






Review

# Ethnomedicinal Value of Antidiabetic Plants in Bangladesh: A Comprehensive Review

Md. Masudur Rahman <sup>1,\*</sup>, Md. Josim Uddin <sup>1,2</sup> , A. S. M. Ali Reza <sup>1</sup> , Abu Montakim Tareq <sup>1</sup> ,  
Talha Bin Emran <sup>3,\*</sup>  and Jesus Simal-Gandara <sup>4,\*</sup> 

<sup>1</sup> Department of Pharmacy, International Islamic University Chittagong, Chittagong 4318, Bangladesh; josim84@yahoo.com (M.J.U.); alirezaru@gmail.com (A.S.M.A.R.); montakim0.abu@gmail.com (A.M.T.)

<sup>2</sup> Pharmazeutisches Institut, Abteilung Pharmazeutische Biologie, Christian-Albrechts-Universität zu Kiel, Gutenbergstraße 76, 24118 Kiel, Germany

<sup>3</sup> Department of Pharmacy, BGC Trust University Bangladesh, Chittagong 4381, Bangladesh

<sup>4</sup> Nutrition and Bromatology Group, Department of Analytical and Food Chemistry, Faculty of Food Science and Technology, University of Vigo—Ourense Campus, E32004 Ourense, Spain

\* Correspondence: masud@iiuc.ac.bd (M.M.R.); talhabmb@bgctub.ac.bd (T.B.E.); jsimal@uvigo.es (J.S.-G.); Tel.: +880-171-233-8778 (M.M.R.); +880-181-994-2214 (T.B.E.); +34-988-387000 (J.S.-G.)

**Abstract:** The use of conventional drugs to treat metabolic disorders and the pathological consequences of diabetes further increases the complications because of the side effects, and is sometimes burdensome due to relatively higher costs and occasionally painful route of administration of these drugs. Therefore, shifting to herbal medicine may be more effective, economical, have fewer side effects and might have minimal toxicity. The present review amasses a list of ethnomedicinal plants of 143 species belonging to 61 families, from distinctive domestic survey literature, reported to have been used to treat diabetes by the ethnic and local people of Bangladesh. Leaves of the medicinal plants were found leading in terms of their use, followed by fruits, whole plants, roots, seeds, bark, stems, flowers, and rhizomes. This review provides starting information leading to the search for and use of indigenous botanical resources to discover bioactive compounds for novel hypoglycemic drug development.

**Keywords:** antidiabetic plants; ethnomedicinal plants; medicinal plants; traditional plants; diabetes mellitus; antihyperglycemic



**Citation:** Rahman, M.M.; Uddin, M.J.; Reza, A.S.M.A.; Tareq, A.M.; Emran, T.B.; Simal-Gandara, J. Ethnomedicinal Value of Antidiabetic Plants in Bangladesh: A Comprehensive Review. *Plants* **2021**, *10*, 729. <https://doi.org/10.3390/plants10040729>

Academic Editors: Suresh Awale, Mariangela Marrelli and Luigi Milella

Received: 15 February 2021

Accepted: 5 April 2021

Published: 8 April 2021

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Diabetes mellitus (DM) is the most prevalent, and overwhelming chronic non-communicable disease. It is a major worldwide health problem, particularly in third-world countries. Nowadays, it is considered a worldwide epidemic. DM may cause several complications, including chronic damage, dysfunction and organ failure (kidneys, heart, and blood vessels) [1]. Long-term complications of DM are cardiovascular disease [2], microangiopathy, retinopathy, nephropathy [3], and cognitive deficit [4]. According to the International Diabetes Federation (IDF) report, there are about 425 million people with diabetes in 2017, which will rise to an estimated 629 million in 2045 worldwide [5]. The estimated prevalence of DM in Bangladesh is about 11.1 million in 2000 [6]. In DM, the biguanides, sulfonylureas, alpha-glucosidase inhibitors (acarbose, miglitol, voglibose), thiazolidinediones and, meglitinides are used to lower blood glucose level as insulin and hypoglycemic agents. However, the use of antidiabetic agents is limited because of their unfavorable impacts including hypoglycemic coma and liver and kidney complications [7,8]. Hence, it is practical in the current situation to search for new and stronger phytotherapy substances with efficacy. Recently, herbal medicines have become a topic of interest, and many herbal medicines have been recommended for the treatment of diabetes. Additionally, several compounds isolated from different plant species with their mechanistic studies.

The trigonelline is a major hypoglycemic alkaloid isolated from *Trigonella foenum-graecum* L., whereas steroid charantin from *Momordica charantia* L., galegine from *Galega officinalis* L., castanospermine from *Castanospermum australe* A. Cunn. and C. Fraser, panaxans A-E from *Panax ginseng* C. A. Mey., and reserpine from *Rauwolfia serpentina* (L.) Benth. ex Kurz have been isolated [9]. Hypoglycemic activity has been reported by catharanthine (alkaloid), leurosine (alkaloid), lochnerine (alkaloid), tetrahydroalstonine (yohimban alkaloid), vindoline (alkaloid ester) and vindolinine (indole alkaloid), which was isolated from *Catharanthus roseus* [10]. According to a few studies, several medicinal plants are useful in diabetes in distinct Bangladeshi local areas, divisions, and district [11–14]. Here, this review compiled a list of antidiabetic medicinal plants from the survey reports of the whole country.

## 2. Methods

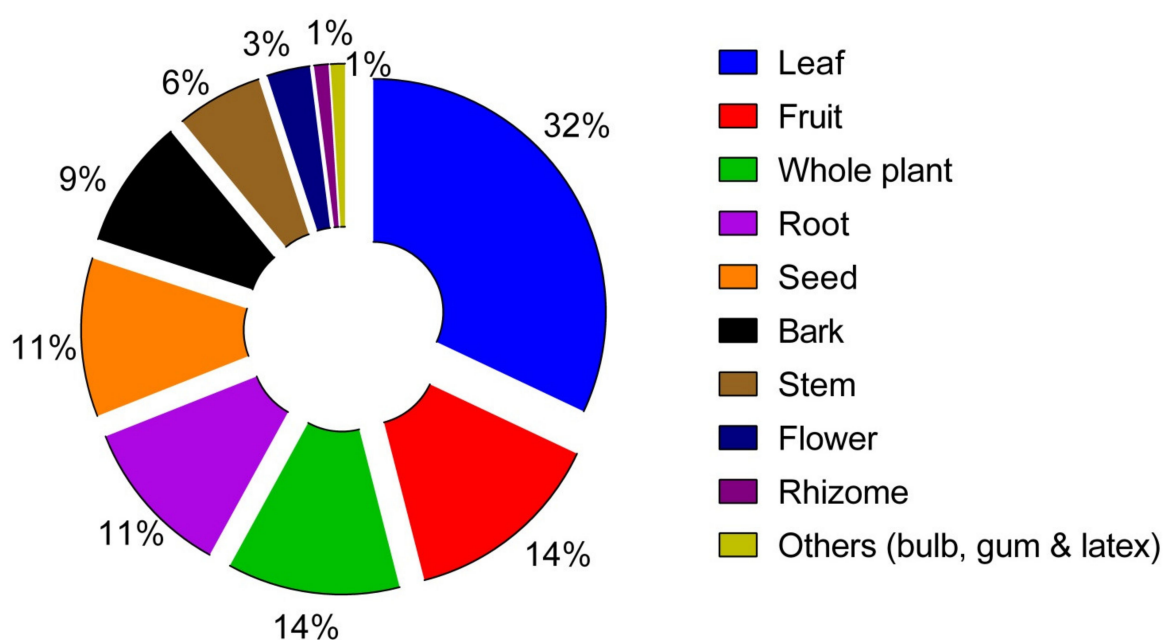
We reviewed scientific articles published in journals by electronic databases (Google Scholar, PubMed, Medline, Web of Science, DOAJ, and Scopus) using specific keywords such as “medicinal plants”, “traditional plants”, “antidiabetic plants”, “antihyperglycemic plants”, “survey of antidiabetic plants”, “survey of medicinal plants”, “ethnobotanical survey”, “ethnomedicinal survey”, plus “Bangladesh”. We reviewed 96 survey articles that gave data about the utilization of therapeutic plant species that are used to treat diabetes by local communities. We utilized distributions introducing direct ethnobotanical data to prepare a list of medicinal plants to treat diabetes in Bangladesh.

## 3. Dependency in Medicinal Plants

Bangladesh is considered an excellent source for medicinal plants due to its favorable farming condition and seasonal variety. Also, Bangladesh comprises tropical forest and boggy jungle areas with bio-diverse flora. About 75% of the country’s population lives in rural territories, and almost 80% is reliant on medicinal plants for their primary healthcare whereas herbal medication is a well-known and acknowledged form of treatment [15,16]. Moreover, Bangladesh has various indigenous communities or clans, such as Chakma, Marma, Garo, Santal, Manipuri, Tripura, who still depend on their traditional or tribal medical practitioner for treatment of assorted illnesses, including, diarrhoea, infection, diabetes, cold, cough, fever, malaria, etc. These tribal practitioners have been using medicinal plants for centuries to cure completely or at least to relieve major symptoms of diseases [17].

## 4. Ethnomedicinal Use of Plants in Diabetes

Treatment of hyperglycemic according to the traditional system of medicine is often easier, cheaper and cost effective due to indigenous availability of certain herbs with hypoglycemic effects [18]. A handful of ethnomedicinal surveys on medicinal plants have been accomplished from different divisions, districts, villages, and even hill tract and tribe areas of the country. A limited number of plant species have been reported to be antidiabetic. For each species, botanical name(s), family, local name(s), part(s) used, and reference(s) are presented in Table 1. Few herbal agents that possess antidiabetic properties have been cited notably in the survey, including *Azadirachta indica* A. Juss., *Centella asiatica* L. Urb., *Ficus racemose* L., *Ficus hispida* L.f., *Mangifera indica* L., *Momordica charantia* L., *Syzygium cumini* L. Skeels, *Terminalia chebula* Retz., *Coccinia grandis* L. Voigt., *Coccinia cordifolia* L. Cogn., *Aegle marmelos* L. Corrêa, *Tinospora cordifolia* Hook. F. and Thoms., *Trigonella foenum-graecum* L., *Tamarindus indica* L., *Moringa oleifera* Lam., *Kalanchoe pinnata* (Lamk.) Pers., *Bombax ceiba* L., *Cajanus cajan* L. Millsp., *Psidium guajava* L., *Clerodendrum viscosum* Vent., and *Scoparia dulcis* L. Different parts of the plants are used for antidiabetic potential such as the leaf, fruit, flower, root, bark, rhizome, bulb, latex, seed, and whole plant. Here, the leaf is the most commonly used plant part (32%) abided by the fruit (14%), whole plant (12%), root (11%), seed (11%), bark (9%), stem (6%), flower (3%), rhizome (1%), and others (bulb, gum and latex, 1%), as shown in Figure 1.



**Figure 1.** Percentage of parts of antidiabetic plants used for the treatment of diabetes in Bangladesh. Percentages were calculated as the ratio between the number of plant parts used belonging to a certain family and the total number of plants.

**Table 1.** List of ethnomedicinal plants used for the treatment of diabetes in Bangladesh.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Abroma augusta</i> L.f.	Sterculiaceae	Ulotkombol	Leaf, bark, root	Yes	[19–24]
<i>Abutilon indium</i> Sweet var.	Malvaceae	Palu-lobboi	Leaf	No	[25]
<i>Acanthus ilicifolius</i> L.	Acanthaceae	Hargoza	Root	Yes	[26]
<i>Achyranthes aspera</i> L.	Amaranthaceae	Apang, Upatlengra	Root, seed, whole plant	Yes	[11,19]
<i>Adiantum capillus-veneris</i> L.	Adiantaceae	Bidhayapata, Gobalelota	Seed, whole plant	Yes	[11,27]
<i>Aegle marmelos</i> L. Corrêa.	Rutaceae	Bel	Fruit, leaf	Yes	[13,28,29]
<i>Allium sativum</i> L.	Amaryllidaceae	Rosun	Root, whole plant, bulb	Yes	[11,14,29,30]
<i>Alocasia macrorrhizos</i> L. G. Don	Araceae	Mankachu	Rhizome, whole plant	Yes	[31]
<i>Aloe vera</i> L. Burm. f.	Aloaceae	Ghritokumari	Leaf	Yes	[32,33]
<i>Alstonia scholaris</i> L. R. Br.	Apocynaceae	Chaitan	Leaf	Yes	[34,35]
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Katadenga	Leaf, root	Yes	[29,36,37]
<i>Amomum aromaticum</i> Roxb.	Zingiberaceae	Elach	Fruit	No	[13]
<i>Amorphophallus campanulatus</i> Blume ex Decne	Araceae	OI	Tuber	Yes	[13]

Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Andrographis paniculata</i> Wall. ex Nees	Acanthaceae	Kalomegh	Leaf, whole plant	Yes	[11,14,38–40]
<i>Anthocephalus chinensis</i> (Lam.) A. Rich. ex	Rubiaceae	Kadam	Stem, bark	No	[17,41]
<i>Argemone Mexicana</i> L.	Papaveraceae	Shialkanta	Stem	Yes	[42–46]
<i>Asparagus racemosus</i> L.	Asparagaceae	Sotomuli	Root, whole plant	Yes	[11,14,42–48]
<i>Asteracantha longifolia</i> L. Nees	Acanthaceae	Talmakhna	Seed	Yes	[49]
<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Bark, leaf, seed	Yes	[11,13,14,16,20,29,30,49–54]
<i>Bambusa tulda</i> Roxb.	Poaceae	Jowa bans, Mitenga	Leaf	No	[55]
<i>Bombax ceiba</i> L.	Bombacaceae	Shimul	Bark, root	Yes	[42,44,45,47,56]
<i>Bryophyllum pinnatum</i> (Lam.) Oken	Crassulaceae	Jeus	Whole plant	Yes	[57]
<i>Bunium persicum</i> Bois.	Apiaceae	Kalo jeera	Seed, whole plant	Yes	[11,14]
<i>Caesalpinia crista</i> L.	Fabaceae	Nata	Leaf	Yes	[58]
<i>Cajanus cajan</i> L. Millsp.	Fabaceae	Mehndher	Leaf, root, seed	Yes	[19,29,41,42,44,45,47,55,56,58]
<i>Canna indica</i> L.	Cannaceae	Sarbajaya, Kalaboti	Leaf, flower	No	[59]
<i>Cardiospermum helicacabum</i> L.	Sapindaceae	Phutka, Lataphutiki	Leaf, fruit	Yes	[58]
<i>Carica papaya</i> L.	Caricaceae	Pepe, Papaya	Fruit, seed	Yes	[28,60–62]
<i>Carissa carandas</i> L.	Apocynaceae	Koromcha	Fruit	Yes	[63]
<i>Cassia fistula</i> Linn.	Fabaceae	Sonalu, bandor lathi	Leaf, stem bark	Yes	[64]
<i>Cassia occidentalis</i> L.	Leguminosae	Sonali	Leaf, root, fruit	No	[21,28,60]
<i>Cassia sophera</i> L.	Leguminosae	Kasunda	Bark, leaf, seed	No	[25]
<i>Catharanthus roseus</i> L. G. Don	Apocynaceae	Noyontara	Leaf	Yes	[2–34,38,40,63,65]
<i>Centella asiatica</i> L. Urb.	Apiaceae	Thankuni	Leaf, whole plant	Yes	[11,13,14,29,30,65]
<i>Clitoria ternatea</i> L.	Fabaceae	Aparajita	Leaf	Yes	[58,66]
<i>Cinnamomum tamala</i> T. Nees and Eberm	Lauraceae	Tejpata	Leaf	Yes	[67–70]

Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Cinnamomum verum</i> J. Presl.	Lauraceae	Daruchini	Leaf, bark	Yes	[29,71]
<i>Citrus aurantium</i> L.	Rutaceae	Jambura, Batabilebu	Fruit	Yes	[29,72]
<i>Citrus aurantifolia</i> Christm. Swingle	Rutaceae	Lebu, Kaghzilebu, Patilebu	Fruit	Yes	[29]
<i>Clerodendrum viscosum</i> Vent.	Verbenaceae	Vant, Ghetu, Baik pata	Leaf	Yes	[21,34,52,55,57]
<i>Coccinia cordifolia</i> L. Cogn.	Cucurbitaceae	Telakucha	Leaf, fruit	Yes	[15,42,44,53,55,73–76]
<i>Coccinia grandis</i> L. J. Voigt	Cucurbitaceae	Telakucha	Leaf, stem, root	Yes	[13,20,22,29,32–34,37,38,43,45,46,50,77–92]
<i>Coccinia indica</i> W. and A.	Cucurbitaceae	Telachuka	Fruit, leaf, root, whole	Yes	[11,14,93–95]
<i>Cocos nucifera</i> L.	Arecaceae	Narikel, Dab	Kernel of seed, fruit juice	Yes	[29,54]
<i>Colocasia esculenta</i> L.	Araceae	Kochu shak	Leaf	Yes	[31,96]
<i>Corchorus aestuans</i> L.	Tiliaceae	Titabhaet	Young leaf	No	[67]
<i>Costus speciosus</i> Sm.	Costaceae	Kushtha	Rhizome	Yes	[43,45,46,49,97,98]
<i>Cuminum cyminum</i> L.	Apiaceae	Jeera	Seed	Yes	[13,99]
<i>Curculigo orchoides</i> Gaertn.	Amaryllidaceae	Talmuli	Root	Yes	[63,92,100–102]
<i>Curcuma longa</i> L.	Zingiberaceae	Halud	Rhizome	Yes	[20,85,103,104]
<i>Curcuma aromatica</i> Salisb.	Zingiberaceae	Ban Halud	Stem	No	[52]
<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Shornolata, Tarulata	Stem, whole plant	Yes	[30,52,64,105,106]
<i>Cycas pectinata</i> Buch.-Ham	Cycadaceae	Moniraj	Fruit, fruit stalk	No	[17]
<i>Cynodon dactylon</i> L. Pers.	Poaceae	Durba, Dubla	Leaf, whole plant	Yes	[11,14,59,73,107]
<i>Datura stramonium</i> L.	Solanaceae	Dhotura	Seed	Yes	[11,14,108,109]
<i>Diospyros peregrine</i> (Gaertn.) Gürke.	Ebenaceae	Bilati gab	Fruit	Yes	[32,110]
<i>Diospyros discolor</i> Wild.	Ebenaceae	Bilati gab	Fruit	No	[48]

Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Diplazium esculentum</i> (Retz.) Sw.	Dryopteridaceae	Dhekishak	Root	Yes	[37,111]
<i>Drynaria quercifolia</i> (L.) J. Smith	Polypodiaceae	Pankhiraj	Stem	Yes	[21,34,112]
<i>Eclipta alba</i> L.	Asteraceae	Bringoraj, Kalokeshi	Leaf	Yes	[11,14,29,59,88,113]
<i>Emblca officinalis</i> Gaertn.	Euphorbiaceae	Amloki	Fruit, fruit pulp	Yes	[13,20,25,114]
<i>Enhydra fluctuans</i> Lour.	Asteraceae	Helencha	Leaf, stem	Yes	[34,91,115,116]
<i>Eupatorium odoratum</i> L.	Compositae	Assamlata	Leaf, flower	Yes	[51,117]
<i>Flacourtia indica</i> (Burm. f.) Merr.	Flacourtiaceae	Bouchi, Boichi	Leaf, fruit	No	[13]
<i>Ficus benghalensis</i> L.	Moraceae	Bot, Kathali Pata Bot	Leaf	Yes	[11,14,50,118,119]
<i>Ficus hispida</i> L.f.	Moraceae	Dumur, Kakdumur	Fruit, bark	Yes	[13,22,26,28,40,49,57,60,86,94,120,121]
<i>Ficus racemosa</i> L.	Moraceae	Jagadumur	Bark, fruit	Yes	[11,14,20–22,29,40,42,44,45,47,50,56,82,100,122–124]
<i>Geodorum densiflorum</i> (Lam.) Schltr.	Orchidaceae	Shonkhomuni	Whole plant	No	[22]
<i>Glycosmis pentaphylla</i> (Retz.) Corr.	Rutaceae	Ashshaora, Kawatuti	Leaf	Yes	[36,90,125]
<i>Gymnema sylvestre</i> R. Br.	Asclepiadaceae	Medhasingi, Gorshar	Whole plant	Yes	[11,126]
<i>Heliotropium indicum</i> L.	Boraginaceae	Hatisur	Leaf	Yes	[11,127]
<i>Hemidesmus indicus</i> L. R. Br.	Apocynaceae	Anantomul	Root	Yes	[11,128]
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Jaba, Raktajaba	Flower, leaf	Yes	[25,129]
<i>Hibiscus schizopetalus</i> (Mast.) Hook. f.	Malvaceae	Shish joba	Fruit	Yes	[78,130]
<i>Hiptage benghalensis</i> (L.) Kurz.	Malphigiaceae	Madhabilata	Flower, root	Yes	[63,131]
<i>Hoya parasitica</i> Wall.	Asclepiadaceae	Chera pata	Leaf	No	[25]

Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Hygrophila auriculata</i> (Schumach.) Heine	Acanthaceae	Kulekhara, Talmakhna	Seed	No	[86]
<i>Justicia adhatoda</i> L.	Acanthaceae	Bashok	Leaf	Yes	[20,132]
<i>Kalanchoe pinnata</i> (Lamk.) Pers.	Crassulaceae	Patharkuchi	Leaf	Yes	[42–47,56,58,73,133–135]
<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	Jarul	Leaf, bark, seed	Yes	[11,14,21,24,136–138]
<i>Lansea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Jiga, Jika	Bark, root	Yes	[22,34,40,139]
<i>Lawsonia inermis</i> L.	Lythraceae	Mehedi, Mendi	Leaf	Yes	[49,51,73,120,140]
<i>Leonurus sibiricus</i> L.	Lamiaceae	Raktodrone, Guma	Leaf	No	[29]
<i>Mangifera indica</i> L.	Anacardiaceae	Aam	Seed, gum, leaf, bark	Yes	[11,13,30,48,50,54,55,73,84,141,142]
<i>Mikania cordata</i> (Burm.f.) B. L. Robinson	Asteraceae	Jarmanylata	Top of young stem, leaf, flower	Yes	[13,61,92,143,144]
<i>Mikania scandens</i> (L.) Willd.	Asteraceae	Mayalota	Leaf	Yes	[16,145]
<i>Mimosa pudica</i> L.	Fabaceae	Lojjaboti, Sada Lojjaboti	Whole plant	Yes	[11,14,146,147]
<i>Moghania macrophylla</i> (Willd.) Kuntze	Leguminosae	Blumai-kongda	Root	No	[148]
<i>Momordica charantia</i> L.	Cucurbitaceae	Korola, Usta	Fruit, leaf, whole plant	Yes	[11,13–15,22,29,32,34,36,40,43–45,47,56,57,80,83–85,87,133,149,150]
<i>Momordica cochinchinensis</i> (Lour.) Spreng.	Cucurbitaceae	Kakrol	Fruit	Yes	[29,151]
<i>Moringa oleifera</i> Lam.	Moringaceae	Sajna, Sajina, Khonjhon	Leaf, fruit, root	Yes	[19,22,29,38,40,45,47,79,152,153]
<i>Murraya koenigii</i> (L.) Spreng	Rutaceae	Gandhal, Girinim	Leaf	Yes	[29,61,154]
<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	Alkushi	Leaf, seed	Yes	[136,155]
<i>Musa ornata</i> L.	Musaceae	Ramkola	Spadix	No	[65]



Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Musa sapientum</i> L.	Musaceae	Kola, Aita kola	Fruit, cluster of flowers, inner trunk, young leaf	Yes	[11,13,38,40,45,156,157]
<i>Nymphaea nouchali</i> Burm.f.	Nymphaeaceae	Shapla, Sada Shapla	Leaf, whole plant, stem	Yes	[19,79,158]
<i>Ocimum basilicum</i> L.	Lamiaceae	Babui Tulshi	Leaf	Yes	[57,159,160]
<i>Ocimum sanctum</i> L.	Lamiaceae	Krisno Tulshi, Kalo Tulshi	Whole plant, Leaf, bark	Yes	[11,14,57,85,159,161]
<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Tulshi	Leaf, seed	Yes	[19,162]
<i>Pavetta indica</i> L.	Rubiaceae	Kukurchura	Leaf, root	No	[58]
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Poaceae	Nol-khagra	Whole plant	No	[60]
<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Amloki	Fruit, leaf, seed, whole plant	Yes	[11,14,30,34,79,149,163,164]
<i>Piper betle</i> L.	Piperaceae	Paan	Leaf	Yes	[49,165]
<i>Piper cubeba</i> L.F.	Piperaceae	Kabab chini	Fruit	Yes	[13,166]
<i>Piper longum</i> L.	Piperaceae	Pipul, Pipla	Fruit	Yes	[13,91,167]
<i>Polyalthia longifolia</i> (Sonn.) Thwaites (PL)	Annonaceae	Debdaru	Bark	Yes	[57,85,168]
<i>Psidium guajava</i> L.	Myrtaceae	Peyara	Leaf, bark, fruit, seed	Yes	[13,19,52,60,169,170]
<i>Punica granatum</i> L.	Lythraceae	Dalim	Fruit, seed	Yes	[54,171]
<i>Saccharum spontaneum</i> L.	Poaceae	Kash, Khagra	Leaf	No	[93]
<i>Senna occidentalis</i> (L.) Link.	Fabaceae	Junjunea	Leaf	Yes	[53,172]
<i>Scoparia dulcis</i> L.	Scrophulariaceae	Bandhoney, Chinigura	Leaf, whole plant	Yes	[29,36,58,59,73,92,115,136,173]
<i>Sida cordifolia</i> L.	Malvaceae	Berela	Bark of root	Yes	[17,20,174]
<i>Smilax zeylanica</i> L.	Smilacaceae	Kumarilata	Stem	Yes	[136,175,176]
<i>Solanum nigrum</i> L.	Solanaceae	Kakmachi, Phuti begun	Leaf	Yes	[17,177,178]
<i>Solanum melongena</i> L.	Solanaceae	Begun	Fruit	Yes	[179]
<i>Solanum torvum</i> Swartz	Solanaceae	Tit baegun, Gotha begun	Leaf, root, fruit	Yes	[12,13,21,76,99,180]
<i>Stephania japonica</i> (Thunb.) Miers	Menispermaceae	Har jora	Leaf, whole plant	Yes	[100,181]



Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Stevia rebaudiana</i> Bertoni	Asteraceae	Mistipata	Leaf	Yes	[67,182,183]
<i>Swietenia macrophylla</i> King.	Meliaceae	Mahogany	Leaf, bark	Yes	[84,91,184,185]
<i>Swietenia mahagoni</i> L. Jacq.	Meliaceae	Mahogany	Seed	Yes	[11,14,186–188]
<i>Swertia chirata</i> (Roxb. ex Fleming) H. Karst	Gentianaceae	Chirota	Root, Whole plant	No	[11,13–15]
<i>Syzygium aqueum</i> (Burm.f.) Alston	Myrtaceae	Jamrul	Fruit	Yes	[34,189]
<i>Syzygium cumini</i> L. Skeels	Myrtaceae	Jam	Leaf, bark, seed	Yes	[11,13,15,22,26,29,31,32,35,42,44,45,47,56,59,63,77,84,86,90,123,133,149,190,191]
<i>Tabernaemontana coronaria</i> Willd.	Apocynaceae	Tagar, Dudhphul	Leaf, stem bark, latex	No	[58]
<i>Tamarindus indica</i> L.	Fabaceae	Tetul	Seed, fruit	Yes	[13,17,21,24,28,41,54,80,192]
<i>Tagetes patula</i> L.	Asteraceae	Genda	Leaf	No	[75]
<i>Terminalia arjuna</i> W. and A.	Combretaceae	Arjun	Seed, bark	Yes	[11,14,20,115,120,193]
<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Combretaceae	Bohera	Fruit	No	[13,17,194]
<i>Terminalia bellirica</i> L.	Combretaceae	Bohera, Jonglee bohera	Seed	Yes	[11,195]
<i>Terminalia chebula</i> Retz.	Combretaceae	Horituki	Seed, fruit, leaf	Yes	[11,13,14,34,57,196]
<i>Tinospora cordifolia</i> Hook. F. and Thoms.	Menispermaceae	Gulanchalota, Gulancha	Bark, leaf, root, whole plant, stem	Yes	[11,13,19,20,32,197]
<i>Tinospora crispa</i> (L.) Hook. F. and Thoms.	Menispermaceae	Gorincha	Leaf	Yes	[22,198,199]
<i>Tragia involucrata</i> L.	Euphorbiaceae	Bichchuti	Leaf, root	Yes	[22,200]
<i>Trichosanthes kirilowii</i> Maxim.	Cucurbitaceae	Lota-mohakaal	Whole plant	Yes	[24,201]
<i>Trigonella foenum-graecum</i> L.	Fabaceae	Methi	Seed, whole plant	Yes	[11,14,202]
<i>Vernonia anthelmintica</i> Willd.	Asteraceae	Somraj	Whole plant	Yes	[11,14,203,204]

Table 1. Cont.

Botanical Name	Family	Local Name(s) <sup>a</sup>	Part(s) Utilized	In Vivo/In Vitro Study <sup>b</sup>	Reference(s)
<i>Vinca rosea</i> L.	Apocynaceae	Golapi Noyontara	Leaf, stem	Yes	[11,14,205,206]
<i>Vitex negundo</i> L.	Lamiaceae	Nishinda, Samalu	Leaf	Yes	[11,14,207–210]
<i>Wedelia chinensis</i> (Osbeck) Merr.	Asteraceae	Bhimraj	Whole plant	Yes	[29,61,211,212]
<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Aswagandha	Leaf, root, whole plant	Yes	[11,14,213,214]
<i>Xanthium indicum</i> Linn.	Asteraceae	Banokra, Ghagra	Leaf, root, stem, whole plant	Yes	[42,43,46,215–217]
<i>Zea mays</i> L.	Poaceae	Bottha	Fruit, root	Yes	[54,218]
<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	Kul, Boro	Seed	Yes	[28,219,220]

<sup>a</sup> All local name(s) are in the Bengali language. Local name(s) are adapted from survey literatures, Ethnobotanical Database of Bangladesh, and Medicinal Plants Database of Bangladesh. <sup>b</sup> The presence of antidiabetic effect (in vivo and in vitro study) was analyzed in global perspective.

## 5. Modes of Preparation

The major modes of preparations are powder (*Syzygium cumini* L., *Azadirachta indica* A., *Momordica charantia* L., *Mikania scandens* L., *Sida cordifolia* L., *Asparagus racemosus* L., *Ficus racemosa* L.) [16,42,43,50,56,67], juice (*Cycas pectinata* B., *Cajanus cajan* L., *Ocimum tenuiflorum* L., *Moringa oleifera* Lam., *Solanum torvum* Swartz, *Coccinia grandis* L., *Stevia rebaudiana* Bertoni, *Kalanchoe pinnata* Pers., *Momordica charantia* L., *Syzygium cumini* L. [16,17,42,43,50,56,67,77], and paste (*Tinospora cordifolia* H., *Psidium guajava* L., *Nymphaea nouchali* B.) [42]. Some parts or whole plants are cooked as vegetables and eaten with meals (*Ficus hispida* L., *Momordica charantia* L., *Coccinia cordifolia* L.) [16,31,50,56,67,73] and others are also taken raw directly (*Corchorus aestuans* L., *Tamarindus indica* L., *Hibiscus schizopetalus* M.) [56,67,78,79]. Generally, whole plant or plant parts are used in the extraction of juice by soaking, crushing or boiling in water and, after that, oral administration of the juice directly or either with meals. Occasionally, plant juice or plant parts are mixed with a small amount of sugar, salt or honey before oral administration, typically to make the juice more edible and pleasant [20,120]. In a combinational medicinal plants therapy used by traditional healers (Kavirajes) for the treatment of diabetes, for example, *Azadirachta indica* A. leaves are added to the leaves of *Lawsonia inermis* L., *Costus speciosus* SM. (crêpe ginger) leaves are masticated with leaves of *Piper betle* L., and *Asteracantha longifolia* L. seeds are used in combination with *Andrographis paniculata* W. leaves, *Curculigo orchhioides* G. leaves, *Ipomoea mauritiana* Jacq. leaves and fruits of *Ficus hispida* L. [49].

## 6. Antidiabetic Plant Species

The current review comprised a total of 143 plant species belong to 61 families traditionally used for the treatment of diabetes. The therapeutic plant species in the families show in Table 2. Asteraceae, and Fabaceae are characterized by nine species of each followed by Cucurbitaceae seven species; Acanthaceae and Apocynaceae six species, respectively; Lamiaceae, Poaceae and Rutaceae five species, respectively; and Combretaceae, Malvaceae and Solanaceae are represented by 4 species respectively. Triple species are found in 10 families of each and also double species are recorded in another 10 families of each. A single species in each is noted by 30 families. The review demonstrated that the common families of medicinal plant used for the treatment of diabetes in Bangladesh are Asteraceae, Fabaceae, Cucurbitaceae, Acanthaceae, Apocynaceae, Lamiaceae, Poaceae and Rutaceae. The most commonly used traditional remedies for DM are *Momordica charantia* L. (Cucurbitaceae), *Ficus racemosa* L. (Moraceae), *Syzygium cumini* L. (Myrtaceae), *Azadirachta*

*indica* A. Juss. (Meliaceae), *Cajanus cajan* L. (Fabaceae), and *Coccinia grandis* L. J. Voigt (Cucurbitaceae).

**Table 2.** Presentation of the antidiabetic plant species of Bangladesh in 61 families.

Families	No. of Species	% of Species <sup>a</sup>	Families	No. of Species	% of Species <sup>a</sup>
Asteraceae	9	6.29	Adiantaceae	1	0.70
Fabaceae	9	6.29	Aloaceae	1	0.70
Cucurbitaceae	7	4.89	Annonaceae	1	0.70
Acanthaceae	6	4.19	Arecaceae	1	0.07
Apocynaceae	6	4.19	Asparagaceae	1	0.70
Lamiaceae	5	3.49	Bombacaceae	1	0.70
Poaceae	5	3.49	Boraginaceae	1	0.70
Rutaceae	5	3.49	Cannaceae	1	0.70
Combretaceae	4	2.79	Caricaceae	1	0.70
Malvaceae	4	2.79	Compositae	1	0.70
Solanaceae	4	2.79	Costaceae	1	0.70
Apiaceae	3	2.09	Cuscutaceae	1	0.70
Araceae	3	2.09	Cycadaceae	1	0.70
Leguminosae	3	2.09	Dryopteridaceae	1	0.70
Lythraceae	3	2.09	Flacourtiaceae	1	0.70
Meliaceae	3	2.09	Gentianaceae	1	0.70
Menispermaceae	3	2.09	Malphigiaceae	1	0.70
Moraceae	3	2.09	Moringaceae	1	0.70
Myrtaceae	3	2.09	Nymphaeaceae	1	0.70
Piperaceae	3	2.09	Orchidaceae	1	0.70
Zingiberaceae	3	2.09	Papaveraceae	1	0.70
Amaranthaceae	2	1.40	Phyllanthaceae	1	0.70
Amaryllidaceae	2	1.40	Polypodiaceae	1	0.70
Anacardiaceae	2	1.40	Rhamnaceae	1	0.70
Asclepiadaceae	2	1.40	Sapindaceae	1	0.70
Crassulaceae	2	1.40	Scrophulariaceae	1	0.70
Ebenaceae	2	1.40	Smilacaceae	1	0.70
Euphorbiaceae	2	1.40	Sterculiaceae	1	0.70
Lauraceae	2	1.40	Tiliaceae	1	0.70
Musaceae	2	1.40	Verbenaceae	1	0.70
Rubiaceae	2	1.40			

<sup>a</sup> Percentages were calculated as the ratio between the number of plants belonging in a certain family and the total number of plants.

## 7. Phytochemical and Experimental Studies of Antidiabetic Plants in Bangladesh

A common way to deal with species determination for phytochemical and pharmacological analysis is by reviewing the ethnobotanical literature [221]. Several phytochemical and in vivo studies have been executed in Bangladesh on the antidiabetic properties of traditional practitioners' medicinal plants, divulging antidiabetic plants' active principles. Examples of such studies are: Akter, Mahabub-Uz-Zaman, and Rahman, 2013; Al-Amin, Uddin, Rizwan, and Islam, 2013; Ali et al., 1993; Amran, Sultan, Rahman, and Rashid, 2013; Bhuyan, Rokeya, Masum, Hossain, and Mahmud, 2010; Borhanuddin, Shamsuzzoha, and Hussain, 1994b; A. Chowdhury and Biswas, 2012; A. R. Das, Mostofa, Hoque, Das, and Sarkar, 2010; Habib and Gafur, 2003; J. M. A. Hannan et al., 2003; E. Haque, Saha, Islam, and Islam, 2012; M. A. Hossain et al., 2012; Md Alamgir Hossain, Roy, Ahmed, Chowdhury, and Rashid, 2007b; M. Z. Hossain, Shibib, and Rahman, 1992; Islam et al., 2009; M. A. Islam et al., 2011; I. A. Jahan et al., 2009; Mostofa et al., 2007b; Mowl, Alauddin, Rahman, and Ahmed, 2009; Rafiq, Sherajee, Nishiyama, Sufiun, and Mostofa, 2009; Md Masudur Rahman, Hossain, Siddique, Biplab, and Uddin, 2012b; Md Mahfuzur Rahman, Sayeed, Haque, Hassan, and Islam, 2012; M. W. Rahman et al., 2005; Rokeya, Bhowmik, Khan, and Khter, 2009; M. G. Roy et al., 2010; Shahreen et al., 2012; Shibib, Khan, and Rahman, 1993; Sikder, Kaiser, Rahman, Hussain, and Rashid, 2011; Talukder, Khan, Uddin, Jahan,

and Alam, 2012; Urmi et al., 2012; Zulfiker et al., 2011 [222–252]. These scientific studies emphasized the correlation among traditional use and the pharmacological properties of antidiabetic plants.

Various parts of the *A. augusta* plant are used in the treatment of diabetes, such as roots and leaves and bark. The methanol leaves extract of 300 mg/kg dose in alloxan-induced rat showed antidiabetic effects. In contrast, the 200 mg/kg in combination (1:1) with water extract (root and leaves) of *A. augusta* and *Azadirachta indica*, respectively, after 8 weeks exhibited significant lowering of blood sugar. In a human study, a significant blood sugar-lowering effect was observed with an alcoholic extract [253]. A significant change in body weight and decrease in blood glucose was reported by Mostofa et al., 2007 for *Catharanth roseus* leaves (1 g/kg), *Azadirachta indica* leaves (500 mg/kg), and *Allium sativum* seed (1 g/kg) aqueous extracts (14 days of treatment) [254].

According to Venkataiah et al. 2013, ethanolic roots extract of *A. ilicifolius* reported that the 200 and 400 mg/kg significantly reduced blood glucose levels in diabetic albino Wistar rat models [255], while 50, 100, 200, and 400 mg/kg doses of methanol leaves extract reported significant and dose-dependent reduction in blood glucose level of Swiss albino mice [256]. A similar result was observed by an in vitro DNSA method for aqueous, ethanol and methanol extract, whereas methanol leaves extract demonstrated highest concentration-dependent manner inhibition of  $\alpha$ -amylase and  $\alpha$ -glucosidase [257].

Akhtar et al., 1991 studied the aqueous and methanol extracts of the *Achyranthes aspera* whole plant demonstrated hypoglycemic activity at 2, 3, and 4 g/kg dose for alloxan-induced diabetic rabbits [258], while the ethanol leaves extract in Streptozotocin-induced rats showed a significant reduction in blood glucose level [259]. A similar result was observed in ethanol seed extract at 300 and 600 mg/kg [260].

In maceration with 80% ethanol, however, the *Adiantum capillus-veneris* extract did not demonstrate hypoglycemic activity at a dose of 25 mg/kg for mice, while the whole plant extract prepared by boiling the dried material in water was given orally to mice in same dose, glucose-induced hyperglycemia was reduced [261,262]. The alcoholic and aqueous extract exhibited a significant reduction in blood glucose level in rabbits and a DNS assay, respectively [263,264].

*A. marmelos* fruit water extract was tested in streptozotocin-induced Wistar rats at a dosage of 125 and 250 mg/kg, whereas 250 mg/kg is more efficient in lowering blood glucose [265]. Kesari et al., 2006 reported a similar result for water seed extract, whereas 100, 250 and 500 mg/kg was administered to diabetic rats [266]. An in vitro hypoglycemic activity was examined using a leaves extract of ethanol and petroleum ether in alpha-amylase inhibitory and glucose assay in yeast cells. The ethanol extract exhibited 60.2% inhibition in alpha-amylase (250  $\mu$ g/mL), which was higher than petroleum ether extract [267].

*A. macrorrhizome* rhizome methanol extract was used in alloxan-induced hyperglycemic mice at a single dose (250 and 500 mg/kg), whereas a substantial decrease ( $p < 0.05$ ) in the glucose level was observed at 500 mg/kg [268].

Acetone extracts from *A. campanulatus* have been found to be possible antidiabetic agents for streptozotocin-induced Wistar male diabetic rats at a dosage of 0.1% to 0.25% [269]. The corm methanol extract decreases glucose level in blood at 37.4%, with albino mice weighing 400 mg/kg, while 50, 100, and 200 mg/kg dosage also used [269,270].

Several studies reported antidiabetic effects of *A. paniculata* [271–275]. As of the second hour of observation, Akhtar et al. recorded 50, and 100 mg/kg water extract from *A. paniculata* leaves exhibited significantly lower glucose levels [276]. Alternatively, hot water (0.8 g/kg) and ethanol (2 g/kg) extract administration of *A. paniculata* lowered blood sugar levels in alloxan-induced diabetes rats by 46.21% and 45.13%, respectively [277].

The ethanol extract of *A. sativum* displayed antidiabetic effects on streptozotocin and alloxan-induced diabetic mice and rabbits by inducing insulin secretion from pancreatic parietal cells [278]. Several other studies of *A. sativum* in streptozotocin and alloxan-induced diabetes recorded which was beneficial in decreasing of the blood glucose of rats

and mice [279,280]. Clinical research reported the antidiabetic effect of administering *A. sativum* pills at 900 mg/day in type-II diabetes patients [281].

In 2020, Muñiz-Ramirez et al., reported the methanol leaves extract of *A. vera* (5 mg/mL) showed 87% inhibitory activity in  $\alpha$ -amylase enzyme, while 66% was observed in  $\alpha$ -glucosidase enzyme [282]. *A. vera* gel (200 and 300 mg/kg) alcoholic extracts on streptozotocin-induced diabetic rats have demonstrated that they can reduce blood glucose levels without harming the subject [283]. In contrast, the administration of leaf pulp (500 mg/kg) and gel (10 mL/kg) extracts by oral administration has not been successful in another rat trial [284].

An ethanolic extract of the leaves of *A. scholaris* administration of 100, 200 and 400 mg/kg dosage by oral administration has effectively reduced blood glucose level in streptozotocin-induced diabetic rats [285]. The isolated compound from dichloromethane leaves extract, namely cycloecalenol (a), cycloartanol (b) and lupeol (c); exposed a hypoglycemic activity at a dose of 25 mg/kg (combination of a–c) in mice [286]. In a patient based study, the leaves extract at a dose of 1, 2 and 3 g lowered the blood glucose level in a consistent manner [287].

The *Amaranthus spinosus* stems 250 and 500 mg/kg dosage [288] and leaves 200, 250, 400 and 500 mg/kg dosage [289,290] exposed antidiabetic effects in streptozotocin (STZ)-induced diabetic rats trial.

Aqueous extract and hydro-alcoholic extract from *A. mexicana* aerial parts (200 and 400 mg/kg) were reported to have hypoglycemic efficacy in alloxan and Streptozotocin-induced diabetic rats [291,292].

In 2011, Vadivelan et al. observed the blood glucose levels and fluid intake of diabetic-induced rats have substantially decreased during the oral administration of the ethanol extract of *A. racemosus*, 200 and 400 mg/kg for 21 days [293]. *A. racemosus* root was subject to  $\alpha$ -amylase and  $\alpha$ -glucosidase inhibitory activity in n-hexane, chloroform, ethyl acetate, and methanol, whereas less inhibitory activity of ethyl acetate and aqueous extracts was noticeable [294].

A significant reduction in plasma glucose, glycosylated hemoglobin, alanine transaminase, aspartate transaminase and total cholesterol was seen for the dose of 100, 200, and 400 mg/kg of aqueous extract of *Asteracantha longifolia* to alloxan-treated rats [295].

Shravan et al. (2011) evaluated the hypoglycemic effect of *Azadirachta indica*, whereas diabetic rat after 250 mg/kg (single and multiple dose study) treatment for 24 h and 15 days reduced creatinine, urea, lipids, triglycerides and glucose [296]. The root bark and leaves' extracts was also effective in treating diabetes [297].

The leaf and flower portion of *B. ceiba* was extracted using various solvents, including water, 50% ethanol, and 95% ethanol, which was subjected to  $\alpha$ -glucosidase and  $\alpha$ -amylase inhibitory assays for antidiabetic efficacy, while the maximum effect was observed for ethanol flower extract [298]. *B. ceiba* leaf hydroalcoholic extract (200 and 400 mg/kg) showed substantial reductions in glucose levels [299].

In four separate doses of *B. pinnatum* (200, 400, 800 mg/kg and 800 mg/kg + glibenclamide 2 mg/kg), the presence of antidiabetic activity in diabetic-induced rats was shown in Aransiola et al., 2014. Their blood sugar was lower in 200 mg/kg than the other dose of aqueous extract. An 800 mg/kg aqueous extract mixture with glibenclamide (2 mg/kg), however, showed a higher efficiency than 200 mg/kg and others [300]. An anti-hyperglycemic effect on 200 and 400 mg/kg of alloxan-induced Wistar albino rats was identified [301].

*B. persicum* seed ethanol and aqueous extract decreased significantly in glucose and insulin levels at varying concentrations in diabetic rats. *B. persicum* water extract has shown protective effects on renal damage caused by diabetes in rats [302,303].

An additional study found in alloxan-induced diabetic mice that the methanol extract of *C. cajan* and *Tamarindus indica* root decreases significantly in blood glycolysis level ( $p < 0.001$ ) in a five-day observation [192]. The antidiabetic activity of methanol extract of *C. cajan* leaves exposed a significant and dose-dependent (400 and 600 mg/kg) decrease in



blood sugar of alloxan-induced diabetic rats, with the maximum effect at 4–6 h [304]. The three-dose extract of *C. indica* (100, 200, and 400 mg/kg) exhibited a significant decrease in blood glucose level [305].

*C. carandas* exhibited significant antidiabetic effects in aqueous extract (300 mg/kg), methanol fruit extract (400 mg/kg), and methanol leaves extract (50, 100 and 200 mg/kg) [306–308].

*C. crista* ethanol/aqueous seed extracts were subjected for antidiabetic effect in streptozotocin-induced pup models, while both ethanolic and aqueous seed extracts showed antidiabetic activity; however, aqueous *C. crista* extract had a more significant effect compared to ethanolic extract [309].

In 2008, Veeramani et al., reported antihyperglycemic effects in streptozotocin (STZ) diabetic rats by ethanolic extract of *C. halicacabum* at 50, 100, and 200 mg/kg dosage [310]. In addition, the alcoholic extract at 15, 30, and 60 mg/kg dosage significantly decrease blood glucose level in mice model [311].

A 24-week observation study on aqueous extract of *C. papaya* leaves in streptozotocin-induced diabetic rats reported reduction in fasting blood sugar, and lipid profile [312], while ethanol leaves' extract also reported reduction in blood glucose level without any alteration of body weight [313]. In another report on ethanol leaves' extract at a dose of 200, 400, and 600 mg/kg showed significant reduction in blood glucose level in alloxan-induced diabetic rats [314].

The *Clitoria ternatea* extract and its different fractions at 100 and 200 mg/kg dosage exposed antidiabetic effect in STZ-induced diabetic rats, while 200 mg/kg dose of ethanol and butanol exhibited significant antidiabetic and antihyperlipidemic activity [66].

*Cassia fistula* stem's ethanolic extract significantly ( $p < 0.05$ ) decreased blood sugar levels in alloxan-induced diabetic and glucose-induced hyperglycemic rats at 250 and 500 mg/kg, respectively. Results of glucose tolerance showed substantial improvement respectively in the dose of 250 and 500 mg/kg body weight of ethanolic extract [315].

The methanol leaves extract of *Clerodendrum viscosum* reported significant blood glucose reduction (1st to 3rd h observation) at 250 and 500 mg/kg dose in a mice model [316]. In another similar study at different doses (200 and 400 mg/kg), the extract demonstrated 25.2% and 33.3% blood glucose level reduction, respectively [317].

The ethanol *Coccinia grandis* leaves reported a non-significant hypoglycemic effect comparable to the standard drug metformin at 750 mg/kg dose [318]. Another report by Islam et al. 2014 exhibited a substantial reduction in fasting blood glucose levels from *C. grandis* and *Centella asiatica* at a dose of 3 mL/kg in both normal and therapeutic models of alloxan-induced diabetic rats [319]. In 2012, Rhaman et al., reported that the ethanolic leaves of *Centella asiatica* extract (250, 500, and 1000 mg/kg) demonstrated 32.6%, 38.8%, and 29.9% blood glucose reduction at the 3rd hourly observation, respectively, whereas no toxicity sign was observed even at 3000 mg/kg dose [226].

*Cocos nucifera* mesocarp showed (50, 100, and 200 mg/kg) significant blood glucose lowering effect with increased creatinine and glucose tolerance level for streptozotocin-induced rat [320].

The methanol and chloroform extracts of *Cuscuta reflexa* whole plants reported a significant hypoglycemic effect at the dose of 50, 100, and 200 mg/kg in glucose-induced Long-Evan rats [105]. Another report by Rath et al. 2016 exhibited that the *C. reflexa* aerial parts in methanol and aqueous extracts at the dose of 200 and 400 mg/kg showed antidiabetic effects, while the 400 mg/kg significantly reduced the blood glucose level after 3rd hour observations [106].

The chloroform extract derived from *Eclipta alba* demonstrated substantial antidiabetic efficacy in 100 type-II diabetic patients. Oral administration of *E. alba* leaf suspension (2 and 4 g/kg body weight) for 60 days leads to a significant decrease in blood glucose levels [113].

The aqueous extract derived from the seeds of *Embllica officinalis* was studied due to its antidiabetic effect in animal models. Streptozotocin-induced type-II diabetes models were

considered in this regard. The results of the study reported that the doses ranging from 100–400 mg/kg body weight of this extract significantly reduced the level of blood glucose in normal rats where the reduction level was at its peak at 300 mg/kg [114].

*E. fluctuans* with partial antidyslipidemic properties in euglycemic rats and diabetic ones, appear to have a strong antihyperglycemic impact in diabetes and Cd toxicity. Twenty-one days of *E. fluctuans* extract therapy at a dosage of 200 mg/kg greatly decreased blood glucose levels in normal rats treated with both plant extract and CdCl<sub>2</sub> (N-PCd) and diabetic treated with both plant extract and CdCl<sub>2</sub> (DM-PCd) ( $p < 0.05$ ) community [116].

The assessment of antidiabetic activity of *Eupatorium odoratum* leaves was conducted on male mice using alloxan with blood glucose levels  $>200$  mg/dL. A research study has shown that the extract with dose concentrations ranging from 5–20% will reduce the blood glucose level of mice with hyperglycemia 20% more effectively [117].

*Ficus bengalensis* Linn, generally referred to as the banyan tree, is a member of the Moraceae family. Its bark is used for diabetes therapy. In this analysis, ethanol extracts from the different aerial sections of *Ficus bengalensis* Linn have been tested comparatively for their reduced blood-glucose activity. Histopathology in treatment classes for the beta-totropic function of different sections of *Ficus bengalensis* has been conducted. The ethanolic extracts of the fruit were shown to have a stronger antidiabetic influence at a dose of 120 mg/kg than the ethanol extract of the bark or root [119].

*Ficus hispida* bark ethanol extract (1.25 g/kg) shows a substantial reduction in blood glucose levels in both mild ( $p < 0.01$ ) and diabetic ( $p < 0.001$ ) rats. However, the blood glucose level drop was smaller than that of glibenclamide, the standard treatment [121].

The antidiabetic action of aqueous (AE) and ethanol (EE) extracts of *Ficus racemosa* was evaluated in a diabetes model induced by Streptozotocin via investigating the level of blood glucose. Treatment with AE (500 mg/kg) and EE (400 mg/kg) of *Ficus racemosa* revealed a substantial decrease ( $p < 0.05$ ) in blood glucose levels relative to diabetic control rats [124].

*Glycosmis pentaphylla* (Retz.) Correa, a medicinal plant is widely used in Bangladesh as a herbal remedy. A study was developed for the assessment of the antihyperglycemic properties of ethanol extract of *Glycosmis pentaphylla* (GP). About 60 Swiss Albino male mice were used for this purpose (weight 20–25 g). The findings show that GP extract has a short and a week-long antihyperglycemic impact comparable to metformin HCl, a recognized and commonly used antihyperglycemic agent [125].

The effectiveness of extract from *Gymnema sylvestre* leaves was investigated in 22 type-II diabetic patients on conventional oral anti-hyperglycemic agents. GS<sub>4</sub> (400 mg/day) was administered for 18–20 months as a supplement to conventional oral drugs. The supplementation of extract at a dose of 400 mg/day demonstrated a substantial reduction in blood glucose level, glycosylated plasma proteins, and glycosylated hemoglobin. These data propose that the *beta* cells can be repaired in type-II diabetic patients on *Gymnema sylvestre* extract supplementation [126].

A study was conducted in Streptozotocin-mediated diabetic rats to screen phytochemical constituents as well as the antihyperglycemic function of *Heliotropium indicum* (HI). Diabetic rats were treated with various solvent extracts of HI at a dosage of 500 mg/kg, produced substantial ( $p < 0.0001$ ) antidiabetic activity with methanol and aqueous extracts [127].

Gayathri M. et al. 2008 evaluated the antidiabetic activity of *Hemidesmus indicus* on diabetic rats caused by streptozotocin. The results of the study concluded that aqueous extracts from the root of *H. indicus* induced significant antidiabetic activity at a dose of 500 mg/kg/day. It improves the amounts of electrolytes, hepatic microsomal protein, glucose metabolizing enzymes, and P-450 mono-oxygenase-dependent hepatic cytochrome systems at almost regular levels as well as the corresponding metabolic changes in testable induced diabetic rats [128].

Venkatesh, S. et al. conducted an experiment to find out the antidiabetic activity of *Hibiscus rosa-sinensis* flowers. *Hibiscus rosa-sinensis* ethanolic extracts at doses of 250 mg/kg



and 500 mg/kg greatly decreased blood glucose levels caused by alloxan. Only a dosage of 500 mg/kg demonstrated substantial blood sugar reductions after 1 h, while the extract showed a significant drop ( $P < 0.05$ ) in the level of blood glucose levels after 3 h at a dose of 250 mg/kg. A substantial decrease in blood glucose, compared to the blood glucose group treated with glibenclamide (10 mg/kg), was seen in the subacute study at a dosage of 500 mg/kg by the end of the investigation [129].

In a study, the leaves and flower extracts of *Hibiscus schizopetalus* were investigated for antihyperglycemic behaviors in alloxan-mediated diabetic rats. The hypoglycemic activity was assessed in fasting normal rats and glucose-loaded rats (100 mg/kg body weight). Body weight observations were also reported. The extracts revealed a substantial ( $p < 0.001$ ) decrease in typical fasting rats' blood glucose levels [130].

A study was undertaken to consider the antidiabetic efficacy of stem of *Hiptage benghalensis* where it has been shown that the extract exhibited substantial glucose absorption inhibition at a dosage of 500 mg/kg and had hypoglycemic results in Long-Evans rats of 80–200 gm [131].

The consequences of the roots and leaves of *J. adhatoda* have been studied in animals with diabetes induced by alloxan. This experiment assessed the effects of plant leaves and root extracts on blood glucose level as well as other diabetes parameters. Oral dosing of 50 and 100 mg/kg of ethanol extracts of *Justicia* leaves to standard and experimental diabetic rats resulted in a substantial ( $p < 0.05$ ) decrease in blood glucose from 2 to 6 days of therapy relative to *J. adhatoda* (100 mg/kg) and glibenclamide (5 mg/kg) root extracts [132].

The antidiabetic effect in glucose-induced mice for methanol bark extract of *Lannea coromandelica* at a dose of 100, 200, and 400 mg/kg exhibited dose-dependent and significant reduction of serum-glucose levels [139].

The *Murraya koenigii* aqueous extract (200, 300, and 400 mg/kg) showed the lowering of blood glucose levels in normal as well as in diabetic rabbits after single oral administration [154]. The ethanol extract of *Mucuna pruriens* seed demonstrated a significant and dose-dependent (5, 10, 20, 30, 40, 50, and 100 mg/kg) reduction of plasma glucose level in alloxan-induced diabetic rats [155]. The stem extract of *Musa sapientum* with different doses (25, 50, and 100 mg/kg) reduced blood-glucose level in streptozotocin-induced rats, while 50 mg/kg dose was most effective [156,157]. The hot water and cold ethanol extracts of *Piper betle* leaves showed significant and dose-dependent efficacy in reducing the blood glucose level in normoglycaemic and streptozotocin-induced diabetic rats, while none of the extracts shows any toxicity sign [165].

*V. anthelmintica* exhibited significant antidiabetic effects in aqueous seeds extract (100, 200, and 500 mg/kg), and ethanol seeds extract (250, 500, and 750 mg/kg), whereas the higher showed maximum reduction in blood glucose level [203,204].

*V. rosea* exhibited significant antidiabetic effects in methanol whole plant extract at doses of 300 and 500 mg/kg in diabetic rats [321], while the alcoholic extract of leaves also reported reduction of blood glucose level [206].

The isolation of iridoid glucoside from *V. negundo* leaves were subjected for antidiabetic effect at a dose of 50 mg/kg, whereas it shows significant effectiveness in glycoprotein metabolism [208]. Idopyranose from methanol leaves' extract at a dose of 50 mg/kg protects the pancreatic  $\beta$ -cells [209], while ethanolic extract (60%) was found to be a strong antidiabetic agent [210].

The methanol extract of *W. chinensis* leaf (100 and 200 mg/kg) in alloxan-induced Swiss albino diabetic mice reported antidiabetic effect, while the  $\alpha$ -amylase inhibition assay and  $\alpha$ -glucosidase activity exposed 48.39% and 39.37% inhibition at 500  $\mu$ g/L and 10  $\mu$ g/mL, respectively [211]. A significant in vitro  $\alpha$ -amylase inhibition assay and  $\alpha$ -glucosidase activity was observed for the isolated compound from the methanol leaves extract [212].

Ethanol *W. somnifera* roots and leaves extract at 100 and 200 mg/kg dose increase the blood glucose level while a decrease in total protein, glycogen and tissues protein [213]. Leaves and root extract showed antidiabetic activity, while the isolated compounds Withaferin A (10  $\mu$ M) showed an increase glucose uptake (54%) [214].

Dosage-dependent and statistically significant antihyperglycemic activity has been shown in the *Xanthium indicum* methanol extracts in doses of 50, 100, 200, and 400 mg/kg. The higher dose (400 mg) was observed for the reduction in blood glucose level (31.2%) [217].

For antidiabetic and hypolipidemic potentials in alloxan-induced rats, *Zea mays* husk extract, and fractions (187–748 mg/kg) were used, whereas dichloromethane fraction observed the highest activity [218].

Antihyperglycemic and hypoglycemic behaviors were demonstrated at 200 and 400 mg/kg for aqueous extract, petroleum ether extract and the non-polysaccharide fraction of the aqueous extract of *Z. mauritiana* fruits [219]. Another study of aqueous leaves extract reported decreased hyperglycemic effects at 300 mg/kg dose [322]. The aqueous ethanol seed extract at different doses of 100, 400, and 800 mg/kg reported hypoglycemic effects [220].

## 8. Future Prospects for Antidiabetic Plant Research

According to the ethnobotanical study, almost 800 plants were reported to have antidiabetic effects [323]. Traditional plant medicines are used all over the world for diabetic presentations which may offer a natural key to uncover a critical anticipated medication for the future. For example, several plant-derived pharmaceuticals and phytotherapies presently are used by the native people of all over the world. *Galega officinalis* L. has been used since the earlier period in Europe aimed at treating symptoms associated with type-II diabetes mellitus (T2DM) [324]. It is currently accepted that its hypoglycemic and insulin-sensitizing potential is related with its guanide compound (galegine). A related compound, the biguanide metformin molecule, was later evolved and is still broadly utilized in antidiabetic treatment [325]. In addition, to treat diabetic hyperglycemia in either long or short duration, a number of natural compounds have been identified with their different mechanisms. S-methyl cysteine sulfoxide (*Allium cepa* L.) [326], lophenol (*Aloe vera* L.) [327], and gymnemic acids (*Gymnema sylvestre* R.) [328,329] contribute significant effect on insulin secreting beta cells. While S-allyl cysteine (*Allium sativum* L.) [330], insulin like protein or so called plant insulin (*Momordica charantia* L.) act as alternatives to insulin, tetrahydrocurcumin (*Curcuma longa* L.) displays its activity by modifying glucose utilization [331], and 4-hydroxyisoleucine, a novel amino acid potentiator of insulin secretion derived from *Trigonella foenum-graecum* L. [332]. Several commercially available natural products are claimed to have antidiabetic effects. It has previously been shown that *Salvia officinalis* with tea exhibited metformin-like effects [333]. *Agaricus bisporus* L. (edible mushroom) is considered a useful nutritive aide for diabetes and showed an appreciable hypoglycemic outcome [334]. Moreover, amongst the spices, *Trigonella foenum-graecum* L. (fenugreek seeds), *Cuminum cyminum* L. (cumin seeds), *Zingiber officinale* Roscoe (ginger), *Brassica nigra* L. K. Koch (mustard), *Murraya koenigii* L. (curry leaves) and *Coriandrum sativum* L. (coriander) are reported to have hypoglycemic effects [335].

## 9. Conclusions

Bangladesh is abundant in medicinal plants that have been proved in their ethnomedicinal uses by local and ethnic people. Therefore, there is increasing evidence that old molecules are finding new therapeutic effects through better observation of traditional knowledge and clinical interpretation. Evidence-based and safe use of economical plant-derived drugs against the prevalence of diabetes may offer an enormous public health interest, particularly for developing countries like Bangladesh. Hence, we suggest an emphasis on advanced research to conduct excellent clinical studies focusing on those plants that have revealed potential antidiabetic effects.

**Author Contributions:** Conceptualization, Investigation, Writing—original draft, Project administration, M.M.R.; Formal analysis, Writing—original draft, Visualization, M.J.U.; Methodology, Resources, Supervision, A.S.M.A.R.; Methodology, Supervision, Writing—original draft, A.M.T.; Methodology, Investigation, Writing—original draft, Supervision, Visualization; T.B.E. Writing—original draft,

Formal analysis, Supervision, Visualization, Funding acquisition, J.S.-G. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Data Availability Statement:** All data generated or analyzed are contained within the present article.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* **2009**, *32*, S62–S67. [[CrossRef](#)]
2. Huxley, R.; Barzi, F.; Woodward, M. Excess risk of fatal coronary heart disease associated with diabetes in men and women: Meta-analysis of 37 prospective cohort studies. *BMJ* **2006**, *332*, 73–78. [[CrossRef](#)]
3. Yun, J.-S.; Ko, S.-H.; Kim, J.-H.; Moon, K.-W.; Park, Y.-M.; Yoo, K.-D.; Ahn, Y.-B. Diabetic retinopathy and endothelial dysfunction in patients with type 2 diabetes mellitus. *Diabetes Metab. J.* **2013**, *37*, 262–269. [[CrossRef](#)]
4. Cukierman, T.; Gerstein, H.C.; Williamson, J.D. Cognitive decline and dementia in diabetes—Systematic overview of prospective observational studies. *Diabetologia* **2005**, *48*, 2460–2469. [[CrossRef](#)]
5. Cho, N.H.; Shaw, J.E.; Karuranga, S.; Huang, Y.; da Rocha Fernandes, J.D.; Ohlrogge, A.W.; Malanda, B. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res. Clin.* **2018**, *138*, 271–281. [[CrossRef](#)] [[PubMed](#)]
6. Wild, S.; Roglic, G.; Green, A.; Sicree, R.; King, H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care* **2004**, *27*, 1047–1053. [[CrossRef](#)]
7. Bolen, S.; Feldman, L.; Vassy, J.; Wilson, L.; Yeh, H.C.; Marinopoulos, S.; Wiley, C.; Selvin, E.; Wilson, R.; Bass, E.B.; et al. Systematic review: Comparative effectiveness and safety of oral medications for type 2 diabetes mellitus. *Ann. Intern. Med.* **2007**, *147*, 386–399. [[CrossRef](#)]
8. Price, W.A.; Zimmer, B.; Conway, R.; Szekely, B. Insulin-induced factitious hypoglycemic coma. *Gen. Hosp. Psychiatry* **1986**, *8*, 291–293. [[CrossRef](#)]
9. Marles, R.J.; Farnsworth, N.R. Antidiabetic plants and their active constituents. *Phytomedicine* **1995**, *2*, 137–189. [[CrossRef](#)]
10. Svoboda, G.H.; Neuss, N.; Gorman, M. Alkaloids of *Vinca rosea* Linn. (*Catharanthus roseus* G. Don.). V. Preparation and characterization of alkaloids. *J. Am. Pharm Assoc.* **1959**, *48*, 659–666. [[CrossRef](#)]
11. Ocvirk, S.; Kistler, M.; Khan, S.; Talukder, S.H.; Hauner, H. Traditional medicinal plants used for the treatment of diabetes in rural and urban areas of Dhaka, Bangladesh—An ethnobotanical survey. *J. Ethnobiol. Ethnomed.* **2013**, *9*, 43. [[CrossRef](#)]
12. Kadir, M.F.; Bin Sayeed, M.S.; Shams, T.; Mia, M.M.K. Ethnobotanical survey of medicinal plants used by Bangladeshi traditional health practitioners in the management of diabetes mellitus. *J. Ethnopharmacol.* **2012**, *144*, 605–611. [[CrossRef](#)]
13. Biswas, K.R.; Ishika, T.; Rahman, M.; Swarna, A.; Khan, T.; Monalisa, M.N.; Seraj, S.; Rahman, M.A.; Mou, S.M.; Rahmatullah, M. A review of scientific literature on anti-diabetic activity in medicinal plants used by folk medicinal practitioners of two villages in Narail and Chuadanga districts, Bangladesh for treatment of diabetes. *Am. Eurasian J. Sustain. Agric.* **2011**, *5*, 196–208.
14. Rahman, M.M.; Mishuk, A.; Halder, S.; Rouf, A.S.S. A survey on traditional medicinal plants used for the treatment of diabetes in urban areas of Dhaka and Khulna, Bangladesh. *Glob. J. Med. Res. Pharma Drug Disc. Toxicol. Med.* **2013**, *13*, 21–26.
15. Rahman, M.H. A Study on Exploration of Ethnobotanical Knowledge of Rural Community in Bangladesh: Basis for Biodiversity Conservation. *ISRN Biodivers.* **2013**, *2013*, 369138. [[CrossRef](#)]
16. Chowdhury, M.S.H.; Koike, M.; Muhammed, N.; Halim, M.A.; Saha, N.; Kobayashi, H. Use of plants in healthcare: A traditional ethno-medicinal practice in rural areas of southeastern Bangladesh. *Int. J. Biodivers. Sci. Manag.* **2009**, *5*, 41–51. [[CrossRef](#)]
17. Rahmatullah, M.; Azam, M.N.K.; Malek, I.; Nasrin, D.; Jamal, F.; Rahman, M.A.; Khatun, Z.; Jahan, S.; Seraj, S.; Jahan, R. An ethnomedicinal survey among the marakh sect of the Garo tribe of Mymensingh district, Bangladesh. *Int. J. Pharmtech. Res.* **2012**, *4*, 141–149.
18. Joseph, B.; Jini, D. Insight into the hypoglycaemic effect of traditional Indian herbs used in the treatment of diabetes. *Res. J. Med. Plant.* **2011**, *5*, 352–376. [[CrossRef](#)]
19. Rahmatullah, M.; Mukti, I.J.; Haque, A.; Mollik, M.A.H.; Parvin, K.; Jahan, R.; Chowdhury, M.H.; Rahman, T. An ethnobotanical survey and pharmacological evaluation of medicinal plants used by the Garo tribal community living in Netrakona district, Bangladesh. *Adv. Nat. Appl. Sci.* **2009**, *3*, 402–418.
20. Rahmatullah, M.; Mollik, M.A.H.; Islam, M.K.; Islam, M.R.; Jahan, F.I.; Khatun, Z.; Seraj, S.; Chowdhury, M.H.; Islam, F.; Miajee, Z.U.M. A survey of medicinal and functional food plants used by the folk medicinal practitioners of three villages in Sreepur Upazilla, Magura district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 363–373.
21. Mollik, M.; Hossan, M.; Paul, A.; Taufiq-Ur-Rahman, M.; Jahan, R.; Rahmatullah, M. A Comparative Analysis of Medicinal Plants Used by Folk Medicinal Healers in Three Districts of Bangladesh and Inquiry as to Mode of Selection of Medicinal Plants. *Ethnobot. Res. Appl.* **2010**, *8*, 195–218. [[CrossRef](#)]
22. Sarker, S.; Seraj, S.; Sattar, M.M.; Haq, W.M.; Chowdhury, M.H.; Ahmad, I.; Jahan, R.; Jamal, F.; Rahmatullah, M. Medicinal plants used by folk medicinal practitioners of six villages in Thakurgaon district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2011**, *5*, 332–344.

23. Zahan, T.; Ahmed, I.; Omi, S.I.; Naher, K.; Islam, S.; Mahmud Asmsb, S.S.; Shahriar, S.M.S.; Khatun, Z.; Rahmatullah, M. Ethnobotanical uses of medicinal plants by the Tudu sub-clan of the Santal tribe in Joypurhat district of Bangladesh. *Am. Eur. J. Sustain. Agric.* **2013**, *7*, 137–142.
24. Rahmatullah, M.; Islam, M.R.; Kabir, M.Z.; Harun-or-Rashid, M.; Jahan, R.; Begum, R.; Seraj, S.; Khatun, M.A.; Chowdhury, A.R. Folk medicinal practices in Vasu Bihar village, Bogra district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 86–93.
25. Hossain, M.S.; Hanif, A.; Khan, M.; Bari, S.; Jahan, R.; Rahamatullah, M. Ethnobotanical survey of the Rakhian tribe inhabiting the Chittagong hill tracts region of Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2009**, *3*, 172–180.
26. Tuhin, M.I.H.; Asaduzzaman, M.; Islam, E.; Khatun, Z.; Rahmatullah, M. Medicinal plants used by folk medicinal herbalists in seven villages of Bhola district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2013**, *7*, 210–218.
27. Sarker, S.K.; Hossain, A.B.M.E. Pteridophytes of greater Mymensingh district of Bangladesh used as vegetables and medicines. *Banglad. J. Plant Taxon.* **2009**, *16*, 47–56. [[CrossRef](#)]
28. Rahmatullah, M.; Mollik, A.H.; Rahman, S.; Hasan, N.; Agarwala, B.; Jahan, R. A medicinal plant study of the Santal tribe in Rangpur district, Bangladesh. *J. Altern. Complementary Med.* **2010**, *16*, 419–425. [[CrossRef](#)]
29. Rahmatullah, M.; Jahan, R.; Khatun, M.A.; Jahan, F.I.; Azad, A.K.; Bashar, A.B.M.; Miajee, Z.U.M.; Ahsan, S.; Nahar, N.; Ahmad, I. A pharmacological evaluation of medicinal plants used by folk medicinal practitioners of Station Purbo Para Village of Jamalpur Sadar Upazila in Jamalpur district, Bangladesh. *Am. Eurasian J. Sustain.* **2010**, *4*, 170–195.
30. Rahmatullah, M.; Azam, M.N.K.; Mollik, M.A.H.; Hasan, M.M.; Hassan, A.I.; Jahan, R.; Jamal, F.; Nasrin, D.; Ahmed, R.; Rahman, M.M. Medicinal plants used by the Kavirajes of Daulatdia Ghat, Kushtia district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2010**, *4*, 219–229.
31. Aiubali, R.M.M.; Hossain, M.Y.; Aziz, N.; Mostafa, M.N.; Mahmud, M.S.; Islam, M.F.; Seraj, S.; Rahmatullah, M. Home remedies of the Teli clan of the Telegu tribe of Maulvibazar district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2013**, *7*, 290–294.
32. Bashar, A.; Ahmed, R.; Ahmed, I.; Jahan, R.; Ahsan, S.; Chowdhury, H. A survey on the use of medicinal plants by folk medicinal practitioners in three areas of Pirojpur district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 247–259.
33. Karim, M.S.; Rahman, M.M.; Shahid, S.B.; Malek, I.; Rahman, M.A.; Jahan, S.; Jahan, F.I.; Rahmatullah, M. Medicinal plants used by the folk medicinal practitioners of Bangladesh: A randomized survey in a village of Narayanganj district. *Am. Eur. J. Sustain. Agric.* **2011**, *5*, 405–414.
34. Rahmatullah, M.; Azam, N.K.; Khatun, Z.; Seraj, S.; Islam, F.; Rahman, A.; Jahan, S.; Aziz, S. Medicinal plants used for treatment of diabetes by the Marakh sect of the Garo tribe living in Mymensingh district, Bangladesh. *Afr. J. Tradit Complementary Altern. Med.* **2012**, *9*, 380–385. [[CrossRef](#)]
35. Rahmatullah, M.; Hossain, M.S.; Hanif, A.; Roy, P.; Jahan, R.; Khan, M.; Chowdhury, M.H.; Rahman, T. Ethnomedicinal applications of plants by the traditional healers of the Marma tribe of Naikhongchhari, Bandarban district, Bangladesh. *Adv. Nat. Appl. Sci.* **2009**, *3*, 392–401.
36. Rahmatullah, M.; Das, A.K.; Mollik, M.A.H.; Jahan, R.; Khan, M.; Rahman, T.; Chowdhury, M.H. An ethnomedicinal survey of Dhamrai sub-district in Dhaka District, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2009**, *3*, 881–888.
37. Jamal, R.J.; Khatun, A.; Nahar, N.; Ahsan, S.; Nahar, A.; Ahmad, I. A survey of medicinal plants used by the folk medicinal practitioners of Shetabganj village in Dinajpur district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 196–203.
38. Masum, G.Z.H.; Dash, B.K.; Barman, S.K.; Sen, M.K. A comprehensive ethnomedicinal documentation of medicinal plants of Islamic University, region, Bangladesh. *Int. J. Pharm. Sci. Res.* **2013**, *4*, 1202.
39. Hasan, M.E.; Akter, S.; Piya, N.S.; Nath, P.K.; Nova, U.S.R.; Chowdhury, H.R.; Anjoom, N.F.; Khatun, Z.; Rahmatullah, M. Variations in selection of medicinal plants by tribal healers of the Soren clan of the Santal tribe: A study of the Santals in Rajshahi district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2012**, *6*, 315–324.
40. Gazi, M.Z.H.; Priyanka, S.; Abu, N.M.; Mafizur, R.M.; Mizanur, R.M. Medicinal plants used by Kabiraj of fourteen villages in Jhenaidah district, Bangladesh. *Glob. J. Res. Med. Plants Indig. Med.* **2013**, *2*, 10.
41. Anisuzzaman, M.; Rahman, A.; Harun-or-Rashid, M.; Naderuzzaman, A.T.M.; Islam, A. An ethnobotanical study of Madhupur, Tangail. *J. Appl. Sci. Res.* **2007**, *3*, 519–530.
42. Rahman, A. Ethno-botanical survey of traditional medicine practice for the treatment of cough, diabetes, diarrhea, dysentery and fever of santals at Abdullahpur village under Akkelpur Upazilla of Joypurhat district, Bangladesh. *Biomed. Biotechnol.* **2013**, *1*, 27–30.
43. Rahman, A.; Nitu, S.K.; Ferdows, Z.; Islam, A. Medico-botany on herbaceous plants of Rajshahi, Bangladesh. *Am. J. Life Sci.* **2013**, *1*, 136–144. [[CrossRef](#)]
44. Rahman, A.H.M.M.; Sultana, N.; Islam, A.K.M.R.; Zaman, A. Study of Medical Ethno-botany at the Village Genda under Savar Upazilla of District Dhaka, Bangladesh. *J. Med. Plants* **2013**, *1*, 18–31.
45. Rahman, A.H.M.M.; Kabir, E.; Islam, A.K.M.R.; Zaman, A. Medico-botanical investigation by the tribal people of Naogaon district, Bangladesh. *J. Med. Plants* **2013**, *1*, 136–147.
46. Rahman, A. Medico-botanical study of commonly used angiosperm weeds of Rajshahi, Bangladesh. *Wudpecker J. Med. Plants* **2013**, *2*, 44–52.
47. Rahman, A. Medico-botanical study of the plants found in the Rajshahi district of Bangladesh. *Prudence J. Med. Plants Res.* **2013**, *1*, 1–8.



48. Rahmatullah, M.; Ferdousi, D.; Mollik, M.A.H.; Azam, M.N.K.; Rahman, M.T.; Jahan, R. Ethnomedicinal survey of Bheramara area in Kushtia district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2009**, *3*, 534–541.
49. Islam, N.; Afroz, R.; Sadat, A.; Seraj, S.; Jahan, F.I.; Islam, F.; Chowdhury, A.R.; Aziz, M.S.; Biswas, K.R.; Jahan, R. A survey of medicinal plants used by folk medicinal practitioners in three villages of Jessore district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2011**, *5*, 219–225.
50. Chowdhury, A.R.; Jahan, F.I.; Seraj, S.; Khatun, Z.; Jamal, F.; Ahsan, S.; Jahan, R.; Ahmad, I.; Chowdhury, M.H.; Rahmatullah, M. A survey of medicinal plants used by Kavirajes of Barisal town in Barisal district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 237–247.
51. Arfin Khan, M.A.S.; Mukul, S.A.; Uddin, M.S.; Kibria, M.G.; Sultana, F. The use of medicinal plants in healthcare practices by Rohingya refugees in a degraded forest and conservation area of Bangladesh. *Int. J. Biodivers. Sci. Manag.* **2009**, *5*, 76–82. [[CrossRef](#)]
52. Shaheen, E.K.; Syef, A.; Saha, S.S.; Islam, S.; Al Hossain, D.; Sujan, A.I.; Rahmatullah, M. Medicinal plants used by the folk and tribal medicinal practitioners in two villages of Khakiachora and Khasia Palli in Sylhet district, Bangladesh. *Adv. Nat. Appl. Sci.* **2011**, *5*, 100–111.
53. Mukul, S.A.; Uddin, M.B.; Tito, M.R. Medicinal plant diversity and local healthcare among the people living in and around a conservation area of Northern Bangladesh. *Int. J. Usuf. Manag.* **2007**, *8*, 50–63.
54. Rahmatullah, M.; Mollik, M.A.H.; Khatun, M.A.; Jahan, R.; Chowdhury, A.R.; Seraj, S.; Hossain, M.S.; Nasrin, D.; Khatun, Z. A survey on the use of medicinal plants by folk medicinal practitioners in five villages of Boalia sub-district, Rajshahi district, Bangladesh. *Adv. Nat. Appl. Sci.* **2010**, *4*, 39–44.
55. Roy, S.; Uddin, M.Z.; Hassan, M.A.; Rahman, M.M. Medico-botanical report on the Chakma community of Bangladesh. *Bangladesh. J. Plant Taxon.* **2008**, *15*, 67–72. [[CrossRef](#)]
56. Rahman, A.; Kabir, E.; Sima, S.N.; Sultana, R.S.; Nasiruddin, M.; Naderuzzaman, A.T.M. Study of an ethnobotany at the village Dohanagar, Naogaon. *J. App. Sci. Res.* **2010**, *6*, 1466–1473.
57. Esha, R.T.; Chowdhury, M.R.; Adhikary, S.; Haque, K.M.A.; Acharjee, M.; Nurunnabi, M.; Khatun, Z.; Le, Y.K.; Rahmatullah, M. Medicinal plants used by tribal medicinal practitioners of three clans of the Chakma tribe residing in Rangamati district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2012**, *6*, 74–84.
58. Biswas, A.; Bari, M.A.; Roy, M.; Bhadra, S.K. Inherited folk pharmaceutical knowledge of tribal people in the Chittagong hill tracts, Bangladesh. *Indian J. Trad. Knowl.* **2010**, *9*, 77–89.
59. Rahmatullah, M.; Mollik, M.A.H.; Azam, A.; Islam, M.R.; Chowdhury, M.A.M.; Jahan, R.; Chowdhury, M.H.; Rahman, T. Ethnobotanical survey of the Santal tribe residing in Thakurgaon District, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2009**, *3*, 889–898.
60. Rahmatullah, M.; Ferdousi, D.; Mollik, A.; Jahan, R.; Chowdhury, M.H.; Haque, W.M. A survey of medicinal plants used by Kavirajes of Chalna area, Khulna district, Bangladesh. *Afr. J. Tradit. Complementary Altern. Med.* **2010**, *7*, 91–97. [[CrossRef](#)]
61. Ghosh, K.C.; Rahman, H.; Alam, J.; Faruque, M.O.; Mahamudul, M. A comparative analysis of medicinal plants used by folk medicinal healers in villages adjoining the Ghaghot, Bangali and Padma Rivers of Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 70–85.
62. Azam, M.N.K.; Ahmed, M.N.; Rahman, M.M.; Rahmatullah, M. Ethnomedicines used by the Oraon and Gor tribes of Sylhet district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2013**, *7*, 391–402.
63. Hasan, M.M.; Annay, M.E.A.; Sintaha, M.; Khaleque, H.N.; Noor, F.A.; Nahar, A.; Seraj, S.; Jahan, R.; Chowdhury, M.H.; Rahmatullah, M. A survey of medicinal plant usage by folk medicinal practitioners in seven villages of Ishwardi Upazilla, Pabna district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 326–333.
64. Hossain, M.S.; Roy, P.; Seraj, S.; Mou, S.M.; Monalisa, M.N.; Jahan, S.; Khan, T.; Swarna, A.; Jahan, R.; Rahmatullah, M. Ethnomedicinal knowledge among the Tongchongya tribal community of Roangchaari Upazila of Bandarban district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2012**, *6*, 349–359.
65. Uddin, S.B.; Ratna, R.S.; Faruque, M.O. Ethnobotanical study on medicinal plants of Rakhaing Indigenous Community of Cox's Bazar District of Bangladesh. *J. Pharm. Phytochem.* **2013**, *2*, 164–174.
66. Verma, P.R.; Itankar, P.R.; Arora, S.K. Evaluation of antidiabetic antihyperlipidemic and pancreatic regeneration, potential of aerial parts of *Clitoria ternatea*. *Rev. Bras. Farm.* **2013**, *23*, 819–829. [[CrossRef](#)]
67. Mawla, F.; Khatun, S.; Rehana, F.; Jahan, S.; Shelley, M.M.R.; Hossain, S.; Haq, W.M.; Rahman, S.; Debnath, K.; Rahmatullah, M. Ethnomedicinal plants of folk medicinal practitioners in four villages of Natore and Rajshahi districts, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2012**, *6*, 406–416.
68. Bisht, S.; Sisodia, S.S. Assessment of antidiabetic potential of *Cinnamomum tamala* leaves extract in streptozotocin induced diabetic rats. *Indian J. Pharm.* **2011**, *43*, 582. [[CrossRef](#)]
69. Chakraborty, U.; Das, H. Antidiabetic and antioxidant activities of *Cinnamomum tamala* leaf extracts in STZ-treated diabetic rats. *Glob. J. Biotechnol. Biochem.* **2010**, *5*, 12–18.
70. Kumar, S.; Vasudeva, N.; Sharma, S. GC-MS analysis and screening of antidiabetic, antioxidant and hypolipidemic potential of *Cinnamomum tamala* oil in streptozotocin induced diabetes mellitus in rats. *Cardiovasc. Diabetol.* **2012**, *11*, 1–11. [[CrossRef](#)] [[PubMed](#)]

71. El-Desoky, G.E.; Aboul-Soud, M.A.M.; Al-Numair, K.S. Antidiabetic and hypolipidemic effects of Ceylon cinnamon (*Cinnamomum verum*) in alloxan-diabetic rats. *J. Med. Plant. Res.* **2012**, *6*, 1685–1691.
72. Suntar, I.; Khan, H.; Patel, S.; Celano, R.; Rastrelli, L. An Overview on *Citrus aurantium* L.: Its Functions as Food Ingredient and Therapeutic Agent. *Oxidative Med. Cell. Longev.* **2018**, *2018*, 7864269. [[CrossRef](#)]
73. Mollik, M.; Jilani, M.; Hasan, M.; Faruque, M.; Haque, M.; Ferdousi, D.; Jahan, R.; Rahmatullah, M.; Rahman, M. Plants used by traditional health practitioners of Natore and Naogaon districts, Bangladesh to treat diabetes mellitus. *Am. Soc. Trop. Med. Hyg.* **2010**, *83*, 22.
74. Afroz, S.S.; Sen, U.S.; Islam, M.J.; Morshed, M.T.; Bhuiyan, M.S.A.; Ahmed, I. Ethnomedicinal plants of various tribal and folk medicinal practitioners of six localities of Rangamati and Khagrachari districts in Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2013**, *7*, 262–271.
75. Halim, M.A.; Chowdhury, M.S.H.; Wadud, A.I.; Uddin, M.S.; Sarker, S.K.; Uddin, M.B. The use of plants in traditional health care practice of the “Shaiji” community in southwestern Bangladesh. *J. Trop. For. Sci.* **2007**, *19*, 168–175.
76. Jahan, N.; Khan, A.; Hasan, M.N.; Hossain, M.U.; Das, U.; Sultana, S.; Rahmatullah, M. Ethnomedicinal plants of fifteen clans of the Garo tribal community of Madhupur in Tangail district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2013**, *7*, 188–196.
77. Mukti, M.; Ahmed, A.; Chowdhury, S.; Khatun, Z.; Bhuiyan, P.; Debnath, K.; Rahmatullah, M. Medicinal plant formulations of Kavirajes in several areas of Faridpur and Rajbari districts, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2012**, *6*, 234–247.
78. Rahmatullah, M.; Kabir, A.; Rahman, M.M.; Hossain, M.S.; Khatun, Z.; Khatun, M.A.; Jahan, R. Ethnomedicinal practices among a minority group of Christians residing in Mirzapur village of Dinajpur District, Bangladesh. *Adv. Nat. Appl. Sci.* **2010**, *4*, 45–51.
79. Rahmatullah, M.; Noman, A.; Hossain, M.S.; Rashid, M.H.; Rahman, T.; Chowdhury, M.H.; Jahan, R. A survey of medicinal plants in two areas of Dinajpur district, Bangladesh including plants which can be used as functional foods. *Am. Eurasian J. Sustain. Agric.* **2009**, *3*, 862–876.
80. Rahman, A. Ethno-medico-botanical investigation on cucurbits of the Rajshahi Division. *J. Med. Plants Stud.* **2013**, *1*, 118–125.
81. Rahmatullah, M.; Mollik, M.A.H.; Ahmed, M.N.; Bhuiyan, M.Z.A.; Hossain, M.M.; Azam, M.N.K.; Seraj, S.; Chowdhury, M.H.; Jamal, F.; Ahsan, S. A survey of medicinal plants used by folk medicinal practitioners in two villages of Tangail district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 357–362.
82. Rahmatullah, M.; Mollik, A.H.; Ali, M.; Abbas, F.B.; Jahan, R.; Chowdhury, M.H.; Seraj, S.; Miajee Zumeu, A.A.K.; Bashar, A.; Chowdhury, A.R. An ethnomedicinal survey of Vitbilila village in Sujanagar sub-district of Pabna district, Bangladesh. *Am. Eurasian J. Agric. Environ. Sci.* **2011**, *10*, 106–111.
83. Rahman, A. Ethno-medical investigation on ethnic community in the northern region of Bangladesh. *Am. J. Life Sci.* **2013**, *1*, 77–81. [[CrossRef](#)]
84. Rahmatullah, M.; Khatun, M.A.; Morshed, N.; Neogi, P.K.; Khan, S.U.A.; Hossain, M.S.; Mahal, M.J.; Jahan, R. A randomized survey of medicinal plants used by folk medicinal healers of Sylhet Division, Bangladesh. *Adv. Nat. Appl. Sci.* **2010**, *4*, 52–62.
85. Rahmatullah, M.; Chowdhury, A.R.; Esha, R.T.; Chowdhury, M.R.; Adhikary, S.; Haque, K.M.A.; Paul, A.; Akber, M. Ayurvedic influence on use of medicinal plants in Chakma traditional medicine. *Am. Eurasian J. Sustain. Agric.* **2012**, *6*, 107–112.
86. Das, P.R.; Islam, M.T.; Mahmud, A.; Kabir, M.H.; Hasan, M.E.; Khatun, Z.; Rahman, M.M.; Nurunnabi, M.; Khatun, Z.; Lee, Y.K. An ethnomedicinal survey conducted among the folk medicinal practitioners of three villages in Kurigram district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2012**, *6*, 85–96.
87. Sajib, N.H.; Uddin, S.B. Medico-botanical studies of Sandwip island in Chittagong, Bangladesh. *Bangladesh. J. Plant Taxon.* **2013**, *20*, 39–49. [[CrossRef](#)]
88. Rahmatullah, M.; Hasan, A.; Parvin, W.; Moniruzzaman, M.; Khatun, A.; Khatun, Z.; Jahan, F.I.; Jahan, R. Medicinal plants and formulations used by the Soren clan of the Santal tribe in Rajshahi district, Bangladesh for treatment of various ailments. *Afr. J. Trad. Complementary Altern. Med.* **2012**, *9*, 350–359. [[CrossRef](#)]
89. Rahmatullah, M.; Momen, A.M.I.; Rahman, M.; Nasrin, D.; Hossain, S.; Khatun, Z.; Jahan, F.I.; Khatun, A.; Jahan, R. A randomized survey of medicinal plants used by folk medicinal practitioners in Daudkandi sub-district of Comilla district, Bangladesh. *Adv. Nat. Appl. Sci.* **2010**, *4*, 99–105.
90. Mollik, A.; Hassan, A.I.; Paul, T.K.; Sintaha, M.; Khaleque, H.N.; Noor, F.A.; Nahar, A.; Seraj, S.; Jahan, R.; Chowdhury, M.A.H.; et al. A Survey of Medicinal Plant Usage by Folk Medicinal Practitioners in Two Villages by the Rupsha River in Bagerhat District, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2010**, *4*, 349–357.
91. Islam, F.; Jahan, F.I.; Seraj, S.; Malek, I.; Sadat, A.; Bhuiyan, M.S.A.; Swarna, A.; Sanam, S.; Rahmatullah, M. Variations in diseases and medicinal plant selection among folk medicinal practitioners: A case study in Jessore district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2011**, *5*, 282–291.
92. Mohammed, R.; Rahman, M.A.; Uddin, M.F.; Mehedi, H.; Khatun, M.A.; Bashar, A.; Shamima, A.; Mou, S.M.; Rahima, B.; Rownak, J. An ethnomedicinal survey conducted amongst folk medicinal practitioners in the two southern districts of Noakhali and Feni, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2011**, *5*, 115–131.
93. Nahar, M.N.; Ferdous, J.; Samanta, F.Z.; Shuly, K.A.; Nahar, S.; Saha, R.; Islam, S.; Mahal, M.J.; Seraj, S.; Rahmatullah, M. Ethnomedicinal plants of the Rai Clan of the Tipra tribe of Sylhet district, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2013**, *7*, 403–414.
94. Khatun, A.; Jahan, M.; Bashar, A.B.M.A.; Azad, A.K. A scientific evaluation of medicinal plants used in the folk medicinal system of five villages in Narsinghdi district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2010**, *4*, 55–64.

95. Bristy, T.A.; Barua, N.; Tareq, A.M.; Sakib, S.A.; Etu, S.T.; Chowdhury, K.H.; Jyoti, M.A.; Aziz, M.; Ibn, A.; Reza, A. Deciphering the pharmacological properties of methanol extract of *Psychotria calocarpa* leaves by in vivo, in vitro and in silico approaches. *Pharmaceuticals* **2020**, *13*, 183. [CrossRef]
96. Kumawat, N.S.; Chaudhari, S.P.; Wani, N.S.; Deshmukh, T.A.; Patil, V.R. Antidiabetic activity of ethanol extract of *Colocasia esculenta* leaves in alloxan induced diabetic rats. *Int. J. Pharmtech. Res.* **2010**, *2*, 1246–1249.
97. Rahman, J.; Tareq, A.M.; Hossain, M.M.; Sakib, S.A.; Islam, M.N.; Uddin, A.B.M.N.; Hoque, M.; Nasrin, M.S.; Ali, M.H.; Caiazzo, E.; et al. Biological evaluation, DFT calculations and molecular docking studies on the antidepressant and cytotoxicity activities of *Cycas pectinata* Buch.-Ham. Compounds. *Pharmaceuticals* **2020**, *13*, 232. [CrossRef]
98. Rani, A.S.; Sulakshana, G.; Patnaik, S. *Costus speciosus*, an antidiabetic plant-review. *FS J. Pharm. Res.* **2012**, *1*, 51–53.
99. Srivastava, R.; Srivastava, S.P.; Jaiswal, N.; Mishra, A.; Maurya, R.; Srivastava, A.K. Antidiabetic and antidiabetic activities of *Cuminum cyminum* L. in validated animal models. *Med. Chem. Res.* **2011**, *20*, 1656–1666. [CrossRef]
100. Rahmatullah, M.; Das, P.R.; Islam, T.; Ripa, R.J.; Hasan, E.; Akter, S.; Khatun, Z.; Seraj, S.; Jahan, R. Medicinal plants and formulations of the Bongshi tribe of Bangladesh. *Am. Eur. J. Sustain. Agric.* **2012**, *6*, 181–187.
101. Madhavan, V.; Joshi, R.; Murali, A.; Yoganasimhan, S.N. Antidiabetic activity of *Curculigo orchioides*. Root tuber. *Pharm. Biol.* **2007**, *45*, 18–21. [CrossRef]
102. Rakib, A.; Ahmed, S.; Islam, M.A.; Uddin, M.M.N.; Paul, A.; Chy, M.N.U.; Emran, T.B.; Seidel, V. Pharmacological studies on the antinociceptive, anxiolytic and antidepressant activity of *Tinospora crispa*. *Phytother. Res.* **2020**, *34*, 2978–2984. [CrossRef]
103. Widowati, W.; Wargasetia, T.L.; Afifah, E.; Mozef, T.; Kusuma, H.S.W.; Nufus, H.; Arumwardana, S.; Amalia, A.; Rizal, R. Antioxidant and antidiabetic potential of *Curcuma longa* and its compounds. *Asian J. Agric. Biol.* **2018**, *6*, 149–161.
104. Lekshmi, P.C.; Arimboor, R.; Nisha, V.M.; Menon, A.N.; Raghu, K.G. In vitro antidiabetic and inhibitory potential of turmeric (*Curcuma longa* L) rhizome against cellular and LDL oxidation and angiotensin converting enzyme. *J. Food Sci. Technol.* **2014**, *51*, 3910–3917. [CrossRef] [PubMed]
105. Rahmatullah, M.; Sultan, S.; Toma, T.; Lucky, S.; Chowdhury, M.; Haque, W.; Annay, E.; Jahan, R. Effect of *Cuscuta reflexa* stem and *Calotropis procera* leaf extracts on glucose tolerance in glucose-induced hyperglycemic rats and mice. *Afr. J. Tradit. Complementary Altern. Med.* **2010**, *7*, 109–112. [CrossRef] [PubMed]
106. Rath, D.; Kar, D.M.; Panigrahi, S.K.; Maharana, L. Antidiabetic effects of *Cuscuta reflexa* Roxb. in streptozotocin induced diabetic rats. *J. Ethnopharmacol.* **2016**, *192*, 442–449. [CrossRef] [PubMed]
107. Singh, S.K.; Kesari, A.N.; Gupta, R.K.; Jaiswal, D.; Watal, G. Assessment of antidiabetic potential of *Cynodon dactylon* extract in streptozotocin diabetic rats. *J. Ethnopharmacol.* **2007**, *114*, 174–179. [CrossRef] [PubMed]
108. Tareq, A.M.; Farhad, S.; Uddin, A.N.; Hoque, M.; Nasrin, M.S.; Uddin, M.M.R.; Hasan, M.; Sultana, A.; Munira, M.S.; Lyzu, C. Chemical profiles, pharmacological properties, and in silico studies provide new insights on *Cycas pectinata*. *Heliyon* **2020**, *6*, e04061. [CrossRef]
109. Belayneh, Y.M.; Birhanu, Z.; Birru, E.M.; Getenet, G. Evaluation of in vivo antidiabetic, antidiabetic, and in vitro antioxidant activities of hydromethanolic root extract of *Datura stramonium* L. (Solanaceae). *J. Exp. Pharmacol.* **2019**, *11*, 29. [CrossRef]
110. Dewanjee, S.; Bose, S.; Sahu, R.; Mandal, S. Antidiabetic effect of matured fruits of *Diospyros peregrina* in alloxan-induced diabetic rats. *Int. J. Green Pharm.* **2008**, *2*, 95. [CrossRef]
111. Rakib, A.; Ahmed, S.; Islam, M.A.; Haye, A.; Uddin, S.N.; Uddin, M.M.N.; Hossain, M.K.; Paul, A.; Emran, T.B. Antipyretic and hepatoprotective potential of *Tinospora crispa* and investigation of possible lead compounds through in silico approaches. *Food Sci. Nutr.* **2020**, *8*, 547–556. [CrossRef] [PubMed]
112. Prasanna, G.; Devi, R.; Ishwarya, G. In vitro evaluation of antidiabetic and cytotoxicity potentials of the rhizome extract of *Drynaria quercifolia* (L.) J. Smith. *Asian J. Pharm. Clin. Res.* **2019**, *12*, 72–76. [CrossRef]
113. Ananthi, J.; Prakasam, A.; Pugalendi, K.V. Antihyperglycemic activity of *Eclipta alba* leaf on alloxan-induced diabetic rats. *Yale J. Biol. Med.* **2003**, *76*, 97. [PubMed]
114. Mehta, S.; Singh, R.K.; Jaiswal, D.; Rai, P.K.; Watal, G. Anti-diabetic activity of *Embllica officinalis* in animal models. *Pharm. Biol.* **2009**, *47*, 1050–1055. [CrossRef]
115. Afroz, R.; Islam, N.; Biswas, K.R.; Ishika, T.; Rahman, M.; Swarna, A.; Khan, T.; Monalisa, M.N.; Seraj, S.; Rahman, M.A. Medicinal plants used by folk medicinal practitioners in three randomly surveyed villages of Rajbari district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2011**, *5*, 226–232.
116. Hasan, M.N.; Sabrin, F.; Rokeya, B.; Khan, M.S.H.; Ahmed, M.U.; Matondo, A.; Billah, M.M.; Akter, S. Glucose and lipid lowering effects of *Enhydra fluctuans* extract in cadmium treated normal and type-2 diabetic model rats. *BMC Complementary Altern. Med.* **2019**, *19*, 1–10. [CrossRef] [PubMed]
117. Amaliah, U.N.; Johannes, E.; Hasan, M.S.; Tambaru, E. The Use Extract of Siam Leaf *Eupatorium odoratum* L. as Alternative Material In Lowering Blood Glucose. *Int. J. Appl. Biol.* **2019**, *3*, 15–23. [CrossRef]
118. Uddin, M.Z.; Paul, A.; Rakib, A.; Sami, S.A.; Mahmud, S.; Rana, M.S.; Hossain, S.; Tareq, A.M.; Dutta, M.; Emran, T.B.; et al. Chemical Profiles and Pharmacological Properties with In Silico Studies on *Elatostema papillosum* Wedd. *Molecules* **2021**, *26*, 809. [CrossRef]
119. Sharma, S.; Chaturvedi, M.; Edwin, E.; Shukla, S.; Sagrawat, H. Evaluation of the phytochemicals and antidiabetic activity of *Ficus bengalensis*. *Int. J. Diabetes Dev. Ctries.* **2007**, *27*, 56.



120. Kabir, M.H.; Hasan, N.; Rahman, M.M.; Rahman, M.A.; Khan, J.A.; Hoque, N.T.; Bhuiyan, M.R.Q.; Mou, S.M.; Jahan, R.; Rahmatullah, M. A survey of medicinal plants used by the Deb barma clan of the Tripura tribe of Moulvibazar district, Bangladesh. *J. Ethnobiol. Ethnomed.* **2014**, *10*, 19. [[CrossRef](#)] [[PubMed](#)]
121. Ghosh, R.; Sharatchandra, K.H.; Rita, S.; Thokchom, I.S. Hypoglycemic activity of *Ficus hispida* (bark) in normal and diabetic albino rats. *Indian J. Pharm.* **2004**, *36*, 222.
122. Rahman, A.; Khanom, A. Taxonomic and ethno-medicinal study of species from Moraceae (Mulberry) Family in Bangladesh Flora. *Res. Plant Sci.* **2013**, *1*, 53–57.
123. Tayab, M.A.; Chowdhury, K.A.A.; Javed, M.; Mohammed Tareq, S.; Kamal, A.T.M.M.; Islam, M.N.; Uddin, A.M.K.; Hossain, M.A.; Emran, T.B.; Simal-Gandara, J. Antioxidant-Rich *Woodfordia fruticosa* Leaf Extract Alleviates Depressive-Like Behaviors and Impede Hyperglycemia. *Plants* **2021**, *10*, 287. [[CrossRef](#)] [[PubMed](#)]
124. Bhavsar, S.K. Evaluation of phytochemical profile and antidiabetic activity of *Ficus racemosa* (Linn.) stem bark in rats. *Indian Drugs* **2017**, *54*, 49.
125. Khatun, M.C.S.; Mia, M.R.; Ali, M.A.; Rahman, M.M.; Begum, K.; Begum, K. Antidiabetic and analgesic effects of *Glycosmis pentaphylla* (Retz.) in Swiss albino mice. *Ibrahim Med. Coll. J.* **2012**, *6*, 21–26. [[CrossRef](#)]
126. Aziz, M.A.I.; Barua, N.; Tareq, A.M.; Alam, N.; Prova, R.J.; Mamun, M.N.; Sayeed, M.A.; Chowdhury, M.A.U.; Emran, T.B. Possible neuropharmacological effects of *Adenia trilobata* (Roxb.) in the Swiss Albino mice model. *Future J. Pharm. Sci.* **2020**, *6*, 1–8. [[CrossRef](#)]
127. Mohammad, S.A.; Abdul Nabi, S.; Marella, S.; Thandaiah, K.T.; Venkateshwarulu, M.; Kumar, J.; Rao, C.A. Phytochemical screening and antihyperglycaemic activity of *Heliotropium indicum* whole plant in Streptozotocin induced diabetic rats. *J. Appl. Pharm. Sci.* **2014**, *4*, 65–71.
128. Gayathri, M.; Kannabiran, K. Hypoglycemic activity of *Hemidesmus indicus* R. Br. on streptozotocin-induced diabetic rats. *Int. J. Diabetes Dev. Ctries.* **2008**, *28*, 6. [[PubMed](#)]
129. Venkatesh, S.; Thilagavathi, J. Anti-diabetic activity of flowers of *Hibiscus rosasinensis*. *Fitoterapia* **2008**, *79*, 79–81. [[CrossRef](#)] [[PubMed](#)]
130. Rizwani, G.H.; Shareef, H.; Huma, A.; Hasan, S.M.F. Antihyperglycemic and hypolipidemic effects of *Hibiscus schizopetalus* (Mast) Hook in alloxan-induced diabetic rats. *Pak. J. Pharm. Sci.* **2014**, *27*, 83–89.
131. Hridi, S.U.; Ferdous, N.; Majumder, F.U.; Hannan, J.M.A. Phytochemical screening and anti-diabetic efficacy of stem of *Hiptage benghalensis* (L) Kurz. *J. Sci. Innov. Res.* **2013**, *2*, 736–744.
132. Gulfraz, M.; Ahmad, A.; Asad, M.J.; Afzal, U.; Imran, M.; Anwar, P.; Zeenat, A.; Abbasi, K.S.; Maqsood, S.; Qureshi, R.U. Antidiabetic activities of leaves and root extracts of *Justicia adhatoda* Linn against alloxan induced diabetes in rats. *Afr. J. Biotechnol.* **2011**, *10*, 6101–6106.
133. Rahman, A.; Alam, M.S.; Ahmad, S.; Naderuzzaman, A.T.M.; Islam, A. An ethnobotanical portrait of a village: Koikuri, Dinajpur with reference to medicinal plants. *Int. J. Biosci.* **2012**, *2*, 1–10.
134. Patil, S.B.; Dongare, V.R.; Kulkarni, C.R.; Joglekar, M.M.; Arvindekar, A.U. Antidiabetic activity of *Kalanchoe pinnata* in streptozotocin-induced diabetic rats by glucose independent insulin secretagogue action. *Pharm. Biol.* **2013**, *51*, 1411–1418. [[CrossRef](#)] [[PubMed](#)]
135. Menon, N.; Sparks, J.; Omoruyi, F. Hypoglycemic and hypocholesterolemic activities of the aqueous preparation of *Kalanchoe pinnata* leaves in streptozotocin-induced diabetic rats. *Asian Pac. J. Trop. Biomed.* **2015**, *5*, 3–9. [[CrossRef](#)]
136. Biswas, A.; Haq, W.M.; Akber, M.; Ferdousi, D.; Seraj, S.; Jahan, F.I.; Chowdhury, A.R.; Rahmatullah, M. A survey of medicinal plants used by folk medicinal practitioners of Paschim Shawra and Palordi villages of Gaurnadi Upazila in Barisal district, Bangladesh. *Am. Eur. J. Sustain. Agric.* **2011**, *5*, 15–22.
137. Klein, G.; Kim, J.; Himmeldirk, K.; Cao, Y.; Chen, X. Antidiabetes and Anti-Obesity Activity of *Lagerstroemia speciosa*. *Evid. Based Complementary Altern. Med.* **2007**, *4*, 547546. [[CrossRef](#)]
138. Judy, W.V.; Hari, S.P.; Stogsdill, W.W.; Judy, J.S.; Naguib, Y.M.A.; Passwater, R. Antidiabetic activity of a standardized extract (Glucosol™) from *Lagerstroemia speciosa* leaves in Type II diabetics: A dose-dependence study. *J. Ethnopharmacol.* **2003**, *87*, 115–117. [[CrossRef](#)]
139. Mannan, M.; Das, H.; Rahman, M.; Jesmin, J.; Siddika, A.; Rahman, M.; Rahman, S.; Chowdhury, M.; Rahmatullah, M.; Activity, A. Antihyperglycemic Activity Evaluation of *Leucas Aspera* (Willd.) Link Leaf and Stem and *Lannea Coromandelica* (Houtt.) Merr. Bark Extract in Mice. *Adv. Nat. Appl. Sci.* **2010**, *4*, 385–388.
140. Ankur, C.; Mukesh, O.; Ashish, M.; Shilpi, M.; Patil, U.K. Hypoglycemic and antihyperglycemic effect of ethanolic extract of whole plant of *Lawsonia inermis* (Henna) in streptozotocin induced diabetic rats. *Int J. Pharm. Sci. Res.* **2010**, *1* (Suppl. S8), 74–77.
141. 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](#)]
142. Aderibigbe, A.O.; Emudianughe, T.S.; Lawal, B.A.S. Evaluation of the antidiabetic action of *Mangifera indica* in mice. *Phytother. Res.* **2001**, *15*, 456–458. [[CrossRef](#)]
143. Nasrin, F.; Hakim, M.; Hassan, M.; Afroz, N.; Azam, S. Hypoglycemic study of ethanolic extract of *Mikania cordata* leaf. *World J. Pharm. Res.* **2020**, *4*, 1–9.
144. Jayatilake, P.L.; Munasinghe, H. In Vitro Determination of Antimicrobial and Hypoglycemic Activities of *Mikania cordata* (Asteraceae) Leaf Extracts. *Biochem. Res. Int.* **2020**, *2020*, 8674708. [[CrossRef](#)]

145. Joarder, M.H.; Islam, M.U.; Ahamed, K.; Yameen, M.B.; Sharmin, R. *Mikania Scandens* Leaves Possess Potent & Prolong Antidiabetic Effect in Alloxan Induced Diabetes Mice. *J. Biomed. Pharm. Sci.* **2019**, *2*, 117.
146. Tunna, T.S.; Ahmed, Q.U.; Uddin, A.B.M.H.; Sarker, M.Z.I. Weeds as Alternative Useful Medicinal Source: *Mimosa pudica* Linn. on Diabetes Mellitus and its Complications. *Adv. Mater. Res.* **2014**, *995*, 49–59. [[CrossRef](#)]
147. Sutar, N.; Sutar, U.; Behera, B. Antidiabetic activity of the leaves of *Mimosa pudica* Linn. in albino rats. *J. Herb. Med. Toxicol.* **2009**, *3*, 123–126.
148. Hossan, M.S.; Hanif, A.; Khan, M.; Bari, S.; Jahan, R.; Rahmatullah, M. Ethnobotanical survey of the Tripura tribe of Bangladesh. *Am. Eur. J. Sustain. Agric.* **2009**, *3*, 253–261.
149. Zakaria, D.M.; Islam, M.; Anisuzzaman, S.M.; Kundu, S.K.; Khan, M.S.; Begum, A.A. Ethnomedicinal survey of medicinal plants used by folk medical practitioners in four different villages of Gazipur district, Bangladesh. *Adv. Nat. Appl. Sci.* **2011**, *5*, 458–465.
150. Joseph, B.; Jini, D. Antidiabetic effects of *Momordica charantia* (bitter melon) and its medicinal potency. *Asian Pac. J. Trop. Dis.* **2013**, *3*, 93–102. [[CrossRef](#)]
151. Sampannang, A.; Arun, S.; Sukhorum, W.; Burawat, J.; Nualkaew, S.; Maneenin, M.C.; Sripanidkulchai, B.; Iamsaard, S. Antioxidant and Hypoglycemic Effects of *Momordica cochinchinensis* Spreng.(Gac) Aril Extract on Reproductive Damages in Streptozotocin (STZ)-Induced Hyperglycemia Mice. *Int. J. Morphol.* **2017**, *35*, 667–675. [[CrossRef](#)]
152. Al-Malki, A.L.; El Rabey, H.A. The Antidiabetic Effect of Low Doses of *Moringa oleifera* Lam. Seeds on Streptozotocin Induced Diabetes and Diabetic Nephropathy in Male Rats. *Biomed. Res. Int.* **2015**, *2015*, 381040. [[CrossRef](#)] [[PubMed](#)]
153. Gupta, R.; Mathur, M.; Bajaj, V.K.; Katariya, P.; Yadav, S.; Kamal, R.; Gupta, R.S. Evaluation of antidiabetic and antioxidant activity of *Moringa oleifera* in experimental diabetes. *J. Diabetes* **2012**, *4*, 164–171. [[CrossRef](#)] [[PubMed](#)]
154. Kesari, A.N.; Gupta, R.K.; Watal, G. Hypoglycemic effects of *Murraya koenigii* on normal and alloxan-diabetic rabbits. *J. Ethnopharmacol.* **2005**, *97*, 247–251. [[CrossRef](#)]
155. Majekodunmi, S.O.; Oyagbemi, A.A.; Umukoro, S.; Odeku, O.A. Evaluation of the anti-diabetic properties of *Mucuna pruriens* seed extract. *Asian Pac. J. Trop. Med.* **2011**, *4*, 632–636. [[CrossRef](#)]
156. Dikshit, P.; Shukla, K.; Tyagi, M.K.; Garg, P.; Gambhir, J.K.; Shukla, R. Antidiabetic and antihyperlipidemic effects of the stem of *Musa sapientum* Linn. in streptozotocin-induced diabetic rats. *J. Diabetes* **2012**, *4*, 378–385. [[CrossRef](#)]
157. Dhanabal, S.P.; Sureshkumar, M.; Ramanathan, M.; Suresh, B. Hypoglycemic Effect of Ethanolic Extract of *Musa sapientum* on Alloxan-Induced Diabetes Mellitus in Rats and Its Relation with Antioxidant Potential. *J. Herb. Pharmacother.* **2005**, *5*, 7–19. [[CrossRef](#)]
158. Dhanabal, S.P.; Mohan Maruga Raja, M.K.; Ramanathan, M.; Suresh, B. Hypoglycemic activity of *Nymphaea stellata* leaves ethanolic extract in alloxan induced diabetic rats. *Fitoterapia* **2007**, *78*, 288–291. [[CrossRef](#)] [[PubMed](#)]
159. Malapermal, V.; Botha, I.; Krishna, S.B.N.; Mbatha, J.N. Enhancing antidiabetic and antimicrobial performance of *Ocimum basilicum*, and *Ocimum sanctum* (L.) using silver nanoparticles. *Saudi J. Biol. Sci.* **2017**, *24*, 1294–1305. [[CrossRef](#)] [[PubMed](#)]
160. Kadan, S.; Saad, B.; Sasson, Y.; Zaid, H. In vitro evaluation of anti-diabetic activity and cytotoxicity of chemically analysed *Ocimum basilicum* extracts. *Food Chem.* **2016**, *196*, 1066–1074. [[CrossRef](#)]
161. Patil, R.; Patil, R.; Ahirwar, B.; Ahirwar, D. Isolation and characterization of anti-diabetic component (bioactivity—guided fractionation) from *Ocimum sanctum* L. (Lamiaceae) aerial part. *Asian Pac. J. Trop. Med.* **2011**, *4*, 278–282. [[CrossRef](#)]
162. Parasuraman, S.; Balamurugan, S.; Christopher, P.V.; Petchi, R.R.; Yeng, W.Y.; Sujithra, J.; Vijaya, C. Evaluation of Antidiabetic and Antihyperlipidemic Effects of Hydroalcoholic Extract of Leaves of *Ocimum tenuiflorum* (Lamiaceae) and Prediction of Biological Activity of its Phytoconstituents. *Pharmacogn. Res.* **2015**, *7*, 156–165. [[CrossRef](#)]
163. Chowdhury, T.; Uddin, S.B.; Quraishi, D.H.; Mouri, N.J. An ethnobotanical survey of plants of Sylhet in Bangladesh. *Int. J. Curr. Res.* **2011**, *12*, 31–35.
164. Mani, K.; Sankaran, M.; Kandan, K.; Ganesan, D. Antidiabetic and antihyperlipidemic properties of *Phyllanthus emblica* Linn. (Euphorbiaceae) on streptozotocin induced diabetic rats. *Pak. J. Nutr.* **2010**, *9*, 43–51.
165. Arambewela, L.S.R.; Arawawala, L.D.A.M.; Ratnasooriya, W.D. Antidiabetic activities of aqueous and ethanolic extracts of *Piper betle* leaves in rats. *J. Ethnopharmacol.* **2005**, *102*, 239–245. [[CrossRef](#)]
166. Ahmed, A.S.; Ahmed, Q.; Saxena, A.K.; Jamal, P. Evaluation of in vitro antidiabetic and antioxidant characterizations of *Elettaria cardamomum* (L.) Maton (Zingiberaceae), *Piper cubeba* L. f. (Piperaceae), and *Plumeria rubra* L. (Apocynaceae). *Pak. J. Pharm. Sci.* **2017**, *30*, 113–126. [[PubMed](#)]
167. Nabi, S.A.; Kasetti, R.B.; Sirasanagandla, S.; Tilak, T.K.; Kumar, M.V.J.; Rao, C.A. Antidiabetic and antihyperlipidemic activity of *Piper longum* root aqueous extract in STZ induced diabetic rats. *BMC Complementary Altern. Med.* **2013**, *13*, 37. [[CrossRef](#)]
168. Katkar, K.V.; Suthar, A.C.; Chauhan, V.S. The chemistry, pharmacologic, and therapeutic applications of *Polyalthia longifolia*. *Pharm. Rev.* **2010**, *4*, 62–68.
169. Oh, W.K.; Lee, C.H.; Lee, M.S.; Bae, E.Y.; Sohn, C.B.; Oh, H.; Kim, B.Y.; Ahn, J.S. Antidiabetic effects of extracts from *Psidium guajava*. *J. Ethnopharmacol.* **2005**, *96*, 411–415. [[CrossRef](#)]
170. Basha, S.K.; Kumari, V.S. In vitro antidiabetic activity of *Psidium guajava* leaves extracts. *Asian Pac. J. Trop. Dis.* **2012**, *2*, S98–S100. [[CrossRef](#)]
171. Bagri, P.; Ali, M.; Aeri, V.; Bhowmik, M.; Sultana, S. Antidiabetic effect of *Punica granatum* flowers: Effect on hyperlipidemia, pancreatic cells lipid peroxidation and antioxidant enzymes in experimental diabetes. *Food Chem. Toxicol.* **2009**, *47*, 50–54. [[CrossRef](#)]

172. Issa, T.O.; Mohamed Ahmed, A.I.; Mohamed, Y.S.; Yagi, S.; Makhawi, A.M.; Khider, T.O. Physiochemical, Insecticidal, and Antidiabetic Activities of *Senna occidentalis* Linn Root. *Biochem. Res. Int.* **2020**, *2020*, 8810744. [[CrossRef](#)]
173. Pamunuwa, G.; Karunaratne, D.N.; Waisundara, V.Y. Antidiabetic Properties, Bioactive Constituents, and Other Therapeutic Effects of *Scoparia*. *Evid. Based Complementary Altern. Med.* **2016**, *2016*, 8243215. [[CrossRef](#)]
174. Ahmad, M.; Prawez, S.; Sultana, M.; Raina, R.; Pankaj, N.K.; Verma, P.K.; Rahman, S. Anti-Hyperglycemic, Anti-Hyperlipidemic and Antioxidant Potential of Alcoholic-Extract of *Sida cordifolia* (Areal Part) in Streptozotocin-Induced-Diabetes in Wistar-Rats. *Proc. Natl. Acad. Sci. USA* **2014**, *84*, 397–405. [[CrossRef](#)]
175. Rahmatullah, M.; Khatun, Z.; Hasan, A.; Parvin, W.; Moniruzzaman, M.; Khatun, A.; Mahal, M.J.; Bhuiyan, S.A.; Mou, S.M.; Jahan, R. Survey and scientific evaluation of medicinal plants used by the Pahan and Teli tribal communities of Natore district, Bangladesh. *Afr. J. Tradit. Complementary Altern. Med.* **2012**, *9*, 366–373. [[CrossRef](#)]
176. Rajesh, V.; Perumal, P. In vivo assessment of antidiabetic and antioxidant activities of methanol extract of *Smilax zeylanica* leaves in wistar rats. *Orient. Pharm. Exp. Med.* **2014**, *14*, 127–144. [[CrossRef](#)]
177. Umamageswari, M.S.; Karthikeyan, T.M.; Maniyar, Y.A. Antidiabetic Activity of Aqueous Extract of *Solanum nigrum* Linn Berries in Alloxan Induced Diabetic Wistar Albino Rats. *J. Clin. Diagn. Res.* **2017**, *11*, FC16–FC19. [[CrossRef](#)] [[PubMed](#)]
178. Poongothai, K.; Ahmed, K.S.Z.; Ponmurugan, P.; Jayanthi, M. Assessment of antidiabetic and antihyperlipidemic potential of *Solanum nigrum* and *Musa paradisiaca* in alloxan induced diabetic rats. *J. Pharm. Res.* **2010**, *3*, 2203–2205.
179. Kwon, Y.I.; Apostolidis, E.; Shetty, K. In vitro studies of eggplant (*Solanum melongena*) phenolics as inhibitors of key enzymes relevant for type 2 diabetes and hypertension. *Bioresour. Technol.* **2008**, *99*, 2981–2988. [[CrossRef](#)] [[PubMed](#)]
180. Gandhi, G.R.; Ignacimuthu, S.; Paulraj, M.G. *Solanum torvum* Swartz. fruit containing phenolic compounds shows antidiabetic and antioxidant effects in streptozotocin induced diabetic rats. *Food Chem. Toxicol.* **2011**, *49*, 2725–2733. [[CrossRef](#)] [[PubMed](#)]
181. Islam, M.D.; Akter, S.F.; Islam, M.A.; Uddin, M.S. Exploration of Antidiabetic Activity of *Stephania japonica* Leaf Extract in Alloxan-Induced Swiss Albino Diabetic Mice. *J. Pharm. Res. Int.* **2019**, *26*, 1–12. [[CrossRef](#)]
182. Shivanna, N.; Naika, M.; Khanum, F.; Kaul, V.K. Antioxidant, anti-diabetic and renal protective properties of *Stevia rebaudiana*. *J. Diabetes Its Complicat.* **2013**, *27*, 103–113. [[CrossRef](#)] [[PubMed](#)]
183. Kujur, R.S.; Singh, V.; Ram, M.; Yadava, H.N.; Singh, K.K.; Kumari, S.; Roy, B.K. Antidiabetic activity and phytochemical screening of crude extract of *Stevia rebaudiana* in alloxan-induced diabetic rats. *Pharmacogn. Res.* **2010**, *2*, 258–263.
184. Dewanjee, S.; Maiti, A.; Das, A.K.; Mandal, S.C.; Dey, S.P. Swietenine: A potential oral hypoglycemic from *Swietenia macrophylla* seed. *Fitoterapia* **2009**, *80*, 249–251. [[CrossRef](#)]
185. Dutta, M.; Biswas, U.K.; Chakraborty, R.; Banerjee, P.; Maji, D.; Mondal, M.C.; Raychaudhuri, U. Antidiabetic and antioxidant effect of *Swietenia macrophylla* seeds in experimental type 2 diabetic rats. *Int. J. Diabetes Dev. Ctries* **2013**, *33*, 60–65. [[CrossRef](#)]
186. Panda, S.P.; Haldar, P.K.; Bera, S.; Adhikary, S.; Kandar, C.C. Antidiabetic and antioxidant activity of *Swietenia mahagoni* in streptozotocin-induced diabetic rats. *Pharm. Biol.* **2010**, *48*, 974–979. [[CrossRef](#)]
187. De, D.; Chatterjee, K.; Ali, K.M.; Bera, T.K.; Ghosh, D. Antidiabetic Potentiality of the Aqueous-Methanolic Extract of Seed of *Swietenia mahagoni* (L.) Jacq. in Streptozotocin-Induced Diabetic Male Albino Rat: A Correlative and Evidence-Based Approach with Antioxidative and Antihyperlipidemic Activities. *Evid. Based Complementary Altern. Med.* **2011**, *2011*, 892807. [[CrossRef](#)] [[PubMed](#)]
188. Sukardiman; Ervina, M. The recent use of *Swietenia mahagoni* (L.) Jacq. as antidiabetes type 2 phytomedicine: A systematic review. *Heliyon* **2020**, *6*, e03536. [[CrossRef](#)]
189. Palanisamy, U.; Manaharan, T. *Syzygium aqueum* leaf extracts for possible antidiabetic treatment. *Acta Hort.* **2015**, *1098*, 13–22. [[CrossRef](#)]
190. Rahman, A.; Anisuzzaman, M.; Haider, S.A.; Ahmed, F.; Islam, A.; Naderuzzaman, A.T.M. Study of medicinal plants in the Graveyards of Rajshahi city. *Res. J. Agri. Biol. Sci.* **2008**, *4*, 70–74.
191. Kumar, A.; Raju, I.; Jayachandran, T.; Deecaraman, M.; Aravindan, P.; Padmanabhan, N.; Krishan, M. Anti-diabetic activity of *Syzygium cumini* and its isolated compound against streptozotocin-induced diabetic rats. *J. Med. Plants Res.* **2008**, *2*, 246–249.
192. Nahar, L.; Nasrin, F.; Zahan, R.; Haque, A.; Haque, E.; Mosaddik, A. Comparative study of antidiabetic activity of *Cajanus cajan* and *Tamarindus indica* in alloxan-induced diabetic mice with a reference to in vitro antioxidant activity. *Pharmacogn. Res.* **2014**, *6*, 180–187.
193. Kumar, C.; Kumar, R.; Nehar, S. Phytochemical properties, total antioxidant status of acetone and methanol extract of *Terminalia arjuna* Roxb. bark and its hypoglycemic effect on Type-II diabetic albino rats. *J. Pharmacogn. Phytochem.* **2013**, *2*, 199–208.
194. Rahmatullah, M.; Biswas, K.R. Traditional medicinal practices of a Sardar healer of the Sardar (Dhangor) community of Bangladesh. *J. Altern. Complementary Med.* **2012**, *18*, 10–19. [[CrossRef](#)]
195. Gupta, A.; Kumar, R.; Pandey, A.K. Antioxidant and antidiabetic activities of *Terminalia bellirica* fruit in alloxan induced diabetic rats. *South. Afr. J. Bot.* **2020**, *130*, 308–315. [[CrossRef](#)]
196. Rao, N.K.; Nammi, S. Antidiabetic and renoprotective effects of the chloroform extract of *Terminalia chebula* Retz. seeds in streptozotocin-induced diabetic rats. *BMC Complementary Altern. Med.* **2006**, *6*, 17. [[CrossRef](#)]
197. Patel, M.B.; Mishra, S. Hypoglycemic activity of alkaloidal fraction of *Tinospora cordifolia*. *Phytomedicine* **2011**, *18*, 1045–1052. [[CrossRef](#)] [[PubMed](#)]
198. Noor, H.; Ashcroft, S.J.H. Antidiabetic effects of *Tinospora crispa* in rats. *J. Ethnopharmacol.* **1989**, *27*, 149–161. [[CrossRef](#)]



199. Lokman, F.E.; Gu, H.F.; Wan Mohamud, W.N.; Yusoff, M.M.; Chia, K.L.; Östenson, C.-G. Antidiabetic Effect of Oral Borapetol B Compound, Isolated from the Plant *Tinospora crispa* by Stimulating Insulin Release. *Evid. Based Complementary Altern. Med.* **2013**, *2013*, 727602. [[CrossRef](#)] [[PubMed](#)]
200. Yesmin, S.; Paul, A.; Naz, T.; Rahman, A.B.M.A.; Akhter, S.F.; Wahed, M.I.I.; Emran, T.B.; Siddiqui, S.A. Membrane stabilization as a mechanism of the anti-inflammatory activity of ethanolic root extract of Choi (*Piper chaba*). *Clin. Phytosci.* **2020**, *6*, 59. [[CrossRef](#)]
201. Lo, H.-Y.; Li, T.-C.; Yang, T.-Y.; Li, C.-C.; Chiang, J.-H.; Hsiang, C.-Y.; Ho, T.-Y. Hypoglycemic effects of *Trichosanthes kirilowii* and its protein constituent in diabetic mice: The involvement of insulin receptor pathway. *BMC Complementary Altern. Med.* **2017**, *17*, 53. [[CrossRef](#)] [[PubMed](#)]
202. Vats, V.; Grover, J.K.; Rathi, S.S. Evaluation of anti-hyperglycemic and hypoglycemic effect of *Trigonella foenum-graecum* Linn, *Ocimum sanctum* Linn and *Pterocarpus marsupium* Linn in normal and alloxanized diabetic rats. *J. Ethnopharmacol.* **2002**, *79*, 95–100. [[CrossRef](#)]
203. Dogra, N.K.; Kumar, S.; Kumar, D. *Vernonia anthelmintica* (L.) Willd.: An ethnomedicinal, phytochemical, pharmacological and toxicological review. *J. Ethnopharmacol.* **2020**, *256*, 112777. [[CrossRef](#)]
204. Fatima, S.S.; Rajasekhar, M.D.; Kumar, K.V.; Kumar, M.T.S.; Babu, K.R.; Rao, C.A. Antidiabetic and antihyperlipidemic activity of ethyl acetate: Isopropanol (1:1) fraction of *Vernonia anthelmintica* seeds in Streptozotocin induced diabetic rats. *Food Chem. Toxicol.* **2010**, *48*, 495–501. [[CrossRef](#)]
205. Nawaz, A.; Hossain, M.; Karim, M.; Khan, M.; Jahan, R.; Rahmatullah, M. An ethnobotanical survey of Rajshahi district in Rajshahi division, Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2009**, *3*, 143–150.
206. Chattopadhyay, R.R.; Sarkar, S.K.; Ganguly, S.; Banerjee, R.N.; Basu, T.K. Hypoglycemic and antihyperglycemic effect of leaves of *Vinca rosea* linn. *Indian J. Physiol. Pharm.* **1991**, *35*, 145–151.
207. Mukti, M.; Rahman, M.A.; Bashir, A.B.M.A.; Hossain, S.; Rahmatullah, M. Medicinal plants of the Khatriya and Kashya clans of the Bagdi people of Rajbari district in Bangladesh. *Am. Eurasian J. Sustain. Agric.* **2013**, *7*, 170–178.
208. Sundaram, R.; Naresh, R.; Shanthi, P.; Sachdanandam, P. Antihyperglycemic effect of iridoid glucoside, isolated from the leaves of *Vitex negundo* in streptozotocin-induced diabetic rats with special reference to glycoprotein components. *Phytomedicine* **2012**, *19*, 211–216. [[CrossRef](#)]
209. Manikandan, R.; Thiagarajan, R.; Beulaja, S.; Sivakumar, M.R.; Meiyalagan, V.; Sundaram, R.; Arumugam, M. 1, 2 di-substituted idopyranose from *Vitex negundo* l. Protects against streptozotocin-induced diabetes by inhibiting nuclear factor-kappa B and inducible nitric oxide synthase expression. *Microsc. Res. Tech.* **2011**, *74*, 301–307. [[CrossRef](#)]
210. Nadeem, M.; Mumtaz, M.W.; Danish, M.; Rashid, U.; Mukhtar, H.; Irfan, A. Antidiabetic functionality of *Vitex negundo* L. of Chemical Constituents from *Wedelia chinensis* (Osbeck.) Merr. Leaves. *J. Anal. Methods Chem.* **2018**, *2018*, 2794904.
211. Bari, M.W.; Islam, M.M.; Khatun, M.; Sultana, M.J.; Ahmed, R.; Islam, A.; Hossain, M.I.; Rahman, M.M.; Islam, M.A. Antidiabetic effect of *Wedelia chinensis* leaf extract in alloxan induced Swiss albino diabetic mice. *Clin. Phytoscience* **2020**, *6*, 58. [[CrossRef](#)]
212. Thao, N.P.; Binh, P.T.; Luyen, N.T.; Hung, T.M.; Dang, N.H.; Dat, N.T.  $\alpha$ -Amylase and  $\alpha$ -Glucosidase Inhibitory Activities leaves based on UHPLC-QTOF-MS/MS based bioactives profiling and molecular docking insights. *Ind. Crop. Prod.* **2020**, *152*, 112445.
213. Udayakumar, R.; Kasthurirengan, S.; Mariashibu, T.S.; Rajesh, M.; Anbazhagan, V.R.; Kim, S.C.; Ganapathi, A.; Choi, C.W. Hypoglycaemic and Hypolipidaemic Effects of *Withania somnifera* Root and Leaf Extracts on Alloxan-Induced Diabetic Rats. *Int. J. Mol. Sci.* **2009**, *10*, 2367–2382. [[CrossRef](#)] [[PubMed](#)]
214. Gorelick, J.; Rosenberg, R.; Smotrich, A.; Hanuš, L.; Bernstein, N. Hypoglycemic activity of withanolides and elicited *Withania somnifera*. *Phytochemistry* **2015**, *116*, 283–289. [[CrossRef](#)] [[PubMed](#)]
215. Rahman, A. Medico-Ethnobotany: A study on the tribal people of Rajshahi Division, Bangladesh. *Peak J. Med. Plant. Res.* **2013**, *1*, 1–8.
216. Rahman, A. An Ethno-botanical investigation on Asteraceae family at Rajshahi, Bangladesh. *Acad. J. Med. Plant.* **2013**, *1*, 92–100.
217. Haque, M.E.; Rahman, S.; Rahmatullah, M.; Jahan, R. Evaluation of antihyperglycemic and antinociceptive activity of *Xanthium indicum* stem extract in Swiss albino mice. *BMC Complementary Altern. Med.* **2013**, *13*, 296. [[CrossRef](#)] [[PubMed](#)]
218. Okokon, J.E.; Nyong, M.E. Antidiabetic and hypolipidemic activities of *Zea mays* husk extract and fractions. *J. Herbs Spices Med. Plants* **2018**, *24*, 134–150. [[CrossRef](#)]
219. Jarald, E.E.; Joshi, S.B.; Jain, D.C. Antidiabetic activity of extracts and fraction of *Zizyphus mauritiana*. *Pharm. Biol.* **2009**, *47*, 328–334. [[CrossRef](#)]
220. Bhatia, A.; Mishra, T. Hypoglycemic activity of *Zizyphus mauritiana* aqueous ethanol seed extract in alloxan-induced diabetic mice. *Pharm. Biol.* **2010**, *48*, 604–610. [[CrossRef](#)] [[PubMed](#)]
221. Upreti, Y.; Asselin, H.; Dhakal, A.; Julien, N. Traditional use of medicinal plants in the boreal forest of Canada: Review and perspectives. *J. Ethnobiol. Ethnomed.* **2012**, *8*, 7. [[CrossRef](#)] [[PubMed](#)]
222. Rahaman, M.M.; Rakib, A.; Mitra, S.; Tareq, A.T.; Emran, T.B.; Ud-Daulla, S.A.F.M.; Amin, M.N.; Simal-Gandara, J. The Genus *Curcuma* and Inflammation: Overview of the Pharmacological Perspectives. *Plants* **2021**, *10*, 63. [[CrossRef](#)]
223. Dutta, T.; Paul, A.; Majumder, M.; Sultan, R.A.; Emran, T.B. Pharmacological evidence for the use of *Cissus assamica* as a medicinal plant in the management of pain and pyrexia. *Biochem. Biophys. Rep.* **2020**, *21*, 100715. [[CrossRef](#)]
224. Das, A.R.; Mostofa, M.; Hoque, M.E.; Das, S.; Sarkar, A.K. Comparative efficacy of neem (*Azadirachta Indica*) and metformin hydrochloride (comet®) in streptozotocin induced diabetes melitus in rats. *Bangladesh J. Vet. Med.* **2010**, *8*, 75–80. [[CrossRef](#)]

225. Rahman, M.W.; Mostofa, M.; Sardar, S.A.; Sultana, M.R.; Haque, M.M.; Choudhury, M.E. Investigation of comparative hypoglycemic effect of Neem (*Azadirachta indica*), Karala (*Momordica charantea*) and Nayantara (*Cathranthus roseus*) with Glibenclamide on rat. *Int. J. Pharm.* **2005**, *1*, 257–260.
226. Rahman, M.M.; Sayeed, M.S.B.; Haque, M.A.; Hassan, M.M.; Islam, S.A. Phytochemical screening, antioxidant, anti-Alzheimer and anti-diabetic activities of *Centella asiatica*. *J. Nat. Prod. Plant. Resour.* **2012**, *2*, 504–511.
227. Jahan, I.A.; Nahar, N.; Mosihuzzaman, M.; Rokeya, B.; Ali, L.; Azad Khan, A.K.; Makhmur, T.; Iqbal Choudhary, M. Hypoglycaemic and antioxidant activities of *Ficus racemosa* Linn. fruits. *Nat. Prod. Res.* **2009**, *23*, 399–408. [[CrossRef](#)]
228. Urmi, K.F.; Haque, A.; Hamid, K.; Ullah, M.O.; Howlader, M.A.; Hossain, M.A. Hypoglycemic and hypolipidemic activity of aqueous extract of *Ficus racemosa* seeds. *Pharm. Commun.* **2012**, *2*, 38–41.
229. Zulfiker, A.H.M.; Saha, M.R.; Sarwar, S.; Nahar, L.; Hamid, K.; Rana, M.S. Hypoglycemic and in vitro antioxidant activity of ethanolic extracts of *Ficus racemosa* Linn. fruits. *Am. J. Sci. Ind. Res.* **2011**, *2*, 391–400. [[CrossRef](#)]
230. Barua, N.; Aziz, M.A.I.; Tareq, A.M.; Sayeed, M.A.; Alam, N.; ul Alam, N.; Uddin, M.A.; Lyzu, C.; Emran, T.B. In vivo and in vitro evaluation of pharmacological activities of *Adenia trilobata* (Roxb.). *Biochem. Biophys. Rep.* **2020**, *23*, 100772. [[CrossRef](#)] [[PubMed](#)]
231. Ahmed, S.; Rakib, A.; Islam, M.A.; Khanam, B.H.; Faiz, F.B.; Paul, A.; Chy, M.N.U.; Bhuiya, N.M.A.; Uddin, M.M.N.; Ullah, S.A. In vivo and in vitro pharmacological activities of *Tacca integrifolia* rhizome and investigation of possible lead compounds against breast cancer through in silico approaches. *Clin. Phytosci.* **2019**, *5*, 36. [[CrossRef](#)]
232. Al-Amin, M.M.; Uddin, M.M.N.; Rizwan, A.; Islam, M.S. Effect of ethanol extract of *Coccinia grandis* Lin leaf on glucose and cholesterol lowering activity. *J. Pharm. Res. Int.* **2013**, *3*, 1070–1078. [[CrossRef](#)]
233. Rafiq, K.; Sherajee, S.J.; Nishiyama, A.; Sufiun, M.A.; Mostofa, M. Effects of indigenous medicinal plants of Bangladesh on blood glucose level and neuropathic pain in streptozotocin-induced diabetic rats. *Afr. J. Pharm. Pharm.* **2009**, *3*, 636–642.
234. Hossain, M.A.; Mostofa, M.; Debnath, D.; Alam, A.; Yasmin, Z.; Moitry, N.F. Antihyperglycemic and antihyperlipidemic of Karala (*Momordica charantia*) fruits in streptozotocin induced diabetic rats. *J. Environ. Sci. Nat. Resour.* **2012**, *5*, 29–37. [[CrossRef](#)]
235. Ali, L.; Khan, A.K.A.; Mamun, M.I.R.; Mosihuzzaman, M.; Nahar, N.; Nur-e-Alam, M.; Rokeya, B. Studies on hypoglycemic effects of fruit pulp, seed, and whole plant of *Momordica charantia* on normal and diabetic model rats. *Planta Med.* **1993**, *59*, 408–412. [[CrossRef](#)] [[PubMed](#)]
236. Uddin, M.Z.; Rana, M.S.; Hossain, S.; Dutta, E.; Ferdous, S.; Dutta, M.; Emran, T.B. In vivo neuroprotective, antinociceptive, anti-inflammatory potential in Swiss albino mice and in vitro antioxidant and clot lysis activities of fractionated *Holigarna longifolia* Roxb. bark extract. *J. Complementary Integr. Med.* **2019**, *17*, 1–10. [[CrossRef](#)] [[PubMed](#)]
237. Sikder, M.A.A.; Kaisar, M.A.; Rahman, M.S.; Hussain, M.; Rashid, M.A. Active hypoglycemic fraction from *Syzygium cumini* L. seed and its safety profile. *Bangladesh Pharm. J.* **2011**, *14*, 87–91.
238. Bhuyan, Z.A.; Rokeya, B.; Masum, N.; Hossain, S.; Mahmud, I. Antidiabetic effect of *Syzygium cumini* L. seed on type 2 diabetic rats. *Dhaka. Univ. J. Pharm. Sci.* **2010**, *19*, 157–164. [[CrossRef](#)]
239. Shahreen, S.; Banik, J.; Hafiz, A.; Rahman, S.; Zaman, A.T.; Shoyeb, A.; Chowdhury, M.H.; Rahmatullah, M. Antihyperglycemic activities of leaves of three edible fruit plants (*Averrhoa carambola*, *Ficus hispida* and *Syzygium samarangense*) of Bangladesh. *Afr. J. Tradit. Complementary Altern. Med.* **2012**, *9*, 287–291. [[CrossRef](#)]
240. Hannan, J.M.A.; Rokeya, B.; Faruque, O.; Nahar, N.; Mosihuzzaman, M.; Azad Khan, A.K.; Ali, L. Effect of soluble dietary fibre fraction of *Trigonella foenum graecum* on glycemic, insulinemic, lipidemic and platelet aggregation status of Type 2 diabetic model rats. *J. Ethnopharmacol.* **2003**, *88*, 73–77. [[CrossRef](#)]
241. Mowl, A.; Alauddin, M.; Rahman, M.; Ahmed, K. Antihyperglycemic effect of *Trigonella foenum-graecum* (Fenugreek) seed extract in alloxan-induced diabetic rats and its use in diabetes mellitus: A brief qualitative phytochemical and acute toxicity test on the extract. *Afr. J. Tradit. Complementary Altern. Med.* **2009**, *6*, 255–261. [[CrossRef](#)]
242. Roy, M.G.; Rahman, S.; Rehana, F.; Munmun, M.; Sharmin, N.; Hasan, Z.; Al Mamun, A.; Khatun, A.; Rahmatullah, M. Evaluation of anti-hyperglycemic potential of methanolic extract of *Tamarindus indica* L.(Fabaceae) fruits and seeds in glucose-induced hyperglycemic mice. *Adv. Nat. Appl. Sci.* **2010**, *4*, 159–163.
243. Talukder, F.Z.; Khan, K.A.; Uddin, R.; Jahan, N.; Alam, M.A. In vitro free radical scavenging and anti-hyperglycemic activities of *Achyranthes aspera* extract in alloxan-induced diabetic mice. *Drug Discov. Ther.* **2012**, *6*, 298–305. [[CrossRef](#)] [[PubMed](#)]
244. Jahan, I.; Tona, M.R.; Sharmin, S.; Sayeed, M.A.; Tania, F.Z.; Paul, A.; Chy, M.; Uddin, N.; Rakib, A.; Emran, T.B. GC-MS phytochemical profiling, pharmacological properties, and in silico studies of *Chukrasia velutina* leaves: A novel source for bioactive agents. *Molecules* **2020**, *25*, 3536. [[CrossRef](#)]
245. Chowdhury, A.; Biswas, S.K. Comparative Study of hypoglycemic effect of ethanolic and hot water extracts of *Andrographis paniculata* in alloxan induced rat. *Int. J. Pharm. Sci. Res.* **2012**, *3*, 815.
246. Jyoti, M.A.; Barua, N.; Hossain, M.S.; Hoque, M.; Bristy, T.A.; Mahmud, S.; Adnan, M.; Chy, M.; Uddin, N.; Paul, A.; et al. Unravelling the biological activities of the *Byttneria pilosa* leaves using experimental and computational approaches. *Molecules* **2020**, *25*, 4737. [[CrossRef](#)] [[PubMed](#)]
247. Banu, N.; Alam, N.; Islam, M.N.; Islam, S.; Sakib, S.A.; Hanif, N.B.; Chowdhury, M.R.; Tareq, A.M.; Chowdhury, K.H.; Jahan, S.; et al. Insightful Valorization of the Biological Activities of Pani Heloch Leaves through Experimental and Computer-Aided Mechanisms. *Molecules* **2020**, *25*, 5153. [[CrossRef](#)]

248. Islam, M.A.; Akhtar, M.A.; Islam, M.R.; Hossain, M.S.; Alam, M.K.; Wahed, M.I.I.; Rahman, B.M.; Anisuzzaman, A.S.M.; Shaheen, S.M.; Ahmed, M. Antidiabetic and hypolipidemic effects of different fractions of *Catharanthus roseus* (Linn.) on normal and streptozotocin-induced diabetic rats. *J. Sci. Res.* **2009**, *1*, 334–344. [[CrossRef](#)]
249. Haque, E.; Saha, S.K.; Islam, D.; Islam, R. Comparative study between the effect of *Coccinia cordifolia* (leaf and root) powder on hypoglycemic and hypolipidemic activity of alloxan induced type 2 diabetic Long-Evans rats. *J. Diabetes Endocrinol.* **2012**, *3*, 37–43. [[CrossRef](#)]
250. Islam, M.A.; Khan, M.D.; Hossain, M.S.; Alam, A.K.; Wahed, M.I.I.; Rahman, B.M.; Anisuzzaman, A.S.M.; Shaheen, S.; Ahmed, M. Antidiabetic and hypolipidemic effects of different fractions of *Coccinia cordifolia* L. on normal and streptozotocin-induced diabetic rats. *Pak. J. Pharm. Sci.* **2011**, *24*, 331–338. [[PubMed](#)]
251. Shibib, B.A.; Khan, L.A.; Rahman, R. Hypoglycaemic activity of *Coccinia indica* and *Momordica charantia* in diabetic rats: Depression of the hepatic gluconeogenic enzymes glucose-6-phosphatase and fructose-1, 6-bisphosphatase and elevation of both liver and red-cell shunt enzyme glucose-6-phosphate dehydrogenase. *Biochem. J.* **1993**, *292*, 267–270.
252. Hossain, M.Z.; Shibib, B.A.; Rahman, R. Hypoglycemic effects of *Coccinia indica*: Inhibition of key gluconeogenic enzyme, glucose-6-phosphatase. *Indian J. Exp. Biol.* **1992**, *30*, 418. [[PubMed](#)]
253. Al Mahmud, Z.; Qais, N.; Bachar, S.C.; Hasan, C.M.; Emran, T.B.; Uddin, M.M.N. Phytochemical investigations and antioxidant potential of leaf of *Leea macrophylla* (Roxb.). *BMC Res. Notes* **2017**, *10*, 245. [[CrossRef](#)] [[PubMed](#)]
254. Mostofa, M.; Choudhury, M.E.; Hossain, M.A.; Islam, M.Z.; Islam, M.S.; Sumon, M.H. Antidiabetic effects of *Catharanthus roseus*, *Azadirachta indica*, *Allium sativum* and gimepride in experimentally diabetic induced rat. *Bangladesh J. Vet. Med.* **2007**, *5*, 99–102. [[CrossRef](#)]
255. Venkataiah, G.; Ahmed, I.M.; Reddy, D.S.; Rejeena, M. Anti-diabetic activity of *Acanthus ilicifolius* root extract in alloxan induced diabetic rats. *INDO Am. J. Pharm. Res.* **2013**, *3*, 9007–9012.
256. Ahmed, M.N.; Sultana, T.; Azam, M.N.K.; Rahmatullah, M. A preliminary antihyperglycemic and antinociceptive activity evaluation of a mangrove species *Acanthus ilicifolius* L. leaves in mice. *Asian J. Tradit. Med.* **2014**, *9*, 143–149.
257. Al Mahmud, Z.; Emran, T.B.; Qais, N.; Bachar, S.C.; Sarker, M.; Uddin, M.M.N. Evaluation of analgesic, anti-inflammatory, thrombolytic and hepatoprotective activities of roots of *Premna esculenta* (Roxb.). *J Basic Clin. Physiol. Pharmacol.* **2016**, *27*, 63–70. [[CrossRef](#)] [[PubMed](#)]
258. Akhtar, M.S.; Iqbal, J. Evaluation of the hypoglycaemic effect of *Achyranthes aspera* in normal and alloxan-diabetic rabbits. *J. Ethnopharmacol.* **1991**, *31*, 49–57. [[CrossRef](#)]
259. Emran, T.B.; Rahman, M.A.; Uddin, M.M.N.; Dash, R.; Hossen, M.F.; Mohiuddin, M.; Alam, M.R. Molecular docking and inhibition studies on the interactions of *Bacopa monnieri*'s potent phytochemicals against *Staphylococcus aureus*. *DARU J. Pharma. Sci.* **2015**, *23*, 26. [[CrossRef](#)]
260. Vijayaraj, R.; Kumar, K.N.; Mani, P.; Senthil, J.; Jayaseelan, T.; Kumar, G.D. Hypoglycemic and antioxidant activity of *Achyranthes aspera* seed extract and its effect on streptozotocin induced diabetic rats. *Int. J. Biol. Pharm. Res.* **2016**, *7*, 23–28.
261. Al-Snafi, A.E. The chemical constituents and pharmacological effects of *Adiantum capillus-veneris*—A review. *Asian J. Pharm. Sci. Technol.* **2015**, *5*, 106–111.
262. Neef, H.; Declercq, P.; Laekeman, G. Hypoglycaemic activity of selected European plants. *Phytother. Res.* **1995**, *9*, 45–48. [[CrossRef](#)]
263. Sallam, M.M. Phytochemical and Biological Study of *Adiantum Capillus-Veneris* l. Growing in Egypt. *Al-Azhar J. Pharm. Sci.* **2019**, *59*, 9–26. [[CrossRef](#)]
264. Ibraheim, Z.Z.; Ahmed, A.S.; Gouda, Y.G. Phytochemical and biological studies of *Adiantum capillus-veneris* L. *Saudi Pharm. J.* **2011**, *19*, 65–74. [[CrossRef](#)]
265. Kamalakkannan, N.; Prince, P.S.M. Hypoglycaemic effect of water extracts of *Aegle marmelos* fruits in streptozotocin diabetic rats. *J. Ethnopharmacol.* **2003**, *87*, 207–210. [[CrossRef](#)]
266. Kesari, A.N.; Gupta, R.K.; Singh, S.K.; Diwakar, S.; Watal, G. Hypoglycemic and antihyperglycemic activity of *Aegle marmelos* seed extract in normal and diabetic rats. *J. Ethnopharmacol.* **2006**, *107*, 374–379. [[CrossRef](#)]
267. Mulyaningsih, A.P.; Yetti, R.D.; Rivai, H. Phytochemical and Pharmacological Review of Maja (*Aegle Marmelos*). *World J. Pharm. Pharm. Sci.* **2020**, *9*, 19–42.
268. Rahman, M.M.; Hossain, M.A.; Siddique, S.A.; Biplab, K.P.; Uddin, M.H. Antihyperglycemic, antioxidant and cytotoxic activities of *Alocasia macrorrhizos* (Linn.) rhizomes extract. *Turk. J. Biol.* **2012**, *36*, 574–579.
269. Mallik, J.; Das, J.; Banik, R.K. Pharmacognostic Profile and Pharmacological Activity of different parts of *Amorphophallus campanulatus* (Roxb.) Blume—A Complete Overview. *Asian J. Pharm. Res. Dev.* **2018**, *6*, 4–8. [[CrossRef](#)]
270. Rahaman, M.M.; Hasan, M.M.; Badal, I.H.; Swarna, A.; Rahman, S.; Rahmatulla, M. A preliminary antihyperglycemic and antinociceptive activity evaluation of *Amorphophallus campanulatus* corms. *Int. J. Pharm. Pharm. Sci.* **2014**, *6*, 613–616.
271. Borhanuddin, M.; Shamsuzzoha, M.; Hussain, A.H. Hypoglycaemic effects of *Andrographis paniculata* Nees on non-diabetic rabbits. *Bangladesh Med. Res. Counc. Bull.* **1994**, *20*, 24–26.
272. Husen, R.; Pihie, A.H.L.; Nallappan, M. Screening for antihyperglycaemic activity in several local herbs of Malaysia. *J. Ethnopharmacol.* **2004**, *95*, 205–208. [[CrossRef](#)]
273. Zhang, X.; Tan, B.K.-H. Anti-diabetic property of ethanolic extract of *Andrographis paniculata* in streptozotocin-diabetic rats. *Acta Pharmacol. Sin.* **2000**, *21*, 1157–1164.



274. Zhang, X.F.; Tan, B.K.H. Antihyperglycaemic and anti-oxidant properties of *Andrographis paniculata* in normal and diabetic rats. *Clin. Exp. Pharmacol. Physiol.* **2000**, *27*, 358–363. [[CrossRef](#)]
275. Yu, B.-C.; Chen, W.-C.; Cheng, J.-T. Antihyperglycemic effect of andrographolide in streptozotocin-induced diabetic rats. *Planta Med.* **2003**, *69*, 1075–1079. [[PubMed](#)]
276. Akhtar, M.T.; Bin Mohd Sarib, M.S.; Ismail, I.S.; Abas, F.; Ismail, A.; Lajis, N.H.; Shaari, K. Anti-Diabetic Activity and Metabolic Changes Induced by *Andrographis paniculata* Plant Extract in Obese Diabetic Rats. *Molecules* **2016**, *21*, 1026. [[CrossRef](#)] [[PubMed](#)]
277. Hossain, M.A.; Roy, B.K.; Ahmed, K.; Chowdhury, A.M.S.; Rashid, M.A. Antidiabetic activity of *Andrographis paniculata*. *Dhaka Univ. J. Pharm. Sci.* **2007**, *6*, 15–20. [[CrossRef](#)]
278. Patel, D.K.; 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](#)]
279. Emran, T.B.; Rahman, M.A.; Uddin, M.M.N.; Rahman, M.M.; Uddin, M.Z.; Dash, R.; Layzu, C. Effects of organic extracts and their different fractions of five Bangladeshi plants on in vitro thrombolysis. *BMC Complementary Altern. Med.* **2015**, *15*, 128. [[CrossRef](#)]
280. Ohaeri, O.C. Effect of garlic oil on the levels of various enzymes in the serum and tissue of streptozotocin diabetic rats. *Biosci. Rep.* **2001**, *21*, 19–24. [[CrossRef](#)]
281. Faroughi, F.; Charandabi, S.M.-A.; Javadzadeh, Y.; Mirghafourvand, M. Effects of garlic pill on blood glucose level in borderline gestational diabetes mellitus: A triple blind, randomized clinical trial. *Iran. Red Crescent Med. J.* **2018**, *20*, e60675. [[CrossRef](#)]
282. Muñiz-Ramirez, A.; Perez, R.M.; Garcia, E.; Garcia, F.E. Antidiabetic Activity of *Aloe vera* Leaves. *Evid. Based Complementary Altern. Med.* **2020**, *2020*, 6371201. [[CrossRef](#)] [[PubMed](#)]
283. Rajasekaran, S.; Sivagnanam, K.; Ravi, K.; Subramanian, S. Hypoglycemic Effect of *Aloe vera* Gel on Streptozotocin-Induced Diabetes in Experimental Rats. *J. Med. Food* **2004**, *7*, 61–66. [[CrossRef](#)] [[PubMed](#)]
284. Okyar, A.; Can, A.; Akev, N.; Baktir, G.; Sütülpinar, N. Effect of *Aloe vera* leaves on blood glucose level in type I and type II diabetic rat models. *Phytother. Res.* **2001**, *15*, 157–161. [[CrossRef](#)] [[PubMed](#)]
285. Arulmozhi, S.; Mazumder, P.M.; Lohidasan, S.; Thakurdesai, P. Antidiabetic and antihyperlipidemic activity of leaves of *Alstonia scholaris* Linn. *R.Br. Eur. J. Integr. Med.* **2010**, *2*, 23–32. [[CrossRef](#)]
286. Ragasa, C.Y.; Lim, K.F.; Shen, C.-C.; Raga, D.D. Hypoglycemic Potential of Triterpenes from *Alstonia scholaris*. *Pharm. Chem. J.* **2013**, *47*, 54–57. [[CrossRef](#)]
287. Akhtar, M.S.; Bano, H. Hypoglycaemic Effect of Powdered *Alstonia Scholaris* (Satona). *Prof. Med. J.* **2002**, *9*, 268–271.
288. Sangameswaran, B.; Jayakar, B. Anti-diabetic, anti-hyperlipidemic and spermatogenic effects of *Amaranthus spinosus* Linn. on streptozotocin-induced diabetic rats. *J. Nat. Med.* **2008**, *62*, 79–82. [[CrossRef](#)]
289. Biswas, F.B.; Roy, T.G.; Rahman, M.A.; Emran, T.B. An in vitro antibacterial and antifungal effects of cadmium(II) complexes of hexamethyltetraazacyclotetradecadiene and isomers of its saturated analogue. *Asian Pacific J. Trop. Med.* **2014**, *7*, S534–S539. [[CrossRef](#)]
290. Girija, K.; Lakshman, K.; Udaya, C.; Sabhya Sachi, G.; Divya, T. Anti-diabetic and anti-cholesterolemic activity of methanol extracts of three species of *Amaranthus*. *Asian Pac. J. Trop. Biomed.* **2011**, *1*, 133–138. [[CrossRef](#)]
291. Rout, S.P.; Kar, D.M.; Mandal, P.K. Hypoglycaemic activity of aerial parts of *Argemone mexicana* L. in experimental rat models. *Int. J. Pharm. Pharm. Sci.* **2011**, *3*, 533–540.
292. Nayak, P.; Kar, D.M.; Maharana, L. Antidiabetic activity of aerial parts of *Argemone mexicana* Linn. in alloxan induced hyperglycaemic rats. *Pharm. Online* **2011**, *1*, 889–903.
293. Vadivelan, R.; Dipanjan, M.; Umasankar, P.; Dhanabal, S.P.; Satishkumar, M.N.; Antony, S.; Elango, K. Hypoglycemic, antioxidant and hypolipidemic activity of *Asparagus racemosus* on streptozotocin-induced diabetic in rats. *Adv. Appl. Sci. Res.* **2011**, *2*, 179–185.
294. Vadivelan, R.; Gopala Krishnan, R.; Kannan, R. Antidiabetic potential of *Asparagus racemosus* Willd leaf extracts through inhibition of  $\alpha$ -amylase and  $\alpha$ -glucosidase. *J. Tradit. Complementary Med.* **2019**, *9*, 1–4. [[CrossRef](#)] [[PubMed](#)]
295. Muthulingam, M. Antidiabetic efficacy of leaf extracts of *Asteracantha longifolia* (Linn.) Nees. on alloxan induced diabetics in male albino wistar rats. *Int. J. Pharm. Biomed. Res.* **2010**, *1*, 28–34.
296. Dholi, S.K.; Rapparla, R.; Mankala, S.K.; Nagappan, K. In vivo Antidiabetic evaluation of Neem leaf extract in alloxan induced rats. *J. Appl. Pharm. Sci.* **2011**, *1*, 100–105.
297. Srivastava, S.K.; Agrawal, B.; Kumar, A.; Pandey, A. Phytochemicals of *Azadirachta indica* source of active medicinal constituent used for cure of various diseases: A review. *J. Sci. Res.* **2020**, *64*, 385–390.
298. Kriintong, N.; Katisart, T. In vitro antioxidant and antidiabetic activities of leaf and flower extracts from *Bombax ceiba*. *Pharmacogn. Res.* **2020**, *12*, 194.
299. Rahman, M.A.; bin Imran, T.; Islam, S. Antioxidative, antimicrobial and cytotoxic effects of the phenolics of *Leea indica* leaf extract. *Saudi J. Biol. Sci.* **2013**, *20*, 213–225. [[CrossRef](#)]
300. Aransiola, E.F.; Daramola, M.O.; Iwalewa, E.O.; Seluwa, A.M.; Olufowobi, O.O. Anti-diabetic effect of *Bryophyllum pinnatum* leaves. *Int. J. Biotechnol. Bioeng.* **2014**, *8*, 89–93.
301. Ezeagu, C.U.; Elijah, J.P.; Nwodo, O.F.C. Antidiabetic potential of ethanol leaf extract of *Bryophyllum pinnatum* on alloxan-induced diabetic rats and their haematological profiles. *Afr. J. Pharm. Pharmacol.* **2017**, *11*, 526–533.
302. Hassanzad Azar, H.; Taami, B.; Aminzare, M.; Daneshamooz, S. *Bunium persicum* (Boiss.) B. Fedtsch: An overview on Phytochemistry, Therapeutic uses and its application in the food industry. *J. Appl. Pharm. Sci.* **2018**, *8*, 150–158.



303. Sadiq, S.; Nagi, A.H.; Shahzad, M.; Zia, A. The reno-protective effect of aqueous extract of *Carum carvi* (black zeera) seeds in streptozotocin induced diabetic nephropathy in rodents. *Saudi J. Kidney Dis. Transplant.* **2010**, *21*, 1058.
304. Rahman, M.A.; Sultana, R.; Emran, T.B.; Islam, M.S.; Rahman, M.A.; Chakma, J.S.; Rashid, H.U.; Hasan, C.M.M. Effects of organic extracts of six Bangladeshi plants on in vitro thrombolysis and cytotoxicity. *BMC Complementary Altern. Med.* **2013**, *13*, 1–7. [[CrossRef](#)] [[PubMed](#)]
305. Yadav, P.K.; Ss, S. Preliminary phytochemical screening, characterization, and antidiabetic activity of leaf extract of *Canna indica* L. In streptozotocin-induced diabetic model. *Asian J. Pharm. Clin. Res.* **2020**, *13*, 58–62. [[CrossRef](#)]
306. Fahad, F.I.; Barua, N.; Islam, M.S.; Sayem, S.A.J.; Barua, K.; Uddin, M.J.; Chy, M.N.U.; Adnan, M.; Islam, M.N.; Sayeed, M.A.; et al. Investigation of the Pharmacological Properties of *Lepidagathis hyaline* Nees through Experimental Approaches. *Life* **2021**, *11*, 180. [[CrossRef](#)] [[PubMed](#)]
307. Itankar, P.R.; Lokhande, S.J.; Verma, P.R.; Arora, S.K.; Sahu, R.A.; Patil, A.T. Antidiabetic potential of unripe *Carissa carandas* Linn. fruit extract. *J. Ethnopharmacol.* **2011**, *135*, 430–433. [[CrossRef](#)] [[PubMed](#)]
308. Rahman, S.K.M.; Islam, M.; Rahman, S.; Mosaiab, T.; Ahmed, R.; Khatun, F.; Nasrin, D.; Nahar, N.; Ahsan, S.; Rahmatullah, M. Antihyperglycemic studies with methanol extract of *Annona reticulata* L. (Annonaceae) and *Carissa carandas* L. (Apocynaceae) leaves in Swiss Albino mice. *Adv. Nat. Appl. Sci.* **2011**, *5*, 218–222.
309. Guha, B.; Arman, M.; Islam, M.N.; Tareq, S.M.; Rahman, M.M.; Sakib, S.A.; Mutsuddy, R.; Tareq, A.M.; Emran, T.B.; Alqahtani, A.M. Unveiling pharmacological studies provide new insights on *Mangifera longipes* and *Quercus gomeziana*. *Saudi J. Biol. Sci.* **2021**, *28*, 183–190. [[CrossRef](#)] [[PubMed](#)]
310. Veeramani, C.; Pushpavalli, G.; Pugalendi, K.V. Antihyperglycaemic effect of *Cardiospermum halicacabum* Linn. leaf extract on STZ-induced diabetic rats. *J. Appl. Biomed.* **2008**, *6*, 19–26. [[CrossRef](#)]
311. Shifah, F.; Tareq, A.M.; Sayeed, M.A.; Islam, M.N.; Emran, T.B.; Ullah, M.A.; Mukit, M.A.; Ullah, M. Antidiarrheal, cytotoxic and thrombolytic activities of methanolic extract of *Hedychium coccineum* leaves. *J. Adv. Biotechnol. Exp. Ther.* **2020**, *3*, 77–83. [[CrossRef](#)]
312. Omonkhua, A.A.; Onoagbe, I.O.; Ajileye, A.F.; Aladegboye, L.O.; Adetoboye, A.R. Long term anti-diabetic, anti-hyperlipidaemic and anti-atherogenic effects of *Carica papaya* leaves in streptozotocin diabetic rats. *Eur. J. Med. Plants* **2013**, *3*, 508.
313. Sasidharan, S.; Sumathi, V.; Jegathambigai, N.R.; Latha, L.Y. Antihyperglycaemic effects of ethanol extracts of *Carica papaya* and *Pandanus amaryfollius* leaf in streptozotocin-induced diabetic mice. *Nat. Prod. Res.* **2011**, *25*, 1982–1987. [[CrossRef](#)]
314. Airaodion, A.I.; Ogbuagu, E.O.; Ekenjoku, J.A.; Ogbuagu, U.; Okoroukwu, V.N. Antidiabetic effect of ethanolic extract of *Carica papaya* leaves in alloxan-induced diabetic rats. *Am. J. Biomed. Sci. Res.* **2019**, *5*, 227–234. [[CrossRef](#)]
315. Ali, M.A.; Sagar, H.A.; Khatun, M.C.S.; Azad, A.K.; Begum, K.; Wahed, M.I.I. Antihyperglycemic and analgesic activities of ethanolic extract of *Cassia fistula* (L.) stem bark. *Int. J. Pharm. Sci. Res.* **2012**, *3*, 416.
316. Hossain, M.S.; Islam, J.; Sarkar, R.; Hossen, S.M.M. Antidiarrheal, antidiabetic, antioxidant and antimicrobial activity of methanolic extracts of leaves of *Clerodendrum viscosum* (vent.). *Int. J. Pharm.* **2014**, *7*, 449–453.
317. Tona, M.R.; Tareq, A.M.; Sayeed, M.A.; Mahmud, M.H.; Jahan, I.; Sakib, S.A.; Shima, M.; Emran, T.B. Phytochemical screening and in vitro pharmacological activities of methanolic leaves extract of *Caryota mitis*. *J. Adv. Biotechnol. Exp. Ther.* **2020**, *3*, 109–115. [[CrossRef](#)]
318. Islam, Z.; Tahsin, M.R.; Faisal, A.U.; Tithi, T.I.; Nova, T.T.; Nila, T.S.; Gorapi, M.Z.H.; Nadvi, F.A.; Mridula, T.N.; Choudhury, A.A. In vivo Assessment of Antidiabetic Potential and Mapping of Pharmacological Properties of Ethanolic Extract of Leaves of *Coccinia grandis* on Alloxan-induced Diabetic Rats. *Asian J. Adv. Res. Rep.* **2019**, *7*, 1–9. [[CrossRef](#)]
319. Emran, T.B.; Dutta, M.; Uddin, M.M.N.; Nath, A.K.; Uddin, M.Z. Antidiabetic and anti-hyperglycemic potentiality of the leaves extract of *Centella asiatica* Linn. in alloxan-induced diabetic rats. *Jahangirnagar Univ. J. Biol. Sci.* **2016**, *4*, 51. [[CrossRef](#)]
320. Das, R.R.; Al-Araby, S.Q.; Rashid, M.M.; Rafi, M.K.J.; Rahman, M.A. The antioxidant effect of the *Cocus nucifera* L. mesocarp helps improve the Streptozotocin (STZ) induced fructose-feed type 2 diabetes mellitus. In Proceedings of the The BSBMB Conference, Chittagong, Bangladesh, 27–28 April 2019.
321. 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](#)]
322. Cisse, A.; Ndiaye, A.; Lopez-Sall, P.; Seck, F.; Faye, B.; Faye, B. Antidiabetic activity of *Zizyphus mauritiana* Lam (Rhamnaceae). *Dakar. Med.* **2000**, *45*, 105–107.
323. Jung, M.; Park, M.; Lee, H.C.; Kang, Y.H.; Kang, E.S.; Kim, S.K. Antidiabetic agents from medicinal plants. *Curr. Med. Chem.* **2006**, *13*, 1203–1218. [[CrossRef](#)] [[PubMed](#)]
324. Momin, M.A.M.; Bellah, S.M.F.; Rahman, S.M.; Rahman, A.A.; Murshid, G.M.M.; Emran, T.B. Phytopharmacological evaluation of ethanol extract of *Sida cordifolia* L. roots. *Asian Pacific J. Trop. Biomed.* **2014**, *4*, 18–24. [[CrossRef](#)]
325. Oubré, A.Y.; Carlson, T.J.; King, S.R.; Reaven, G.M. From plant to patient: An ethnomedical approach to the identification of new drugs for the treatment of NIDDM. *Diabetologia* **1997**, *40*, 614–617. [[CrossRef](#)] [[PubMed](#)]
326. Uddin, M.M.N.; Zahan, S.; Islam, M.A.; Ahmed, S.; Mowla, T.E.; Rahman, M.S.; Sultan, R.A.; Emran, T.B. Evaluation of the anti-diarrheal activity of methanol extract and its fractions of *Urena sinuata* L. (Borss) leaves. *J. Appl. Pharma. Sci.* **2016**, *6*, 56–60. [[CrossRef](#)]
327. Tanaka, M.; Misawa, E.; Ito, Y.; Habara, N.; Nomaguchi, K.; Yamada, M.; Toida, T.; Hayasawa, H.; Takase, M.; Inagaki, M.; et al. Identification of five phytosterols from *Aloe vera* gel as anti-diabetic compounds. *Biol. Pharm. Bull.* **2006**, *29*, 1418–1422. [[CrossRef](#)]

328. Sugihara, Y.; Nojima, H.; Matsuda, H.; Murakami, T.; Yoshikawa, M.; Kimura, I. Antihyperglycemic effects of gymnemic acid IV, a compound derived from *Gymnema sylvestre* leaves in streptozotocin-diabetic mice. *J. Asian Nat. Prod. Res.* **2000**, *2*, 321–327. [[CrossRef](#)] [[PubMed](#)]
329. Uddin, M.M.N.; Ahmed, S.; Kabir, M.S.H.; Rahman, M.S.; Sultan, R.A.; Emran, T.B. In vivo analgesic, anti-inflammatory potential in Swiss albino mice and in vitro thrombolytic activity of hydroalcoholic fruits extract from *Daemonorops robusta* Warb. *J. Appl. Pharma. Sci.* **2017**, *7*, 104–113. [[CrossRef](#)]
330. Augusti, K.T.; Sheela, C.G. Antiperoxide effect of S-allyl cysteine sulfoxide, an insulin secretagogue, in diabetic rats. *Experientia* **1996**, *52*, 115–120. [[CrossRef](#)]
331. Chakraborty, A.J.; Mitra, S.; Tallei, T.E.; Tareq, A.M.; Nainu, F.; Cicia, D.; Dhama, K.; Simal-Gandara, J.; Emran, T.B.; Capasso, R. Bromelain a Potential Bioactive Compound: A Comprehensive Overview from a Pharmacological Perspective. *Life* **2021**, *11*, 317. [[CrossRef](#)]
332. Broca, C.; Breil, V.; Cruciani-Guglielmacci, C.; Manteghetti, M.; Rouault, C.; Derouet, M.; Rizkalla, S.; Pau, B.; Petit, P.; Ribes, G.; et al. Insulinotropic agent ID-1101 (4-hydroxyisoleucine) activates insulin signaling in rat. *Am. J. Physiol. Endocrinol. Metab.* **2004**, *287*, E463–E471. [[CrossRef](#)] [[PubMed](#)]
333. Dash, R.; Ahsan, M.T.; Hosen, S.M.Z.; Rahman, M.G.; Emran, T.B.; Uddin, M.M.N. Evolution of selective COX-2 inhibitor from *Alangium salvifolium*: An in silico approach. *J. Appl. Pharma. Sci.* **2015**, *5*, 89–93. [[CrossRef](#)]
334. Swanston-Flatt, S.K.; Day, C.; Flatt, P.R.; Gould, B.J.; Bailey, C.J. Glycaemic effects of traditional European plant treatments for diabetes. Studies in normal and streptozotocin diabetic mice. *Diabetes Res.* **1989**, *10*, 69–73. [[PubMed](#)]
335. Srinivasan, K. Plant foods in the management of diabetes mellitus: Spices as beneficial antidiabetic food adjuncts. *Int. J. Food Sci. Nutr.* **2005**, *56*, 399–414. [[CrossRef](#)] [[PubMed](#)]