Genomic Medicine, Biomarkers, and Health Sciences (2012) 4, 107–117

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.e-gmbhs.com

ORIGINAL ARTICLE

Antihyperglycemic and antioxidative effect of hydro - methanolic (2:3) extract of the seed of *Swietenia mahagoni* (L.) Jacq. in streptozotocin-induced diabetic male albino rat: An approach through pancreas

Tushar Kanti Bera [a,b], Kausik Chatterjee [a], Kishalay Jana [a], Kazi Monjur Ali [a], Debasis De [a], Soumyajit Maiti [a], Debidas Ghosh [a,*]

[a] *Department of Bio-Medical Laboratory Science and Management (UGC Innovative Funded Department), Vidyasagar University, West Bengal, India*
[b] *Pharmaceutical Division, Southern Health Improvement Samity (SHIS), Bhangar, South 24 Paraganas, West Bengal, India*

Received 7 August 2012; received in revised form 15 October 2012; accepted 27 November 2012
Available online 19 February 2013

KEYWORDS
Carbohydrate metabolic enzymes;
Insulin;
Pancreas;
Swietenia mahagoni

Abstract The goal of this study was to investigate the effects of the hydro - methanolic (2:3) extract of the seed of *Swietenia mahagoni* (L.) Jacq. for the management of streptozotocin (STZ)-induced diabetes. Wistar rats were divided equally into four groups (n = 6): normal control, diabetes control, diabetes + extract treated, and diabetes + metformin treated. The extract (25 mg/100 g by weight) and metformin (2.5 mg/100 g by weight) were administered once a day, orally by gavages for 21 days at fasting condition. Hexokinase, glucose-6-phosphate dehydrogenase, and glucose-6-phosphatase activities were measured in hepatic tissue. Activities of catalase (CAT), peroxidase (Px), and superoxide dismutase (SOD), along with the quantity of thiobarbituric acid reactive substances (TBARS) and conjugated diene (CD) in hepatic and renal tissues, were assessed. Histoarchitecture of the pancreas and serum insulin level were also evaluated. Significant diminution in the activities of hepatic hexokinase and glucose-6-phosphate dehydrogenase along with elevation in glucose-6-phosphatase were noted in STZ-induced animals with diabetes in respect to control animals. Level of fasting blood glucose (FBG) was elevated in animals with diabetes. Activities of CAT, Px, and SOD were diminished significantly along with the elevation in TBARS and CD levels in animals with

* Corresponding author. Department of Bio-Medical Laboratory Science and Management (UGC Innovative Funded Department), Vidyasagar University, West Bengal, India.
E-mail address: debidas_ghosh@yahoo.co.in (D. Ghosh).

http://dx.doi.org/10.1016/j.gmbhs.2012.11.001

diabetes. Diameter of pancreatic islets, count of islets, and degeneration in pancreatic acini were also noted in animals with diabetes. Treatment of these animals with extract or metformin resulted in substantial recovery in the aforementioned biosensors toward the control level. This recovery is not equal to metformin because the plant extract is not the pure form of effective ingredient(s) but provides insight to the pharmaceutical industries that the extract has a protective therapeutic effect against diabetes through ß-cell regeneration capacity.

Introduction

Diabetes is becoming the so-called killer disease, after cancer and cardiovascular diseases, because of its high prevalence, morbidity, and mortality.[1] Several reports indicate that the annual incidence of diabetes mellitus will increase worldwide in the future, especially in India. Currently, there are more than 150 million people in whom diabetes mellitus has been diagnosed and another 314 million with impaired glucose tolerance, a prediabetic state.[2] It has been predicted that approximately 57 million Indians will be affected by diabetes mellitus in 2025.[2] Diabetes mellitus is a syndrome, associated with hyperglycemia hyperlipidemia, oxidative stress, polyuria, polyphagia, polydypsia, ketosis, neuropathy, nephropathy, and cardiovascular disorders.[3,4] Diabetes is also associated with decline in sexual function in both male and female individuals.[5,6] Type 1 diabetes mellitus is a complex disease where by carbohydrate and fat metabolism are impaired.[3] Insulin-dependent diabetes mellitus is noted in both adulthood and childhood.[7] In modern medicine, no satisfactory, effective therapy is available to cure diabetes mellitus. Although insulin therapy is also used for the management of diabetes mellitus, there are several drawbacks such as insulin resistance, anorexia nervosa, brain atrophy, and fatty liver after chronic treatment.[8,9] Oxidative stress induced by chronic hyperglycemia has been associated with dysfunction and apoptosis of several cell types, including pancreatic ß cells, neurons, and glial cells.[10,11] Oxidative stress results from overproduction of reactive oxygen species coupled with insufficient antioxidant capacity. For the treatment of diabetic complications, several synthetic drugs are used that have many adverse effects such as nausea, vomiting, cholestatic jaundice, agranulocytosis, aplastic and hemolytic anemia, generalized hypersensitivity reactions, dermatologic reactions, and lactic acidosis.[12]

Many traditional treatments have been recommended in the complementary and alternative system of medicine for the treatment of diabetes mellitus. In India, herbal drugs are used based on Ayurveda, a common Hindu practice which is less expensive than traditional drugs. The herbal drugs considered of less toxic with fewer side effects compared with synthetic drugs.[13] For various reasons, currently there has been a surge in popularity of traditional and complementary medicine for the treatment of disease. More than 400 species have been reported to display antidiabetic effects, but only a few of them have thoroughly investigated.[14] We have already screened some antidiabetic plants and reported their efficacy in this regard.[15,16]

The plant *Swietenia mahagoni* (L.) Jacq. is a beautiful, lofty, evergreen large tree, native to tropical America, Mexico, and South America as well as India. Usually this plant is 30—40 m high and 3—4 m in girth. *S. mahagoni* is a large medicinally and economically important timber tree native to the West Indies. The aqueous extract of the seed of *S. mahagoni* is widely used in Indonesia as folk medicine to cure diabetes. The local people of West Bengal traditionally used the seed of *S. mahagoni* for curing diabetes. There is a single report about the antidiabetic effect of *S. mahagoni* in model animals. In this report blood glucose level was monitored without further extensive investigation.[17] The current study was undertaken to investigate the antihyperglycemic and antioxidative activity of hydro-methanol i.e. (2:3) extract of the seed of *S. mahagoni* in STZ-induced diabetic male rats.

Materials and methods

Plant materials

The seeds of *S. mahagoni* (L.) Jacq., under the family *Meliaceae*, were collected from Medinipur, District Paschim Medinipur, West Bengal, India, in the month of December. The materials were taxonomically identified by Prof. R. K. Bhakat, Department of Botany and Forestry, Vidyasagar University, Medinipur. The voucher specimen was deposited in the Department of Botany, Vidyasagar University (Ref. No. *S. mahagoni* (L.) Jacq./VU/01/09).

Preparation of hydro - methanolic (2:3) extract of the seed of S. mahagoni (L.) Jacq.

Fresh seeds were dried in an incubator for 2 days at 40°C, crushed separately in an electric grinder, and then pulverized. Out of this powder, 50 g was suspended in 100 mL water and 150 mL methanol (2:3) and kept in an incubator at 37°C for 36 hours. The slurry was stirred intermittently for 2 hours and left overnight. The mixture was then filtered and filtrate was dried by low pressure. From that amount 9 g of light-brown residue was collected. The residue was suspended in water in a fixed dose and used for treatment.

Chemicals and reagents

STZ was purchased from Sigma Aldrich, New York, USA. Other chemicals were purchased from Sigma-Aldrich