A Short Review of Some Medicinal Plants And Phytocompounds With Hypotensive And Hypoglycemic Activities

Eddouks M* and Zeggwagh NA

Faculty of Sciences and Techniques Errachidia, Moulay Ismail University, BP 21, Errachidia, Morocco.

Abstract

This paper aims to review some medicinal plants and compounds of botanical origin which are capable to lower plasma glucose levels and blood pressure. Hypoglycemic natural products comprise flavonoids, xanthones, triterpenoids, alkaloids, glycosides, alkyldisulfides, aminohydroxy acid derivatives, guanidine, polysaccharides and peptides. Hypotensive compounds include flavonoids, diterpenes, alkaloids, glycosides, polysaccharides and proteins.

Keywords: Blood pressure, hypoglycemic activity and medicinal plants.

*Corresponding Author:
Eddouks M,
Faculty of Sciences and Techniques Errachidia, Moulay Ismail University, BP 21, Errachidia, Morocco.
Tel: 00212535574497; Fax: 00212535574485
E-mail: mohamed.eddouks@laposte.net

Received: July 12, 2014
Accepted: July 26, 2014
Published: July 29, 2014


Copyright: Eddouks M© 2014. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Introduction

The serious health risks posed by hyperglycemia and hypertension need little elaboration. Diabetes mellitus, which manifests itself hyperglycemia and other symptoms, would lead, if untreated, to a myriad of complications including retinopathy, neuropathy, coronary heart disease, stroke, etc. Hypertension and hypercholesterolemia may also result in cerebrovascular accident and myocardial infarction if not well taken care of. Atherosclerosis is thickening and hardening of the vessel walls due to soft deposits of intra-arterial fat and fibrin that harden over time [1,2]. Hypertension appears if atherosclerosis increases systemic vascular resistance [3-7]. Atherosclerosis contributes to coronary artery and cerebrovascular disease.

Natural products furnish a good source for treatment of diabetes and hypertension around the world especially in developing countries. In fact, the fungal product mevinolin, a competitive inhibitor of P-hydroxy-p-methylglutaryl CoA reductase, is used to treat hypercholesterolemia, and a host of related drugs (statins) with antithrombotic and antithrombotic properties have been developed [8,12]. Biguanides such as metformin, which has been in use for the treatment of non-insulin-dependent diabetes mellitus, are derived from guanidine, another natural product. Many medicinal plants have demonstrated to exert antidiabetic and hypotensive activities in different animal models as well as in vitro and a lot of compounds responsible for this pharmacological activity have been isolated [13-16]. This non-exhaustive short review focuses on some medicinal plants and botanical compounds with hypoglycemic and hypotensive activities.

Plants And Phytocompounds with Hypoglycemic Activity

Acacia arabica

Wadood et al demonstrated that Acacia arabica seeds contained substance(s) which depressed the blood glucose level in normoglycemic but not in alloxan-diabetic rabbits, suggesting that the mechanism of action involved release of insulin from pancreatic beta-cells [17].

Artemisia herba alba

Aerial parts of Artemisia herba alba, which is used in Iraqi folk medicine as an anti-diabetic agent, exerted a significant hypoglycemic action on normoglycemic and alloxan-diabetic rats [5].

Cleome droserifolia

An extract of the plant suppressed the basal blood glucose level and also the postprandial hyperglycemia in rats rendered glucose-intolerant with tetracycline. Potentiation of peripheral and hepatic insulin sensitivity and reduction of intestinal glucose absorption were implicated in the mechanism of hypoglycemic action of the plant extract. Additionally, the extract might possess anti-atherogenic activity in view of its ability to elevate the ratio of high density lipoprotein-cholesterol to low density lipoprotein-cholesterol in the blood [18,19].

Eugenia jambolana

The pulp as well as the seed extract of E. jambolana fruits displayed hypoglycemic activity. Serum insulin level rose after oral administration of the extracts in normoglycemic and streptozotocin-induced diabetic rats. Insulin secretion from isolated islets of Langerhans from normal and diabetic rats was augmented after incubation with the extracts [20,21].
Ficus bengalensis

Similarly the bark extract of *E. bengalensis* possessed hypoglycemic activity. Insulin secretion was augmented in combination with *E. bengalensis* and *E. santholena* pulp and seed extracts. A flavonoid of leucodelphinin derivative isolated from *E. bengalensis* by Geetha et al. [22] showed hypoglycemic activity in normal and alloxan-induced diabetic rats, comparable with the activity of glibenclamide [22,23].

Glossostemon bruguieri

Mucilage from *G. bruguieri* roots exerted a pronounced hypoglycemic action on diabetic rats, bringing the glucose level down to half of the pre-treatment level within 15 days. It is noteworthy that the powdered root of the plant has been traditionally used in Eastern countries because of its nutritive and therapeutic value [9].

Lagerstroemia speciosa

Colosolic acid isolated from *Lagerstroemia speciosa* can activate glucose transport into Ehrlich ascites tumor cells along with hypoglycemic activity [10].

Lythrum salicaria

The hypoglycemic activity of extracts of this plant has been studied. Lamela et al. [11] subsequently reported that ethereal extracts of the stems and flowers induced hypoglycemia and enhanced insulin secretion in normoglycemic rats.

Momordica charantia

A polypeptide with 66 amino acid residues, designated as polypeptide-P, was isolated from the fruits and seeds of *M. charantia*, elicited hypoglycemia in gerbils, langurs and humans when administered subcutaneously [24,25]. Two polypeptides from the seeds, with a molecular weight of approximately 90,000 and amino acid compositions distinct from that of insulin, displayed insulin-like (i.e. antilipolytic and lipogenic) activities in isolated rat adipocytes. Saponin-free methanolic extract of pulp juice of this plant elicited hypoglycemia in normal rats and glucose-fed normal rats but was devoid of similar effects in streptozotocin-induced diabetic rats and glucose-fed normal rats either in the fasting or postprandial state. Similarly prepared extracts of seeds and the whole plant were ineffective [20]. The results suggest that non-sapogenin compounds in the *M. charantia* fruit pulp produced hypoglycemia by augmenting insulin secretion from beta cells or by potentiating the action of insulin.

Opuntia cactus

The plant extract of this plant can lower blood glucose level in pancreatectomized rabbits as well as normal rabbits, and was used traditionally in Mexico for treating diabetes [27].

Panax ginseng

Glycans isolated from this plant, like panaxans A to E had been demonstrated to elicit hypoglycemia in both normal and diabetic mice [28,29]. A fraction of panaxan called DPG-3-2 exerted its hypoglycemic action or provoked insulin secretion in diabetic and glucose-loaded normal mice. Adenosine, a carboxylic acid, and a peptide with a molecular weight of 1400 inhibited catecholamine-induced lipolysis in rat epididymal fat pads. EPG-3-2, a fraction of DPG-3-2, also exhibited antilipolytic activity [30].

Petiveria alleaceae

Extracts of leaves and stems of *Petiveria alleaceae* showed over 60% reduction in blood glucose concentration one hour after oral administration in male Balb/c mice which had been fasted for 48 hours [21,31,32].

Phaseolus vulgaris

Hypoglycemic activity of the vegetal complex of *P. vulgaris* in experimental diabetes was demonstrated by Khaleeva et al. [20].

Swertia chirayita

Swerchirin (1,8-dihydroxy-3,5dimethoxyxanthone), a xanthone from the hexane fraction of *S. chirayita*, produced hypoglycemic activity in fasted, fed, glucose-loaded and tolbutamide-pretreated rats [21]. Centipiperalone induced hypoglycemia in normal rats, elevation of plasma immunoreactive insulin level and B-cell degranulation. It was also active in streptozotocin-induced severely diabetic rats [22].

Swertia japonica

Five xanthones with two triterpenoids were isolated from the ethyl acetate-soluble fraction of *S. japonica* with hypoglycemic activity [23]. Thysanolactone was one of that triterpene, first isolated from *S. japonica*, while a xanthone bellidifolin manifested a potent hypoglycemic activity in streptozotocin-induced diabetic rats [23].

Tecoma stans

*T. stans* is an allegedly antidiabetic medicinal plant in Mexico. Intravenous administration of T. stans infusion in normal dogs evoked an early hyperglycemic response probably due to hepatic glycogenolysis, followed by a slow decline of blood glucose level [33,34].

Teucrium polium

An aqueous decoction of the aerial parts of *T. polium* produced a decline in blood glucose level 4 hours after intravenous administration and 24 hours after intraperitoneal injection, probably by increasing peripheral metabolism of glucose and not by augmenting insulin release [25].

Among the known hypoglycemic natural products some polysaccharides have been reported such as aconitan A from *Aconitum carmichaeli* root, anemaran A from *Anemarrhena asphodeloides* thizone, dioscoran C from *Discorea japonica* thizopher, lithospermum B from *Lithospermum elythrorhizon* root, panaxan from *Panax ginseng* root and saccharan C from *Saccharum nanum* stalk; while tuber of *Aegophyllum korejac* yielded glucosamin and seeds of *Cyampsis tetragonolobus* showed galactomannan [35,37].

Epicatechin, a flavonoid from *Pterocarpus marsupium* heartwood; alkaloids from leaves of *Catharanthus roseus, Coccinia indica* and *Tecomelinae, Lopinum terminis* seeds; glycosides from *Ficus bengalensis*
bark, *Ficus religiosa* root bark and *Gynemma sylvestre*, leaves and aerial part of *Momordica charantia* were the other hypoglycemic products. Alkyl disulfides from *Allium cepa* and *Allium sativum* bulbs, hypoglycins (aminopropylpropionic acid derivatives) from unripe fruits of *Bignonia acaulis*, aminobutyric acid derivative from *Emicella quadri-lineata* fruiting bodies and guanidine from *Galega officinalis* leaves were among the other anti-diabetic compounds cited [35-37].

Of the aforementioned compounds, guanidine is toxic at high doses. However, biguanides and the antidiabetic drug metformin are derived from guanidine [2]. Alkyl disulfides lack stability and hypoglycins are toxic, hence limiting their usefulness. Hypoglycemic polysaccharides may act within the intestinal tract to retard glucose absorption but they can also suppress blood glucose level when administered parenterally, suggesting a distinct sites of action [35-37].

**Plants And Phyto compounds with Hypotensive Activity**

**Andrographis panicdata**

The *n*-butanol extract of *Andrographis panicdata* evoked a dose dependent fall in mean arterial blood pressure without influencing the heart rate in Sprague-Dawley rats. The hypotensive action was not altered by propranolol, atropine and captopril, indicating that it was not mediated through the β-adrenoceptor, muscarinic cholinergic receptor and angiotensin-converting enzyme. The hypotensive action was mediated by α-adrenoceptors, autonomic ganglion and histaminergic receptors because of the attenuating effect of phenolamine, hexamethonium, pyrilamine and cimetidine [12].

**Cadinellina**

The hypotensive potency of the alkaloid 13-hydroxylupanine-2-pyrolcarbonic acid ester from the plant was higher in anesthetized dogs, monkeys and rats than that in conscious animals. In the isolated rabbit heart with intact accelerator nerves, perfusion with the alkaloid reduced norepinephrine release from nerve endings, diminished the positive inotropic effect and decreased the rise in heart rate by electrical stimulation of the accelerator nerve. The alkaloid inhibited transmission of sympathetic impulse and attenuated sympathetic circulatory reflexes. The antifibrillatory effect of the alkaloid was also demonstrated [16].

**Casimiroa edulis**

An aqueous extract of the seeds suppressed rat aortic ring contractions induced by norepinephrine, serotonin and prostaglandin. An intact vascular endothelium was not required and histamine antagonists had no effect [4].

**Chrysanthemum indicum**

It is a traditional drug used for hypotensive activity. Chrysanthemol, a sesquiterpene, has been isolated from the plant but its hypotensive principle remains to be elucidated [8,9,38].

**Coleus forskohlii**

The diterpene coleonol isolated from *Coleus forskohlii* lowers blood pressure in the anesthetized cat and the spontaneously hypertensive rat due to relaxation of vascular smooth muscle. The diterpene forskolin potentiated the effect of adenosine on coronary relaxation [11,12].

**Cynomorium coccineum**

Fresh juice and its water-soluble fraction blocked the entry of extracellular calcium through calcium channels and inhibited the release of intracellularly stored calcium in the vascular smooth muscle cell [14,15].

**Lindera megaphylla**

Dicentrine, an aporphine derivative and α-adrenoceptor antagonist, was isolated from *Lindera megaphylla*. Intravenous administration of dicentrine elicited a dose-related decrease in mean arterial pressure in anesthetized normotensive rats without affecting heart rate, cardiac output and stroke volume but markedly increasing tail blood flow [19].

**Moringa oleifera**

Niaziminin A, niaziminin B and 4-[(4′-0-acetyl-a-1-rhamnosyl-yl)benzyl] isothiocyanate have been isolated from the ethanolic extract of *M. oleifera* leaves which has been reported to exhibit hypotensive activity [17].

**Ocotea duckei**

A specific platelet-activating factor (PAF) receptor antagonist, yangambin, was isolated from this plant and the pretreatment of yangambin curtailed PAP-induced cardiovascular changes and thrombocytopenia [18,19].

**Phyleanthus amarus**

A preparation of the entire plant showed hypotensive effects on humans with mild hypertension [39].

**Conclusion**

In this non-exhaustive short review, we have reported some known hypoglycemic and antihypertensive medicinal plants. In addition some known active botanical active substances have been cited. This scoop shows the growing interest toward the use of medicinal plants in the treatment of diabetes and hypertension.

**Acknowledgments**

The authors extend their thanks to the Moroccan Government for supporting this work.

**References**


