

In-Vitro and Selected In-Vivo Antidiabetic Effects of Premna Serratifolia Root Ethanolic Extract in Experimental Diabetes

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Abstract: *Premna serratifolia* has been investigated traditionally and experimentally for several pharmacological properties, but the antidiabetic evidence requires integrated evaluation using complementary biochemical and animal endpoints. The present article reports selected antidiabetic findings from an investigation of authenticated *P. serratifolia* root, with emphasis on carbohydrate-digesting enzyme inhibition and selected outcomes in streptozotocin–nicotinamide-induced diabetic rats. The ethanolic root extract inhibited α -glucosidase with an IC₅₀ of 84.57 μ g/mL and α -amylase with an IC₅₀ of 97.83 μ g/mL, while acarbose showed IC₅₀ values of 72.30 and 88.10 μ g/mL, respectively. In the animal experiment, diabetic control rats showed marked body-weight loss and persistent hyperglycaemia. Extract treatment was associated with improvement in body weight and fasting blood glucose. Among the unambiguously documented ethanolic extract groups, the 100 mg/kg group showed a 6.88% reduction in fasting blood glucose by day 28 and the 200 mg/kg group showed a 12.73% reduction. The broader thesis also recorded progressive HbA1c improvement, but detailed dose-group reporting is reserved from the present article because the source treatment schedule contains an internal dose-description inconsistency. The findings provide preclinical evidence that *P. serratifolia* root contains constituents capable of inhibiting carbohydrate-digesting enzymes and improving selected indices of experimental diabetes. The results remain exploratory and do not establish clinical efficacy or equivalence to standard therapy.

Keywords: *Premna serratifolia*; antidiabetic activity; α -amylase; α -glucosidase; acarbose; streptozotocin; nicotinamide; fasting blood glucose; experimental diabetes.

I. INTRODUCTION

Diabetes mellitus is characterized by persistent disturbances of glucose homeostasis and is accompanied by abnormalities in carbohydrate and lipid metabolism and, particularly in chronic disease, oxidative and organ-level disturbances. Control of postprandial glucose can be approached by reducing the digestion and absorption of dietary carbohydrates. α -Amylase catalyses the initial hydrolysis of starch, whereas α -glucosidase participates in the terminal conversion of oligosaccharides and disaccharides to absorbable sugars. Inhibition of these enzymes is therefore a recognized strategy for attenuating rapid glucose appearance after carbohydrate ingestion.

Medicinal plants have attracted interest as sources of chemically diverse constituents that can interact with metabolic enzymes. *P. serratifolia* is a member of the *Premna* genus with reported ethnomedicinal use and diverse phytochemistry. Previous work summarized in the thesis includes evidence for antioxidant and enzyme-inhibitory activity in *Premna* extracts, while the present investigation extended the evaluation to authenticated root material and an experimental diabetic model.



The purpose of this article was to examine selected antidiabetic findings from the thesis without reproducing the entire pharmacological dataset. The emphasis was placed on α -amylase and α -glucosidase inhibition, body weight and fasting blood glucose. Detailed hepatorenal, lipid and oxidative-stress datasets are intentionally reserved for separate future analysis.

II. LITERATURE REVIEW

The genus *Premna* contains chemically diverse secondary metabolites, and reviews have described diterpenoids, iridoid glycosides, flavonoids and other constituents. Such diversity is relevant to metabolic pharmacology because several phytochemical classes have been investigated in other medicinal plants for enzyme inhibition and antioxidant properties.

Previous literature summarized in the thesis reports α -amylase and α -glucosidase inhibition by *P. serratifolia* leaf extracts. Simamora and colleagues reported antioxidant activity, enzyme inhibition potential and phytochemical profiling of *P. serratifolia* leaf extracts. These observations provide context for investigating root extracts but should not be treated as equivalent to the present root study.

The use of the streptozotocin–nicotinamide model is established in experimental diabetes research. The combination produces a diabetic phenotype with features useful for pharmacological screening. In the present thesis protocol, nicotinamide was administered before streptozotocin, and animals with fasting blood glucose above 250 mg/dL were considered diabetic.

An important methodological principle is that in-vitro IC₅₀ values should not be interpreted as animal or human therapeutic doses. They describe the concentration required to inhibit 50% of enzyme activity under the particular assay conditions. Likewise, improvement in fasting blood glucose in an animal model demonstrates experimental activity but does not establish clinical effectiveness.

III. OBJECTIVE

To evaluate selected in-vitro carbohydrate-digesting enzyme inhibitory activities of the ethanolic root extract of *P. serratifolia* and to examine selected in-vivo outcomes—body weight and fasting blood glucose—in streptozotocin–nicotinamide-induced diabetic rats.

IV. RESEARCH METHODOLOGY

4.1 Plant material and extraction

Authenticated *P. serratifolia* roots were washed, shade-dried, powdered and extracted with absolute ethanol using Soxhlet extraction. The thesis reports prolonged hot extraction for ethanol-soluble constituents. The ethanolic root extract was selected for the present pharmacological analysis because it demonstrated a broad phytochemical profile and was used in the enzyme and animal studies.

4.2 α -Glucosidase inhibition

The ethanolic root extract was evaluated for inhibition of α -glucosidase activity and the concentration producing 50% inhibition was expressed as IC₅₀. Acarbose was used as the standard comparator. The assay results were interpreted using the IC₅₀ values reported in the thesis.

4.3 α -Amylase inhibition

The ethanolic root extract was similarly evaluated for α -amylase inhibition. IC₅₀ was used as the primary measure of inhibitory potency and compared with acarbose under the same experimental framework.

4.4 Experimental animals

Healthy albino Wistar rats aged 12–15 weeks and weighing approximately 250–300 g were housed at 22 ± 3 °C under a 12-hour light/dark cycle with standard laboratory diet and water. Animals were acclimatized before experimentation. The study was approved through the institutional animal ethics process documented in the thesis.



4.5 Induction of experimental diabetes

Animals were fasted overnight before induction. Nicotinamide was administered intraperitoneally at 110 mg/kg, followed 15 minutes later by streptozotocin at 60 mg/kg prepared in citrate buffer at pH 4.5. A 10% glucose solution was provided after six hours and continued for the subsequent 24 hours according to the source protocol. Fasting blood glucose was assessed three days after induction; animals with values >250 mg/dL were considered diabetic.

4.6 Treatment groups and reporting limitation

The source protocol describes a normal control, diabetic control, glibenclamide standard and *P. serratifolia* treatment groups. Glibenclamide was administered at 5 mg/kg. The source documentation clearly identifies ethanolic extract groups at 100 and 200 mg/kg. A further group is described inconsistently as a chloroform fraction at 50 mg/kg and elsewhere as 300 mg/kg. Because this discrepancy was not independently resolvable from the supplied thesis text, that group is excluded from the present article's dose-specific analysis.

4.7 Outcome measures and statistics

Body weight was recorded at baseline and day 28. Fasting blood glucose was assessed at baseline, day 14 and day 28. The thesis reports data as mean $\pm$ SEM and analysis using one-way ANOVA followed by Tukey's multiple-comparison test, with significance set at $P \leq 0.001$. The present article retains the statistical descriptions reported in the thesis and does not introduce new inferential calculations.

V. RESULTS AND DISCUSSION

5.1 α -Glucosidase inhibition

Table 1. α -Glucosidase inhibitory activity

Sample	IC ₅₀ (μ g/mL)
Ethanolic extract of <i>P. serratifolia</i>	84.57
Acarbose	72.30

The ethanolic extract produced an α -glucosidase IC₅₀ of 84.57 μ g/mL, whereas acarbose showed 72.30 μ g/mL. Because lower IC₅₀ values indicate greater inhibitory potency under the assay conditions, the standard showed stronger activity in this experiment. Nevertheless, the extract demonstrated measurable inhibition, indicating that constituents within the root extract can interfere with α -glucosidase activity. The extract required approximately 1.17-fold the concentration of acarbose to reach 50% inhibition.

5.2 α -Amylase inhibition

Table 2. α -Amylase inhibitory activity

Sample	IC ₅₀ (μ g/mL)
Ethanolic extract of <i>P. serratifolia</i>	97.83
Acarbose	88.10

The ethanolic extract inhibited α -amylase with an IC₅₀ of 97.83 μ g/mL compared with 88.10 μ g/mL for acarbose. The extract therefore displayed appreciable activity but lower inhibitory potency than the standard under the experimental conditions. The relatively close values for both enzymes indicate that the extract possessed activity against two complementary steps in carbohydrate digestion.

5.3 Interpretation of dual enzyme inhibition

α -Amylase participates in the initial hydrolysis of complex carbohydrates, while α -glucosidase contributes to the final production of absorbable monosaccharides. Inhibition at both points could theoretically slow the release and absorption of glucose following carbohydrate intake. The present results provide biochemical evidence compatible with such an effect.

The phytochemical screening in the thesis identified alkaloids, flavonoids and triterpenoids in the ethanolic root extract. These classes provide plausible candidates for future investigation because phytochemicals from several structural classes have been studied for carbohydrate-digesting enzyme inhibition. However, the present study did not isolate



individual constituents or establish enzyme-binding mechanisms. Therefore, the activity should be attributed to the extract as a whole rather than to a named compound.

5.4 Body-weight changes

Table 3. Selected body-weight findings

Group	Initial weight (g)	Final weight, day 28 (g)	% change
Normal control	210.10 ± 0.011	243.86 ± 0.032	+16.07
Diabetic control	209.45 ± 0.054	167.98 ± 0.022	-19.80
Standard	208.09 ± 0.012	238.55 ± 0.018	+14.64
P. serratifolia 100 mg/kg	209.11 ± 0.012	212.87 ± 0.049	+1.80
P. serratifolia 200 mg/kg	208.88 ± 0.087	215.55 ± 0.064	+3.19

The diabetic control group lost 19.80% of body weight during the 28-day period, whereas the normal control group gained 16.07%. The standard-treated group gained 14.64%. The documented 100 and 200 mg/kg ethanolic extract groups showed smaller gains of 1.80% and 3.19%, respectively. Thus, within the unambiguously documented ethanolic groups, the 200 mg/kg group showed a greater improvement in weight change than the 100 mg/kg group. Body weight is a supportive rather than a direct measure of glucose-lowering efficacy because food intake, hydration, substrate utilization and general metabolic status can influence weight.

5.5 Fasting blood glucose

Table 4. Selected fasting blood glucose findings

Group	Day 0 (mg/dL)	Day 14 (mg/dL)	Day 28 (mg/dL)	% change by day 28
Normal control	80.80 ± 0.307	83.30 ± 0.667	82.30 ± 0.667	+1.86
Diabetic control	280.00 ± 0.477	282.00 ± 0.792	301.00 ± 0.725	+7.50
Standard	264.39 ± 0.477	131.01 ± 0.872	95.70 ± 0.577	-63.80
P. serratifolia 100 mg/kg	276.00 ± 0.365	259.99 ± 0.401	257.00 ± 0.365	-6.88
P. serratifolia 200 mg/kg	275.00 ± 0.365	244.00 ± 0.365	240.00 ± 0.333	-12.73

The normal control group remained near its baseline glucose concentration, whereas the diabetic control group increased from 280.00 to 301.00 mg/dL. The standard treatment produced a marked reduction to 95.70 mg/dL by day 28. The 100 mg/kg extract group declined from 276.00 to 257.00 mg/dL, corresponding to a 6.88% reduction, while the 200 mg/kg group declined from 275.00 to 240.00 mg/dL, corresponding to a 12.73% reduction. The direction of change was consistent with a dose-related effect across these two clearly documented ethanolic extract groups, although the response remained substantially smaller than that of the standard.

5.6 Relationship between in-vitro and in-vivo findings

The in-vitro and in-vivo observations provide complementary evidence. The extract inhibited α -amylase and α -glucosidase in biochemical assays and was associated with lower fasting blood glucose in diabetic rats. One plausible interpretation is that reduced carbohydrate digestion could contribute to glucose control. However, the animal response cannot be explained solely by the enzyme assays because oral administration involves absorption, metabolism, tissue distribution and multiple physiological pathways. The study did not directly measure intestinal enzyme activity in vivo, insulin sensitivity, glucose transporter expression or hepatic glucose production.

The thesis also reports improvement in HbA1c, with the diabetic control value substantially above normal and extract treatment associated with progressive reduction. Because the treatment-group description contains an unresolved dose inconsistency, detailed HbA1c dose-wise values are intentionally not reproduced here. This preserves the integrity of



the article while leaving the complete dataset available for a future dedicated analysis after verification of the original laboratory record.

5.7 Possible phytochemical basis

The ethanolic extract contained alkaloids, flavonoids and triterpenoids in the qualitative screening. These broad classes may contribute to enzyme inhibition or metabolic effects, but qualitative detection cannot establish causation. The complex nature of a botanical extract also means that one constituent, several constituents, additive effects or other interactions could underlie the observed response. Bioassay-guided fractionation and quantitative chemical profiling would therefore be required to identify active principles.

5.8 Comparison with acarbose

Acarbose produced lower IC₅₀ values than the *P. serratifolia* extract for both α -glucosidase and α -amylase. The extract nevertheless showed measurable inhibition under the same assay framework. This comparison places the activity in a pharmacological context without implying that the plant extract is equivalent to the established standard. A crude extract contains multiple compounds and is not directly comparable to a purified drug in terms of composition or exposure.

5.9 Interpretation of the animal response

The selected animal results demonstrate three consistent observations: the diabetic control group developed marked metabolic deterioration; the standard group showed substantial improvement; and the documented ethanolic extract groups showed improvement in body weight and fasting blood glucose relative to the diabetic control pattern. The 200 mg/kg group showed a greater reduction in fasting blood glucose than the 100 mg/kg group. These observations support further experimental investigation of the root extract.

5.10 Limitations

The study was performed in an experimental animal model and cannot establish clinical efficacy. The in-vitro assays were conducted under defined laboratory conditions and do not reproduce the complexity of digestion and absorption. The phytochemical findings were qualitative. Most importantly, the supplied thesis contains an internal inconsistency in the description of one treatment group's dose and fraction, so that group was excluded from dose-specific reporting here. The article also intentionally omits the detailed lipid, hepatic, renal and oxidative-stress results to preserve those datasets for a separate future publication.

The article intentionally reports only a selected part of the thesis dataset. Detailed oxidative-stress, lipid, hepatic and renal results remain available for a separate manuscript, subject to verification and appropriate statistical presentation.

The present analysis is based on a preclinical experimental study. The enzyme assays do not reproduce whole-organism pharmacokinetics, and animal glucose responses cannot be extrapolated directly to humans. The phytochemical findings are qualitative. The treatment duration was 28 days for the selected animal outcomes, and the supplied documentation does not establish long-term efficacy or safety.

The chromatographic work provides an opportunity for future bioassay-guided investigation. The alcoholic extract generated a complex HPTLC profile with multiple zones across a broad R_f range. Individual fractions or marker bands can subsequently be evaluated for enzyme inhibition so that chemical features can be linked more directly to biological activity.

The ethanolic root extract showed an intense alkaloid reaction and qualitative detection of flavonoids and triterpenoids. These findings provide chemical context for the enzyme-inhibitory observations, because these broad classes have been investigated elsewhere for metabolic effects. However, the present study does not establish a direct structure-activity relationship. A positive phytochemical test identifies a class rather than a specific constituent.



5.11 Relationship to the phytochemical profile

The IC₅₀ values are properties of the complete extract under the particular assay conditions and cannot be assigned to a single compound. Repeated concentration-response experiments, kinetic analysis and fractionation would be required to determine the precise mode of inhibition and the contribution of individual constituents.

The dual inhibition observed in vitro is biologically relevant because α -amylase and α -glucosidase act sequentially during dietary carbohydrate digestion. Inhibition of α -amylase can reduce the generation of smaller carbohydrate products, while inhibition of α -glucosidase can delay conversion of these products into absorbable monosaccharides. The present extract showed measurable inhibition of both enzymes, providing a biochemical hypothesis for part of the observed glucose-lowering response.

5.12 Biological interpretation of enzyme inhibition

The body-weight data showed a similar directional pattern. The 100 mg/kg group increased by 1.80% and the 200 mg/kg group by 3.19%. These changes were smaller than the increase observed with the standard group, but both differed from the pronounced 19.80% loss in the diabetic control group. Body weight is a supportive rather than a direct measure of glucose-lowering efficacy because food intake, hydration, substrate utilization and general metabolic status can influence weight.

Within the clearly documented ethanolic extract groups, fasting blood glucose showed a progressive difference between the 100 and 200 mg/kg groups. The 100 mg/kg group changed from 276.00 ± 0.365 mg/dL at baseline to 257.00 ± 0.365 mg/dL on day 28, whereas the 200 mg/kg group changed from 275.00 ± 0.365 to 240.00 ± 0.333 mg/dL. The corresponding percentage reductions were 6.88% and 12.73%. The direction of the response was therefore consistent with increasing extract dose across these two groups, although the limited number of clearly documented doses prevents a complete dose-response model.

VI. RESULTS AND DISCUSSION—SCIENTIFIC SIGNIFICANCE

Taken together, the selected results provide a focused preclinical profile of *P. serratifolia* root ethanolic extract. The enzyme assays establish direct biochemical inhibition, while the animal study demonstrates association with improved fasting glycaemia and reduced diabetes-associated weight loss. The convergence of these endpoints strengthens the rationale for further investigation, while the differences from the standard treatment emphasize that the extract should remain classified as an experimental candidate rather than an established therapeutic substitute.

The findings also demonstrate the value of retaining a standardized botanical source. The companion pharmacognostic investigation documented characteristic root morphology, physicochemical parameters, solvent-dependent phytochemical classes and chromatographic fingerprints. Linking the biological observations to a characterized plant material improves reproducibility and provides a basis for future fractionation and marker-based standardization.

Future work should focus on resolving the treatment-group documentation, repeating the enzyme assays with full concentration-response curves and replicates, identifying active fractions, quantifying candidate markers, investigating mechanisms of glucose regulation, and validating the findings in appropriately designed longer-term studies. The detailed hepatorenal, lipid and oxidative-stress results from the thesis can be addressed independently in a dedicated manuscript.

Study limitations and reporting considerations

The remaining thesis findings concerning hepatic and renal biochemical parameters, lipid profile and oxidative-stress markers represent a separate scientific question. Those outcomes can be integrated in a future article focused specifically on metabolic, hepatorenal and oxidative-stress modulation. Separating those data from the present enzyme/glycaemic paper avoids excessive duplication and permits a more focused discussion.

Mechanistic studies could examine intestinal carbohydrate-digesting enzymes, glucose uptake, insulin sensitivity, hepatic glucose production and pancreatic β -cell preservation. These investigations should be accompanied by



quantitative chemical characterization, including validated HPTLC or HPLC methods and, where appropriate, LC-MS/MS or NMR-based identification.

An important next step is resolution of the treatment-group documentation in the original experimental record. The supplied thesis contains a discrepancy for one group, described in different places as a chloroform fraction at 50 mg/kg and elsewhere as 300 mg/kg. The present article deliberately excludes that group from dose-specific interpretation. Verification against the original dosing sheet would allow the complete dataset to be reported accurately in a later manuscript.

The selected results support a staged research pathway for *P. serratifolia* root. First, the botanical material should remain authenticated and chemically characterized. Second, extraction should be standardized so that preparations tested in different experiments are comparable. Third, active fractions should be identified through bioassay-guided fractionation. Finally, isolated or enriched constituents should undergo mechanistic and pharmacokinetic evaluation.

VII. CONCLUSION

The ethanolic root extract of *P. serratifolia* demonstrated inhibitory activity against α -glucosidase and α -amylase, with IC₅₀ values of 84.57 and 97.83 μ g/mL, respectively. In streptozotocin–nicotinamide-induced diabetic rats, the clearly documented 100 and 200 mg/kg ethanolic extract groups showed reductions in fasting blood glucose of 6.88% and 12.73%, respectively, together with smaller losses or gains in body weight compared with the diabetic control pattern. These findings support further preclinical investigation of *P. serratifolia* root as a source of antidiabetic phytochemicals. They do not establish clinical efficacy, and further chemical, mechanistic, safety and reproducibility studies are required.

VIII. ACKNOWLEDGEMENTS

The author acknowledges the guidance of the research supervisors and the support of Shri Jagdishprasad Jhabarmal Tibrewala University and Rajiv Gandhi Institute of Pharmaceutical Sciences and Research. The author also acknowledges the institutional animal research and laboratory staff who supported the experimental work.

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