# Comparison between S-Allyl Cysteine and Gliclazide in Lowering the Blood Glucose Levels in Diabetic Rats

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## ABSTRACT

**BACKGROUND:** Diabetes Mellitus is a global problem caused by the deficiency of Insulin secretion either absolute or relative. Treatment options are Insulin and oral glucose lowering drugs. Current study was designed to find out the glucose lowering properties of S-allylcysteine a garlic derivative sulfur containing amino acid.
**OBJECTIVE:** To compare blood glucose lowering effects of S-allylcysteine with gliclazide in diabetic rat model.
**STUDY DESIGN, PLACE AND DURATION:** This 3 months animal study was carried out in animal house of ISRA University Hyderabad from August 2014 to Oct 2014.
**MATERIAL AND METHODS:** 32 Male Wistar Rats were randomly divided into 4 equal groups A, B, C and D after selection through non-probability purposive sampling. Group A and B served as positive and negative controls respectively. Diabetes was induced in Group B, C and D by injecting alloxan at the dose of 120 mg/kg according to the weight of rats. Rats in group C and D were treated with S-allylcysteine (150 mg/kg), gliclazide (5 mg/kg) respectively. Random blood sugar levels of all groups were measured after weeks 1, 2 & 3. The data was analyzed by SPSS version 21.0.
**RESULTS:** Blood glucose levels after $2^{nd}$ and $3^{rd}$ week were 264.3 ± 43.16 vs. 218.75 ± 36.38 (p=0.0001) for SAC and 229.0 ± 89.87 vs. 241.0 ± 48.19 mg/dl for Gliclazide (p=0.001) while at the end of $3^{rd}$ week results for two control groups were non-significant statistically (p-0.07 and0.09).
**CONCLUSION:** It is concluded that S-allylcysteine possess blood glucose lowering properties that are comparable to gliclazide.

**KEY WORDS:** Alloxan, S-allylcysteine, Gliclazide, Random blood sugar.

## INTRODUCTION

Diabetes Mellitus is an endocrine disorder characterized by hyperglycemia due to partial or complete inability of the body to produce insulin. Persistently raised glucose levels affect almost every organ of the body from eyes, brain, heart, kidneys, Muscles and skin. All age groups are equally affected by this disorder resulting into disturbance of the whole society. Complications of Diabetes are micro and macrovascular; affecting all major organs of the body which include retinopathy, nephropathy, cardiomyopathy and peripheral neuropathy which may be delayed by better glycemic control. The incidence of DM is increasing in world, in USA it affects 25.8 million people, Globally 347 million people are suffering from this disease[1]. According to American Diabetes Association, diabetes is divided into four types: 1) Type 1 Diabetes Mellitus, 2) Type 2 Diabetes, 3) Gestational Diabetes and 4)

Diabetes of genetic origin or drug induced diabetes. Diabetes is the $5^{th}$ leading cause of mortality throughout the world[2]. Most common form of this disorder is type-1diabetes commonly known as insulin dependent diabetes[3]. Type-2 Diabetes is associated with insulin resistance at receptor level so this form best responds to insulin sensitizers. Drugs used for the treatment of diabetes are Insulin, and Oral hypoglycemic agents; both are sub categorized into different groups. Currently available oral agents are sulfonylureas, α-glucosidase inhibitors, bigunides, meglitinides, thiazolidinediones and Dipeptidyl peptidase-4 inhibitors[4]. Oral agents either increase the pancreatic secretion of insulin (secretogoge) or increase the receptor sensitization for the insulin (sensitizers). Gliclazide belong to sulfonylureas group of antidiabetic drugs which are secretogoges in their nature mainly but some sensitizing properties are also documented. Approximately 25% - 30% type-2Diabetic patients do not respond to

oral agents (Primary failures) while 5% patient from those who initially responded become nonresponsive to these agents (Secondary failures)[4]. Apart from this the available drugs have many side effects on human body. Continuous efforts are being made by the scientists to discover new agents for the solution of this global issue. Plants were used as medicine and source of medicine in ancient times. S-allylcysteine is an amino acid derived from Garlic that is used since more than thousands of years[5]. Some anticancer drugs are also derived from the garlic. Garlic was previously studied and found beneficial in many diseases processes. We aimed to study the potential effects of the garlic derivative on blood glucose by artificially inducing the hyperglycemia through alloxan administration[6]. We hypothesized that S-allylcysteine has glucose lowering effects comparable to Gliclazide.

## METHODOLOGY

### Study design, place and duration
This experimental study was conducted in animal house, Isra Postgraduate laboratory and department of pharmacology of ISRA University Hyderabad, for a period of 3 months from August 2014 to Oct 2014.

### Ethical Approval
Ethical review committee approved this experimental work in ISRA University Hyderabad and the research work involved Animal house of ISRA University.

### Sampling Technique:
Animals were selected through non-probability purposive sampling.

### Animal Selection and Grouping of Animals
32 healthy male wistar rats with average body weight of not more than 200 grams were purchased from Karachi. Rats were divided into 4 equal groups with alphabet letters A, B, C and D. Each group contained 8 rats separately kept in cages for acclimatization for 2 weeks. Group A was kept as positive control (Non-Diabetic control) and group B was considered as negative control (Diabetic control)

### Animal diet, Induction of hyperglycemia and drug administration
All groups were fed with same normal laboratory diet orally as well as drinking water was made available with full access. Groups B, C and D were given alloxan by intraperitoneal route at a dose of 120 mg/kg to induce hyperglycemia for 10 days[6]. Alloxan destroys most of the beta cells of the pancreas but few may remain functional; therefore oral hypoglycemic drugs were given to observe the restoration of the function of these remaining cells. Group C was given S-allylcysteine with dose regimen of 150 mg/kg and

group D was administered Gliclazide 5 mg/kg body weight for 3 weeks.

### Blood Sampling and Chemical Analysis
After 1 week of induction of hyperglycemia, 1st blood samples from all rats were drawn from the tails of the rats, 2nd sample was taken after 2 weeks while 3rd and last sample was taken after 3 weeks of induced diabetes. All antiseptic measures were strictly observed while collecting the blood samples. All international protocols of animal sample collection were followed accordingly. Chemical analysis for random blood sugar was done in ISRA University postgraduate laboratory.

### Statistical Analysis
SPSS (Statistical package for social sciences) Version 21 was used for data analysis. Means of Random blood sugar at 1st, 2nd & 3rd week from all groups A, B, C, D. All groups were checked 3 times to observe any fluctuation in glucose readings, mean results were compared using T-test. Significance level was kept as a P-Value<0.05.

## RESULTS

Results showed a significant reduction in blood glucose levels in group C at 2 weeks and 3 weeks interval of treatment with S-allylcysteine P-value 0.0001 while group D also had significant reduction with p-value 0.001 These results were comparable with Gliclazide at both intervals. There was no significant change in the positive (group A) and negative controls (group B), as both were kept medicine free p-value 0.07 and 0.09 respectively showing the uniformity of data.

**TABLE I: RESULTS SHOWING CHANGES IN RANDOM BLOOD SUGAR (RBS) AFTER 01, 02 AND 03 WEEKS OF THE EXPERIMENT**

| Groups | RBS after 1 week | RBS after 2 week | RBS after 3 week | P-Value* |
|---|---|---|---|---|
| (A) Control | 148.2±12.9 | 143.5±13.19 | 148.25±12.98 | 0.07 |
| (B) –ve Control | 412.1±61.0 | 347.1±73.46 | 412.12±61.02 | 0.09 |
| (C) S-allylsysteine | 300.2±81.3 | 264.3±43.16 | 218.75±36.38 | 0.0001 |
| (D) Gliclazide | 268.1±86.5 | 229.0±89.87 | 241.0±48.19 | 0.001 |

*Student t test*

## DISCUSSION

Results of our study were in accordance with the results of Ganapathy S who concluded the glucose lowering effects of S-allylcysteine in streptomycin

**Mashkoor Ahmed Ansari, Quamar Zaman Phull, Ashique Ali Arain, Abdul Rahim Memon, Sadia Kazi, Palwasha Abbasi**

induced hyperglycemic rat model[8]. Similar results were reported by Saravanan G who also declared S-allylcysteine as a hypoglycemic agent[5]. Results of Study by Ganapaty S on 24 rats were comparable with our study who observed hypoglycemic effects of S-allylcysteine on Streptozotocin induced diabetic rats[8]. Garlic has many important advantages like lowering of cholesterol and decreasing the platelet aggregation. Current study proved that garlic has strong impact on blood glucose control. Good glycemic control can reduce morbidity and mortality in diabetic patients[9]. Although the mechanism behind these effects is still unclear the use of garlic and its derivatives is beneficial for the human being as it is an important part of the human diet in different form including prickles, jams and sauce. Nutritional balance has positive impact on glucose homeostasis[10]. Normal values for RBS in group A were proving the pre-study glycemic status of the rats while constantly raised sugar levels in group B were evident for the effectiveness of alloxan administration for induction of hyperglycemia. Group D initially responded well to the traditional hypoglycemic agent gliclazide but the raised level of RBS at the end of 3rd week was witnessing the secondary treatment failure. We studied only S-allylcysteine however many other plants have hypoglycemic properties[11]. Natarajn. A et al studied the effect of extract of Catharanthus roseus[12]. El- Shamy explored the antidiabetic effects of Nigella sativa on diabetic patients[13]. Our study was of shorter duration so we could not check the HbA1c levels, a better predictor of glycemic control. Similarly serum insulin levels remain deficient in our current study.

## CONCLUSION

S-allylcysteine has strong hypoglycemic effects as compared to gliclazide on chronic use.

## RECOMMENDATIONS

Human studies are recommended on diabetic patients using garlic extract or S-allylcysteine as adjuvant therapy to document its role in actual disease condition.
Studies of longer duration observing changes in HbA1C and insulin levels are also recommended.

## ACKNOWLEDGEMENTS

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