GSC Advanced Research and Reviews

eISSN: 2582-4597 CODEN (USA): GARRC2

Cross Ref DOI: 10.30574/gscarr

Journal homepage: https://gsconlinepress.com/journals/gscarr/

(REVIEW ARTICLE)

Diabetes mellitus quality care management: The promise of herbal supplementation

Arar K [1, 2, *] and Ghouini A [1, 2]

[1] *Faculty of Medicine, University Blida Algéria.*

[2] *Hospital center Frantz Fanon, Blida, Algeria.*

GSC Advanced Research and Reviews, 2021, 09(01), 007–012

Publication history: Received on 13 August 2021; revised on 20 September 2021; accepted on 22 September 2021

Article DOI: https://doi.org/10.30574/gscarr.2021.9.1.0197

Abstract

Overcoming diabetes is a major health challenge of the 21st century. WHO predicts that by 2030 it will be the seventh leading cause of death in the world and calls for global action to stop its rise and improve care. Actually, Herbal and nutritional supplementation is required in the management of diabetic patients, a finding shared unanimously by scientists. Recently diabetologists have come to the evidence that a therapeutic supplement consisting of nutrients and herbal is necessary to optimize the treatment of diabetes. The treatment of Type 2 diabetes mellitus, which is very often associated with overweight, is based on hygiene and dietetic measures and, where appropriate, on taking oral antidiabetics .This review describes the therapeutic arsenal of conventional oral antidiabetic drugs and emphasizes on innovative therapeutic option introducing herbal medicine and nutrition to the management of diabetic patients. Recent studies showed interesting potential in the reduction of blood sugar for many herbal for example Cinnamon, also berberine has been linked to the reduction of blood glucose levels, insulin levels and showed to be as effective as metformin, the most commonly prescribed drug for diabetics, at controlling blood sugar levels in diabetics. Moreover, a medicinal plant or herbal mixture can provide multi-targeted therapeutic action due to its complex chemical composition with hundreds of active ingredients such as oligosaccharides, alkaloids, polyphenols, flavonoids, tannins and at the same time ensure safety for the patients. We conclude by the fact that herbal and nutritional supplementation can bring major and promising progress in order to improve the patient care, by slowing the progression of type 2 diabetes and limiting its complications.

Keywords: Diabetes; Insulin; Oral antidiabetics; Nutrition; Herbal medicine

1. Introduction

About 422 million people worldwide have diabetes and 1.6 million deaths are directly attributed to diabetes each year according to WHO 2021 [1]. Faced with these alarming statistics. It becomes important to improve the management of diabetic patients care.

One of the most promising approaches might be herbal diet supplementation combined to modern oral antidiabetics to improve care of diabetes mellitus patients.

Strong evidence supports the efficacy and cost-effectiveness of nutrition therapy as a component of quality diabetes care, including its integration into the medical management of diabetes [2]. In fact, nutrition, herbal medicine and lifestyle management are paramount to bring the diabetic condition into homeostasis [3].

This state of homeostasis and balance between insulin, glucagon, glycogen, cholesterol, release of enzymes and synthesis of hormones cannot be achieved by a single molecule. However a medicinal plant or herbal mixture can

* Corresponding author: Arar K
Faculty of Medicine, University Blida1, Algéria.

provide multi-targeted therapeutic action due to its complex chemical composition with hundreds of active ingredients such as oligosaccharides, alkaloids, polyphenolics, flavonoids, tannins and at the same time ensure safety for the patients.

Diabetes, which is a major public health problem whose prevalence has increased exponentially over the past 20 years, is a disorder in the assimilation, use and storage of sugars provided by food [4].

it is characterized by a state of chronic hyperglycemia exposing it to a risk of vascular complications. It is due to a relative or absolute deficit in the secretion and / or action of insulin [5].

Classically, there is type 1 diabetes, which most often occurs before the age of twenty and which represents 5 to 10% of diabetes, and type 2 diabetes mellitus (T2DM) often appearing after 40-50 years and which concerns about 90-95% of diabetes.

The treatment of T2DM, which is very often associated with overweight, is based on hygiene and dietetic measures and, where appropriate, on taking oral antidiabetics (ADO).

Treatment has diversified greatly over the past decade, with the commercialization of:

- first glitazones of the thiazolidinediones family (pharmacological ligands of the adipocyte transcription factor peroxisome proliferator-activated receptor gamma or PPARɣ, causing a decrease in the level of circulating fatty acids and the amount of abdominal fat).
- then gliptins (inhibitors of dipeptidyl peptidase-4 or DPP4 increasing Glucagon like peptide 1 called insulinotropic GLP1),
- and, finally, very recently, gliflozins (inhibitors of renal co-transport of sodium-glucose SGLT2, partially blocking the reabsorption of glucose and increasing its urinary excretion).

In addition, in addition to oral treatment, there are incretinomimetics (GLP1 analogues) administered subcutaneously which control postprandial blood sugar levels and promote weight loss.

However, the two oral antidiabetics developed more than 50 years ago, biguanides and sulphonylureas, remain the market leaders. Apart from metformin, which reduces hepatic glucose production and food intake, suitable for overweight or obese subjects, the choice of antidiabetic drugs is problematic [6].

Last generation antidiabetics cause significant side effects [7] including cases of intolerance, hypersensitivity, drug resistance and weight gain [8].

This is the case, for example, of thiazolidinediones, troglitazone, rosiglitazone and pioglitazone implicated in particular in the risk of hepatotoxicity and cardiac decompensation. These side effects led either to the non-marketing in Europe and the withdrawal (in March 2000) of the American market of troglitazone or, recently, to the limitation in Europe of the indications for rosiglitazone and pioglitazone [9].

On the other hand, secondary failure of oral antidiabetic therapy in patients with type 2 diabetes is common in the course of the disease, several years after the time of diagnosis [10].

Numerous studies, including the famous United Kingdom Prospective Diabetes Study [11], have shown that current anti-diabetic treatments are only imperfectly effective in controlling blood sugar levels in most T2DM patients, or only temporarily. The same UKPDS study showed that improving blood sugar control alone, at least with a sulfonylurea or insulin, is not enough to significantly improve the cardiovascular prognosis of these patients.

Given the limitations observed with anti-diabetics in modern medicine, the search for new anti-diabetic molecules based on plant extracts would be a promising alternative [12].

The recent boom in herbal medicine offers an opportunity to find natural molecules capable of exerting beneficial effects on the regulation of carbohydrate metabolism, by avoiding the side effects of synthetic substances [13].

A large number of plants are used in the practices of traditional medicine. Therefore, the search for natural active ingredients from medicinal plants that can treat the metabolic disorders of diabetes is of great interest for health.

Many herbs are traditionally considered to be anti-diabetic, some of which are the origin of the development of drugs such as metformin thanks to Galega officinalis. Indeed, the history of biguanides dates back to the use of Galega officinalis as a treatment for diabetes in the Middle Ages. Guanidine, the active component of the plant, was used to synthesize several anti-diabetic compounds in the 1920s, including metformin [14].

Also, experimental work was carried out to verify the anti-diabetic activity of some of these plants as well as the active compounds responsible for this activity [15-19].

The plant kingdom is clearly a deposit of molecules with genuine hypoglycaemic action, the isolation of which could lead to the development of new anti-diabetic agents [20].

Currently, ethnopharmacological investigations are focused on the experimental validation of the curative properties, traditionally attributed to these remedies.

More than 1200 plant species are already used as medicine in traditional diabetes therapy [21]. However, for most of them, scientific evidence has not yet been provided and this is the case, for example, of several plants, sold as anti-diabetic by herbalists.

In Canada, the use of plants with high therapeutic potential is increasingly considered as a complementary alternative to the conventional therapeutic arsenal (Cree community among the aboriginal population); to this end, antidiabetic activities, among plants with therapeutic potential, were screened using in vitro assays using different cell lines. Several parameters such as the capacity of glucose uptake in the muscle line and the secretion of insulin by pancreatic cells were evaluated. This bioassay served as a reference to guide the fractionation of the plant (Rhododendron groenlandicum, a medicinal plant of the James Bay Cree), in order to isolate and identify the active components responsible for its effect.

In addition, in vivo animal model studies of insulin resistance have been performed to determine the mechanisms of action and to validate the safety of the plant [22].

In Algeria, work carried out on *Zygophyllum geslini* tested its antidiabetic activity on Wistar rats rendered diabetic by streptozotocin [23] and in the world *Swietenia humilis* [24], *Aralia taibaiensis* [25], *Oncocalyx glabratus* [26] and *Ocimum gratissimum* [27].

All these studies were carried out on models of diabetes induced by alloxan or streptozotocin, the latter focused on chemical models of diabetes less representative of T2DM than the diabetes induced by a diet high in fat and in sugars.

Other studies have reported a toxic effect of certain medicinal plants in the pathology of diabetes: Zygophyllum album [28], Nigella sativa [29], Nerium oleander [30].

In fact, nutritional supplementation has long been studied as a possible treatment alternative or as an adjunct to the standard treatments for common ailments and diseases. According to the latest research, the Chileanmaqui berry, Aristotelia chilensis, has been shown to reduce postprandial insulin levels by as much as fiftypercent. The berry, which has been shown to be as effective as metformin at increasing insulin sensitivity and controlling blood glucose levels [31]. the study of natural resources with the aim of contributing to better population health appears more and more as a central task of modern pharmacological research.

Furthermore, the isolation and determination of the structure of a natural plant-based product responsible for anti-diabetic activity can only be achieved by evaluating the pharmacological activity.

According to G. Brusotti [32], so that the isolation and characterization of the natural product is carried out properly, the preparation of the plant material, the production of several extracts, the evaluation of their pharmacological activity, their purification and finally the characterization of the isolated natural product should be undertaken chronologically.

In addition, S. Sasididharan [33] adopted the same approach in his work based on the simultaneous combination of purification and pharmacological evaluation; obviously, the isolation of natural active ingredients can only be achieved by evaluating, simultaneously, the pharmacological activity and the purification of the extract.

Recent interessting study showed fructooligosaccharide (FOS) enhanced enzymatic activities of catalase and glutathione reductase in a dose-dependent manner, FOS can be positioned as a nutraceutical product, beneficial in diabetes-associated metabolic abnormalities [34].

Also, Berberine has been linked to the reduction of blood glucose levels and insulin levels. In fact, berber-ine has been shown to be as effective as metformin, the most commonly prescribed drug for diabetics, at controlling blood sugar levels in diabetics. Berberine causes a decrease in HbA1c which leads to a hypoglycemic effect. Even cinnamon has been implicated in the reduction of blood sugar. Cinnamon helps to make cells more insulin sensitive and can also help with more efficient utilization of sugar for energy [35].

To date, it is important to consider that nutritional supplements and herbal products are not standardized or regulated yet. Therefore, micronutrients, herbal supplements, and risk of medication associated eficiency diabetes or prediabetes have not been supported by evidence, and therefore routine use is not recommended. Research is needed to add evidence supporting the addition of herbal supplements to manage glycemia and get newer therapies that minimize the frequency and severity of diabetes.

2. Conclusion

Diabetes affects millions of patients around the world, with daunting complications, including, cardiovascular diseases, neuropathy and retinopathy. However, the progression of TD2M might be slowed down and its health impact limited. This study suggests optimizing the management of diabetic patients through herbal medicine and nutritional supplementation, which may offer major progress in terms of patients' glycemic control. In fact, in addition to the therapeutic arsenal of already existing oral anti-diabetics, herbal supplementation whose clinical effectiveness proved by several recent studies, are essential in the overall care, a finding shared unanimously by diabetologists. Nevertheless, supplementation with medicinal plants and dietary supplements needs to be supervised by health professionals, especially for the monitoring of such a sneaky pathology as diabetes. Therefore, it is important to define harmonized and standardized measures of supplementation with medicinal plants to promote the care of diabetic patients and determine the safety profile of herbal by considering toxicological evaluations.

Compliance with ethical standards

Acknowledgments

The authors are grateful to the faculty of medicine, University of Blida1, for providing facilities and resources.

Disclosure of conflict of interest

Authors declare that there is no conflict of interest.

References

[1] American Diabetes Association. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes. Diabetes Care. 2021; 44(Suppl. 1):S15–S33.

[2] Evert AB, Dennison M, Gardner CD, Garvey WT, Lau KHK, MacLeod J, et al. Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report. Diabetes Care. 2019; 42(5): 731-54.

[3] Fraysse A. The combination of nutrition and herbal medicine to bring balance to diabetic conditions. 1. J Diabetol, 2019; 3: 34.

[4] Grimaldi. A. Traité de Diabétologie. Flammarion Médecine Science. 2009.

[5] Giacco F, Brownlee M. Oxidative stress and diabetic complications. Circ Res. 2010; 107(9): 1058-1070.

[6] Scheen AJ, Charbonnel B. Effets antidiabétiques des thiazolidinediones. Médecine Thérapeutique. 2001; 7(9): 672-9.

[7] Nissen SE, Wolski K. Effect of Rosiglitazone on the Risk of Myocardial Infarction and Death from Cardiovascular Causes. N Engl J Med. 2007; 356(24): 2457-71.

[8] Jayakumar G, Ajithabai MD, Sreedevi S, Viswanathan PK, Remeshkumar B. Ethnobotanical survey of the plants used in the treatment of diabetes. 2010; 9(1): 100-104.

[9] Scheen A-J. Antidiabétiques oraux dans le traitement du diabète de type 2 : perspectives historique et médico-économique. Médecine Mal Métaboliques. 2015; 9(2): 186-97.

[10] Monnier L, Colette C. Échec des antidiabétiques oraux à doses maximales tolérées : Quels traitements injectables? Médecine Mal Métaboliques. 2016; 10(2): 121-30.

[11] Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). The Lancet. 1998; 352(9131): 837-53.

[12] Cotonou B. Étude ethnobotanique des plantes utilisées dans le traitement du diabète chez les femmes enceintes à Cotonou et Abomey-Calavi (Bénin). J Anim Plant Sci. 2013; 18(1): 2647-58.

[13] Eddouks M, Ouahidi ML, Farid O, Moufid A, Khalidi A, Lemhadri A. L'utilisation des plantes médicinales dans le traitement du diabète au Maroc. Phytothérapie. 2007; 5(4): 194-203.

[14] Bailey CJ, Turner RC. Metformin. N Engl J Med. 1996; 334(9): 574-9.

[15] Renjith RS, Chikku AM, Rajamohan T. Cytoprotective, antihyperglycemic and phytochemical properties of Cocos nucifera (L.) inflorescence. Asian Pac J Trop Med. 2013; 6(10): 804-10.

[16] Weng Y, Yu L, Cui J, Zhu Y-R, Guo C, Wei G, et al. Antihyperglycemic, hypolipidemic and antioxidant activities of total saponins extracted from Aralia taibaiensis in experimental type 2 diabetic rats. J Ethnopharmacol. 2014; 152(3): 553-60.

[17] Pereira FL, Oliveira VB, Viana CT, Campos PP, Silva MA, Brandão MG. Antihyperlipidemic and antihyperglycemic effects of the Brazilian salsaparrilhas Smilax brasiliensis Spreng.(Smilacaceae) and Herreria salsaparrilha Mart.(Agavaceae) in mice treated with a high-refined-carbohydrate containing diet. Food Res Int. 2015; 76: 366-72.

[18] Zhang L, Tu Z, Xie X, Lu Y, Wang Z, Wang H, et al. Antihyperglycemic, antioxidant activities of two Acer palmatum cultivars, and identification of phenolics profile by UPLC-QTOF-MS/MS: new natural sources of functional constituents. Ind Crops Prod. 2016; 89: 522-32.

[19] Guang-Kai XU, Xiao-Ying QIN, Guo-Kai W, Guo-Yong XIE, Xu-Sen LI, Chen-Yu SUN, et al. Antihyperglycemic, antihyperlipidemic and antioxidant effects of standard ethanol extract of Bombax ceiba leaves in high-fat-diet- and streptozotocin-induced Type 2 diabetic rats. Chin J Nat Med. 2017; 15(3): 168-77.

[20] Schlienger J-L. Diabète et phytothérapie: les faits. Médecine Mal Métaboliques. 2014; 8(1): 101-6.

[21] Campbell IW. Antidiabetic drugs present and future. Drugs. 2000; 60(5): 1017-28.

[22] Ouchfoun M. Validation des effets antidiabétiques de Rhododendron groenlandicum, une plante médicinale des Cri de la Baie James, dans le modèle *in vitro* et *in vivo*: élucidation des mécanismes d'action et identification des composés actifs. 2011.

[23] Boudjelthia K, Hammadi K, Kouidri M, Djebli N. Evaluation of antidiabetic activity of two plants Berberis vulgaris and Zygophyllum geslini. J Phys Chem Biophys. 2017;7(1):1–7

[24] Ovalle-Magallanes B, Medina-Campos ON, Pedraza-Chaverri J, Mata R. Hypoglycemic and antihyperglycemic effects of phytopreparations and limonoids from Swietenia humilis. Phytochemistry. 2015; 110: 111–9.

[25] Weng Y, Yu L, Cui J, Zhu Y-R, Guo C, Wei G, et al. Antihyperglycemic, hypolipidemic and antioxidant activities of total saponins extracted from Aralia taibaiensis in experimental type 2 diabetic rats. Journal of Ethnopharmacology. 2014;152(3):553–60.

[26] Ahmed S, Al-Rehaily AJ, Ahmad MS, Yousaf M, Nur-e-Alam M, Parvez MK, et al. Chemical constituents from Oncocalyx glabratus and their biological activities. Phytochem Lett. 2017; 20: 128-32.

[27] Okon UA, Umoren IU. Comparison of antioxidant activity of insulin, Ocimum gratissimum L., and Vernonia amygdalina L. in type 1 diabetic rat model. J Integr Med. 2017; 15(4): 302-9.

[28] El Ghoul J, Ghanem-Boughanmi N, Ben-Attia M. Biochemical study on the protective effect of ethanolic extract of Zygophyllum album on streptozotocin-induced oxidative stress and toxicity in mice. Biomed Prev Nutr. 2011; 1(2): 79-83.

[29] Zaoui A, Cherrah Y, Mahassini N, Alaoui K, Amarouch H, Hassar M. Acute and chronic toxicity of Nigella sativa fixed oil. Phytomedicine. 2002; 9(1): 69-74.

[30] Langford SD, Boor PJ. Oleander toxicity: an examination of human and animal toxic exposures. Toxicology. 1996; 109(1): 1-13.

[31] Miller J, Deutsch J, Kang S. Food studies. Introd Res Methods. 2009.

[32] Brusotti G, Cesari I, Dentamaro A, Caccialanza G, Massolini G. Isolation and characterization of bioactive compounds from plant resources: The role of analysis in the ethnopharmacological approach. J Pharm Biomed Anal. 2014; 87: 218-28.

[33] Sasidharan S, Chen Y, Saravanan D, Sundram KM, Latha LY. Extraction, isolation and characterization of bioactive compounds from plants' extracts. Afr J Tradit Complement Altern Med. 2011; 8(1).

[34] Bharti SK, Krishnan S, Kumar A, Rajak KK, Murari K, Bharti BK, et al. Antidiabetic activity and molecular docking of fructooligosaccharides produced by Aureobasidium pullulans in poloxamer-407-induced T2DM rats. Food Chem. 2013; 136(2): 813-21.

[35] Deters B, Saleem M. Hyperinsulinemia, cancer and maqui berry: The promise of nutritional supplementation. Food Sci Hum Wellness. 2019; 8(3): 264-7.