Antidiabetic and Hepatoprotective Effects of *Clinacanthus nutans* Leaf Extract in Type 2 Diabetic Rats

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ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a significant health concern often associated with obesity, which is linked to the development of Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD). This study aimed to evaluate the efficacy of *Clinacanthus nutans* (*C. nutans*) extract in ameliorating diabetes and preventing liver damage in experimental models. Male Wistar rats were divided into a normal diet (ND) control group and a high-fat (HF) diet group. Diabetes was induced in the HF group via administration of nicotinamide and streptozotocin (STZ). After confirmation of diabetes, the diabetic rats were treated with *C. nutans* extract at doses of 100 and 200 mg/kg (DM100, DM200), a combination of *C. nutans* extract and metformin at 100 mg/kg (DMCOM), or metformin at 100 mg/kg (DMMET) for 4 weeks. The results showed that *C. nutans* extract significantly improved metabolic parameters and liver function markers ($p < 0.05$) compared to the diabetic group, particularly in the DMCOM group. Histopathological examination of the liver tissue from diabetic rats revealed evidence of steatosis (fatty liver) and ballooning degeneration. However, administration of *C. nutans* extract, or in combination with metformin, significantly attenuated these hepatic tissue abnormalities. These effects were particularly pronounced in the combination therapy group. These findings suggest the potential of *C. nutans* as a promising adjunctive therapeutic option for the future treatment of diabetes.

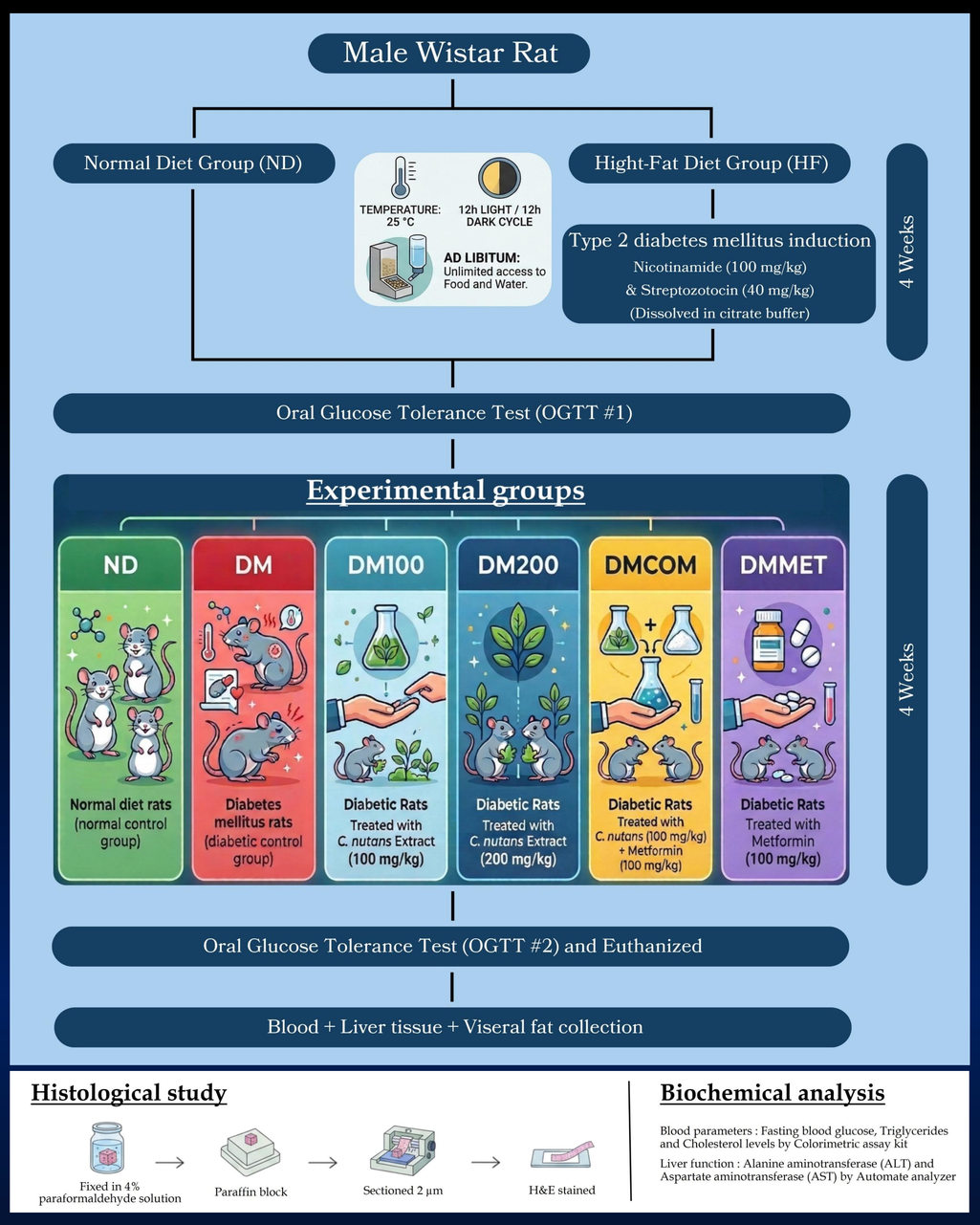
INTRODUCTION

Obesity is a condition characterized by excessive fat accumulation beyond normal levels or beyond the body's capacity to metabolize it. Obesity is considered one of the major causes of type 2 diabetes. Diabetes mellitus is a condition in which the body has impaired regulation of the hormone insulin, whose primary function is to transport glucose in the bloodstream for energy utilization. When insulin levels are reduced or when the body becomes resistant to insulin, glucose cannot be utilized efficiently, resulting in elevated blood glucose levels. In this study, we focused on type 2 diabetes, which is caused by insulin resistance and the progressive dysfunction of β-cells. Currently, evidence indicates that obesity-induced insulin resistance promotes hepatic fat accumulation, thereby impairing liver metabolism and exacerbating hyperglycemia, ultimately leading to β-cell dysfunction and progression of type 2 diabetes mellitus. This establishes a vicious cycle of inflammation, progressive insulin resistance, and sustained hyperglycemia. Therefore, controlling blood glucose levels as well as blood lipid levels is crucial in delaying liver damage. At present, various medications and dietary supplements are used to help prevent liver injury. *Clinacanthus nutans*, commonly known in Thai as Phaya Yor or Saled Phangphon Tua Mia, is a medicinal plant with diverse beneficial properties, such as blood glucose–lowering effects and the ability to reduce lipid accumulation in the liver. Therefore, this plant was selected for use in the present study.

OBJECTIVES

- To investigate the antidiabetic and hepatoprotective effects of *Clinacanthus nutans* extract in type 2 diabetic rats.

METHODOLOGY



Biochemical analysis

Blood parameters : Fasting blood glucose, Triglycerides and Cholesterol levels by Colorimetric assay kit

Liver function : Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) by Automate analyzer

RESULTS

BIOCHEMICAL ANALYSIS

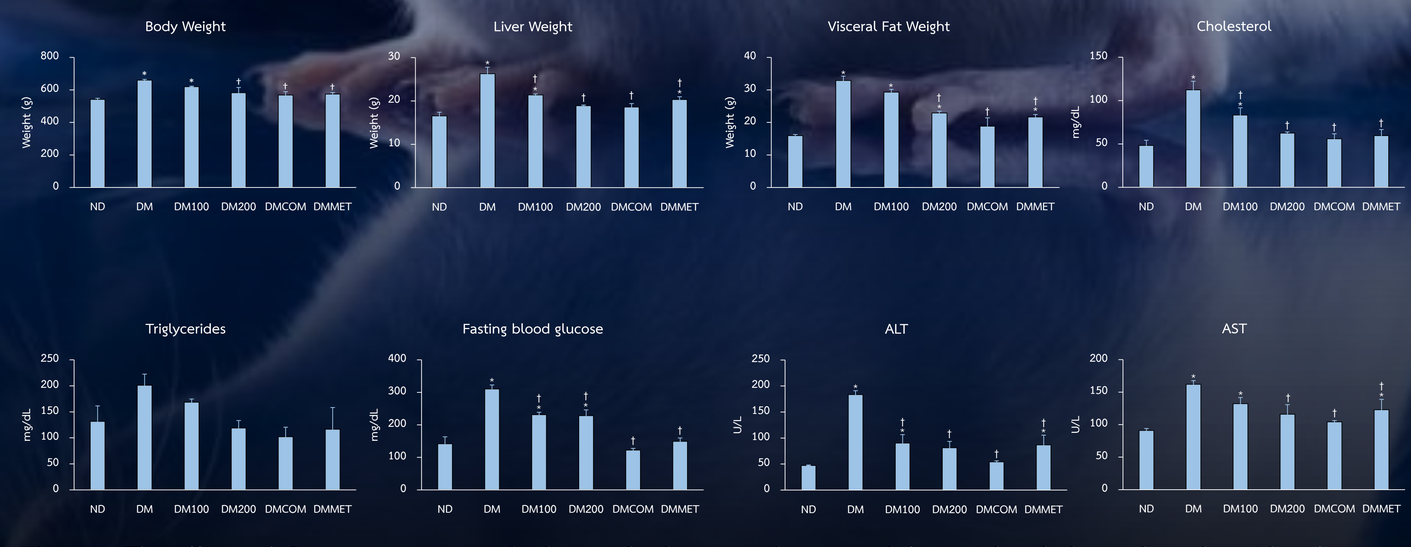


Figure 1 The effects of *C. nutans* extract on body weight, liver weight, visceral fat weight, cholesterol, triglycerides, fasting blood glucose, ALT, and AST levels, respectively. *$p < 0.05$ compared with ND; †$p < 0.05$ compared with DM.

HISTOLOGICAL CHANGE

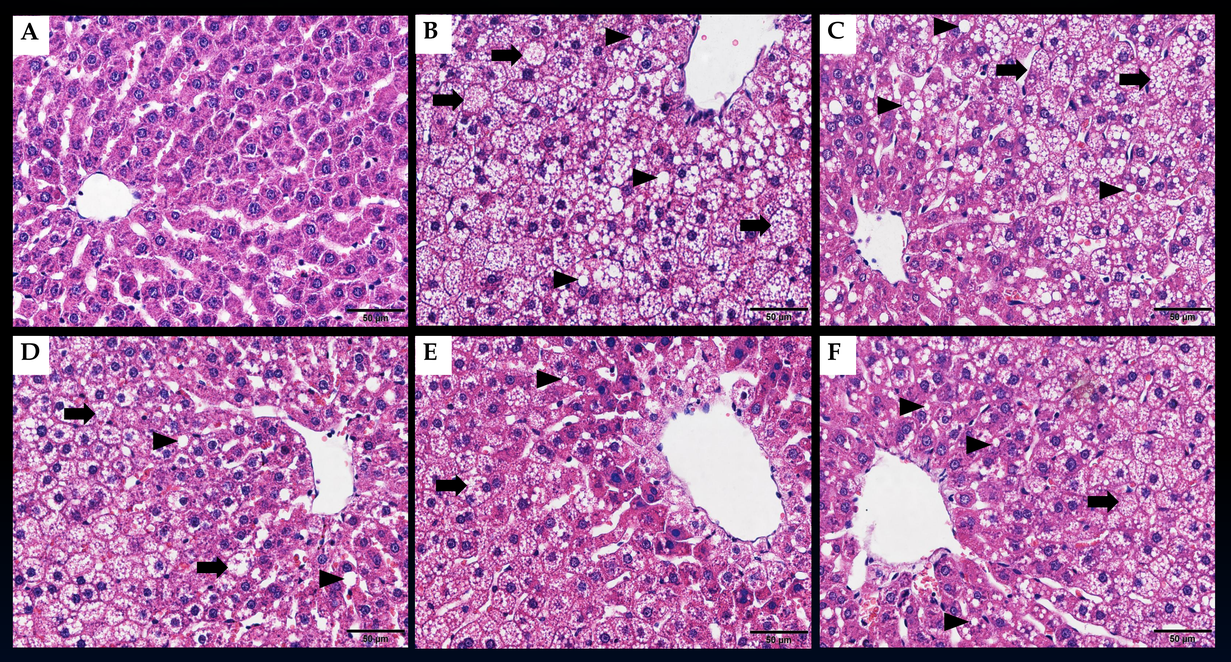


Figure 2 The histopathological changes in liver tissue stained with hematoxylin and eosin (H&E) to compare differences among the experimental groups. Panel A shows normal hepatocytes and the central vein in the ND group. Panel B, C, D, E and F show hepatocytes and the central vein in the DM, DM100, DM200, DMCOM and DMMET groups, respectively. Fatty liver (arrowheads) and ballooning degeneration (arrows)

CONCLUSION

The study demonstrated that *Clinacanthus nutans* extract possesses significant antidiabetic and hepatoprotective properties in type 2 diabetic rats. Regarding its antidiabetic effect, the extract effectively improves metabolic parameters and reduces diabetes-induced systemic inflammation. In terms of hepatoprotection, the extract enhances liver function and mitigates structural damage, particularly by reducing fatty liver and ballooning degeneration of hepatocytes. These findings suggest that *C. nutans* may serve as a potential therapeutic agent for managing of diabetes and its associated hepatic complications.

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