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ORIGINAL ARTICLE

Effect of *Gymnema sylvestre* R. Br. leaves extract on certain physiological parameters of diabetic rats

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Plasma insulin;
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Abstract *Gymnema sylvestre* R. Br. (*G. sylvestre*) belonging to the family Asclepiadaceae, has been used as a traditional medicine plant in Africa, Australia and Asia especially in India.

Aim of the study: The present study aimed to clarify the effect of *G. sylvestre* leaves extract on several physiological parameters of diabetic rats.

Materials and methods: *G. sylvestre* leaves extract (18 mg/kg body weight) was orally administered for 30 days to normal and streptozotocin (STZ) diabetic rats.

Results: STZ-diabetic rats exhibited a significant increase in plasma glucose, liver function enzymes [alanine aminotransaminase (ALT) and aspartate aminotransaminase (AST)], triglycerides, total cholesterol, LDL-cholesterol malondialdehyde, catalase, reduced glutathione and a significant decrease in insulin, HDL-cholesterol and erythrocyte superoxide dismutase levels. Treatment diabetic rats with *G. sylvestre* leaves extract significantly decreased plasma glucose, ALT, AST, triglycerides, total cholesterol, LDL-cholesterol, malondialdehyde and significantly increased insulin, HDL-cholesterol and erythrocyte superoxide dismutase levels compared to untreated diabetic rats.

Conclusion: It could be concluded that *G. sylvestre* leaves extract treated diabetic rats' complications including hyperglycemia, hypoinsulinemia, hyperlipidemia and oxidative stress.

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1. Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia resulting from defective insulin secretion, resistance to insulin action or both (Jarald et al., 2008; Vasi and Austin, 2009; Khan et al., 2012). DM is a widespread disease, associates with chronic micro- and macro-vascular complications (Goycheva et al., 2006; Ahmed et al., 2011; Aralelimath and Bhise, 2012). Total recovery from diabetes has not been reported up to now and this explains the intensive studies done on it.

Untreated diabetes leads to serious complications or even premature death. The treatment of diabetes mellitus is based on insulin and/or oral hypoglycemic drugs (Daisy et al., 2009). These drugs act by various mechanisms to control the blood glucose level, but many side-effects have been reported (Patel et al., 2012). Therefore, there is considerable interest in the field of medicinal plants due to their natural origin and less side effects (Jarald et al., 2008). One of these medicinal plants is *Gymnema sylvestre* (Gurmar), which means sugar killer (Najafi and Deokule, 2011). It is a wild plant that grows in the open forest in India, China, Indonesia, Japan, Malaysia, Sri Lanka, Vietnam, and South Africa (Gurav et al., 2007; Spasov et al., 2008). The leaves of the plant in particular are used as antiviral, diuretic, antiallergic, hypoglycemic, hypolipidemic, antibiotic, in stomach pains and in rheumatism (Saneja et al., 2010).

Most studies on *G. sylvestre* leaves extract focused on its role as hypoglycemic medicinal plant, but the present study demonstrates the effect of *G. sylvestre* leaves extract (18 mg/kg body weight) on several etiological factors of STZ-diabetic rats including hyperglycemia, hypoinsulinemia, hyperlipidemia and oxidative stress at the same time.

2. Materials and methods

2.1. Experimental animals

White male albino rats (*Rattus norvegicus*) weighing 200 ± 10 g were purchased from the Center of Laboratory animals, venoms & crude antisera production, Helwan, Cairo, Egypt. Animals were maintained under laboratory conditions [temperature (20 ± 2 C) and photoperiod (12 h light and 12 h dark cycle)]. Animals were allowed *ad libitum* to food and tap water. Rats were allowed to acclimatize for one week before the onset of the experiment.

2.2. Diabetogenic agent and Gymnema sylvestre leaves extract

- Streptozotocin (STZ) was purchased from Sigma Company (U.S.A) and given as a single intraperitoneal dose (45 mg/kg body weight) dissolved in citrate buffer (pH 4.5) according to El-Seifi et al. (1993).
- *Gymnema sylvestre* (*G. sylvestre*) leaves extract is used as drug called (Diaglu), that is produced by Arab Company for Pharmaceuticals and Medicinal Plants (MEPACO) Enshas El Raml, Sharkeiya, Egypt. Diaglu contains *G. sylvestre* leaves extract only. *G. sylvestre* leaves extract was given in a dose of (18 mg/kg body weight) dissolved in 1 ml distilled water according to Paget and Barnes (1964).

  Kirtikar and Basu (1998) classified *G. sylvestre as the following*:

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Gentianales
Family	Asclepiadaceae
Genus	*Gymnema*
Species	*sylvestre* R. Br.

- Common name: Gurmar, Gymnema, Gurmari, Gurmarbooti, periploca of the woods, and meshasring.
- Physicochemical properties: *G. sylvestre* leaves extract is soluble in water and other polar solvents as it contains monosaccharides. *G. sylvestre* leaves extract has an acidic nature due to the presence of carboxylic groups. *G. sylvestre* contains more than 20 triterpene saponins that form molecular complexes with proteins, lipids, sterols and tannins (Spasov et al., 2008).

2.3. Induction of diabetes mellitus

Diabetes mellitus was experimentally induced in rats previously fasted for 12 h by a single intraperitoneal dose (45 mg/kg body weight) of streptozotocin dissolved in citrate buffer (pH 4.5). In order to overcome the hypoglycemic coma that occurs within the first 24 h following STZ injection, animals were given 5% glucose solution instead of drinking water for 2 days until sustained hyperglycemia was established (Abdel-Moneim et al., 2002). Three days after streptozotocin injection, rats were screened for blood glucose levels. Blood samples were withdrawn from the lateral tail vein and glucose concentration was measured from overnight fasted animals (10–12 h). Rats having glucose ranging from 180 to 200 mg/dl were considered as mild diabetic and included in the experiment according to (Abdel-Moneim et al., 2002).

2.4. Experiment design

Rats under study were classified into five groups (6 rats each):

- **Group I: normal rat group**.

Rats of this group were given intragastrically 1 ml distilled water once a day for 30 days.

- **Group II: rat group injected with citrate buffer**.

Rats of this group were injected with a single intraperitoneal dose of 1 ml citrate buffer (pH 4.5).

- **Group III: rat group supplemented with *G. sylvestre* leaves extract**.

Rats of this group were supplemented with *G. sylvestre* leaves extract (18 mg/kg b.w.) dissolved in 1 ml distilled water once a day for 30 days.

- **Group IV: STZ-diabetic rat group**.

Rats of this group were injected intraperitoneally with a single dose (45 mg/kg b.w.) of STZ dissolved in citrate buffer (pH 4.5).

The diabetic rats were housed at the experimental condition for 30 days.

- **Group V: rat group treated with *G. sylvestre* leaves extract post STZ-diabetic induction**.

Rats of this group were treated intragastrically with *G. sylvestre* leaves extract (18 mg/kg b.w.) dissolved in 1 ml dis-