada, D.R. Antidiabetic activity of papaya leaf extract (*Carica Papaya* L.) isolated with maceration method in alloxan-induces diabetic mice. *Syst. Rev. Pharm.* **2020**, *11*, 774–778. [CrossRef]
122. Varghese, G.K.; Bose, L.V.; Habtemariam, S. Antidiabetic components of *Cassia alata* leaves: Identification through α-glucosidase inhibition studies. *Pharm. Biol.* **2013**, *51*, 345–349. [CrossRef] [PubMed]
123. Fatmawati, S.; Purnomo, A.S.; Bakar, M.F.A. Chemical constituents, usage and pharmacological activity of *Cassia alata*. *Heliyon* **2020**, *6*, e04396. [CrossRef]
124. Mwangi, R.W.; Macharia, J.M.; Wagara, I.N.; Bence, R.L. The medicinal properties of *Cassia fistula* L.: A review. *Biomed. Pharmacother.* **2021**, *144*, 112240. [CrossRef]

125. Danish, M.; Singh, P.; Mishra, G.; Srivastava, S.; Jha, K.; Khosa, R. *Cassia fistula* Linn. (Amulthus)—An important medicinal plant: A review of its traditional uses, phytochemistry and pharmacological properties. *J. Nat. Prod. Plant Resourse* **2011**, *1*, 101–118.
126. Einstein, J.W.; Mohd Rais, M.; Mohd, M.A. Comparative evaluation of the antidiabetic effects of different parts of *Cassia fistula* Linn, a Southeast Asian Plant. *J. Chem.* **2013**, *2013*, 714063. [CrossRef]
127. Jarald, E.; Joshi, S.; Jain, D.; Edwin, S. Biochemical evaluation of the hypoglycemic effects of extract and fraction of *Cassia fistula* Linn. in alloxan-induced diabetic rats. *Indian J. Pharm. Sci.* **2013**, *75*, 427. [CrossRef]
128. Kumar, S.; Singh, B.; Singh, R. *Catharanthus roseus* (L.) G. Don: A review of its ethnobotany, phytochemistry, ethnopharmacology and toxicities. *J. Ethnopharmacol.* **2022**, *284*, 114647. [CrossRef]
129. Tiong, S.H.; Looi, C.Y.; Hazni, H.; Arya, A.; Paydar, M.; Wong, W.F.; Cheah, S.C.; Mustafa, M.R.; Awang, K. Antidiabetic and Antioxidant Properties of Alkaloids from *Catharanthus roseus* (L.) G. Don. *Molecules* **2013**, *18*, 9770–9784. [CrossRef] [PubMed]
130. Ahmed, M.F.; Kazim, S.M.; Ghori, S.S.; Mehjabeen, S.S.; Ahmed, S.R.; Ali, S.M.; Ibrahim, M. Antidiabetic activity of *Vinca rosea* extracts in alloxan-induced diabetic rats. *Int. J. Endocrinol.* **2010**, *2010*, 841090. [CrossRef] [PubMed]
131. Rivera-Mondragón, A.; Ortíz, O.O.; Bijttebier, S.; Vlietinck, A.; Apers, S.; Pieters, L.; Caballero-George, C. Selection of chemical markers for the quality control of medicinal plants of the genus *Cecropia*. *Pharm. Biol.* **2017**, *55*, 1500–1512. [CrossRef] [PubMed]
132. Street, R.A.; Sidana, J.; Prinsloo, G. *Cichorium intybus*: Traditional Uses, Phytochemistry, Pharmacology, and Toxicology. *Evid.-Based Complementary Altern. Med.* **2013**, *2013*, 579319. [CrossRef] [PubMed]
133. Wang, J.; Su, B.; Jiang, H.; Cui, N.; Yu, Z.; Yang, Y.; Sun, Y. Traditional uses, phytochemistry and pharmacological activities of the genus *Cinnamomum* (Lauraceae): A review. *Fitoterapia* **2020**, *146*, 104675. [CrossRef]
134. Ota, A.; Ulrih, N.P. An overview of herbal products and secondary metabolites used for management of type two diabetes. *Front. Pharmacol.* **2017**, *8*, 436. [CrossRef]
135. Basli, A.; Younici, S.; Benkerrou, Z.; Khettal, B.; Madani, K. Evaluation of in-vitro antidiabetic and hypolipidaemic activities of extracts citrus lemon fruit. *J. Environ. Sci. Eng. A* **2016**, *5*, 612–618. [CrossRef]
136. Klimek-Szczykutowicz, M.; Szopa, A.; Ekiert, H. *Citrus limon* (Lemon) Phenomenon—A Review of the Chemistry, Pharmacological Properties, Applications in the Modern Pharmaceutical, Food, and Cosmetics Industries, and Biotechnological Studies. *Plants* **2020**, *9*, 119. [CrossRef]
137. Sharma, M.; Fernandes, J.; Ahirwar, D.; Jain, R. Hypoglycemic and hypolipidimic activity of alcoholic extract of *citrus aurantium* in normal and alloxan-induced diabetic rats. *Pharmacologyonline* **2008**, *3*, 161–171.
138. Suryawanshi, J.A.S. An overview of *Citrus aurantium* used in treatment of various diseases. *Afr. J. Plant Sci.* **2011**, *5*, 390–395. [CrossRef]
139. Erukainure, O.L.; Sanni, O.; Ijomone, O.M.; Ibeji, C.U.; Chukwuma, C.I.; Islam, M.S. The antidiabetic properties of the hot water extract of kola nut (*Cola nitida* (Vent.) Schott & Endl.) in type 2 diabetic rats. *J. Ethnopharmacol.* **2019**, *242*, 112033. [CrossRef] [PubMed]
140. Adeosun, O.I.; Olaniyi, K.S.; Amusa, O.A.; Jimoh, G.Z.; Oniyide, A.A. Methanolic extract of *Cola nitida* elicits dose-dependent diuretic, natriuretic and kaliuretic activities without causing electrolyte impairment, hepatotoxicity and nephrotoxicity in rats. *Int. J. Physiol. Pathophysiol. Pharmacol.* **2017**, *9*, 231. [PubMed]
141. Zhen, Z.; Chang, B.; Li, M.; Lian, F.-M.; Chen, L.; Dong, L.; Wang, J.; Yu, B.; Liu, W.K.; Li, X.Y. Anti-Diabetic Effects of a *Coptis chinensis* Containing New Traditional Chinese Medicine Formula in Type 2 Diabetic Rats. *Am. J. Chin. Med.* **2011**, *39*, 53–63. [CrossRef] [PubMed]
142. Friedemann, T.; Ying, Y.; Wang, W.; Kramer, E.R.; Schumacher, U.; Fei, J.; Schröder, S. Neuroprotective Effect of *Coptis chinensis* in MPP+ and MPTP-Induced Parkinson's Disease Models. *Am. J. Chin. Med.* **2016**, *44*, 907–925. [CrossRef] [PubMed]
143. He, K.; Song, S.; Zou, Z.; Feng, M.; Wang, D.; Wang, Y.; Li, X.; Ye, X. The Hypoglycemic and Synergistic Effect of Loganin, Morroniside, and Ursolic Acid Isolated from the Fruits of *Cornus officinalis*. *Phytother. Res.* **2016**, *30*, 283–291. [CrossRef] [PubMed]
144. Kim, J.S. Seeds of *Cornus officinalis* and Diabetic Cataracts. In *Handbook of Nutrition, Diet and the Eye*, 1st ed.; Preedy, V.R., Ed.; Academic Press: Cambridge, MA, USA, 2014; pp. 451–458. [CrossRef]
145. Tung, B.T.; Nham, D.T.; Hai, N.T.; Thu, D.K. Curcuma longa, the Polyphenolic Curcumin Compound and Pharmacological Effects on Liver. In *Dietary Interventions in Liver Disease*; Watson, R.R., Preedy, V.R., Eds.; Academic Press: Cambridge, MA, USA, 2019; pp. 125–134. [CrossRef]
146. Olatunde, A.; Joel, E.; Tijjani, H.; Obidola, S.; Luka, C. Anti-diabetic activity of aqueous extract of *Curcuma longa* (Linn) rhizome in normal and alloxan-induced diabetic rats. *Researcher* **2014**, *6*, 58–65.
147. Fukai, T.; Oku, Y.; Hou, A.J.; Yonekawa, M.; Terada, S. Antimicrobial activity of Hydrophobic Xanthones from *Cudrania cochinchinensis* against Bacillus subtilis and Methicillin-Resistant Staphylococcus aureus. *Chem. Biodivers.* **2004**, *1*, 1385–1390. [CrossRef]
148. Antu, K.A.; Riya, M.P.; Mishra, A.; Anilkumar, K.S.; Chandrakanth, C.K.; Tamrakar, A.K.; Srivastava, A.K.; Raghu, K.G. Antidiabetic property of *Symplocos cochinchinensis* is mediated by inhibition of alpha glucosidase and enhanced insulin sensitivity. *PLoS ONE* **2014**, *9*, e105829. [CrossRef]
149. Tran, N.; Pham, B.; Le, L. Bioactive Compounds in Anti-Diabetic Plants: From Herbal Medicine to Modern Drug Discovery. *Biology* **2020**, *9*, 252. [CrossRef]
150. Singh, S.; Bhagwati, D. *Cyamopsis tetragonoloba* (L). Taub.: A Phyto-Pharmacological Review. *Int. J. Pharm. Pharm. Res.* **2016**, *7*, 166–174.

151. Shah, M.H.; Mukhtar, I.; Khan, S.N. Medicinal importance and association of pathological constraints with *Dalbergia sissoo*. *Pak. J. Phytopathol.* **2010**, *22*, 135–138.
152. Sehra, S.; Sharma, J. Pharmacological Effects and Medicinal Importance of *Dalbergia sissoo*—A Review. *Int. J. Pharm. Chem. Biol. Sci.* **2018**, *8*, 234–243.
153. Tanaka, K.; Nishizono, S.; Makino, N.; Tamaru, S.; Terai, O.; Ikeda, I. Hypoglycemic Activity of *Eriobotrya japonica* Seeds in Type 2 Diabetic Rats and Mice. *Biosci. Biotechnol. Biochem.* **2008**, *72*, 686–693. [CrossRef]
154. Baljinder, S.; Seena, G.; Dharmendra, K.; Vikas, G.; Bansal, P. Pharmacological potential of *Eriobotrya japonica*—An overview. *Int. Res. J. Pharm.* **2010**, *1*, 95–99.
155. Ansari, P.; Flatt, P.R.; Harriott, P.; Abdel-Wahab, Y.H.A. Insulinotropic and antidiabetic properties of *Eucalyptus citriodora* leaves and isolation of bioactive phytomolecules. *J. Pharm. Pharmacol.* **2021**, *23*, 1049–1061. [CrossRef] [PubMed]
156. Saba, I.; Iqbal, M.; Iqbal, M. Bioactivity of *Eucalyptus citriodora* leaves essential oil. *J. Agrochim.* **2013**, *57*, 128.
157. Gray, A.M.; Flatt, P.R. Antihyperglycemic actions of *Eucalyptus globulus* (Eucalyptus) are associated with pancreatic and extra-pancreatic effects in mice. *J. Nutr.* **1998**, *128*, 2319–2323. [CrossRef]
158. Hayat, U.; Jilani, M.I.; Rehman, R.; Nadeem, F. A Review on *Eucalyptus globulus:* A new perspective in therapeutics. *Int. J. Chem. Biochem. Sci.* **2015**, *8*, 85–91.
159. Maroyi, A. *Euclea undulata* Thunb.: Review of its botany, ethnomedicinal uses, phytochemistry and biological activities. *Asian Pac. J. Trop. Med.* **2017**, *10*, 1030–1036. [CrossRef]
160. Jana, K.; Bera, T.K.; Ghosh, D. Antidiabetic effects of *Eugenia jambolana* in the streptozotocin-induced diabetic male albino rat. *Biomark. Genom. Med.* **2015**, *7*, 116–124. [CrossRef]
161. Khalique, A.; Rauf, A. An overview of Jamun (*Eugenia Jambolana* Linn): A traditional multipotential drug. *Indian J. Unani Med.* **2016**, *9*, 71–75.
162. Ghosh, P.; Ghosh, C.; Das, S.; Das, C.; Mandal, S.; Chatterjee, S. Botanical Description, Phytochemical Constituents and Pharmacological Properties of *Euphorbia hirta* Linn.: A review. *Int. J. Health Sci. Res.* **2019**, *9*, 273–286.
163. Kumar, S.; Malhotra, R.; Kumar, D. *Euphorbia hirta*: Its Chemistry, Traditional and Medicinal Uses, and Pharmacological Activities. *Pharmacogn. Rev.* **2010**, *4*, 58. [CrossRef] [PubMed]
164. Rizvi, S.I.; Matteucci, E.; Atukeren, P. Traditional Medicine in Management of Type 2 Diabetes Mellitus. *J. Diabetes Res.* **2013**, *2013*, 580823. [CrossRef] [PubMed]
165. Patel, R.; Gautam, P. Medicinal Potency of *Ficus Bengalensis*: A Review. *Int. J. Med. Chem. Anal.* **2014**, *4*, 53–58.
166. Adaramoye, O. Antidiabetic effect of kolaviron, a biflavonoid complex isolated from *Garcinia kola* seeds, in Wistar rats. *Afr. Health Sci.* **2012**, *12*, 498–506. [CrossRef]
167. Emmanuel, O.; Uche, M.E.; Dike, E.D.; Etumnu, L.R.; Ugbogu, O.C.; Ugbogu, E.A. A review on *Garcinia kola* Heckel: Traditional uses, phytochemistry, pharmacological activities, and toxicology. *Biomarkers* **2021**, *27*, 101–117. [CrossRef]
168. Mahmoud, M.H.; Taha, M.M.; Shahy, E.M. Germination of *Glycine max* seeds potentiates its antidiabetic effect in streptozotocin induced diabetic rats. *Int. J. Pharm. Clin. Res.* **2016**, *8*, 1429–1437.
169. Lee, K.J.; Baek, D.-Y.; Lee, G.-A.; Cho, G.-T.; So, Y.-S.; Lee, J.-R.; Ma, K.-H.; Chung, J.-W.; Hyun, D.Y. Phytochemicals and Antioxidant Activity of Korean Black Soybean (*Glycine max* L.) Landraces. *Antioxidants* **2020**, *9*, 213. [CrossRef]
170. Batiha, G.E.S.; Beshbishy, A.M.; El-Mleeh, A.; Abdel-Daim, M.M.; Devkota, H.P. Traditional Uses, Bioactive Chemical Constituents, and Pharmacological and Toxicological Activities of *Glycyrrhiza glabra* L. (Fabaceae). *Biomolecules* **2020**, *10*, 352. [CrossRef]
171. Khan, F.; Sarker, M.; Rahman, M.; Ming, L.C.; Mohamed, I.N.; Zhao, C.; Sheikh, B.Y.; Tsong, H.F.; Rashid, M.A. Comprehensive review on phytochemicals, pharmacological and clinical potentials of *Gymnema sylvestre*. *Front. Pharmacol.* **2019**, *10*, 1223. [CrossRef] [PubMed]
172. Kanetkar, P.; Singhal, R.; Kamat, M. *Gymnema sylvestre*: A Memoir. *J. Clin. Biochem. Nutr.* **2007**, *41*, 77–81. [CrossRef] [PubMed]
173. Kadima, J.; Kasali, F.; Bavhure, B.; Mahano, A.; Bwironde, F. Comparative Antidiabetic Potential and Survival Function of *Harungana madagascariensis, Physalis peruviana, Solanum americanum* and *Tithonia diversifolia* Extracts on Alloxan-Induced Diabetes in Guinea-Pigs. *Int. J. Pharm. Pharm. Res.* **2016**, *5*, 196–206.
174. Suthar, M.; Rathore, G.; Pareek, A. Antioxidant and Antidiabetic Activity of *Helicteres isora* (L.) Fruits. *Indian J. Pharm. Sci.* **2009**, *71*, 695. [CrossRef] [PubMed]
175. Kumar, N.; Singh, A.K. Plant profile, phytochemistry and pharmacology of Avartani (*Helicteres isora* Linn.): A review. *Asian Pac. J. Trop. Biomed.* **2014**, *4*, S22–S26. [CrossRef]
176. Mahmud, I.; Islam, M.K.; Saha, S.; Barman, A.K.; Rahman, M.M.; Anisuzzman, M.; Rahman, T.; Al-Nahain, A.; Jahan, R.; Rahmatullah, M. Pharmacological and Ethnomedicinal Overview of *Heritiera fomes*: Future Prospects. *Int. Sch. Res. Not.* **2014**, *2014*, 938543. [CrossRef]
177. Sabitha, V.; Ramachandran, S.; Naveen, K.; Panneerselvam, K. Antidiabetic and antihyperlipidemic potential of *Abelmoschus esculentus* (L.) Moench. in streptozotocin-induced diabetic rats. *J. Pharm. Bioallied Sci.* **2011**, *3*, 397. [CrossRef]
178. Chanchal, D.K.; Alok, S.; Kumar, M.; Bijauliya, R.K.; Rashi, S.; Gupta, S. A Brief Review on *Abelmoschus esculentus* Linn. Okra. *Int. J. Pharm. Sci. Res.* **2018**, *9*, 58–66. [CrossRef]
179. Ansari, P.; Azam, S.; Hannan, J.M.A.; Flatt, P.R.; Wahab, Y.H.A. Anti-hyperglycaemic activity of *H. rosa-sinensis* leaves is partly mediated by inhibition of carbohydrate digestion and absorption, and enhancement of insulin secretion. *J. Ethnopharmacol.* **2020**, *253*, 112647. [CrossRef]

180. Jadhav, V.; Thorat, R.; Kadam, V.; Sathe, N. Traditional medicinal uses of *Hibiscus rosa-sinensis*. *J. Pharm. Res.* **2009**, *2*, 1220–1222.
181. Kumar, J.; Singh, S.P.; Choudhary, G.K. Pharmacological evaluation of leaves of *Jatropha curcas* L. for anti-diabetic activity in alloxan induced diabetic rats. *Indian J. Anim. Sci.* **2016**, *86*, 387–391.
182. Pabón, L.C.; Hernández-Rodríguez, P. Chemical importance of *Jatropha curcas* and its biological, pharmacological and industrial applications. *Rev. Cuba. De Plantas Med.* **2012**, *17*, 194–209.
183. Sen, S.; Chakraborty, R. Pharmacognostic and anti-hyperglycemic evaluation of *Lantana camara* (L.) var. aculeate leaves in alloxan-induced hyperglycemic rats. *Int. J. Res. Pharm. Sci.* **2010**, *1*, 247–252.
184. Kirimuhuzya, C.; Waako, P.; Joloba, M.; Odyek, O. The anti-mycobacterial activity of *Lantana camara* a plant traditionally used to treat symptoms of tuberculosis in South-western Uganda. *Afr. Health Sci.* **2009**, *9*, 40–45. [PubMed]
185. Palla, A.H.; Khan, N.A.; Bashir, S.; Iqbal, J.; Gilani, A.H. Pharmacological basis for the medicinal use of *Linum usitatissimum* (Flaxseed) in infectious and non-infectious diarrhea. *J. Ethnopharmacol.* **2015**, *160*, 61–68. [CrossRef]
186. Saleem, M.; Tanvir, M.; Akhtar, M.F.; Iqbal, M.; Saleem, A. Antidiabetic Potential of *Mangifera indica* L. cv. Anwar Ratol Leaves: Medicinal Application of Food Wastes. *Medicina* **2019**, *55*, 353. [CrossRef]
187. Shah, K.; Patel, M.; Patel, R.; Parmar, P. *Mangifera indica* (mango). *Pharmacogn. Rev.* **2010**, *4*, 42. [CrossRef]
188. Bortolotti, M.; Mercatelli, D.; Polito, L. *Momordica charantia*, a nutraceutical approach for inflammatory related diseases. *Front. Pharmacol.* **2019**, *10*, 486. [CrossRef]
189. Azad, S.B.; Ansari, P.; Azam, S.; Hossain, S.M.; Shahid, M.I.-B.; Hasan, M.; Hannan, J.M.A. Anti-hyperglycaemic activity of *Moringa oleifera* is partly mediated by carbohydrase inhibition and glucose-fibre binding. *Biosci. Rep.* **2017**, *3*, BSR20170059. [CrossRef]
190. Mishra, G.; Singh, P.; Verma, R.; Kumar, S.; Srivastav, S.; Jha, K.; Khosa, R. Traditional uses, phytochemistry and pharmacological properties of *Moringa oleifera* plant: An overview. *Der Pharm. Lett.* **2011**, *3*, 141–164.
191. Balakrishnan, R.; Vijayraja, D.; Jo, S.-H.; Ganesan, P.; Su-Kim, I.; Choi, D.-K. Medicinal Profile, Phytochemistry, and Pharmacological Activities of Murraya koenigii and its Primary Bioactive Compounds. *Antioxidants* **2020**, *9*, 101. [CrossRef] [PubMed]
192. Murthy, S.S.N.; Felicia, C. Antidiabetic activity of *Musa sapientum* fruit peel extract on streptozotocin induced diabetic rats. *Int. J. Pharma Bio Sci.* **2015**, *6*, 537–543.
193. Imam, M.Z.; Akter, S. *Musa paradisiaca* L. and *Musa sapientum* L.: A Phytochemical and Pharmacological Review. *J. Appl. Pharm. Sci.* **2011**, *1*, 14–20.
194. Hannan, J.M.A.; Ansari, P.; Haque, A.; Sanju, A.; Huzaifa, A.; Rahman, A.; Ghosh, A.; Azam, S. *Nigella sativa* stimulates insulin secretion from isolated rat islets and inhibits the digestion and absorption of (CH_2O) n in the gut. *Biosci. Rep.* **2019**, *39*, BSR20190723. [CrossRef] [PubMed]
195. Salehi, B.; Quispe, C.; Imran, M.; Ul-Haq, I.; Živković, J.; Abu-Reidah, I.M.; Sen, S.; Taheri, Y.; Acharya, K.; Azadi, H. *Nigella* Plants–Traditional Uses, Bioactive Phytoconstituents, Preclinical and Clinical Studies. *Front. Pharmacol.* **2021**, *12*, 417. [CrossRef] [PubMed]
196. Ezeani, C.; Ezenyi, I.; Okoye, T.; Okoli, C. *Ocimum basilicum* extract exhibits antidiabetic effects via inhibition of hepatic glucose mobilization and carbohydrate metabolizing enzymes. *J. Intercult. Ethnopharmacol.* **2017**, *6*, 22–28. [CrossRef]
197. El-Beshbishy, H.; Bahashwan, S. Hypoglycemic effect of basil (*Ocimum basilicum*) aqueous extract is mediated through inhibition of α-glucosidase and α-amylase activities: An in vitro study. *Toxicol. Ind. Health* **2012**, *28*, 42–50. [CrossRef]
198. Joshi, R.K. Chemical composition and antimicrobial activity of the essential oil of *Ocimum basilicum* L. (sweet basil) from Western Ghats of North West Karnataka, India. *Anc. Sci. Life* **2014**, *33*, 151. [CrossRef]
199. Hannan, J.M.A.; Marenah, L.; Ali, L.; Rokeya, B.; Flatt, P.R.; Abdel-Wahab, Y.H.A. *Ocimum sanctum* leaf extracts stimulate insulin secretion from perfused pancreas, isolated islets and clonal pancreatic β-cells. *J. Endocrinol.* **2006**, *189*, 127–136. [CrossRef]
200. Qadir, N.M.; Ali, K.A.; Qader, S.W. Antidiabetic effect of Oleuropein from *Olea europaea* Leaf against Alloxan Induced Type 1 Diabetic in Rats. *Braz. Arch. Biol. Technol.* **2016**, *59*, 347–350. [CrossRef]
201. Khan, Y.; Panchal, S.; Vyas, N.; Butani, A.; Kumar, V. *Olea europaea*: A phyto-pharmacological review. *Pharmacogn. Rev.* **2007**, *1*, 114–118.
202. Attele, A.S.; Zhou, Y.-P.; Xie, J.-T.; Wu, J.A.; Zhang, L.; Dey, L.; Pugh, W.; Rue, P.A.; Polonsky, K.S.; Yuan, C.S. Antidiabetic Effects of *Panax ginseng* Berry Extract and the Identification of an Effective Component. *Diabetes* **2002**, *51*, 1851–1858. [CrossRef] [PubMed]
203. Xiang, Y.Z.; Shang, H.C.; Gao, X.M.; Zhang, B.L. A comparison of the ancient use of *ginseng* in traditional Chinese medicine with modern pharmacological experiments and clinical trials. *Phytother. Res.* **2008**, *22*, 851–858. [CrossRef] [PubMed]
204. Muhoya, F.K.; Kadima, J.N.; Ranarivelo, N.; Frédérich, M.; Hubert, P.; Marini, R.D. Preliminary Phytochemical Content and Antidiabetic Potential Investigations of *Panda oleosa* (Pierre) Used in Kisangani Areas. *Am. J. Anal. Chem.* **2017**, *8*, 564–581. [CrossRef]
205. Saleem, Z.M.; Ahmed, S.; Hasan, M.M. *Phaseoulus vulgaris* Linn.: Botany, Medicinal Uses, Phytochemistry and Pharmacology. *World J. Pharm. Res.* **2016**, *5*, 1611–1616. [CrossRef]
206. Lawson-Evi, P.; Eklu-Gadegbeku, K.; Agbonon, A.; Aklikokou, K.; Creppy, E.; Gbeassor, M. Antidiabetic activity of *Phyllanthus amarus* Schum and Thonn (Euphorbiaceae) on Alloxan Induced Diabetes in Male Wistar Rats. *J. Appl. Sci.* **2011**, *11*, 2968–2973. [CrossRef]

207. Patel, J.R.; Tripathi, P.; Sharma, V.; Chauhan, N.S.; Dixit, V.K. *Phyllanthus amarus*: Ethnomedicinal uses, phytochemistry and pharmacology: A review. *J. Ethnopharmacol.* **2011**, *138*, 286–313. [CrossRef]
208. Hannan, J.M.A.; Ali, L.; Khaleque, J.; Akhter, M.; Flatt, P.R.; Abdel-Wahab, Y.H.A. Aqueous extracts of husks of *Plantago ovata* reduce hyperglycaemia in type 1 and type 2 diabetes by inhibition of intestinal glucose absorption. *Br. J. Nutr.* **2006**, *96*, 131–137. [CrossRef]
209. Madgulkar, A.R.; Rao, M.R.; Warrier, D. Characterization of Psyllium (*Plantago ovata*) Polysaccharide and Its Uses. In *Polysaccharides*; Ramawat, K., Mérillon, J.M., Eds.; Springer: New York, NY, USA, 2015; pp. 871–890. [CrossRef]
210. Reyad-ul-Ferdous, M.; Ahmmed, A.; Kamal, M.A.H.M.; Ansari, P.; Shahjahan, D.S.; Akter, F.; Sakib, M.H. Herbal remedies as Alternative to Antidiabetic and Plants are Available in Bangladesh: A comprehensive. *World J. Pharm. Res.* **2015**, *4*, 2382–2389.
211. Rahman, M.S.; Mujahid, M.; Siddiqui, M.A.; Rahman, M.A.; Arif, M.; Eram, S.; Khan, A.; Azeemuddin, M. Ethnobotanical Uses, Phytochemistry and Pharmacological Activities of *Pterocarpus marsupium*: A Review. *Pharmacogn. J.* **2018**, *10*, s1–s8. [CrossRef]
212. Tang, D.; Liu, L.; Ajiakber, D.; Ye, J.; Xu, J.; Xin, X.; Aisa, H.A. Anti-diabetic Effect of *Punica granatum* Flower Polyphenols Extract in Type 2 Diabetic Rats: Activation of Akt/GSK-3β and Inhibition of IRE1α-XBP1 Pathways. *Front. Endocrinol.* **2018**, *9*, 586. [CrossRef] [PubMed]
213. Bhowmik, D.; Gopinath, H.; Kumar, B.P.; Kumar, K. Medicinal Uses of *Punica granatum* and Its Health Benefits. *J. Pharmacogn. Phytochem.* **2013**, *1*, 28–35.
214. Zhu, H.; Wang, Y.; Liu, Z.; Wang, J.; Wan, D.; Feng, S.; Yang, X.; Wang, T. Antidiabetic and antioxidant effects of catalpol extracted from *Rehmannia glutinosa* (Di Huang) on rat diabetes induced by streptozotocin and high-fat, high-sugar feed. *Chin. Med.* **2016**, *11*, 25. [CrossRef] [PubMed]
215. Zhang, R.-X.; Li, M.-X.; Jia, Z.-P. *Rehmannia glutinosa*: Review of botany, chemistry and pharmacology. *J. Ethnopharmacol.* **2008**, *117*, 199–214. [CrossRef] [PubMed]
216. Kumar, R.; Anjum, N.; Tripathi, Y. Phytochemistry and Pharmacology of *Santalum album* L.: A Review. *World J. Pharm. Res.* **2015**, *4*, 1842–1876.
217. Paswan, S.K.; Gautam, A.; Verma, P.; Rao, C.V.; Sidhu, O.P.; Singh, A.P.; Srivastava, S. The Indian Magical Herb 'Sanjeevni'(*Selaginella bryopteris* L.)—A Promising Anti-inflammatory Phytomedicine for the Treatment of Patients with Inflammatory Skin Diseases. *J. Pharmacopunct.* **2017**, *20*, 93–99. [CrossRef]
218. Amutha, K.; Godavari, A. In-vitro-antidiabetic activity of N-butanol extract of *Sesamum indicum*. *Asian J. Pharm. Clin. Res.* **2016**, *9*, 60–62.
219. Anilakumar, K.R.; Pal, A.; Khanum, F.; Bawa, A.S. Nutritional, medicinal and industrial uses of sesame (*Sesamum indicum* L.) seeds-an overview. *Agric. Conspec. Sci.* **2010**, *75*, 159–168.
220. Nyaga, S.N.; Mathiu, P.M.; Onyango, C.M.; Areba, G.O. Antidiabetic Properties of *Solanum Villosum* and *Solanum Nigrum* Var. sarrachoides in a Streptozotocin-induced Diabetic Mice Model. *Int. J. Basic Clin. Pharmacol.* **2019**, *8*, 2396–2402. [CrossRef]
221. Kuete, V. Physical, hematological, and histopathological signs of toxicity induced by African medicinal plants. In *Toxicological Survey of African Medicinal Plants*; Elsevier Inc.: Amsterdam, The Netherlands, 2014; pp. 635–657. [CrossRef]
222. Hannan, J.M.A.; Ansari, P.; Azam, S.; Flatt, P.R.; Wahab, Y.H.A. Effects of *Spirulina platensis* on insulin secretion, dipeptidyl peptidase IV activity and both carbohydrate digestion and absorption indicate potential as an adjunctive therapy for diabetes. *Br. J. Nutr.* **2020**, *124*, 1021–1034. [CrossRef]
223. Kumari, D.J.; Babitha, B.; Jaffar, S.; Prasad, M.G.; Ibrahim, M.; Khan, M.S. Potential health benefits of *Spirulina platensis*. *Int. J. Adv. Pharm. Sci.* **2011**, *2*, 417–422.
224. Kumar, V.; Van Staden, J. A review of *Swertia chirayita* (Gentianaceae) as a traditional medicinal plant. *Front. Pharmacol.* **2016**, *6*, 308. [CrossRef] [PubMed]
225. Kuru, P. *Tamarindus indica* and its health related effects. *Asian Pac. J. Trop. Biomed.* **2014**, *4*, 676–681. [CrossRef]
226. Amalraj, A.; Gopi, S. Medicinal Properties of *Terminalia arjuna* (Roxb.) Wight & Arn.: A review. *J. Tradit. Complementary Med.* **2017**, *7*, 65–78. [CrossRef]
227. Kumar, G.P.S.; Arulselvan, P.; Kumar, D.S.; Subramanian, S.P. Anti-diabetic Activity of Fruits of *Terminalia chebula* on Streptozotocin Induced Diabetic Rats. *J. Health Sci.* **2006**, *52*, 283–291. [CrossRef]
228. Jokar, A.; Masoomi, F.; Sadeghpour, O.; Nassiri-Toosi, M.; Hamedi, S. Potential therapeutic applications for *Terminalia chebula* in Iranian traditional medicine. *J. Tradit. Chin. Med.* **2016**, *36*, 250–254. [CrossRef]
229. Saha, S.; Ghosh, S. *Tinospora cordifolia*: One plant, many roles. *Anc. Sci. Life* **2012**, *31*, 151–159. [CrossRef]
230. Hannan, J.M.A.; Ali, L.; Rokeya, B.; Khaleque, J.; Akhter, M.; Flatt, P.R.; Abdel-Wahab, Y.H.A. Soluble dietary fibre fraction of *Trigonella foenum-graecum* (fenugreek) seed improves glucose homeostasis in animal models of type 1 and type 2 diabetes by delaying carbohydrate digestion and absorption and enhancing insulin action. *Br. J. Nutr.* **2007**, *97*, 514–521. [CrossRef]
231. Mandal, S.; DebMandal, M. Fenugreek (*Trigonella foenum-graecum* L.) Oils. In *Essential Oils in Food Preservation, Flavor and Safety*; Preedy, V.R., Ed.; Academic Press: Cambridge, MA, USA, 2016; pp. 421–429. [CrossRef]
232. Ahangarpour, A.; Mohammadian, M.; Dianat, M. Antidiabetic effect of hydroalcholic *Urtica dioica* leaf extract in male rats with fructose-induced insulin resistance. *Iran. J. Med. Sci.* **2012**, *37*, 181–186.
233. Hall, J.; Bravo-Clouzet, R. Anti-Inflammatory Herbs for Arthritis. In *Bioactive Food as Dietary Interventions for Arthritis and Related Inflammatory Diseases*, 2nd ed.; Watson, R.R., Preedy, V.R., Eds.; Academic Press: Cambridge, MA, USA, 2013; pp. 619–631.

234. Asante, D.-B.; Effah-Yeboah, E.; Barnes, P.; Abban, H.A.; Ameyaw, E.O.; Boampong, J.N.; Ofori, E.G.; Dadzie, J.B. Antidiabetic effect of young and old ethanolic leaf extracts of *Vernonia amygdalina*: A comparative study. *J. Diabetes Res.* **2016**, *2016*, 8252741. [CrossRef]
235. Oyeyemi, I.T.; Akinlabi, A.A.; Adewumi, A.; Aleshinloye, A.O.; Oyeyemi, O.T. *Vernonia amygdalina*: A folkloric herb with anthelminthic properties. *Beni-Suef Univ. J. Basic Appl. Sci.* **2018**, *7*, 43–49. [CrossRef]
236. Gupta, P.C. *Withania coagulans* Dunal-an overview. *Int. J. Pharm. Sci. Rev. Res.* **2012**, *12*, 68–71.
237. Akram, M.; Shah, M.I.; Usmanghan, K.; Mohiuddin, E.; Sami, A.; Asif, M.; Shah, S.A.; Ahmed, K.; Shaheen, G. *Zingiber officinale* roscoe (A medicinal plant). *Pak. J. Nutr.* **2011**, *10*, 399–400. [CrossRef]
238. Firdous, S. Phytochemicals for treatment of diabetes. *EXCLI J.* **2014**, *13*, 451–453. [PubMed]
239. Prabhakar, P.; Banerjee, M. Antidiabetic phytochemicals: A comprehensive review on opportunities and challenges in targeted therapy for herbal drug development. *Int. J. Pharm. Res.* **2020**, *12*, 1673–1696.
240. Soni, H.; Malik, J.; Yadav, A.P.; Yadav, B. Characterization of rutin isolated by leaves *Annona squamosa* by modern analytical techniques. *Eur. J. Biomed. Pharm. Sci.* **2018**, *5*, 484–489.
241. Zhang, R.; Yao, Y.; Wang, Y.; Ren, G. Antidiabetic activity of isoquercetin in diabetic KK-A y mice. *Nutr. Metab.* **2011**, *8*, 85. [CrossRef]
242. Sangeetha, R. Luteolin in the Management of Type 2 Diabetes Mellitus. *Curr. Res. Nutr. Food Sci. J.* **2019**, *7*, 393–398. [CrossRef]
243. Xu, F.; Wu, H.; Wang, Y.; Yang, Y.; Wang, X. Study on the Mechanism of Lupenone for Treating type 2 Diabetes by Integrating Pharmacological Evaluation and Network Pharmacology. *Pharm. Biol.* **2021**, *60*, 997–1010. [CrossRef]
244. Pawar, M.R.V.; Karthikeyan, E. Role of Catechins in Diabetes Mellitus. *Eur. J. Mol. Clin. Med.* **2020**, *7*, 7604–7609.
245. Celine, S.; Tomy, S.; Ujwala, T.; Johnson, S.; Chander, U. A detailed overview of medicinal plants having hypoglycemic activity. *Int. J. Phytomedicine* **2016**, *8*, 139–175. [CrossRef]
246. Abdulkhaleq, L.A.; Assi, M.A.; Noor, M.H.M.; Abdullah, R.; Saad, M.Z.; Taufiq-Yap, Y.H. Therapeutic uses of epicatechin in diabetes and cancer. *Vet. World* **2017**, *10*, 869–872. [CrossRef] [PubMed]
247. Lakshmi, T.; Ramasamy, R.; Thirumalaikumaran, R. Preliminary phytochemical analysis and in vitro antioxidant, FTIR spectroscopy, anti-diabetic activity of *Acacia catechu* ethanolic seed extract. *Pharmacogn. J.* **2015**, *7*, 356–362. [CrossRef]
248. Bharti, S.K.; Krishnan, S.; Kumar, A.; Kumar, A. Antidiabetic phytoconstituents and their mode of action on metabolic pathways. *Ther. Adv. Endocrinol. Metab.* **2018**, *9*, 81–100. [CrossRef]
249. Niture, N.T.; Ansari, A.A.; Naik, S.R. Anti-hyperglycemic activity of rutin in streptozotocin-induced diabetic rats: An effect mediated through cytokines, antioxidants and lipid biomarkers. *Indian J. Exp. Biol.* **2014**, *52*, 720–727.
250. Ramalingam, S.; Packirisamy, M.; Karuppiah, M.; Vasu, G.; Gopalakrishnan, R.; Gothandam, K.; Thiruppathi, M. Effect of β-sitosterol on glucose homeostasis by sensitization of insulin resistance via enhanced protein expression of PPRγ and glucose transporter 4 in high fat diet and streptozotocin-induced diabetic rats. *Cytotechnology* **2020**, *72*, 357–366. [CrossRef]
251. Nigam, V.; Nambiar, V. Therapeutic potential of *Aegle marmelos* (L.) Correa leaves as an antioxidant and anti-diabetic agent: A review. *Int. J. Pharma Sci. Res.* **2015**, *6*, 611–621.
252. Baliga, M.S.; Thilakchand, K.R.; Rai, M.P.; Rao, S.; Venkatesh, P. *Aegle marmelos* (L.) Correa (Bael) and its phytochemicals in the treatment and prevention of cancer. *Integr. Cancer Ther.* **2013**, *12*, 187–196. [CrossRef]
253. Wei, C.-K.; Tsai, Y.-H.; Korinek, M.; Hung, P.-H.; El-Shazly, M.; Cheng, Y.-B.; Wu, Y.-C.; Hsieh, T.-J.; Chang, F.-R. 6-Paradol and 6-Shogaol, the Pungent Compounds of Ginger, Promote Glucose Utilization in Adipocytes and Myotubes, and 6-Paradol Reduces Blood Glucose in High-Fat Diet-Fed Mice. *Int. J. Mol. Sci.* **2017**, *18*, 168. [CrossRef]
254. Son, M.J.; Miura, Y.; Yagasaki, K. Mechanisms for antidiabetic effect of gingerol in cultured cells and obese diabetic model mice. *Cytotechnology* **2015**, *67*, 641–652. [CrossRef]
255. Wang, X.; Li, Y.L.; Wu, H.; Liu, J.Z.; Hu, J.X.; Liao, N.; Peng, J.; Cao, P.P.; Liang, X.; Hai, C.X. Antidiabetic effect of oleanolic acid: A promising use of a traditional pharmacological agent. *Phytother. Res.* **2011**, *25*, 1031–1040. [CrossRef] [PubMed]
256. Chandramohan, G.; Al-Numair, K.S.; Alsaif, M.A.; Veeramani, C. Antidiabetic effect of kaempferol a flavonoid compound, on streptozotocin-induced diabetic rats with special reference to glycoprotein components. *Prog. Nutr.* **2015**, *17*, 50–57.
257. Gupta, R.; Sharma, A.K.; Sharma, M.; Dobhal, M.; Gupta, R. Evaluation of antidiabetic and antioxidant potential of lupeol in experimental hyperglycaemia. *Nat. Prod. Res.* **2012**, *26*, 1125–1129. [CrossRef]
258. Sunil, C.; Irudayaraj, S.S.; Duraipandiyan, V.; Alrashood, S.T.; Alharbi, S.A.; Ignacimuthu, S. Friedelin exhibits antidiabetic effect in diabetic rats via modulation of glucose metabolism in liver and muscle. *J. Ethnopharmacol.* **2021**, *268*, 113659. [CrossRef] [PubMed]
259. Kumar, D.; Dash, G.; Tripathy, N. Hypoglycaemic activity of bark extracts of *Albizia lebbeck* Benth. in streptozotocin induced diabetic rats. *Int. J. Pharm. Sci. Rev. Res.* **2013**, *18*, 28–32.
260. Hashiesh, H.M.; Meeran, M.F.N.; Sharma, C.; Sadek, B.; Kaabi, J.A.; Ojha, S.K. Therapeutic Potential of β-Caryophyllene: A Dietary Cannabinoid in Diabetes and Associated Complications. *Nutrients* **2020**, *12*, 2963. [CrossRef]
261. Zhai, B.; Zhang, C.; Sheng, Y.; Zhao, C.; He, X.; Xu, W.; Huang, K.; Luo, Y. Hypoglycemic and hypolipidemic effect of S-allyl-cysteine sulfoxide (alliin) in DIO mice. *Sci. Rep.* **2018**, *8*, 3527. [CrossRef] [PubMed]
262. Chan, C.-H.; Ngoh, G.-C.; Yusoff, R. A brief review on anti diabetic plants: Global distribution, active ingredients, extraction techniques and acting mechanisms. *Pharmacogn. Rev.* **2012**, *6*, 22–28. [CrossRef]

263. Abdulghafoor, H.A.; Ramadhan, S.J.; Nawfal, A.J. Therapeutic Effects of Allicin against the Diabetes Mellitus Induced by Streptozotocin in Male Rats. *Nat. Volatiles Essent. Oils J.* **2021**, *8*, 8934–8945.
264. Zhong, R.; Chen, L.; Liu, Y.; Xie, S.; Li, S.; Liu, B.; Zhao, C. Anti-diabetic effect of aloin via JNK-IRS1/PI3K pathways and regulation of gut microbiota. *Food Sci. Hum. Wellness* **2022**, *11*, 189–198. [CrossRef]
265. Alinejad-Mofrad, S.; Foadoddini, M.; Saadatjoo, S.A.; Shayesteh, M. Improvement of glucose and lipid profile status with *Aloe vera* in pre-diabetic subjects: A randomized controlled-trial. *J. Diabetes Metab. Disord.* **2015**, *14*, 22. [CrossRef] [PubMed]
266. Martorell, M.; Castro, N.; Victoriano, M.; Capó, X.; Tejada, S.; Vitalini, S.; Pezzani, R.; Sureda, A. An update of anthraquinone derivatives emodin, diacerein, and catenarin in diabetes. *Evid.-Based Complementary Altern. Med.* **2021**, *2021*, 3313419. [CrossRef] [PubMed]
267. Palheta, I.; Ferreira, L. Hypoglycemic potential of *Anacardium occidentale* L. *J. Anal. Pharm. Res.* **2018**, *7*, 152–153.
268. Prabhakar, P.K.; Doble, M. A target based therapeutic approach towards diabetes mellitus using medicinal plants. *Curr. Diabetes Rev.* **2008**, *4*, 291–308. [CrossRef]
269. Muruganandan, S.; Srinivasan, K.; Gupta, S.; Gupta, P.; Lal, J. Effect of mangiferin on hyperglycemia and atherogenicity in streptozotocin diabetic rats. *J. Ethnopharmacol.* **2005**, *97*, 497–501. [CrossRef] [PubMed]
270. Liu, Y.W.; Hao, Y.C.; Chen, Y.J.; Yin, S.Y.; Zhang, M.Y.; Kong, L.; Wang, T.Y. Protective effects of sarsasapogenin against early stage of diabetic nephropathy in rats. *Phytother. Res.* **2018**, *32*, 1574–1582. [CrossRef] [PubMed]
271. Jayachandran, M.; Zhang, T.; Ganesan, K.; Xu, B.; Chung, S.S.M. Isoquercetin ameliorates hyperglycemia and regulates key enzymes of glucose metabolism via insulin signaling pathway in streptozotocin-induced diabetic rats. *Eur. J. Pharmacol.* **2018**, *829*, 112–120. [CrossRef]
272. Amor, A.J.; Gómez-Guerrero, C.; Ortega, E.; Sala-Vila, A.; Lázaro, I. Ellagic Acid as a Tool to Limit the Diabetes Burden: Updated Evidence. *Antioxidants* **2020**, *9*, 1226. [CrossRef]
273. Sharma, V.C.; Kaushik, A.; Dey, Y.N.; Srivastava, B.; Wanjari, M.; Pawar, S.; Chougule, S. Nephroprotective potential of *Anogeissus latifolia* Roxb. (Dhava) against gentamicin-induced nephrotoxicity in rats. *J. Ethnopharmacol.* **2021**, *273*, 114001. [CrossRef]
274. Szkudelski, T.; Szkudelska, K. Anti-diabetic effects of resveratrol. *Ann. N. Y. Acad. Sci.* **2011**, *1215*, 34–39. [CrossRef]
275. Dabe, N.E.; Kefale, A.T. Antidiabetic Effects of *Artemisia* Species: A Systematic Review. *Anc. Sci. Life* **2017**, *36*, 175–181. [CrossRef] [PubMed]
276. Bakun, P.; Czarczynska-Goslinska, B.; Goslinski, T.; Lijewski, S. In vitro and in vivo biological activities of azulene derivatives with potential applications in medicine. *Med. Chem. Res.* **2021**, *30*, 834–846. [CrossRef] [PubMed]
277. Ramírez-Espinosa, J.J.; Saldaña-Ríos, J.; García-Jiménez, S.; Villalobos-Molina, R.; Ávila-Villarreal, G.; Rodríguez-Ocampo, A.N.; Bernal-Fernández, G.; Estrada-Soto, S. Chrysin Induces Antidiabetic, Antidyslipidemic and Anti-Inflammatory Effects in Athymic Nude Diabetic Mice. *Molecules* **2018**, *23*, 67. [CrossRef] [PubMed]
278. Voroneanu, L.; Nistor, I.; Dumea, R.; Apetrii, M.; Covic, A. Silymarin in Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *J. Diabetes Res.* **2016**, *2016*, 5147468. [CrossRef]
279. Mousavi, L.; Salleh, M.; Vikneswaran, M.; Asmawi, M. Anti-diabetic chemical constituents isolated from traditional medicinal plants. *J. Glob. Trends Pharm. Sci.* **2016**, *7*, 3074–3083.
280. Maji, S. Role of Neem leaves in Diabetes and Obesity. In *Role of Phytochemicals in Human Physiological Disorders: Diabetes and Obesity*; Scholars' Press: Atlanta, GA, USA, 2020; pp. 85–102.
281. Zaky, A.S.; Kandeil, M.; Abdel-Gabbar, M.; Fahmy, E.M.; Almehmadi, M.M.; Ali, T.M.; Ahmed, O.M. The Antidiabetic Effects and Modes of Action of the *Balanites aegyptiaca* Fruit and Seed Aqueous Extracts in NA/STZ-Induced Diabetic Rats. *Pharmaceutics* **2022**, *14*, 263. [CrossRef]
282. Yin, J.; Ye, J.; Jia, W. Effects and mechanisms of berberine in diabetes treatment. *Acta Pharm. Sin. B* **2012**, *2*, 327–334. [CrossRef]
283. Sankaranarayanan, C.; Nishanthi, R.; Pugalendi, P. Ameliorating effect of berbamine on hepatic key enzymes of carbohydrate metabolism in high-fat diet and streptozotocin induced type 2 diabetic rats. *Biomed. Pharmacother.* **2018**, *103*, 539–545. [CrossRef]
284. Chang, C.L.-T.; Liu, H.-Y.; Kuo, T.-F.; Hsu, Y.-J.; Shen, M.-Y.; Pan, C.-Y.; Yang, W.-C. Antidiabetic effect and mode of action of cytopiloyne. *Evid.-Based Complementary Altern. Med.* **2013**, *2013*, 685642. [CrossRef]
285. Barky, A.; Ezz, A.; Mohammed, T. The Potential role of apigenin in diabetes mellitus. *Int. J. Clin. Case Rep. Rev.* **2020**, *3*, 32. [CrossRef]
286. Parveen, G.; Ali, M. Extraction Isolation and Phytochemical Screening of Leaves and Stems of *Bidens Pilosa* and Evaluation of Antifungal Potential of Extracts. *J. Pharm. Biol. Sci.* **2019**, *14*, 73–85. [CrossRef]
287. Kim, H.J.; Park, K.S.; Lee, S.K.; Min, K.W.; Han, K.A.; Kim, Y.K.; Ku, B.J. Effects of pinitol on glycemic control, insulin resistance and adipocytokine levels in patients with type 2 diabetes mellitus. *Ann. Nutr. Metab.* **2012**, *60*, 1–5. [CrossRef] [PubMed]
288. Hafizur, R.M.; Hameed, A.; Shukrana, M.; Raza, S.A.; Chishti, S.; Kabir, N.; Siddiqui, R.A. Cinnamic acid exerts anti-diabetic activity by improving glucose tolerance in vivo and by stimulating insulin secretion in vitro. *Phytomedicine* **2015**, *22*, 297–300. [CrossRef]
289. Ortsäter, H.; Grankvist, N.; Wolfram, S.; Kuehn, N.; Sjöholm, Å. Diet supplementation with green tea extract epigallocatechin gallate prevents progression to glucose intolerance in db/db mice. *Nutr. Metab.* **2012**, *9*, 11. [CrossRef] [PubMed]
290. Wolfram, S.; Raederstorff, D.; Preller, M.; Wang, Y.; Teixeira, S.R.; Riegger, C.; Weber, P. Epigallocatechin gallate supplementation alleviates diabetes in rodents. *J. Nutr.* **2006**, *136*, 2512–2518. [CrossRef]

291. Belury, M.A.; Cole, R.M.; Snoke, D.B.; Banh, T.; Angelotti, A. Linoleic acid, glycemic control and Type 2 diabetes. *Prostaglandins Leukot. Essent. Fat. Acids* **2018**, *132*, 30–33. [CrossRef]
292. Pu, J.; Peng, G.; Li, L.; Na, H.; Liu, Y.; Liu, P. Palmitic acid acutely stimulates glucose uptake via activation of Akt and ERK1/2 in skeletal muscle cells [S]. *J. Lipid Res.* **2011**, *52*, 1319–1327. [CrossRef]
293. Mishra, C.; Code, Q. Comparative anti-diabetic study of three phytochemicals on high-fat diet and streptozotocin-induced diabetic dyslipidemic rats. *Int. J. Biomed. Adv. Res.* **2018**, *9*, 286–293. [CrossRef]
294. Majidi, Z.; Bina, F.; Kahkeshani, N.; Rahimi, R. *Bunium persicum*: A review of ethnopharmacology, phytochemistry, and biological activities. *Tradit. Integr. Med.* **2020**, *5*, 150–176. [CrossRef]
295. Babujanarthanam, R.; Kavitha, P.; Pandian, M.R. Quercitrin, a bioflavonoid improves glucose homeostasis in streptozotocin-induced diabetic tissues by altering glycolytic and gluconeogenic enzymes. *Fundam. Clin. Pharmacol.* **2010**, *24*, 357–364. [CrossRef]
296. Han, X.-X.; Jiang, Y.-P.; Liu, N.; Wu, J.; Yang, J.-M.; Li, Y.-X.; Sun, M.; Sun, T.; Zheng, P.; Yu, J.-Q. Protective effects of astragalin on spermatogenesis in streptozotocin-induced diabetes in male mice by improving antioxidant activity and inhibiting inflammation. *Biomed. Pharmacother.* **2019**, *110*, 561–570. [CrossRef] [PubMed]
297. Yusuf, M.; Nasiruddin, M.; Sultana, N.; Akhtar, J.; Khan, M.I.; Ahmad, M. Regulatory Mechanism of Caffeic acid on glucose Metabolism in Diabetes. *Res. J. Pharm. Technol.* **2019**, *12*, 4735–4740. [CrossRef]
298. Kadakol, A.; Malek, V.; Goru, S.K.; Pandey, A.; Sharma, N.; Gaikwad, A.B. Esculetin ameliorates insulin resistance and type 2 diabetic nephropathy through reversal of histone H3 acetylation and H2A lysine 119 monoubiquitination. *J. Funct. Foods* **2017**, *35*, 256–266. [CrossRef]
299. Song, J.-X.; Ren, H.; Gao, Y.-F.; Lee, C.-Y.; Li, S.-F.; Zhang, F.; Li, L.; Chen, H. Dietary capsaicin improves glucose homeostasis and alters the gut microbiota in obese diabetic ob/ob mice. *Front. Physiol.* **2017**, *8*, 602. [CrossRef]
300. Marcelino, G.; Machate, D.J.; de Cássia Freitas, K.; Hiane, P.A.; Maldonade, I.R.; Pott, A.; Asato, M.A.; Candido, C.J.; de Cássia Avellaneda Guimarães, R. β-Carotene: Preventive Role for Type 2 Diabetes Mellitus and Obesity: A Review. *Molecules* **2020**, *25*, 5803. [CrossRef] [PubMed]
301. Meng, S.; Cao, J.; Feng, Q.; Peng, J.; Hu, Y. Roles of chlorogenic acid on regulating glucose and lipids metabolism: A review. *Evid.-Based Complementary Altern. Med.* **2013**, *2013*, 801457. [CrossRef] [PubMed]
302. Ranđelović, S.; Bipat, R. A Review of Coumarins and Coumarin-Related Compounds for Their Potential Antidiabetic Effect. *Clin. Med. Insights: Endocrinol. Diabetes* **2021**, *14*, 11795514211042023. [CrossRef]
303. Malik, A.; Jamil, U.; Butt, T.T.; Waquar, S.; Gan, S.H.; Shafique, H.; Jafar, T.H. In silico and in vitro studies of lupeol and iso-orientin as potential antidiabetic agents in a rat model. *Drug Des. Dev. Ther.* **2019**, *13*, 1501–1513. [CrossRef]
304. Bak, E.-J.; Kim, J.; Jang, S.; Woo, G.-H.; Yoon, H.-G.; Yoo, Y.-J.; Cha, J.-H. Gallic acid improves glucose tolerance and triglyceride concentration in diet-induced obesity mice. *Scand. J. Clin. Lab. Investig.* **2013**, *73*, 607–614. [CrossRef]
305. Goboza, M.; Aboua, Y.G.; Chegou, N.; Oguntibeju, O.O. Vindoline effectively ameliorated diabetes-induced hepatotoxicity by docking oxidative stress, inflammation and hypertriglyceridemia in type 2 diabetes-induced male Wistar rats. *Biomed. Pharmacother.* **2019**, *112*, 108638. [CrossRef]
306. Alonso-Castro, A.J.; Zapata-Bustos, R.; Gómez-Espinoza, G.; Salazar-Olivo, L.A. Isoorientin reverts TNF-α-induced insulin resistance in adipocytes activating the insulin signaling pathway. *Endocrinology* **2012**, *153*, 5222–5230. [CrossRef] [PubMed]
307. Cadena-Zamudio, J.D.; Nicasio-Torres, M.d.P.; Guerrero-Analco, J.A.; Ibarra-Laclette, E. Ethnopharmacological studies of *Cecropia obtusifolia* (Urticaceae) and its importance in the treatment of type 2 diabetes mellitus: A mini-review. *Acta Bot. Mex.* **2019**, *126*. [CrossRef]
308. Abbas, Z.K.; Saggu, S.; Sakeran, M.I.; Zidan, N.; Rehman, H.; Ansari, A.A. Phytochemical, antioxidant and mineral composition of hydroalcoholic extract of chicory (*Cichorium intybus* L.) leaves. *Saudi J. Biol. Sci.* **2015**, *22*, 322–326. [CrossRef] [PubMed]
309. Guo, X.; Sun, W.; Huang, L.; Wu, L.; Hou, Y.; Qin, L.; Liu, T. Effect of cinnamaldehyde on glucose metabolism and vessel function. *Med. Sci. Monit. Int. Med. J. Exp. Clin. Res.* **2017**, *23*, 3844–3853. [CrossRef]
310. Singh, P.; Jayaramaiah, R.H.; Agawane, S.B.; Vannuruswamy, G.; Korwar, A.M.; Anand, A.; Dhaygude, V.S.; Shaikh, M.L.; Joshi, R.S.; Boppana, R. Potential dual role of eugenol in inhibiting advanced glycation end products in diabetes: Proteomic and mechanistic insights. *Sci. Rep.* **2016**, *6*, 18798. [CrossRef] [PubMed]
311. Hsu, C.-C.; Lin, M.H.; Cheng, J.-T.; Wu, M.C. Diosmin, a Citrus Nutrient, Activates Imidazoline Receptors to Alleviate Blood Glucose and Lipids in Type 1-Like Diabetic Rats. *Nutrients* **2017**, *9*, 684. [CrossRef]
312. Revathy, J.; Sheik Abdullah, S. The role of hesperetin in the management of diabetes mellitus and its complications. *J. Cancer Treat. Res.* **2017**, *5*, 1–6. [CrossRef]
313. Den Hartogh, D.J.; Tsiani, E. Antidiabetic Properties of Naringenin: A Citrus Fruit Polyphenol. *Biomolecules* **2019**, *9*, 99. [CrossRef]
314. Yan, F.; Benrong, H.; Qiang, T.; Qin, F.; Jizhou, X. Hypoglycemic activity of jatrorrhizine. *J. Huazhong Univ. Sci. Technol. [Med. Sci.]* **2005**, *25*, 491–493. [CrossRef]
315. Li, Y.; Sun, M.; Liu, Y.; Liang, J.; Wang, T.; Zhang, Z. Gymnemic acid alleviates type 2 diabetes mellitus and suppresses endoplasmic reticulum stress in vivo and in vitro. *J. Agric. Food Chem.* **2019**, *67*, 3662–3669. [CrossRef]

316. Castro, A.J.G.; Frederico, M.J.S.; Cazarolli, L.H.; Mendes, C.P.; Bretanha, L.C.; Schmidt, E.C.; Bouzon, Z.L.; de Medeiros Pinto, V.A.; da Fonte Ramos, C.; Pizzolatti, M.G. The mechanism of action of ursolic acid as insulin secretagogue and insulinomimetic is mediated by cross-talk between calcium and kinases to regulate glucose balance. *Biochim. Et Biophys. Acta (BBA)-Gen. Subj.* **2015**, *1850*, 51–61. [CrossRef] [PubMed]
317. Marton, L.T.; Pescinini-e-Salzedas, L.M.; Camargo, M.E.C.; Barbalho, S.M.; Haber, J.F.; Sinatora, R.V.; Detregiachi, C.R.P.; Girio, R.J.; Buchaim, D.V.; Cincotto dos Santos Bueno, P. The effects of curcumin on diabetes mellitus: A systematic review. *Front. Endocrinol.* **2021**, *12*, 443. [CrossRef] [PubMed]
318. Lekshmi, P.; Arimboor, R.; Raghu, K.; Menon, A.N. Turmerin, the antioxidant protein from turmeric (*Curcuma longa*) exhibits antihyperglycaemic effects. *Nat. Prod. Res.* **2012**, *26*, 1654–1658. [CrossRef]
319. Zabad, I.E.M.; Amin, M.N.; El-Shishtawy, M.M. Protective effect of vanillin on diabetic nephropathy by decreasing advanced glycation end products in rats. *Life Sci.* **2019**, *239*, 117088. [CrossRef] [PubMed]
320. Zhou, Q.; Chen, L.; Chen, Q.-W.; Chen, H.-W.; Dong, J.-X. Chemical constituents of *Cudrania cochinchinensis*. *J. Chin. Med. Mater.* **2013**, *36*, 1444–1447.
321. Oza, M.J.; Kulkarni, Y.A. Biochanin A improves insulin sensitivity and controls hyperglycemia in type 2 diabetes. *Biomed. Pharmacother.* **2018**, *107*, 1119–1127. [CrossRef]
322. Yao, X.; Li, K.; Liang, C.; Zhou, Z.; Wang, J.; Wang, S.; Liu, L.; Yu, C.-L.; Song, Z.-B.; Bao, Y.-L. Tectorigenin enhances PDX1 expression and protects pancreatic β-cells by activating ERK and reducing ER stress. *J. Biol. Chem.* **2020**, *295*, 12975–12992. [CrossRef]
323. Sultana, S.; Asif, H.M.; Naveed Akhtar, N.; Akhtar, N. *Dalbergia sissoo* Roxb: Monograph. *Int. J. Pharmacogn.* **2015**, *2*, 440–443.
324. Yuan, Y.-L.; Guo, C.-R.; Cui, L.-L.; Ruan, S.-X.; Zhang, C.-F.; Ji, D.; Yang, Z.-L.; Li, F. Timosaponin B-II ameliorates diabetic nephropathy via TXNIP, mTOR, and NF-κB signaling pathways in alloxan-induced mice. *Drug Des. Dev. Ther.* **2015**, *9*, 6247–6258. [CrossRef]
325. Qa'dan, F.; Verspohl, E.J.; Nahrstedt, A.; Petereit, F.; Matalka, K.Z. Cinchonain Ib isolated from *Eriobotrya japonica* induces insulin secretion in vitro and in vivo. *J. Ethnopharmacol.* **2009**, *124*, 224–227. [CrossRef]
326. Song, T.-J.; Park, C.-H.; In, K.-R.; Kim, J.-B.; Kim, J.H.; Kim, M.; Chang, H.J. Antidiabetic effects of betulinic acid mediated by the activation of the AMP-activated protein kinase pathway. *PLoS ONE* **2021**, *16*, e0249109. [CrossRef]
327. Kim, D.Y.; Kang, M.-K.; Lee, E.-J.; Kim, Y.-H.; Oh, H.; Kim, S.-I.; Oh, S.Y.; Na, W.; Kang, Y.-H. Eucalyptol Inhibits Amyloid-β-Induced Barrier Dysfunction in Glucose-Exposed Retinal Pigment Epithelial Cells and Diabetic Eyes. *Antioxidants* **2020**, *9*, 1000. [CrossRef]
328. Kolhe, S.S.; Rachh, P.R. Review on potent anti-diabetic plants or herbs from traditional medicine. *J. Drug Deliv. Ther.* **2018**, *8*, 92–98. [CrossRef]
329. Cherian, S.; Kumar, R.V.; Augusti, K.; Kidwai, J. Antidiabetic effect of a glycoside of pelargonidin isolated from the bark of *Ficus bengalensis* Linn. *Indian J. Biochem. Biophys.* **1992**, *29*, 380–382.
330. Murugesu, S.; Selamat, J.; Perumal, V. Phytochemistry, Pharmacological Properties, and Recent Applications of *Ficus benghalensis* and *Ficus religiosa*. *Plants* **2021**, *10*, 2749. [CrossRef]
331. Ayepola, O.R.; Chegou, N.N.; Brooks, N.L.; Oguntibeju, O.O. Kolaviron, a *Garcinia* biflavonoid complex ameliorates hyperglycemia-mediated hepatic injury in rats via suppression of inflammatory responses. *BMC Complementary Altern. Med.* **2013**, *13*, 363. [CrossRef]
332. Ogunmoyole, T.; Olalekan, O.; Fatai, O.; Makun, J.; Kade, I. Antioxidant and phytochemical profile of aqueous and ethanolic extract of *Garcinia kola*. *J. Pharmacogn. Phytother.* **2012**, *4*, 66–74. [CrossRef]
333. Sharma, V.; Katiyar, A.; Agarwal, R.C. Glycyrrhiza glabra: Chemistry and Pharmacological Activity. In *Sweeteners*; Ramawat, K., Mérillon, J.M., Eds.; Springer: New York, NY, USA, 2018; pp. 87–100. [CrossRef]
334. Takii, H.; Kometani, T.; Nishimura, T.; Nakae, T.; Okada, S.; Fushiki, T. Antidiabetic effect of glycyrrhizin in genetically diabetic KK-Ay mice. *Biol. Pharm. Bull.* **2001**, *24*, 484–487. [CrossRef]
335. Kalaiarasi, P.; Pugalendi, K.V. Antihyperglycemic effect of 18β-glycyrrhetinic acid, aglycone of glycyrrhizin, on streptozotocin-diabetic rats. *Eur. J. Pharmacol.* **2009**, *606*, 269–273. [CrossRef]
336. Gupta, R.; Bajpai, K.G.; Johri, S.; Saxena, A. An overview of Indian novel traditional medicinal plants with anti-diabetic potentials. *Afr. J. Tradit. Complementary Altern. Med.* **2008**, *5*, 1–17.
337. Ahangarpour, A.; Oroojan, A.A.; Khorsandi, L.; Shabani, R.; Mojaddami, S. Preventive effects of betulinic acid on streptozotocin-nicotinamide induced diabetic nephropathy in male mouse. *J. Nephropathol.* **2016**, *5*, 128–133. [CrossRef]
338. Iwalewa, E.O.; Adewale, I.O.; Taiwo, B.J.; Arogundade, T.; Osinowo, A.; Daniyan, O.M.; Adetogun, G.E. Effects of *Harungana madagascariensis* stem bark extract on the antioxidant markers in alloxan induced diabetic and carrageenan induced inflammatory disorders in rats. *J. Complementary Integr. Med.* **2008**, *5*. [CrossRef]
339. Amalan, V.; Vijayakumar, N.; Indumathi, D.; Ramakrishnan, A. Antidiabetic and antihyperlipidemic activity of p-coumaric acid in diabetic rats, role of pancreatic GLUT 2: In vivo approach. *Biomed. Pharmacother.* **2016**, *84*, 230–236. [CrossRef]
340. Wang, J.; Huang, M.; Yang, J.; Ma, X.; Zheng, S.; Deng, S.; Huang, Y.; Yang, X.; Zhao, P. Anti-diabetic activity of stigmasterol from soybean oil by targeting the GLUT4 glucose transporter. *Food Nutr. Res.* **2017**, *61*, 1364117. [CrossRef]
341. Sindhu, R.K.; Puri, V. Phytochemical, nutritional and pharmacological evidences for *Abelmoschus esculentus* (L.). *J. Phytopharm.* **2016**, *5*, 238–241. [CrossRef]

342. Anwar, A.; Azmi, M.A.; Siddiqui, J.A.; Panhwar, G.; Shaikh, F.; Ariff, M. Thiamine level in type I and type II diabetes mellitus patients: A comparative study focusing on hematological and biochemical evaluations. *Cureus* **2020**, *12*, e8027. [CrossRef]
343. Shi, L.; Du, X.; Guo, P.; Huang, L.; Qi, P.; Gong, Q. Ascorbic acid supplementation in type 2 diabetes mellitus: A protocol for systematic review and meta-analysis. *Medicine* **2020**, *99*, e23125. [CrossRef]
344. Chowdhury, S.; Ghosh, S.; Das, A.K.; Sil, P.C. Ferulic acid protects hyperglycemia-induced kidney damage by regulating oxidative insult, inflammation and autophagy. *Front. Pharmacol.* **2019**, *10*, 27. [CrossRef]
345. Wang, H.; Wang, J.; Qiu, C.; Ye, Y.; Guo, X.; Chen, G.; Li, T.; Wang, Y.; Fu, X.; Liu, R.H. Comparison of phytochemical profiles and health benefits in fiber and oil flaxseeds (*Linum usitatissimum* L.). *Food Chem.* **2017**, *214*, 227–233. [CrossRef]
346. Mitra, A.; Mahadevappa, M. Antidiabetic and hypolipidemic effects of mahanimbine (carbazole alkaloid) from *Murraya koenigii* (rutaceae) leaves. *Int. J. Phytomedicine* **2010**, *2*, 22–30. [CrossRef]
347. Song, S.E.; Jo, H.J.; Kim, Y.-W.; Cho, Y.-J.; Kim, J.-R.; Park, S.-Y. Delphinidin prevents high glucose-induced cell proliferation and collagen synthesis by inhibition of NOX-1 and mitochondrial superoxide in mesangial cells. *J. Pharmacol. Sci.* **2016**, *130*, 235–243. [CrossRef]
348. Desai, S.; Saheb, S.H.; Das, K.K.; Haseena, S. Phytochemical Analysis of *Nigella sativa* and its Antidiabetic Effect. *J. Pharm. Sci. Res.* **2015**, *7*, 527–532.
349. Abdelrazek, H.; Kilany, O.E.; Muhammad, M.A.; Tag, H.M.; Abdelazim, A.M. Black seed thymoquinone improved insulin secretion, hepatic glycogen storage, and oxidative stress in streptozotocin-induced diabetic male Wistar rats. *Oxidative Med. Cell. Longev.* **2018**, *2018*, 8104165. [CrossRef]
350. Saravanan, S.; Pari, L. Role of thymol on hyperglycemia and hyperlipidemia in high fat diet-induced type 2 diabetic C57BL/6J mice. *Eur. J. Pharmacol.* **2015**, *761*, 279–287. [CrossRef]
351. More, T.A.; Kulkarni, B.R.; Nalawade, M.L.; Arvindekar, A.U. Antidiabetic activity of linalool and limonene in streptozotocin-induced diabetic rat: A combinatorial therapy approach. *Int. J. Pharm. Pharm. Sci.* **2014**, *6*, 159–163.
352. Al-Azzawie, H.F.; Alhamdani, M.S.S. Hypoglycemic and antioxidant effect of oleuropein in alloxan-diabetic rabbits. *Life Sci.* **2006**, *78*, 1371–1377. [CrossRef]
353. Dai, S.; Hong, Y.; Xu, J.; Lin, Y.; Si, Q.; Gu, X. Ginsenoside Rb2 promotes glucose metabolism and attenuates fat accumulation via AKT-dependent mechanisms. *Biomed. Pharmacother.* **2018**, *100*, 93–100. [CrossRef]
354. Li, Y.; Zheng, X.; Yi, X.; Liu, C.; Kong, D.; Zhang, J.; Gong, M. Myricetin: A potent approach for the treatment of type 2 diabetes as a natural class B GPCR agonist. *FASEB J.* **2017**, *31*, 2603–2611. [CrossRef]
355. Kulkarni, C.R.; Joglekar, M.M.; Patil, S.B.; Arvindekar, A.U. Antihyperglycemic and antihyperlipidemic effect of *Santalum album* in streptozotocin induced diabetic rats. *Pharm. Biol.* **2012**, *50*, 360–365. [CrossRef]
356. Paswan, S.K.; Verma, P.; Azmi, L.; Srivastava, S.; Venkateswara Rao, C. Phytochemical Investigation and HPTLC Fingerprinting Analysis of *Selaginella bryopteris* Ethanolic Plant Extract for Analgesic and Anti-inflammatory Activities in Animals. *J. Biol. Act. Prod. Nat.* **2021**, *11*, 395–405. [CrossRef]
357. Neeta, M.; Mukta, N.; Bilwa, K. Comparative qualitative phytochemical analysis of *Sesamum indicum* L. *Int. J. Curr. Microbiol. Appl. Sci.* **2015**, *2*, 172–181.
358. Mohammad Shahi, M.; Zakerzadeh, M.; Zakerkish, M.; Zarei, M.; Saki, A. Effect of sesamin supplementation on glycemic status, inflammatory markers, and adiponectin levels in patients with type 2 diabetes mellitus. *J. Diet. Suppl.* **2017**, *14*, 65–75. [CrossRef] [PubMed]
359. Bhadoriya, S.S.; Ganeshpurkar, A.; Bhadoriya, R.P.S.; Sahu, S.K.; Patel, J.R. Antidiabetic potential of polyphenolic-rich fraction of *Tamarindus indica* seed coat in alloxan-induced diabetic rats. *J. Basic Clin. Physiol. Pharmacol.* **2018**, *29*, 37–45. [CrossRef] [PubMed]
360. Harakeh, S.; Almuhayawi, M.; Al Jaouni, S.; Almasaudi, S.; Hassan, S.; Al Amri, T.; Azhar, N.; Abd-Allah, E.; Ali, S.; El-Shitany, N. Antidiabetic effects of novel ellagic acid nanoformulation: Insulin-secreting and anti-apoptosis effects. *Saudi J. Biol. Sci.* **2020**, *27*, 3474–3480. [CrossRef]
361. Chang, C.L.; Lin, C.S. Phytochemical composition, antioxidant activity, and neuroprotective effect of *Terminalia chebula* Retzius extracts. *Evid.-Based Complementary Altern. Med.* **2012**, *2012*, 125247. [CrossRef]
362. Liu, X.; Kim, J.-k.; Li, Y.; Li, J.; Liu, F.; Chen, X. Tannic acid stimulates glucose transport and inhibits adipocyte differentiation in 3T3-L1 cells. *J. Nutr.* **2005**, *135*, 165–171. [CrossRef]
363. Rajalakshmi, M.; Anita, R. β-cell regenerative efficacy of a polysaccharide isolated from methanolic extract of *Tinospora cordifolia* stem on streptozotocin-induced diabetic Wistar rats. *Chem.-Biol. Interact.* **2016**, *243*, 45–53. [CrossRef]
364. Kalailingam, P.; Kannaian, B.; Tamilmani, E.; Kaliaperumal, R. Efficacy of natural diosgenin on cardiovascular risk, insulin secretion, and beta cells in streptozotocin (STZ)-induced diabetic rats. *Phytomedicine* **2014**, *21*, 1154–1161. [CrossRef]
365. Leng, J.; Li, X.; Tian, H.; Liu, C.; Guo, Y.; Zhang, S.; Chu, Y.; Li, J.; Wang, Y.; Zhang, L. Neuroprotective effect of diosgenin in a mouse model of diabetic peripheral neuropathy involves the Nrf2/HO-1 pathway. *BMC Complementary Med. Ther.* **2020**, *20*, 126. [CrossRef]
366. Alara, O.R.; Abdurahman, N.H.; Ukaegbu, C.I.; Kabbashi, N.A. Extraction and characterization of bioactive compounds in *Vernonia amygdalina* leaf ethanolic extract comparing Soxhlet and microwave-assisted extraction techniques. *J. Taibah Univ. Sci.* **2019**, *13*, 414–422. [CrossRef]
367. Balbi, M.E.; Tonin, F.S.; Mendes, A.M.; Borba, H.H.; Wiens, A.; Fernandez-Llimos, F.; Pontarolo, R. Antioxidant effects of vitamins in type 2 diabetes: A meta-analysis of randomized controlled trials. *Diabetol. Metab. Syndr.* **2018**, *10*, 18. [CrossRef] [PubMed]

368. Ram, H.; Kumar, P.; Purohit, A.; Kashyap, P.; Kumar, S.; Kumar, S.; Singh, G.; Alqarawi, A.A.; Hashem, A.; Abd-Allah, E.F. Improvements in HOMA indices and pancreatic endocrinal tissues in type 2-diabetic rats by DPP-4 inhibition and antioxidant potential of an ethanol fruit extract of *Withania coagulans*. *Nutr. Metab.* **2021**, *18*, 43. [CrossRef] [PubMed]
369. Peerzade, N.; Sayed, N.; Das, N. Antimicrobial and phytochemical screening of methanolic fruit extract of *Withania coagulans* L. Dunal for evaluating the antidiabetic activity. *Pharma Innov. J.* **2018**, *7*, 197–204.
370. Osadebe, P.O.; Odoh, E.U.; Uzor, P.F. Natural products as potential sources of antidiabetic drugs. *J. Pharm. Res. Int.* **2014**, *4*, 2075–2095. [CrossRef]
371. Dev, S. *Prime Ayurvedic Plant Drugs: A Modern Scientific Appraisal*, 1st ed.; Ane Books Pvt. Limited: New Delhi, India, 2012; p. 464.
372. Adedapo, A.; Ogunmiluyi, I. The use of natural products in the management of diabetes: The current trends. *J. Drug Deliv. Ther.* **2020**, *10*, 153–162. [CrossRef]
373. Kalita, P.; Deka, S.; Saharia, B.J.; Chakraborty, A.; Basak, M.; Deka, M. An overview and future scope on traditionally used herbal plants of Assam having Antidiabetic activity. *Int. J. Adv. Pharm. Biol. Chem.* **2014**, *3*, 299–304.
374. Rout, S.P.; Chowdary, K.; Kar, D.; Das, L. Plants as source of novel anti-diabetic drug: Present scenario and future perspectives. *Curr. Trends Biotechnol. Pharmacol.* **2008**, *3*, 614–632.
375. Verma, S.; Singh, S. Current and future status of herbal medicines. *Vet. World* **2008**, *1*, 347. [CrossRef]
376. Kifle, Z.D.; Abdelwuhab, M.; Melak, A.D.; Meseret, T.; Adugna, M. Pharmacological evaluation of medicinal plants with antidiabetic activities in Ethiopia: A review. *Metab. Open* **2022**, *13*, 100174. [CrossRef]