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1) In-vitro Hypoglycemic Activity of *Barleria prionitis L.*

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ABSTRACT

Barleria prionitis is a shrub with yellow flowers and two flat seeds shielded with matted hairs, inhabit most parts of India. Various parts of the plant such as leaves, roots, aerial parts, flowers, and stems are used in the traditional system of medicine. Conventionally, various infusions are prepared using the plant parts and utilized for the treatment of different kinds of diseases. Owing to its incredible odontalgic property, it is extensively used in treating bleeding gums and toothache. *Barleria prionitis* plant extracts have been tested for their effects on glucose adsorption and diffusion. Adsorbed glucose is derived from the plant and glucose adsorption is greatly enhanced with an increase in glucose levels. The rate of diffusion from glucose in the kinetic amylolysis experimental model increased from 30 to 180 minutes, with plant extracts showing major inhibitory effects on glucose movement through the dialysis membrane to the external solution, in comparison to control. The results confirmed *Barleria prionitis* antidiabetic activity. By increasing glucose adsorption, growing glucose diffusion rate and at the cellular level, the hypoglycemic effect experienced by the extracts is mediated.

Keywords: *Barleria prionitis*, Glucose adsorption, Glucose diffusion, Hypoglycemic activity.

I. INTRODUCTION

Barleria prionitis also known as the porcupine flower, which belongs to the family Acanthaceae and genus Barleria[1]. It is native to India, also distributed widely throughout Asia including Malaysia, Pakistan, Philippines, Sri Lanka, Bangladesh, Yemen and tropical Africa, Sri Lanka and Eastern Southern and Central Africa[2-3]. It is an erect, perennial, prickly, and evergreen shrub, usually single-stemmed, growing to about 1.5 m in height from a single taproot. Lateral roots branching in all directions. Owing to its

traditional use, *B. prionitis* has been studied for different types of pharmacological activities[4-6]. Numerous *in vitro* and *in vivo* studies on different cell lines and animals have been reported. The present review is focused on giving an overview of the pharmacological activities that have been reported on *B. prionitis* in the past and present[7-9]. The ideology of Green chemistry calls for the development of new chemical reactivities and reaction conditions that can potentially provide benefits for chemical syntheses in terms of resource and energy efficiency, product selectivity, operational simplicity and health and environmental safety[10-15]. Conventional method of organic synthesis usually requires longer heating time, tedious apparatus setup which result in higher cost of process and the excessive use of solvents or reagents lead to environmental pollution. Growth of green chemistry holds necessary potential for the reduction of by product, a reduction in the waste production and a lowering of energy cost[16-18]. Due to its ability to couple directly with reaction molecule and passing thermal conductivity leading to fast rise in the temperature microwave irradiation had used to improve many organic synthesis[19-27]. Experiments have proved that microwave, in comparison with the Soxhlet extraction, use a lesser volume of solvent and sample and perform extraction at a much faster rate were previously reported for various plant extraction[28-35]. Computational studies are the crucial steps in the drug designing. Docking study is the computational routine to determine probable binding manners of a ligand to the dynamic site of a receptor. It makes an image of the dynamic site with interaction points known as grid. Then it fits the ligand in the binding site either by grid search or energy search. Due to failure of ADME so it necessary to perform docking studies before pharmacological activity. An outbreak of coronavirus disease (COVID-19) caused by the novel severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) raises an unparalleled challenge in the discovery of appropriate drugs for prevention and treatment[36-47]. Given the rapid pace of scientific research and clinical data produced by the large number of people quickly infected with SARS-CoV-2, clinicians need reliable proof of successful medical care for this infection as in intial stage with help of molecular docking software it is easy to do research with help of docking software. The chemical modification of drug delivery system for protein and peptide drugs is important in improving both enzymatic stability and membrane permeations can help to have good biological activity from any heterocyclic compound modification[48-56]. Someday soon, you might be making your own medicines at home. That's because researchers have tailored a 3D printer to synthesize pharmaceuticals and other chemicals from simple, widely available starting compounds fed into a series[57-62]. Diabetes mellitus is one of metabolic syndrome that alter carbohydrate, lipid and protein metabolism and additionally increased risk of complications of various vascular diseases[63-65]. Hyperlipidemia associated atherosclerosis is the most common cause of death in diabetes. Insulin-dependent diabetes mellitus or type 1 diabetes is an autoimmune disorder characterized by destruction of insulin producing β-cells because auto-aggressive T-lymphocytes infiltrate the pancreas that leads to hypoinsulinemia and thus hyperglycemia[66-69].

II. METHODS AND MATERIAL

Chemicals and Reagents

The glucose oxidase peroxidase kit was purchased from Pathozyme Diagnostics, Kagal, Maharashtra, India. Dialysis bags (12,000 MW cutoff; Himedia laboratories, India) were used in the study. All the chemicals used in the present study were of extra pure analytical grade.

Plant Material

The fresh matured leaves of the *B. prionitis* were collected randomly during the month of May-June, from Sangli region, Maharashtra, India. Department of Botony, Yashwantrao Chavan College of Science, Karad has identified the plant and authenticated it.

Preparation of Plant Extract

Shade drying was done for almost a month to prevent sunlight chemical degradation. The dried material was grinded and transformed in coarse powder with the aid of a grinder. The extraction of *B. prionitis* with solvent methanol was carried out by microwave extraction, and excess solvent present was evaporated.

Evaluation of hypoglycemic activity of plant extracts using various *in-vitro* methods:

In-vitro method includes

- *Determination of glucose adsorption capacity*
- *Effect of plant extracts on in-vitro glucose diffusion*

a) Determination of glucose adsorption capacity

In addition to 25 ml of glucose, the plant extract samples (1 percent) were added. The mixture was well blended, incubated for 6 hours at 37°C in a shaker water bath, centrifuged for 20 min at 4,000×g and the glucose level was calculated in the supernatant. The bound glucose concentration was determined with the following formula,

$$\text{Glucose bound} = \frac{G_1 - G_6}{\text{Weight of the sample}} \times \text{Volume of solution}$$

Where, G_1 is the glucose concentration of the original solution.

G_6 is the glucose concentration after 6 hours.

b) Effect of plant extracts on in-vitro glucose diffusion

The samples of plant extracts (1 %) and the 25 mL of glucose solution (20 mM) were dialyzed into 200 mL of distilled water in shaker baths at a temperature of 37°C i. Diagnostic kit for glucose oxidase peroxidase was used to test glucose content in the dialysate at 300, 60, 120 and 180. A sample-free control test was performed. Glucose dialysis retardation index (GDRI) was calculated by using the following formula[69].

$$\text{GDRI} = 100 - \frac{\text{Glucose content with additional of sample (mg/dl)}}{\text{Glucose content of the control (mg/dl)}}$$

III. RESULTS AND DISCUSSION

a) Glucose adsorption capacity of Barleria prionitis extract

Glucose adsorption capacity of the selected plant extracts is depicted in following table. The adsorption capacities of the samples were found to be directly proportional to the molar concentration of glucose and higher amounts of glucose was bound with increased time shown in table 1.

Table 1. Glucose adsorption capacity of Barleria prionitis extract

Sample	Glucose content in dialysate (mM)			
	30 min	**60 min**	**120 min**	**180 min**
Control	0.78±0.02	1.24±0.01	1.59±0.02	1.81±0.01
Test	0.34±0.02	1.02±0.01	1.31±0.02	1.62±0.02

Mean values (n=3)

Values in parenthesis indicate glucose dialysis retardation index (GDRI)

b) Effect of P.niruri extract on in-vitro glucose diffusion

The effect of the plant extracts on retarding glucose diffusion across the dialysis membrane is shown in following table. The rate of glucose diffusion was found to increase with time from 30 to 180 min. In the present study, the movement of glucose across the dialysis membrane was monitored once in 30 min till 180 min and it was found that, the samples of plant extracts demonstrated significant inhibitory effects on movement of glucose into external solution across dialysis membrane compared to control shown in table 2.

Table 2. Effect of P.niruri extract on in-vitro glucose diffusion

Sample	Glucose content in dialysate (mM)			
	30 min	**60 min**	**120 min**	**180 min**
Control	0.14±0.01	0.41±0.01	1.45±0.01	1.63±0.01
Test	0.02±0.01	0.29±0.01	0.95±0.01	1.18±0.01

Mean values (n=3)

IV. CONCLUSION

The results of the current study concluded by illustrating the hypoglycemic activity of *Barleria prionitis* extract as evaluated by different in-vitro methods. The *Barleria prionitis* hypoglycemic effect was shown to be mediated by increasing glucose adsorption, increasing glucose diffusion and promoting glucose transportation over the cell membrane at cell level. These results identified can also be verified by the use of multiple in-vivo models

and clinical trials, which may help to better use diabetes mellitus in an efficient way.

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