Philippine Christian University
1648 Taft Avenue cor. Pedro Gil St., Malate, Manila

Hypoglycemic effects of *Salvia officinalis L.* Stem Extract in Dexamethasone-Induced Albino Rats

Author

Delfin, Angelica Marie et.al.,

Abstract

The sage plant (Salvia Officinalis L.) has been reported in previous studies to exhibit hypoglycemic properties. The researcher evaluates the effectiveness of sage plant stem extract in lowering blood sugar level in albino rats induced with dexamethasone, examining numerous dosages and considering its efficacy as a remedy for type II diabetes, using metformin as positive control. The results indicated that sage plant stem extract substantially reduced blood glucose level in dexamethasone-induced albino rats, especially at a 50% dosage, showing constant decreases in each blood sugar levels and heart rates. No observable difference in glucose-lowering trend was noted between 50% stem extract group and metformin-treated rat. However, the 25% concentration did not drastically have an effect on blood sugar levels compared to other doses. Some potential side effects, such as reduced appetite, were observed. These findings recommend that sage plant stem extract ought to offer a promising alternative remedy for type II diabetes, leading to the approval of new medication and the development of pharmaceutical merchandise based on herbal treatments. In conclusion, the studies support the hypoglycemic efficacy of sage plant stem extract, in particular at a 50% dosage. Further therapeutic potential of other parts of Salvia officinalis, including other hematological analysis related to blood sugar increase, like ketone and lipoproteins analysis, is recommended.

Key Words

Salvia Officinalis L., glucose level, dexamethasone, albino rats, hypoglycemic, metformin.

Introduction

Hyperglycemia, also called raised blood glucose is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels. Diabetes mellitus, is a group of common endocrine diseases characterized by sustained high blood sugar levels. Diabetes is due to either the inability of pancreas to produce enough insulin, due to unresponsive to signal hormones (Hung Sun et.al. 2022). Cando LFT., et. al., (2024), an estimated 4.3 million Filipinos were diagnosed with diabetes, while 2.8 million remained undiagnosed in 2021. Diabetic retinopathy is a top cause of preventable blindness in Region 3, which contributes to 38% of renal disease cases in the Philippines. The 2021 Philippine Guidelines on Periodic Health Examination (PhEX) advocate for the utilization of fasting blood sugar (FBS) as a screening measure for Type 2 Diabetes Mellitus (T2DM) in healthy adults aged 40 years and older or in those with specified risk factor.

Globally, there exists a vast array of therapeutic plants, especially Salvia species gaining widespread recognition for their remarkable health advantages (Abd Rashed and Rathi 2021; Uysal et al. 2023). Dexamethasone-induced hyperglycemia is a well-established experimental model for assessing insulin resistance and screening antidiabetic agents. The hypoglycemic effects of sage *(Salvia officinalis*) extracts contains component like carnosic substance, phenolic acids, rosmarinic acid, and flavonoids or their derivatives have been shown in previous research like *Salviablancoana* subsp. *mesatlantica* (SB) by Suoad M, (2022). In this study theresearcher use the *Salvia officinale* to determine if this specie exhibit the antidiabetic potential using dexamethasone

induced wistar rat. The study aims to determine the significant differences in the hypoglycemic efficacy between 25% and 50% concentration of sage extract, as well as the positive control, and to compare observed glucose-lowering trends of sage stem extract with metformin as a reference drug.

Subsection

Sage (Salvia officinalis)

A perennial, evergreen subshrub, with woody stems, grayish edible leaves, and blue to purplish flowers. *S. officinalis* L. also known as Dalmatian sage, common sage or garden sage. Schoch et al., (2020) It is a member of the mint family Lamiaceae and native to the Mediterranean region, though it has been naturalized in many places throughout the world according to Greeventory Philippine (2020). The sage plant has also been used to promote memory and wisdom from drinking brewed tea. Hence, sage plant was popular during the Middle Ages because of its high value in healing properties.

Plants produce bioactive secondary metabolites, which are classified into four groups: phenolic compounds, terpenoids, alkaloids, and sulphur compounds (Akacha et al., 2022; Ben Akacha et al., 2023; and Ben Saad et al., 2019). The research by Generalić MekinićSage etal.,(2024). emphasizes the antioxidant properties of *S. officinalis* due to its flavonoids and phenolic acids. Both *in vitro* and *in vivo* studies demonstrate its effectiveness against bacterial infections. Recent research also suggests that *S. officinalis* has the potential to extend the shelf life of various foods by reducing lipid oxidation, making it an important ingredient in the food industry as a natural food additive. Mahdi et al., (2021) The study shows that Salvia officinalis L.'s hydro-methanolic extract and its phenolic-enriched fractions have antioxidant activity as demonstrated by their ability to scavenge DPPH and ABTS radicals and lower ferric ions in leaves and stems. It explores the phenolic-enriched fractions and hydro-methanolic extract from Salvia officinalis L.'s hemolytic and antioxidant properties. Leaves and stems, increasing understanding of its biological functions and possible health effects. Mahdi et al., (2021) The study shows that Salvia officinalis L.'s hydro-methanolic extract and its phenolic-enriched fractions have antioxidant activity as demonstrated by their ability to scavenge DPPH and ABTS radicals and lower ferric ions in leaves and stems.

Diabetes

The global diabetes prevalence in 20-79 year olds in 2021 was estimated to be 10.5% (536.6 million people), rising to 12.2% (783.2 million) in 2045. Diabetes prevalence was similar in men and women and was highest in those aged 75-79 years. According to the study of Misra et al. (2019), the prevalence of type 2 diabetes (T2D) has risen dramatically in emerging countries, with differences depending on rural or urban location and amount of urbanization

The study of Forouhi and Wareham (2019), they stated that diabetes mellitus is a major public health problem worldwide, offering significant difficulties to people, caregivers, healthcare systems, and society. Diabetes can cause a variety of consequences, including microvascular difficulties such as retinopathy, nephropathy, and neuropathy, as well as macrovascular concerns such as ischemic heart disease, stroke, and peripheral vascular disease. While the origins of type 1 diabetes are still unknown, there is a more excellent knowledge of modifiable variables that contribute to type 2 diabetes, making prevention a realistic and essential public health goal. (Symptoms, 2023). Cole & Florez,(2020), the illness is linked to severe macrovascular problems such as cardiovascular disease as well as microvascular complications such as diabetic kidney disease, retinopathy, and neuropathy. These problems lead to higher mortality rates, blindness, renal failure, and a general deterioration in diabetes-related quality of life, Polderman et al. (2019) stated in their study that dexamethasone is the most effectively used ro prevented prophylaxis of postoperative nausea and vomiting, improved postoperative recovery, and promotes discharge after ambulatory surgery. However, after the long-

term treatment of dexamethasone can be a result of multiple side effects, such as: adrenal sufficiency, increase the risk of wound infections, hyperglycemia, and development of diabetes mellitus.

Methods

A. Collection of Specimen

The total of seven Albino rats will be collected from Cartimar Pet Center, Buendia and Salvia Officinalis stem will be ordered online. The experimental animals were carefully chosen by the researchers to assure it won't be easily deceased within the 7 days' experimental time period. The cage is also purchased from Cartimar Pet Center to confined the experimental animals enables the researcher to properly observe the rats.

B. Preparation

Solution of *Salvia officinalis* Stem Extract

The researcher will obtain the *Salvia officinalis* stem from online. The stems were cut out from the plant, then the researchers put it on the oven for an hour with 175-250 degrees. After that, the stems were dried and crushed down until it powderized. A decoction method was used to obratained extract from the *Salvia officinalis* stem. The researchers then put the powderized stem into a boiling hot water then later strained it and used a clean cloth to filtrate the liquid to make it an extract. The stem extract was 42 ml. the researchers then divide it into two groups containing exactly 21 ml. each. For the 25% concentration of the extract, the 21 ml. was diluted with distilled water (20 ml.) and then for the 50% concentration, the 21 ml. of extract, the researchers remained it as is.

Treatment.

Inducing of Dexamethasone

The dexamethasone tablets will be purchased along with a doctor's prescription in 1020 San Andres Generika Drugstore. The noted per gram of wistar rat will be given for dosage required of dexamethasone. The process went by grounding the tablets with the used of the mortar and pestle and was diluted with distilled water to orally induced it to the albino rats.

Segregating the Albino rats into Groups

The experimental animals were divided into three set ups. The first set up had 3 albino rats with the 25% concentration. Second set up had 3 albino rats with the 50% concentration. And the third set up (positive control) has only one albino rat that received the metformin.

Limitation

The study was limited by short treatment duration with small sample size with no biochemical markers such as lipid profile and ketone levels.

Data collection

The researcher observed the blood glucose level with the use of glucometer to measure if the blood glucose increase, the two set-up experimental animals were given the stem extract. And the third set-up was observed by using the glucometer to measure if the blood glucose increase, and after that received the metformin. As for observing the rats heart rate, the researchers used a smart-watch to identify the measure of the heart rate.

Results

Table 1. Hypoglycemic efficacy of Sage (*Salvia officinalis)* on dexamethasone induced wistar rat based on the blood glucose level. (mg/dl)

Concentration	trial 1			trial2			trial3			average
	Before	after	diff	Before	after	diff	Before	after	diff	
25%	156	144	12	121	117	4	129	106	23	13
50%	157	102	55	124	98	26	150	91	59	46.67

Table 1.1 illustrates the hypoglycemic efficacy of Salvia Officinalis L. stem extract on dexamethasone-induced albino rats. The average blood sugar level after 25 % treatment shows a decrease of 13 mg/dl, and at 50% extract, blood sugar decrease an average of 46.57 mg/dl.

Table 2. average heart rate (bpm) of albino rat before and after treatment of sage stem extract

Conc	trial1			trial2			trial3			ave
	Before	after	diff.	before	after	diff	before	after	diff	
25%	84	86	2	80	79	1	54	57	3	2bpm
50%	60	86	26	80	84	-4	82	78	-4	6 bmp

Table 1.2 demonstrates the impact of Sage stem extract on albino rat heart rates. The 25% dosage showed irregular effects while the 50% dosage consistently lowered heart rates. Overall, higher doses of Salvia Officinalis L. exhibited more consistent effects on heart rates and blood sugar levels compared to lower dosages.

Table 3. significant differences of hypoglycemic efficacy of sage extract

Conc	blood glucose(mg/ml)	heart rate (bmp)	T test	pvalue	loS	decision
25%	13	2 bmp	0. 89411	0.2328	.05	accepted
50%	46. 67	6 bmp				

Table 3. summarizes the effects of sage on blood glucose levels and heart rate during hypoglycemic treatment. It presents concentrations tested (25% and 50%), average hypoglycemic efficacy of Sage (Salvia Officinalis L.) stem extract. on Dexamethasone Induced Albino rats, and heart rates before and after treatment. The decision to accepted the hypothesis thus there is no significant differencws on the effectiveness of the two (2) different concentration of extract.

Table 4. Significant differences between the sage stem extract and the positive control.

Table 4 the hypoglycemic effect between stem extract (Salvia Officinalis L.) and positive control (Metformin) and its effects on glucose levels as it illustrates in table 1.1 with a concentration level of

25% and at 50% with an average of blood glucose level 3 and20, compared to the average of metformin 4.66666. As observed in the tables above, the hypoglycemic activity of stem extract has the same range of 25% of concentration, average of 3 in blood glucose level. The results show of 25% concentration of sage stem extract has a stable difference average than positive control (Metformin). he data shows the null hypothesis is rejected. Therefore, there is no significant differences in glucose level and heart rate in Sage stem extract (Salvia Officinalis L.) and metformin (positive control). In which T- test result is significantly than the P value (0.1118<0.9212).

Discussion

The researchers, through analysis and interpretations regarding the stem extract of sage plant (Salvia Officinalis L.) shows that it proves the lowering properties on blood glucose level of albino rats. Based on the observations, the researchers used two different concentrations decreased the glucose level of the albino rats and it also rectified their appetite. The stem extract helps them to have stable glucose levels while under a high level of glucose. However, other trials are experiencing inaccuracy of glucose levels after taking the treatment, the albino rats' glucose level can increase while under the treatment. Furthermore, after taking the treatment on the first day of the procedure, it gradually decreased after inducing the rats with dexamethasone. After two days' rest from the treatment, the glucose level further decreased from the first day of the procedure. The stem extract has proven that it has the ability to decrease the glucose level of albino rats. The hypoglycemic effect may be attributed to phenolic compounds such as rosmarinic acid and flavonoids reported in salvia officinalis.

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