
Research Article

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# THE EFFECT OF AQUEOUS EXTRACT OF *Gymnema Sylvestre* ON BLOOD SUGAR LEVEL OF ALLOXAN-INDUCED DIABETIC ALBINO RATS (*Rattus Norvergicus*)

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**ABSTRACT:**

This work was carried out to determine the anti-diabetic effect of aqueous extract of Gymnema sylvestre on the blood sugar level of alloxan-induced diabetic rats. 25 experimental animals used were divided into five groups each containing five rats. Group 1 served as control rats fed with normal diet, group 2 served as control rats + extract (CE), i.e. non diabetic rats fed with extract, group 3 served as Alloxan-induced rats +extract (IE), i.e. diabetic treated with extract, group 4 served as Alloxan-induced rats + drug (ID), diabetic rats treated with synthetic drug, Glibenclimide and group 5 served as Alloxan-induced diabetic rats + normal diet, i.e. diabetic rats fed with normal diet. 250mg per kg body weight of aqueous extract of Gymnema sylvestre and 125mg per kg body weight of glibenclimide was administered to rats in groups, IE, CE and ID respectively for 28 days. On a daily basis, the blood sugar level of the animals was checked. The result of the blood sugar level is presented in this work as "average blood sugar level per week". The findings from this work revealed that, diabetic rats treated with aqueous extract of Gymnema sylvestre had a significant drop in blood sugar level. Diabetic rats treated with the synthetic drug also had a drop in blood sugar level, but not as fast as that of the extract. The non diabetic rats treated with aqueous extract of Gymnema sylvestre maintained normal blood sugar level, possibly because the pancreatic beta-cells were not impaired.

**KEYWORDS:**

Gymnema sylvestre, Type 2 diabetes, Alloxan, Glibenclimide

## INTRODUCTION

Diabetes is a complex group of diseases with a variety of causes. Diabetes mellitus is a leading cause of morbidity and mortality worldwide with an estimated 80% of the world population with diabetes living in developing countries (Wild *et al.*; 2004). It is epidemic diseases which can lead to severe chronic complication most patients with the disease have type 2 diabetes. The prevalence of the type 2 disease is rising at an alarming rate throughout the world, due to increase in life expectancy, obesity and sedentary lifestyles. Of particular cause for concern is the dramatic rise of type 2 diabetes in children and adolescents (IDF, 2005). The causes of type 2 diabetes are multi-factional and diet plays important roles on its incidence, seventy and management (ADA, 2007), hence, studies have frequently focused on dietary components beneficial in the prevention and treatment of diabetes. Recent studies have demonstration that herbal products have beneficial effects in the prevention and treatment of diabetes. Recent studies have demonstrate that herbal products have beneficial effects in patients with diabetes by improving glucose and lipid metabolism, anti oxidants status and capillary function (Bailey & Day, 1989). The plant (*Gymnema sylvestre)* is one of such a dietary component that has shown to have biologically active substances with insulin mimetic properties. Experimental induction of diabetes models is essential for the advancement of our knowledge and understanding of the various aspects of its pathogenesis and ultimately funding new therapies and cure (Mahmoud, 2009).

## MATERIALS AND METHOD

### MATERIALS

#### Animals

25 experimental animals used for this study weighing 80-120g and of 6 weeks old were obtained from the Animal house of the Salem University, Lokoja, Kogi State,Nigeria.

#### Plant used

Leaves and stems of the plant *Gymnema sylvestre* were harvested from a botanical garden at Ajaokuta, Kogi State, Nigeria, and were properly identified. The barks were removed from the roots and macerated into tiny pieces, air dried at ambient temperature and pulverized into powdered form and stored in air tight containers.

#### Chemicals/reagents

All chemicals used in this study were of analytical grade and products of Merck, Germany; BOH Chemicals LTD, England. Reagents used for all assays were commercial kits and products of Merck, Germany; BOH Chemicals LTD, England. They include; 2% HCl, Dragen droff's reagent, Meyers reagent, Wagners reagent, dilute sulphuric acid, potassium hydroxide, olive oil, ethanol, ethyl acetate, ammonia, acetone, millions reagent, Molisch's reagent, choloroform, Alloxan, Glibenclimide (synthetic drug).

#### Induction of experimental animals (albino rats) with alloxan and grouping of the animals

The animals were allowed to acclimatize for a period of two weeks by keeping them in a cage of 5 rats each. They were fed with grower poultry feed. The animals adjusted well to captivity and gained weight. After acclimatization, 15 of the 25 animals were induced to have diabetes using alloxan.

### Preparation of Alloxan and Induction

60mg of Alloxan was dissolved in 2mls of normal saline and administered to rats per kg body weight. The induction was done intraperitonially.

### Grouping of experimental animals

**Group 1:** This group served as the standard control (non-diabetic). The rats were fed with normal diet only.

**Group 2:** This group served as control rats (non-diabetic) administered with *Gymnema sylveste* extract.

**Group 3:** This group served as Alloxan-induced diabetic rats treated with *Gymnema sylveste* extract.

**Group 4:** This group served as Alloxan-induced diabetic rates treated with the synthetic drug Glibenclimide.

**Group 5:** This group served as Alloxan-induced diabetic rats, but not treated.

### Administration of *Gymnema sylvestre* extract/Glibenclimide

250mg of *Gymnema sylvestre* extract was dissolved in 5mls of distilled water and allowed to stand for a day and administered to the rats based on kg body weight orally.
125mg of Glibenclimide was made into powder and dissolved in 5mls of distilled water and administered based on kg body weight.

### Checking of blood glucose level

The rats' blood glucose level was checked using an Accu-check active glucometer, with its comfort curve test strip. This was done by:

1. Swaping the tail of rat on the spot to be pierced with cotton wool moistened with methylated spirit to prevent alteration of result.
2. Piercing the swapped area with a lancet.
3. Put a drop of the blood on the appropriate area on the strip already inserted in the glucometer.
4. Wait for few seconds for result.

The normal range for fasting blood glucose = 70-120mg/dl.
Blood glucose level termed diabetic = above 120.

## RESULTS

### Physical observation of the experimental animals

Changes on general behaviour, body weight, loss of appetite, frequent urination were very important for evaluation of the effect of these compounds (Alloxan, *Gymnema sylvestre* dry powder, and Glibenclimide) on experimental animals in the course of the research.

Animals in the control group were active and normal; there was increase in body weight, and no loss of appetite.
Animals in the group, control + extract had a reduced body weight.
Animals in the group, induced rats + extract were not active for some period of days; they had loss of appetite and loss of weight. After continued administration of *G. sylvestre* dry powder, they became active, regained appetite, but still experienced loss of weight.
Animals in the group, induced + drug were not active; they had weight loss and loss of appetite. After continued administration of drug (glibenclimide), the rats gradually became active; regained appetite and gained weight.
Animals in the group, induced + normal diet were sluggish; they had loss of appetite, loss of weight and even death. As time went on, the remaining rats gradually became active.

### Results for average blood sugar level after daily administration with *Gymnema sylvestre* extract, Glibenclimide and normal diet for 28 days

***Table 1:*** **The average results of blood sugar levels for week 1, week 2, week 3, and week 4 are given in the table below:**

| GROUP | | NC mg/dl | IE mg/dl | CE mg/dl | ID mg/dl | IN mg/dl |
|---|---|---|---|---|---|---|
| WEEK 1 | 1 | 90 | 167 | 82 | 122 | 143 |
| | 2 | 72 | 182 | 87 | 138 | 162 |
| | 3 | 75 | 168 | 92 | 153 | 139 |
| | 4 | 103 | 160 | 108 | 148 | 136 |
| | 5 | 78 | 170 | 93 | 134 | 189 |
| WEEK 2 | 1 | 88 | 120 | 70 | 102 | 138 |
| | 2 | 74 | 132 | 68 | 120 | 158 |
| | 3 | 72 | 110 | 74 | 136 | 139 |
| | 4 | 105 | 122 | 70 | 118 | 132 |
| | 5 | 79 | 133 | 88 | 116 | 0 |
| WEEK 3 | 1 | 90 | 92 | 74 | 87 | 130 |
| | 2 | 74 | 94 | 70 | 111 | 154 |
| | 3 | 73 | 90 | 69 | 115 | 136 |
| | 4 | 102 | 89 | 74 | 94 | 126 |
| | 5 | 79 | 98 | 72 | 87 | 126 |
| WEEK 4 | 1 | 89 | 86 | 67 | 68 | 129 |
| | 2 | 73 | 87 | 68 | 91 | 152 |
| | 3 | 70 | 87 | 69 | 91 | 132 |
| | 4 | 103 | 70 | 71 | 84 | 116 |
| | 5 | 78 | 91 | 74 | 77 | 0 |
| **MEAN** | | **83.26316** | **120.9479** | **77.68421** | **115.1579** | **127.6667** |

**KEY**

**NC**- control rats fed with normal diet
**CE**- control rats administered with *G.sylvestre* extract
**IE**-Alloxan-induced diabetic rats administered with *G.sylvestre* extract
**ID**- Alloxan-induced diabetic rats administered with synthetic drug, glibenclimide
**IN**-Alloxan-induced diabetic rats administered with normal diet

The results of blood sugar levels obtained was based on the repeated administration of aqueous extract *G. sylvestre,* glibenclimide and normal diet which lasted for 28 days (4 weeks).

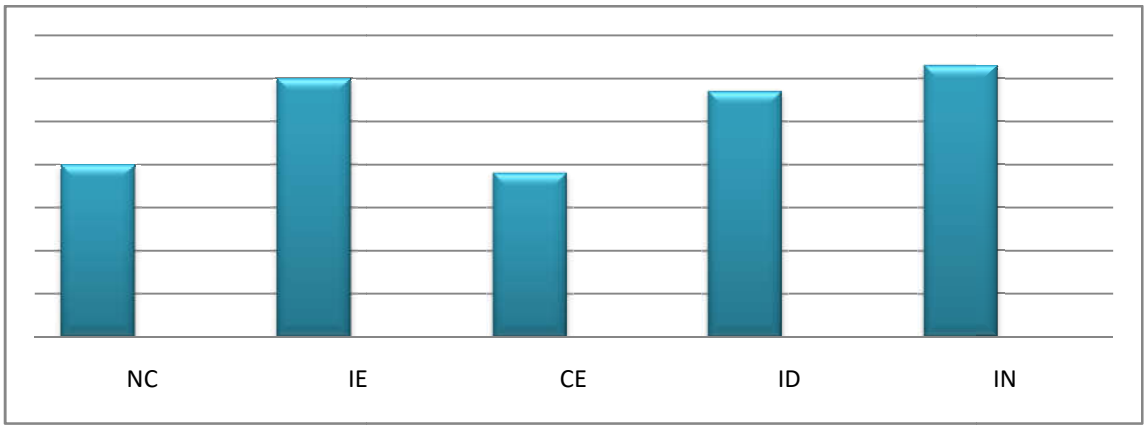


**Figure 1: Histogram showing result for the mean blood sugar level of all groups of animals**

## Result for the effect of *Gymnema sylvestre* and Glibenclimide administered over a period of 4 weeks

***Table 2:*** **Result for mean blood sugar level of animals administered with *Gymnema sylvestre* & glibenclimide**

| | IE WEEK 1 | ID WEEK 1 | IE WEEK 2 | ID WEEK 2 | IE WEEK 2 | ID WEEK 3 | IE WEEK 4 | ID WEEK 4 |
|---|---|---|---|---|---|---|---|---|
| 1 | 167 | 122 | 120 | 102 | 92 | 87 | 86 | 68 |
| 2 | 182 | 138 | 132 | 120 | 94 | 111 | 87 | 91 |
| 3 | 168 | 153 | 110 | 136 | 90 | 115 | 87 | 91 |
| 4 | 160 | 148 | 122 | 118 | 89 | 94 | 70 | 84 |
| 5 | 170 | 134 | 133 | 116 | 98 | 87 | 91 | 77 |
| **MEAN** | 169.4 | 139 | 123.4 | 118.4 | 92.6 | 98.8 | 84.2 | 82.2 |

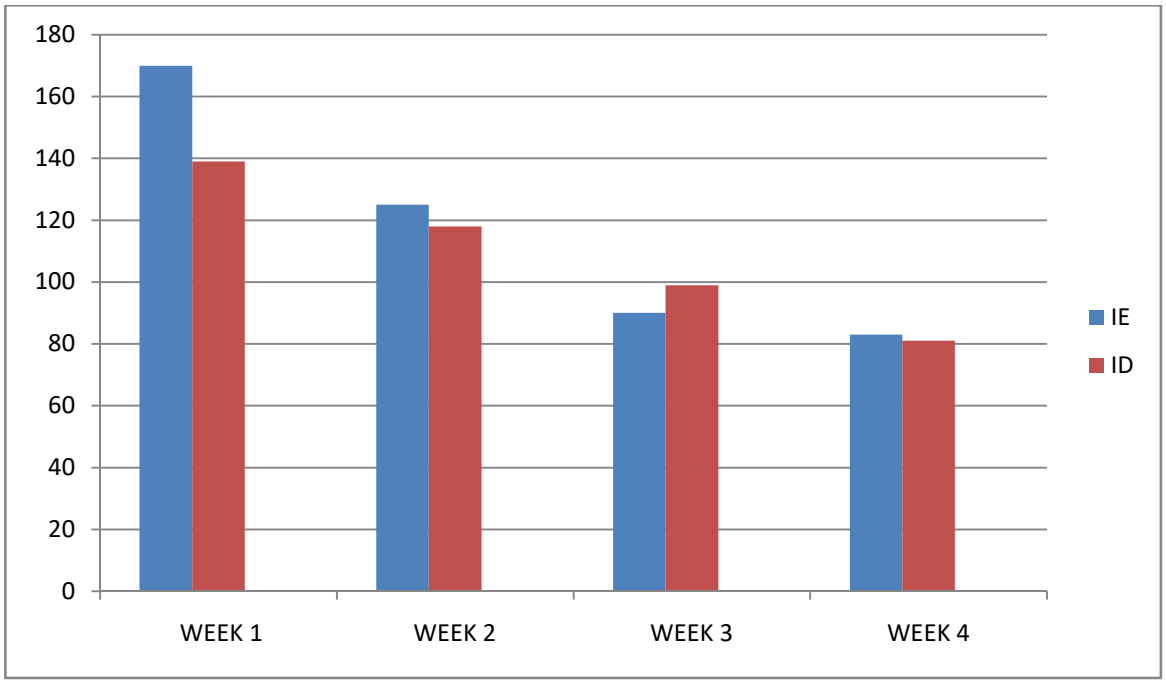


**Figure 2:** Effect of aqueous extract of *Gymnema sylvestre* and Glibenclimide on blood sugar level of the animals for 4 weeks.

## DISCUSSION

Carbohydrates, particularly glucose, are an important source of fuel for living organism. Glucose is a major energy source for all cells, and some tissues (e.g., brain) need a continuous delivery of glucose. Maintenance of serum glucose concentrations within a normal physiological range, critical to the maintenance of normal fuel use, is primarily accomplished by two pancreatic hormones, insulin and glucagon (Craig and Stitzel, 1997). Derangements of glucagon or insulin regulation can result in hyperglycemia or hypoglycemia, respectively. Glucose penetrates most tissues slowly unless insulin is present to facilitate its uptake; however, central nervous system (CNS) cells, capillary endothelial cells, gastrointestinal epithelial cells, pancreatic cells, and renal medullary cells are freely permeable to glucose.

The endocrine portion of the pancreas, called the islets of Langerhans, consists of cord-like groups of cells arranged along pancreatic capillary channels. Two major types of secretary cells exist within the islets: alpha-cells, which produce glucagon; and beta-cells, which produce insulin. These pancreatic cells monitor changes in the availability of small calorgenic molecules, namely glucose, and to a lesser extent amino acids, ketone bodies, and fatty acids. Pancreatic beta-cells appropriately alter their rates of insulin secretion in response to fluctuations in the levels of these calorigenic molecules, with glucose playing the dominant role in regulation of insulin secretion. Glucagon and insulin are the two most important hormones that maintain glucose homeostasis when blood concentrations are perturbed (Craig and Stitzel, 1997).

The number of functionally intact β-cells in the islet organ is of decisive importance for the development course and outcome of diabetes mellitus (Nagappa *et al*., 2003).

The results as shown in fig. 2 revealed a significant decrease of the blood sugar level when administered with both *Gymnema sylvestre* extract and Glibenclimide.

From this research, it can be said that the plant *Gymnema sylvestre* has an important place among antidiabetic herbs because of its ability to boost insulin level. The possible mechanisms by which the *Gymnema sylvestre* exert its hypoglycemic or antihyperglycemic effects are:

- It increases secretion of insulin (Nwaoguikpe, 2010)
- It promotes regeneration of islet cells
- It increases the utilization of glucose: it increase the activities of enzymes responsible for utilization of glucose by insulin-dependent pathways, an increase in phosphorylase activity, decrease in gluconeogenic enzymes and sorbitol dehydrogenase (Asare-Anane, *et al*., 2005).
- It causes inhibition of glucose absorption from intestine, the exact action being unknown. It could be involved in one or more mechanisms. (Sugihara, *et al*., 2000).

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