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Antidiabetic Effect Of Fresh Watermelon (*Citrullus lanatus*) Juice Extract In Streptozotocin Induced Diabetic Rats

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ABSTRACT
The present study investigated the antidiabetic potential of fresh watermelon (*Citrullus lanatus*) juice in streptozotocin (STZ)-induced diabetic rats. Twenty-four male Wistar rats (180–200 g) were divided into four groups: normal control, diabetic control, diabetic + watermelon juice (10 mL/kg BW/day), and diabetic + glibenclamide (5 mg/kg BW/day). Diabetes was induced via a single intraperitoneal injection of STZ (50 mg/kg BW). Treatments were administered orally for 28 days. Fasting blood glucose (FBG), oral glucose tolerance test (OGTT), serum insulin, lipid profile, oxidative stress biomarkers (superoxide dismutase [SOD], catalase [CAT], glutathione peroxidase [GPx], malondialdehyde [MDA]), and pancreatic histopathology were evaluated. Watermelon juice significantly reduced FBG ($p < 0.05$), improved glucose tolerance, increased serum insulin levels, restored antioxidant enzyme activity, reduced MDA levels, and improved lipid profiles compared to diabetic controls. Histopathology revealed preservation of pancreatic islets in juice-treated rats. These results suggest that fresh watermelon juice exerts antihyperglycemic and antioxidant effects in STZ-induced diabetic rats, likely through β-cell protection and oxidative stress mitigation.
Keywords: Antidiabetic, *Citrullus lanatus*, oxidative stress, streptozotocin, watermelon and Wister rat

INTRODUCTION
Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association, 2022). Persistent hyperglycemia is associated with oxidative stress, dyslipidemia, and microvascular and macrovascular complications (Forbes & Cooper, 2013). Despite advances in pharmacotherapy, current treatments may be costly, have side effects, or fail to prevent disease progression, prompting research into complementary plant base therapies. Watermelon (*Citrullus lanatus*) is a widely consumed fruit rich in L-citrulline, lycopene, β-carotene, vitamin C, phenolic acids, and flavonoids, which have been associated with antioxidant, anti-inflammatory, and vasoprotective properties (Perkins-Veazie et al., 2007). Preclinical evidence suggests that watermelon extracts may improve glycemic control and protect pancreatic β-cells in experimental diabetes (Oladunmoye et al., 2014; Ajiboye et al., 2016). However, limited studies have specifically evaluated fresh juice in STZ induced diabetic models.

This study aimed to assess the antidiabetic and antioxidant effects of fresh watermelon juice in STZ-induced diabetic rats with glibenclamide as a reference drug.

MATERIAL AND METHODS

Plant materials and juice preparation

Fresh, ripe watermelon fruits were purchased from a local market, washed, peeled, and deseeded. The red pulp was homogenized using a sterile blender and filtered through muslin cloth to obtain juice. The juice was stored at 4^0C and used within 24 hours.

Experimental animals

Twenty-four male Wistar rats (180–200 g) were housed under standard conditions (12-h light/dark cycle, 25 ± 2 °C) with free access to standard chow and water. The study was conducted in compliance with constitutional animal ethics guidelines.

Induction of diabetes

After overnight fasting, diabetes was induced in 18 rats by a single intraperitoneal injection of STZ (50 mg/kg BW) dissolved in 0.1 M cold citrate buffer (pH 4.5). Hyperglycemia was confirmed 72 h post-injection by FBG ≥ 250 mg/dL.

Experimental design

Rats were randomized into four groups (n=6/group):
Group I: Normal control (distilled water)
Group 2 Diabetic control (distilled water)
Group 3 Diabetic+ watermelon juice (10mL/kg BW/day)
Group 4 Diabetic+ glibenclamide (5mL/kg BW/day)
Treatments were given orally for 28 days.

Biochemical assays

FBG: Measured weekly using a glucometer from tail vein blood after 8 h fasting.
OGTT: Performed on day 28 after overnight fasting and oral glucose load (2 g/kg BW).
Serum insulin: Quantified by ELISA.
Lipid profile: Total cholesterol (TC), triglycerides (TG), HDL-C, LDL-C determined using enzymatic kits.
Oxidative stress markers: SOD, CAT, GPx activities and MDA levels measured in pancreatic tissue homogenates.
Histopathology: Pancreatic tissues fixed in 10% formalin, embedded in paraffin, sectioned, and stained with hematoxylin and eosin.

Statistical analysis

Data expressed as mean ± SD. One-way ANOVA followed by Tukey's post-hoc test; $p < 0.05$ considered significant.

RESULTS

Fasting blood glucose

STZ-induced diabetic rats showed a significant increase in FBG compared to normal controls.
Watermelon juice reduced FBG progressively from week 1 to week 4, comparable to glibenclamide by day 28.

Group	FBG Day 0 (mg/dL)	FBG Day 28 (mg/dL)
Normal control	92 ± 6	94 ± 7
Diabetic control	288 ± 15	302 ± 18
Diabetic + juice	285 ± 14	128 ± 10*
Diabetic + glibenclamide	287 ± 16	110 ± 9*

*Significant vs diabetic control, $p < 0.05$.

OGTT

Juice-treated rats displayed improved glucose tolerance, with a faster return toward baseline glucose levels within 120 min.

Serum insulin and lipid profile

Watermelon juice significantly increased serum insulin, decreased TC, TG, LDL-C, and increased HDL-C compared to diabetic controls.

Oxidative stress markers

Juice treatment increased SOD, CAT, GPx activities and decreased MDA, indicating improved antioxidant defense.

Histopathology

Pancreatic sections from diabetic controls showed shrunken islets with β-cell depletion. Juice-treated rats exhibited preserved islet architecture and reduced β-cell damage, similar to glibenclamide-treated rats.

DISCUSSION

The findings demonstrate that fresh watermelon juice exerts significant antihyperglycemic, antihyperlipidemic, and antioxidant effects in STZ-induced diabetic rats. The hypoglycemic activity may be mediated by:

1. Preservation of β-cell integrity, as evidenced by histological improvement.
2. Enhancement of endogenous insulin secretion, reflected in increased serum insulin.
3. Improved glucose utilization, possibly via up regulation of glucose transporters (GLUTZ 2, GLUT 4) and inhibition of hepatic glucose output
4. Antioxidant protection, attributed to bioactive compounds such as L-citrulline, lycopene, vitamin C and phenolic antioxidants.

These results align with earlier studies showing that watermelon extracts reduce hyperglycemia and oxidative stress in diabetic rodents (Ajiboye et al., 2016; Oladunmoye *et. al.*, 2014).

CONCLUSION

Fresh watermelon juice significantly ameliorates hyperglycemia, improves lipid metabolism, enhances antioxidant defense, and protects pancreatic β-cells in STZ-induced diabetic rats. These effects suggest its potential as a functional dietary adjunct in diabetes management. However, further studies, including controlled clinical trials, are necessary to confirm efficacy and safety in human.

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