

Assessment of hypoglycemic and hypolipidemic activities of aqueous extract of *Trigonella foenum-graecum* in streptozotocin-induced diabetic rats

Zhiyong Zou

University of Saida, Algeria, E-mail: Abdelkrim.berroukche@univ-saida.dz

Abstract

Background & Aim: Diabetes mellitus is a common disease, treated either with insulin or oral anti-diabetics which have undesirable effects because of their chemical composition. As an alternative, diabetes could be treated by medicinal plants. This study aimed to assess the effects of *Trigonella foenum graecum* (TFG) seeds aqueous extract on biochemical parameters in streptozotocin-induced diabetic rats. **Materials & Methods:** A population of forty (40) rats was divided into 4 groups; normal control, experiment control (diabetic rats by STZ), diabetic treated with TFG at the dose 1 mL (100 mg/mL) and non-diabetic treated (TFG). During 30 days of experiments, body weight and biochemical parameters were measured and statistically analyzed using SigmaPlot software. **Results:** No significant difference in body weight was observed in diabetics animals (168 ± 8.5 g/L) and animals treated with TGF (167 ± 4.7 g/L). Significant decrease in blood glucose (1.16 ± 0.15 g/L), triglycerides (0.64 ± 0.21 g/L), serum urea (0.38 ± 0.19 g/L) and creatinine (8.02 mg/L) levels were reported in diabetics treated with TFG compared to diabetic animals non-treated. **Conclusion:** *Trigonella foenum-graecum* was able to regulate and maintain glycaemia and lipid profile at normal levels at diabetic animals.

Diabetes mellitus is a common disease, treated either with insulin or oral antidiabetics which have undesirable effects because of their chemical composition. As an alternative, diabetes should be treated by medicinal plants. This study aimed to assess the effects of fenugreek (Fng) seeds aqueous extract on biochemical parameters in streptozotocine-induced diabetic rats. A population of forty rats was divided into 4 groups; normal control, diabetic rats by STZ, diabetic treated with Fng at the dose 1 mL (0.5 g / kg) and non-diabetic treated (ND-Fng). During 30 days of experiments, body weight and biochemical parameters were measured and statistically analyzed using SigmaPlot software. No significant difference in body weight was observed in diabetics animals (DC) (168 ± 8.5 g/L) and diabetic treated with Fng (167 ± 4.6 g/L). Significant decrease in blood glucose (1.16 ± 0.1 g/L), triglycerides (0.64 ± 0.2 g/L), serum urea (0.38 ± 0.1 g/L) and creatinine (8.02 ± 2.8 mg / L) levels were reported in diabetics treated

with Fng compared to diabetic animals non-treated. Fenugreek, or *Trigonella foenum-graecum*, was able to regulate and maintain glycaemia and lipid profile at normal levels at diabetic animals.

Type 2 Diabetes is non-insulin dependent diabetes mellitus (NIDDM) characterized by a chronic hyperglycemia and deficiency in insulin production by β -cells or insulin cellular resistance [1]. According to International Diabetes Federation (IDF), the diabetic population has been about 415 million, in 2015, and could reaching 642 million diabetics, in 2040 [2]. According to the World Health Organization (WHO), Algerian diabetics was nearly 3 million diabetics and T2D prevalence approached 16 %, in 2003 [3]. T2D results from interaction of multiple factors such as sedentary lifestyle, energy-rich diet intake, obesity, hereditary factors and aging [4]. The diabetes complications are the result of the glucotoxicity, lipotoxicity and inflammation, which leads to insulin resistance and islet β -cell failure. Hyperglycemia promotes protein glycation, structural and functional alteration of proteins which circulating in blood large amounts (Figure 1). Complication of long-term diabetes induces nephropathy, retinopathy, neuropathy and cardiovascular [5]. Increased free fatty acids interacts with $\text{NF}\kappa\beta$ signaling pathway that generates reactive oxygen species (ROS) [6,7]. These free radicals activated C Jun N-terminal kinase (JNK) via $\text{NF}\kappa\beta$ pathway. JNK inhibited insulin receptor substrate-1 (IRS-1) and blocked glucose transporter type 4 (GLUT 4) [8]. The components of the immune system made changes in adipose tissue, pancreatic islets, vasculature and circulating leucocytes. This deregulation is associated with an increased cytokines, chemokins blood levels, apoptosis and tissue fibrosis [9]. All this molecular and cell mechanisms explain T2D pathogenesis [7]. Nothing really can match oral antidiabetic drugs, insulin treatment, appropriate diet and physical activity. It is the main approach in the T2D treatment.

In return, synthetic chemical drugs have toxicity disadvantages to human health. Oral antidiabetics have toxic side effects. As alternative, spices and herbs can be used like natural remedies with less toxicity. Medicinal and aromatic plants are the main source of phenolic acids and

flavonoids. These bioactive compounds have preventive effects against diabetes. In literature, recent studies suggested the important role of polyphenols influencing glucose metabolism through different process illustrated by the glucose absorption in the intestine, stimulation of insulin secretion from pancreatic b-cells, modulation of glucose release from the liver, activation of insulin receptors, glucose uptake in the insulin-sensitive tissues and modulation of hepatic glucose output [7]. Our research project was focused on *Trigonella foenum-graecum* (TFG), or fenugreek. This plant belonged to fabaceae family and mostly cultivated in Asian and Mediterranean areas. It is widely used in the folk medicine to prevent diabetes, fever and abdominal colic [7]. TFG has hypocholesterolemic and antidiabetic actions due to the defatted fraction or fiber [10]. The composition of fenugreek seed extract revealed main hypoglycemic and antioxidant compounds such as 4-Hydroxyisoleucine (modified amino-acid), trigonelline (alkaloid), galactomannans (viscous fiber) and diosgenin (saponin) (Figure 2). The magical molecule of 4-Hydroxyisoleucine has direct effects on the islets of Langerhans and increased releasing insulin to deal hyperglycemia with mainly avoiding the severe hypoglycemia resulting from the therapy of diabetes mellitus [11,12]. In addition, fenugreek elevates viscosity

in intestines and limits the hydrolysis of carbohydrates slowing the glucose intestinal absorption [11,13]. On another hand, some active ingredients found in fenugreek are involved in hypoglycemic process. Among these compounds, galactomannan (or gelling fiber) and diosgenin which recovering antioxidant enzymatic activities of SOD (superoxide dismutase), GPX (glutathione peroxidase) and catalase in hepatic tissue [10]. Fenugreek allows restoring the kidney function of diabetic rats through its antioxidant activity [14]. This present study aimed to assess the pharmacological properties of fenugreek seeds against the complications in streptozotocine-induced diabetic rats.

Biography

Abdekrim Berroukche is currently a Lecturer and Teacher-Researcher, Biology Department, Faculty of Science, University of Saida, Algeria. He has received his PhD in Cell Biology and Nutrition (with Oncology option) from University of Sidi-Bel-Abbes, Algeria. He is Member of Editorial Board of two scientific reviews and is a Peer Reviewer in several journals. He has 32 publications: 30 journal articles and 2 books. He is the Head of research team affiliated to Laboratory of Water Resources and Environment, Biology Department, Faculty of Science, University of Saida, Algeria.