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EVALUATION OF HYPOGLYCEMIC ACTIVITY OF SWARNAVANGA IN STZ. INDUCED HYPERGLYCEMIC MALE WISTAR RATS-AN EXPERIMENTAL PHARMACOLOGICAL STUDY

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ABSTRACT

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia and associated systemic complications. Swarnavanga is a kupipakwa kalpa mentioned in Rasa Tarangini indicated in Prameha roga. This study evaluates its hypoglycemic efficacy in Streptozotocin (STZ) induced hyperglycemic male Wistar rats. **Objectives:** To evaluate the hypoglycemic activity of standardized Swarnavanga in STZ-induced hyperglycemic male Wistar rats. **Methods:** Swarnavanga was prepared by Kupipakva method using shodhita Parada, Vanga, Gandhaka, and Navasadara following Rasatarangini text.24 male Wistar rats were divided into four groups (n=6 each) Normal control, Diabetic control, Standard(Metformin treated) and test group (Swarnavanga treated). Diabetes was confirmed at 72 hours post-STZ injection. Oral medications were administered for 21 consecutive days. Blood glucose levels were estimated on Days 1, 3, 5, 7, 15, and 21 using the glucose oxidase-peroxidase (GOD-POD) enzymatic method. Statistical analysis was performed using one-way ANOVA followed by Dunnett's t-test ($p<0.05$). **Results:** Swarnavanga demonstrated significant hypoglycemic activity, representing a 46.2% reduction. Metformin reduced glucose levels representing a 41.1% reduction. No statistically significant difference was observed between Swarnavanga and metformin. **Conclusion:** Swarnavanga exhibits hypoglycemic activityin STZ-induced diabetic rats, validating its traditional claim as Prameha-hara.

KEYWORDS: Swarnavanga, hypoglycemic activity, streptozotocin.

1. INTRODUCTION

Acharya Charaka explained *Prameha* as one among *Asta Mahagada*. *Prameha roga* presents with *prabhuta avila mutrata, galatalu shosha, pipasa, suptatanga, asya madhuryata, panipada daha* etc. *Prameha*, if not managed timely then gradually leads to *Madhumeha*.[1] *Prameha* can be correlated to Diabetes Mellitus in western science.

Diabetes Mellitus is a metabolic disorder presents with Polyuria, Polydipsia and Polyphagia. In India, it is estimated that 77 million people above the age of 18 years are suffering from Diabetes (type-2) and nearly 25million are Pre-diabetic.[2] There are many medicines for management of type-II Diabetes mellitus like Sulfonylurea's, Biguanides and Thiazolidinediones etc. These medicines are having side effects like weight gain, vitamin B_{12} deficiency, increased cardiovascular risk, hypoglycaemia, premature athero sclerosis, Oedema etc.[3]

Hence, there is a need for new medicine to manage diabetes that can normalize blood glucose levels with less or no side effects. *Prameha* is *kapha pradhana*

tridoshaja vyadhi in which *kapha dosha* and *medo dushti* are predominant factors. *Swarnavanga* is directly indicated in Prameha roga. It possesses *Medohara and Kaphahara* properties.[4] So in this regard, by considering indications of *Swarnavanga* and prevalence of Diabetes Mellitus, Present study "Evaluation of hypoglycaemic activity of *Swarnavanga* in Streptozotocin induced hyperglycemic male wistar rats" Was termed.

2. MATERIALS AND METHODS

MATERIALS

- **Procurement of Raw Drugs:** Parada, Gandhaka, Vanga and Navasadara were procured from M/S Dorle and sons, Kolhapur and authenticated by expert faculty at the Central Research Facility, BVVS Ayurveda College and Hospital, Bagalkot.
- **Procurement of Streptozotocin:** Streptozotocin was procured from Roshni Lab Chem, Mangalore.
- **Preparation of Swarnavanga:** Preparation of Swarnavanga was done at BVVS Ayurved Pharmacy, Bagalkot.
- **Animals**: Healthy Male Wistar Albino rats weighing between 200-250 grams, were procured and maintained in Standard laboratory condition with normal diet and water for 30 days. Animals were approved by Institutional Animal Ethical Committee, Reg No 821/PO/Re/S/04/CPCSEA, Dated 22/02/2025at BVV Sangha's, HSK College of Pharmacy, Bagalkot, Karnataka.

METHODOLOGY

Pharmaceutical Part

Swarnavanga was prepared by Kupipakwa method as described in *Rasa Tarangini* using Parada, Gandhaka, Vanga and Navasadara in equal proportions.[5] Initially, individual shodhana of all ingredients was performed according to classics. Subsequently, Parada–Vanga Pishthi and Kajjali were prepared in a stepwise manner. The prepared Kajjali was filled into a specially designed glass bottle (Kachakupi) and it was placed in a Valuka Yantra, and subjected to Kupi paka using a Kramagni pattern for 15 hours with a maximum temperature of 750°C.

Animal experimentation[6]

1. Rats were fasted overnight and the animals were rendered diabetic by a single intraperitoneal injection of STZ (35 mg/kg body weight). STZ (CDH) at a dose of 35 mg/kg was prepared in cold citrate buffer and administered. The STZ-injected animals showed hyperglycemia after 72 hours.
2. After 72 hours of Streptozotocin injection, i.e. on 4th day (Fasted state) blood samples will be collected for blood glucose estimation.
3. Samples having blood glucose level ≥250mg/dL will be selected for the study.
4. On 5th day, considered as 1st day of drug administration and drugs will be administered for 21 days.
5. Blood sample collected from tail vein and blood glucose level was estimated on 1st, 3rd, 5th, 7th, 15th and 21st day of drug administration.
6. Food, water intake and body weight will be measured periodically.

GROUPING OF ANIMALS

24 Male wistar Rats were divided into the following four equally sized groups for the study. Rats were taken for study after confirmation of a stable diabetic state.

Group name	Number of Animals	Name of the Drug
Group 1 - Control Group	n = 6	Normoglycemic rats received 0.5 ml of distilled water/100 g body weight/rat/day by gavage forcefully.
Group 2 - Diabetic Control	n = 6	Diabetic rats were included here, 0.5 ml distilled water was provided forcefully/100gm body weight/rat/day
Group 3 - Standard Group	n = 6	Diabetic rats were given Metformin (35mg/kg).
Group 4 - Test Group	n = 6	Diabetic rats were forcefully fed by gavage with *Swarnavanga* in mentioned dose.

Preparation method of solution

The suspension of the formulation was made with 3% of TWEEN 80 and distilled water was administered orally to respective groups of animals by using a syringe with an attached gastric tube.

Dosage schedule

The dose was calculated by extrapolating the human dose to animal based on the body surface area ratio by referring to the table of Paget and Barnes (1969).

Conversion formula: Human dose is 250mg.

= 250 x 0.018 = 4.5 mg /200 gms.

Route of administration

1. Streptozotocin was induced in rats by intra-peritoneal route.
2. Normal saline, metformin and *Swarnavanga* in mentioned dose was administered orally.

Estimation of Glucose[7]

Glucose estimation was done using GOD-POP (Glucose oxidase-peroxidase/4-Aminoantipyrine + phenol) Kit.

Rats were anesthetized with Diethyl ether. One ml of blood was taken from rats in order to measure glucose. Samples were collected in sterilized tubes and kept at

4°C and after separating the clot, the serum was separated by centrifuging. Blood glucose was measured by the glucose-oxidase method.

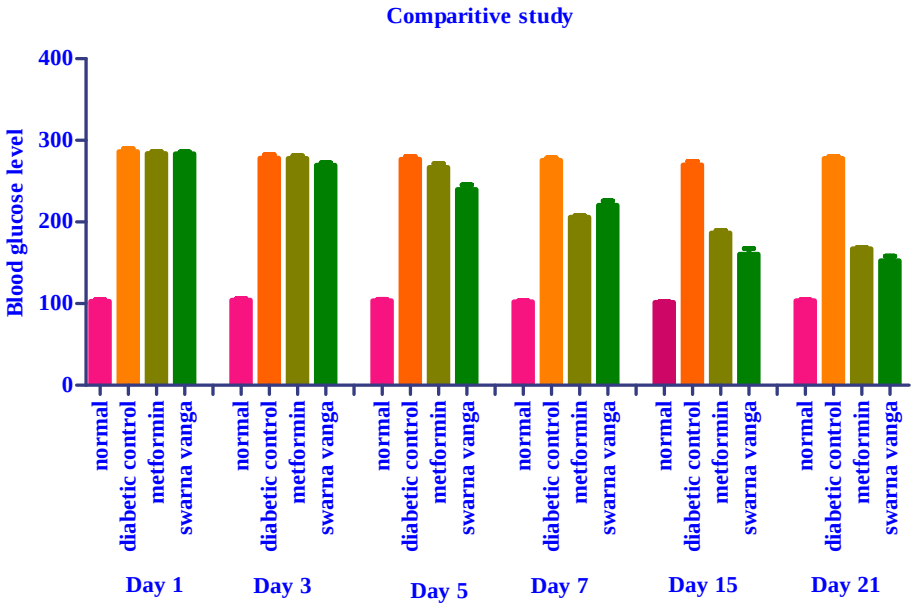
RESULTS

Blood glucose levels were estimated on 1st, 3rd, 5th, 7th, 15th and 21st day of drug administration. Values are expressed in MEAN ± SE and analyzed by using one-way ANOVA Test followed by Dunnet't' test.

Table No. Results of the blood glucose level of complete animal experiment.

Day / Group	Normal	Diabetic Control	Metformin	*Swarnavanga*
Day 1	102.77 ± 2.20	286.10±3.72	283.75±2.52	283.62±2.26
Day 3	104.15± 2.08	278.33±4.01	277.72±3.53	269.55±3.07
Day 5	103.40± 1.63	276.76±3.40	266.75±4.75	239.75±5.74
Day 7	102.22± 1.37	275.46±2.93	205.67±2.00	220.47±5.33
Day 15	101.65± 0.96	269.68±4.53	186.46±3.01	160.60±7.06
Day 21	103.35± 1.44	277.74±2.39	167.10±1.81	152.48±5.72

*Results are in terms of mg/dl.



Graph No1: Represents comparative study of Blood Glucose level.

All values of table were presented as a Mean ± SEM, n=6, One Way Analysis of Variance (ANOVA) followed by multiple Dunnett*'s*'- test, by comparing different doses treated groups with that of control group. The minimum value of $p<0.05$ was considered as significant. $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$ as compared with control.

DISCUSSION

Swarnavanga is a Sagandha, Talastha, Bahirdhuma Kupipakwa Rasayana *explained in Rasatarangini* contains *ingredients like Vanga, Parada, Gandhaka and Navasadara.* It is indicated in diseases caused by *Kapha dosha*. It is *Pramehahara, Medohara, Shukrakara, Vrushya* and *Rasayana.*

Experimental evaluation of hypoglycemic activity of *Swarnavanga* in Streptozotocin induced hyperglycemic male wistar rats were carried out. To induce hyperglycemia single dose of 35mg/kg body weight streptozotocin was administered intraperitoneal route. After confirming the diabetic state (≥250 mg/dL) standard and trial drug was administered with calculated dose for 21days. And an assessment criteria blood glucose level was estimated on 1st, 3rd, 5th, 7th, 15th and 21st day.

Diabetic control group showed persistent hyperglycemia throughout the 21-day observation period. Whereas metformin group and Swarnavanga group demonstrated the progressive decline in glucose levels from Day 7 onwards.

One-way ANOVA analysis followed by Dunnett's t-test revealed statistically significant differences between treatment groups ($p<0.05$). The progressive decrease in glucose levels from Day 7 onwards in both treatment

groups, suggests dose-dependent and time-dependent therapeutic responses. The statistical significance was maintained throughout the treatment period confirms the sustained efficacy of both interventions.

PROBABLE MODE OF ACTION OF SWARNAVANGA

STZ produces selective pancreatic β-cell injuryvia various mechanisms like DNA alkylation, nitric oxide production and marked oxidative stress, culminating in mitochondrial dysfunction and both necrotic and apoptotic β-cell death. Therefore, therapeutic benefit is explained by mechanisms that

- Protect residual β cells from oxidative injury or promote their regeneration.
- Augment insulin secretion from surviving β cells, and/or
- Improve peripheral glucose utilization and hepatic glucose handling.

Swarnavanga has *Agni deepana* action, it stimulates *Jatharagni*, digestive fire may resulting in improving glucose metabolism. *Dhatvagnivruddhi* may strengthens tissue-level metabolism, particularly improving pancreatic function and insulin production capacity.

Rasayana, Vrushya and *ojovruddhikara* action improves nutrient absorption and cellular nourishment, may supporting in pancreatic beta-cell regeneration.

Swarnavanga possesses *Tikta, Lavana* and *Amla rasa, Sheeta, Sara*, and *Rukshaguna*, actions like *Medohara, Shleshmaamayaghna, Agni pradeepaka, Rasayana, Vrushya, Mehahara. Dushita Kapha, abaddha meda* and *vikrutakleda*are the main *nidana* in causation of *Prameha, Ruksha, Medohara, Kaphahara* action are helpful in *Sampraptivighatana* of *prameha*. And there will be *dhatu shaitilyata*in *prameha* may addressed by the *Rasayana, Vrushya* and *ojovruddhikara* action of the *Swarnavanga*.

CONCLUSION

The pharmacological study using Streptozotocin-induced diabetic male Wistar rats demonstrated absence of significant difference between *Swarnavanga* and metformin groups confirms therapeutic equivalence of standard and test drug. But *Swarnavanga Rasayana* property may suggest its benefit in preventing diabetic complications, improving overall metabolic health and enhancing quality of life in diabetic patients.

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