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THERAPEUTIC IMPACT OF GARCINIA CAMBOGIA EXTRACT ON PANCREATIC HISTOPATHOLOGY IN ALLOXAN-INDUCED DIABETIC ALBINO RATS: A PRECLINICAL INVESTIGATION.

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ABSTRACT

BACKGROUND: According to the most recent data from the NCD Risk Factor Collaboration (2022), type 2 diabetes affects 828 million people worldwide, with almost 95% of those patients having the illness. Diabetes mellitus (DM) is a progressive metabolic disorder marked by chronic hyperglycemia due to insulin resistance and/or β-cell dysfunction. The burden of DM in South Asia, particularly Pakistan, is substantial. As pharmacological management remains partially effective in curbing long-term complications, alternative therapies such as plant-based treatments are being explored. According to most product labels, the Hydroxycitric acid HCA, the stated active component, is generally present in high amounts in G. cambogia fruit.This study evaluates the histopathological featues of Garcinia cambogia extract (GcE) on pancreatic β-cell mass structure in alloxan-induced diabetic rats. **METHODS:** This year-long preclinical study was conducted at the Department of Pharmacology and Therapeutics, BMSI, JPMC, Karachi. Sixty male albino Wistar rats were randomly divided into three experimental groups (n=20 each) and induced with diabetes using Alloxan monohydrate (120 mg/kg). GcE was administered at doses of 25, 50, and 75 mg/kg for eight weeks. At the end of the experiment, rats were sacrificed, and histopathological analysis of pancreatic tissues was conducted. Fasting serum insulin levels and β-cell mass were recorded. **RESULTS:** Group C (75 mg/kg GcE) demonstrated the highest mean body weight (305.96±36.16 g), significantly greater than Groups A (293.06±44.16g) and B (295±51.17 g) ($p < 0.001$). Histopathological findings showed a marked increase in β-cell mass in Group C (356±55 units), compared to Group A (282±35 units) and Group B (276±40 units). **CONCLUSION:** Extract of Garcinia cambogia significantly improves pancreatic β-cell mass and islet architecture in diabetic rats, supporting its potential role in complementary DM therapy. Further studies are warranted to elucidate the mechanisms and establish clinical efficacy.

KEYWORDS: Diabetes Mellitus, Garcinia cambogia, Pancreatic β-Cells, Islet Morphology, Alloxan-Induced Diabetes, Herbal Therapy

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INTRODUCTION

A long-term, complicated metabolic disorder known as diabetes mellitus (DM) is characterized by persistent hyperglycemia brought on by impaired insulin release, resistance, or both. [1]. The primary defect often involves β-cell dysfunction, with hyperglycemia leading to downstream disturbances in lipid and protein metabolism. As type 2 diabetes mellitus (T2DM) and obesity become increasingly common, a number of previously unknown problems linked to T2DM are coming to light.Southeast Asia, particularly Pakistan, ranks among the highest globally in diabetes prevalence. We concentrate on hyperinsulinemia and its effects: reduced capacity to lower glucose levels but maintained lipid synthesis and lipoprotein secretion due to acutely impaired but sustained insulin action. By 2045, the International Diabetes Federation (IDF) projects that 700 million people will have diabetes, with Pakistan reporting a prevalence of 26.3%. [2,3]. Despite advances in pharmacotherapy, current anti-diabetic regimens have not proven entirely effective in preventing long-term complications.[4]. This has led to an increasing interest in plant-based remedies due to their cost-effectiveness and favorable safety profiles. [5,6] Among these, Garcinia cambogia—a tropical plant whose rind contains hydroxycitric acid (HCA)—has shown promise in addressing obesity and associated metabolic disorders. Previous studies on HCA indicate its potential in reducing body weight, improving lipid profiles, and influencing glycemic control.[7-9].

This study investigates the histopathological effects of GcE on β-cell mass in alloxan-induced diabetic rats. The research aims to fill the knowledge gap regarding the role of GcE in β-cell regeneration and preservation.

MATERIALS AND METHODS

Study Design and Setting: Preclinical laboratory-based experimental study conducted over 12 months at the Department of Pharmacology and Therapeutics, BMSI, JPMC, Karachi.

Sample and Grouping: Sixty healthy male albino Wistar rats (200–300 g) were randomized into three experimental groups:

Group A: Diabetic + GcE (25 mg/kg)
Group B: Diabetic + GcE (50 mg/kg)
Group C: Diabetic + GcE (75 mg/kg)

Induction of Diabetes: After fasting overnight, rats received intraperitoneal alloxan monohydrate (120 mg/kg). Blood glucose >250 mg/dl after 72 hours was used as the threshold for successful diabetes induction.[10].

Treatment Protocol: All three groups received GcE daily for 8 weeks. Rats were housed under controlled environmental animals were kept in a 12-hour light/dark cycle and provided access to standard laboratory chow and water ad libitum.

Euthanasia and Sample Collection: After the 8-week intervention, rats were anesthetized using ketamine (10 mg/kg) and xylazine (0.5 mg/kg) [11], followed by cervical dislocation. Cardiac puncture was performed for blood collection. Serum was separated and stored at –80°C for insulin assays. Pancreatic tissue was harvested and fixed for histological evaluation.

Histopathological Evaluation: Tissue sections were stained with hematoxylin and eosin (H&E). Parameters assessed included β-cell mass.Quantitative comparisons were made across all three groups.

Body Weight Changes: Group C rats had significantly higher body weights after the 8-week GcE treatment (305.95±36.16 g), compared to Group A (293.05±44.16 g) and Group B (295±51.17 g), with statistical significance ($p < 0.001$).

RESULTS

Table 1

Variables	Average weights in grams± SD	F-Value	Level of Significance
A Group	293.05±44.16		
B Group	295±51.17		
C Group	305.95±36.16	28.58	0.001

β-Cell Mass: Group C showed the highest β-cell mass (355±56 units), significantly greater than Group A (280±36) and Group B (275±41) ($p < 0.005$).

Table 2:
Beta Pancreatic -Cell Mass

Variables	Mean units ± SD	F-Value	df	level of significance
A Group	280±36			
B Group	275±41	3.76	12	P<0.05
C Group	355±56			

DISCUSSION

This preclinical study provides compelling evidence that Garcinia cambogia extract can mitigate alloxan-induced pancreatic damage. The significant increase in β-cell mass and preservation of islet architecture in Group C suggest a dose-dependent effect. These results align with prior studies on Streptozotocin-induced diabetes models, where GcE administration led to improved glycemic control, lipid profiles, and insulin sensitivity.[12]. The bioactive compound hydroxycitric acid (HCA) is hypothesized to play a central role by modulating glucose metabolism and enhancing insulin sensitivity.[13]. Additional benefits such as body weight gain in treated groups may reflect metabolic improvements or better nutrient utilization.[14]. Previous research has also indicated HCA's role in reducing atherogenic risk and oxidative stress, supporting its utility in holistic diabetes management.[15]. However, extrapolation of findings to human populations requires cautious interpretation. Long-term safety, optimal dosage, and molecular mechanisms warrant further exploration through clinical trials and mechanistic studies.

CONCLUSION

Extract of Garcinia cambogia significantly enhances the mass of pancreatic β-cells in diabetic rats, emphasizing its potential as an adjunctive therapy for diabetes mellitus. This study supports the further exploration of GcE in clinical settings to develop cost-effective and natural alternatives for diabetes management.

ETHICS APPROVAL: The Erc Gave Ethical Review Approval.
CONSENT TO PARTICIPATE: Written And Verbal Consent Was Taken From Subjects And Next Of Kin.
FUNDING: The Work Was Not Financially Supported By Any Organization. The Entire Expense Was Taken By The Authors.
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CONFLICT OF INTEREST: No Competing Interest Declared.

REFERENCES

1. Akash H, Rehman K, Jabeen K, Fiayyaz F, Sabir S. Assessment of knowledge, attitude and practice of Pakistani population about the risk factors, causes, complications and management of diabetes mellitus. J Pak Med Assoc. 2021 Jan;71(1 Suppl):286–96.
2. Bhatti MW. Pakistan ranks 3rd in prevalence of diabetes in world after China and India. The News International. 2021 Oct 10.
3. Nadeem S, Siddiqi U, Martins RS, Badini K. Perceptions and understanding of diabetes mellitus technology in adults with type 1 or type 2 DM: A pilot survey from Pakistan. J Diabetes Sci Technol. 2021 Sep;15(5):1052–8.
4. Hargunani P, Sharma S, Pai A, Patil MN, Kagathara VG, Harle UN, et al. Effect of polyherbal formulation in obesity associated diabetes. Int J Pharm Pharm Sci. 2010;2(3):180–6.
5. El-Shaer M, Diab L, El-Sharkawy S. Effect of intake of Garcinia cambogia peels on induced-obesity rats. J Home Econ Menoufia Univ. 2022 Apr 1;32(2):131–43.
6. Hanse M, Akbar S, Layeghkhavidaki H, Yen FT. Garcinia cambogia extract increased hepatic levels of lipolysis-stimulated lipoprotein receptor and lipids in mice on normal diet. Int J Mol Sci. 2023 Nov 14;24(22):16298.
7. Elpasty S, Helal E, Mansoury M, Algendy A. Impact of green coffee extract on body weight and physiological indicators of metabolic state in obese male rats. Egypt J Chem. 2022 Aug 1;65(8):715–23.
8. Mirani P, Afshan G, Mehboob F, Muzammil M, Ameer MK, Mirani K. Effect of Garcinia cambogia as weight reducing agents on the morphology of liver of albino mice in Pakistan. J Sheikh Zayed Med Coll. 2020 Jul 22;11(2):18–23.
9. Dong J, Li W, Du X, He X, Deng B, Zheng H, et al. Garcinia cambogia water extract alleviates insulin resistance and hepatic lipid accumulation in mice fed a high-fat diet. Food Nutr Res. 2023;67:1–11.
10. Agwaya MS, Nandutu AM. Hypoglycemic activity of aqueous root bark extract of Zanthoxylum chalybeum in alloxan-induced diabetic rats. J Diabetes Res. 2016 Mar 16;2016:1–7.
11. Wellington D, Mikaelian I, Singer L. Comparison of ketamine–xylazine and ketamine–dexmedetomidine anesthesia and intraperitoneal tolerance in rats. J Am Assoc Lab Anim Sci. 2013 Jul 1;52(4):481–7.
12. Vanderlaan EL, Nolan JK, Sexton J, Evans-Molina C, Lee H, Voytik-Harbin SL. Development of electrochemical Zn^{2+} sensors for rapid voltammetric detection of glucose-stimulated insulin release from pancreatic β-cells. Biosens Bioelectron. 2023 Sep 1;235:115409.
13. Patil MN, Kagathara VG, Harle UN, Pujari RR, Ingawale DK. Effect of polyherbal formulation in obesity associated diabetes. Int J Pharm Pharm Sci. 2010;2(3):180–6.
14. Rasha HM, Salha A, Thanai A, Zahar A. The biological importance of Garcinia cambogia: A review. Int J Herb Med. 2023;11(2):45–52.
15. Shaikh KR, Amir K, Siddiqui SS. The effects of three different dosages of Garcinia cambogia extract on the atherogenic index of plasma (AIP) and insulin gene expression in T2DM albino Wistar rats. J Popul Ther Clin Pharmacol. 2023 Dec 8;30(17):737–4