ORIGINAL ARTICLE

Phytochemical Analysis and Hypoglycemic Activity of the Aqueous Extract of Sesbania grandiflora (Katuray) in Albino Rats

JEAN N. GUILLASPER[1], GIL P. SORIANO[2], JOHN MICAH M. GABRIEL[1], AND AUBREY MARIE SHALIMAR D. RAZALAN[1]
[1]*College of Nursing, Nueva Ecija University of Science and Technology, Nueva Ecija, Philippines*
[2]*College of Nursing, San Beda University, Manila, Philippines*
Correspondence to Gil P. Soriano, Assistant Professor, College of Nursing, San Beda University, e-mail: gil.p.soriano@gmail.com

ABSTRACT

Background: Plants are known to contain potentially useful phytochemical compounds that are useful in lowering the risk of chronic diseases.
Aim: The aqueous extract of Sesbania grandiflora Linn (Katuray) which belongs to the family Leguminosae was screened for phytochemical properties and hypoglycemic activity.
Methods: The plant samples were collected at Talavera and Zaragosa in Nueva Ecija, Philippines and was authenticated by the National Museum of the Philippines. The aqueous extract of Sesbania grandiflora flowers was subjected to phytochemical analysis and was tested for hypoglycemic activity. Data was analyzed using mean, t-test and ANOVA.
Results: The mean blood glucose level of the test subjects were shown to decrease after induction to the aqueous extract of Sesbania grandiflora flowers in varying concentrations and in different time intervals.
Conclusion: There a significant difference in the mean blood glucose level of the test subjects before and after 180 minutes induction to the aqueous extract of Sesbania grandiflora flowers.
Keywords: Albino rats, aqueous extract, hypoglycemic effect, phytochemical analysis, Sesbania grandifora

INTRODUCTION

According to the World Health Organization[1], the number of people diagnosed with Diabetes Mellitus (DM) has nearly quadrupled since 1980 with increasing cases particularly in low- and middle-income countries. In the Philippines, it is ranked eight on the leading causes of death[2] with a prevalence rate of 6.3% among the adult population[3]. DM is a chronic life-long condition characterized by poor blood glucose control[4] and is related to abnormal insulin production, impaired insulin utilization, or both. Also, DM is the leading cause of adult blindness, end-stage renal disease, non-traumatic lower limb amputations and a major contributing factor for heart disease and stroke[5]. Increasing incidence, progressive process and life-long complications highlights a critical need for effective treatments against DM.

Nowadays, a number of interventions are available to control DM which includes insulin therapy, pharmacotherapy, and diet therapy[6]. For instance, oral hypoglycemic agents (OHA) are used in order to lower the blood glucose levels of DM patients and does it through different mechanism of action. These includes thiazolidinediones which increases the peripheral absorption of glucose[7], biguanides which reduces hepatic glucose production and sodium-glucose cotransported-2 inhibitors which increase urinary glucose excretion. However, the use of these treatments were shown to pose disadvantages such as drug resistance (reduced effectiveness), adverse effects, and even toxicity.[6]Hence, despite the progress in synthetic chemistry and biotechnology, traditional medicines such as the use of plants are still an indispensable source of medicinal preparations, both preventive and curative.

Literatures have revealed that about 80% of people in low- and middle-income countries depend on traditional medicine as the primary treatment for various ailments[8]such as DM. Medicinal plants contains phytochemical compounds which includes carotenoids, flavonoids, terpenoids, alkaloids, and glycosides, and may often have hypoglycemic properties.[9] These compounds enables the plants to improve the performance of pancreatic tissues, by either increasing production of insulin or by decreasing the intestinal absorption of glucose[6].

Sesbania grandiflora of the family Leguminosae: Papilionnoideaeis reported to have great medicinal value in Indian medicine. It is believed to have originated either in India or Southeast Asia and grows primarily in hot and humid tropical areas of the world[11]. It can be found in countries with tropical climate which includes India, Indonesia, Malaysia, Myanmar and Philippines[12].

In the Philippines, the fresh flowers of Sesbania grandiflora (Katuray) are used by the folks in the community in cooking stews and in salads. The green pods and young leaves can be eaten by humans and livestock, and reportedly can increase the milk production of cattle. The leaves are made into leaf meal for feeds while the bark contains a tanning agent, fiber and an extract used medicinally. Gum from the bark has water-proofing capabilities and can prolong the life of fishing tackle. Fishing lines are usually rubbed with the bark.[10]

Despite the multiple benefits and uses of Sesbania grandiflora and its widespread accessibility and availability in the country, there was no scientific study conducted which assessed the hypoglycemic activity of this plant. Thus, the study was conducted in order to determine the phytochemical properties and hypoglycemic activity of its aqueous extract using albino rats.

MATERIALS AND METHODS

Plant Material: The Sesbania grandiflora flowers were collected at Talavera and Zaragosa in Nueva Ecija, Philippines in the month of October 2019. The sample was

verified and authenticated by the Botany Division of the National Museum, Manila (control number 649).

Preparation of aqueous extract of Sesbania grandiflora: The fresh flowers of Sesbania grandiflora were washed first with tap water and air dried for 4 days prior to extraction. The air-dried flowers were also cut and ground into small pieces through a rotary miller. These were then homogenized with the use of an osteorizer and were soaked in distilled water with the ratio of 1:2 sample: solvent and was heated up to 60 degree Celsius, then cooling of extract at room temperature was done before the administration to the test animals.

Phytochemical Screening: Phytochemical screening was done to further know if the target the secondary metabolite is still present in the sample. 2ml of the plant extract was evaporated to syrupy consistency over a steam bath and was used for the following analysis as recommended by Cannell[13]which includes alkaloids, saponins, flavonoids, tannins, cardenolides, total free amino acids and soluble sugars, and total phenolics.

Preparation of the Test Subjects: The samples has undergone extraction process prior to the preparation of treatments to different dosages of 0.10ml, 0.25ml, 0.50ml, 0.75ml, 1.00ml of aqueous extract of Sesbania grandiflora flowers. And was later induced through oral feeding.A total of 12 albino mice were used as the test animals/subjects per treatment. The groups were divided into six consisting of two subjects per group wherein the control group were given metformin while the remaining groups were exposed to varying concentration of aqueous flower extract of Sesbania grandiflora. They were acclimatized for 14 days.

After 12-hour fasting, the initial blood glucose levels of the test subjects were read and the data gathered were recorded as the pretest result (t0).Controlled amount of 75% glucose solution was induced through subcutaneous injection. After 30 minutes, the blood glucose levels were tested and recorded (tG).

The treatments were administered on the respective subgroups and bloodglucose levels were simultaneously checked and tested after 60-minute intervals (t60, t120, t180).After the experiment, the test subjects were observed for any reactions with regards to the previous procedure.

Data Analysis: In order to analyzed the gathered data, t-test was used to determine the difference between the experimental and control group while One-Way-Analysis of Variance (ANOVA) was used to compare the hypoglycemic effect of different concentrations of Sesbania grandiflora flower extracts.

RESULTS

Phytochemical Screening: Table 1 shows the results of phytochemical screening of Sesbania grandiflora. It was shown that alkaloids, saponins, and tannins are present, whereas flavonoids and cardenolides are absent.

Total free amino acids, soluble sugars, and phenolics: The total free amino acids of Sesbania Grandiflora was 8.40% while the total soluble sugars was 10.74%. On the other hand, the total phenolics of flower parts of Sesbania Grandiflora was 2.67%.

Hypoglycemic activity of Sesbania grandiflora: Table 2 illustrates the mean blood glucose level of the subjects exposed in varying concentrations of Sesbania grandiflora. It can be noted that there was a decrease in the blood glucose levels of the control and experimental group before the induction of glucose solution (t0), after induction of glucose solution (tG) and to every 60minutes interval.

Comparison of blood glucose levels among the subjects in different time intervals. : The mean blood glucose level of the subjects before and after glucose induction is presented in Table 3. The results showed that there was no significant difference in the mean blood glucose level of the subjects between initial and after the induction of the plant extract, initial and after 60-minute interval, and initial and 120-minute interval. However, a significant difference was noted in the initial induction and 180 minutes after the induction of the plants extracts.

Table 1: Phytochemical Properties of Sesbania grandiflora

Phytochemical Compounds	Test	Result
Alkaloids	Wagnerreagent	+
	Mayer reagent	+
Saponins	Froth Test	+
Flavonoids	Bate-Smith	-
Tannins	Ferric-to-Ferrous reduction	+
Cardenolides	Keller-Kiliani	-

Table 2: Mean Blood Glucose Levels (mg/dl)of the Subjects

Group	t_0	t_G	t_{60}	t_{120}	t_{180}
Control	88	259	256	184	96
0.1ml dosage (T1)	85	243	245	224	205
0.25ml dosage (T2)	93	267	264	232	181
0.50ml dosage (T3)	93	269	259	219	128
0.75ml dosage T4	93	272	267	221	96
1.0ml dosage (T5)	83	253	240	157	93

Table 3: Blood Glucose levels of the subjects before and after induction of plant extract at different time intervals.

Period	t value	p value	Interpretation
Initial vs. after induction	-65.361	0.894	Not Significant
Initial vs. T60	-58.431	0.721	Not Significant
Initial vs. T120	-16.848	0.647	Not Significant
Initial vs. T180	-1.697	0.032*	Significant

DISCUSSION

Diabetes Mellitus (DM) is one of the most common metabolic diseases as it impairs the metabolism of protein and fats and increases the blood glucose levels of the body. It is consideredas one of the leading causes of mortality worldwide, hence early diagnosis and prompt treatment is imperative to control its life-long complications.Several studies have been conducted in an effort to seek new natural antioxidants molecules which poses less or no side effects[14]. Recently, much attention was focused on plants which contain high concentration of phytochemical compounds which has a significant health-promoting effects[15]. This study determined the phytochemical properties and hypoglycemic effect of Sesbania grandiflora flowers.

The health benefits of medicinal plants can be attributed to their unique phytochemical composition[16]. Phytochemicals are secondary metabolites that are present in plants that act as antioxidants and stimulate protective enzymes in the liver or block damage to genetic materials[17]. Further, it helps prevent the occurrence of

oxidative chemical species, stimulate antioxidant repairing mechanism and scavenging capacity of free radicals n the body.[18]In the study, the aqueous extract of Sesbania grandiflora flowers contains alkaloids, saponins, tannins, and phenolic which are show shown to exhibit anti-diabetic effects[19,20]. For instance, tannins can induce phosphorylation of insulin receptors as well as translocation of glucose transporters 4 (GLUT-4) , the protein factor involved in the signaling pathway of insulin-mediated glucose transport and the inhibition of the expression of key gene for adipogenesis thereby helping to reduce blood glucose level without increasing adiposity[21].

In terms of hypoglycemic activity, the study revealed a decreasing mean blood glucose levels among the subjects that were given varying concentrations of plant extract at different time interval. Further, a significant difference was also noted before the induction of the plant extracts and 180 minutes after administration of the extract.

The mechanism of isulin release in response to a glucose load occurs in two phases in both human and rodents. The early phase peaks within the first 15-30 min and is responsible for limiting the initial rise in glucose upon meal ingestion. The late phase of insulin secretion occurs later than 30 min after a meal, and may persist for several hours. This delayed burst of insulin secretion is responsible for returning glucose to baseline fasting levels. In the face of insulin resistance, the late phase of insulin secretion persists for an extended period and contributes to excessive insulin levels even after a return to the fasted state, resulting in fasting hyperinsulinemia[22]. From this study, the marked reduction in the mean glucose levels may be a result of increased release of insulin from beta cells and may also be attributed to the presence of phytochemical compounds in the aqueous extracts of Sesbania Grandiflora flowers.

CONCLUSION

Based on the results, it was revealed that significant phytochemical compounds can be found Sesbania grandiflora flowers which includes alkaloids, saponins, tannins, and phenols. Furthermore, a significant difference was notedin the blood glucose levels of the subjects before induction of the plant extracts and 180 minutes after the induction of the extracts of Sesbania Grandiflora flowers.

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