

---

## Effect Of *Allium Cepa* On Blood Glucose Levels Of Normal And Alloxan Treated Diabetic Rabbits

Noreen Wadood,\* M.Sc.  
and  
Abdul Wadood,\*\* M.B.,B.S.,  
M. Phil.,  
Khyber Medical College,  
Peshawar, Pakistan.

### Summary

*The aqueous solution of dried powder of the Allium cepa was administered in doses of 100, 150 and 200 mg/kg body weight to normal and alloxan treated diabetic rabbits. The blood glucose levels were estimated before and 2,4,6 and 8 hours after the administration of the solution. The solution exerted a significant ( $p < 0.05$ ) hypoglycaemic effect in both normal and diabetic rabbits. In normal rabbits, oral administration of 150 and 200 mg/kg doses caused decrease in blood glucose levels at 2,4,6 and 8 hours, while maximum decrease was at 6 hours. In the alloxan treated diabetic rabbits, 200 mg/kg dose only could produce significant decrease at 4,6 and 8 hours, while maximum decrease was at 6 hours. The doses used did not show acute toxicity or behavioural changes. It may be concluded that the plant contains one or more hypoglycaemic principles which can reduce the blood glucose in normal rabbits and in those with alloxan induced diabetes.*

### Introduction

*Allium cepa* is a bulbous herb belonging to the family Liliaceae. The bulb contains a volatile oil used as stimulant, diuretic and expectorant, and used in curries as carminative. It is commonly known as piyaz and is claimed to have anti-diabetic activity by Unani stem of medicine<sup>1-3</sup>.

---

\* Research Officer;

\*\* Associate Professor,

Department of Pharmacology, Khyber Medical College.

---

The present work was undertaken with the aim to study the effect of aqueous solution of dried, powdered *Allium cepa* on the blood glucose levels of normal and alloxan treated diabetic rabbits. Acute toxicity and behavioural changes were also studied to check the safety of these doses.

### **Material and Methods**

**Animals:** Experiments were performed on male, adult rabbits of a local strain weighting 0.46 to 1.69 kg. They were fed on green vegetables and grain and allowed tap water ad libitum. The effects of the solution of *Allium cepa* were studied on blood glucose levels of normal rabbits. Similarly separate experiments were performed to study the effects on blood glucose levels of the diabetic rabbits.

**Chemicals:** Alloxan monohydrate was supplied by B.D.H. Laboratories (Chemical Division), Poole England. O-toluidine, glacial acetic acid, thiourea and trichloroacetic acid were obtained from E. Merck, Darmstadt, West Germany.

**Preparation of Plant Material:** The fresh bulbs of *Allium cepa* were carefully washed with tap water and dried under shade. Dried bulbs were crushed into powder and stored in refrigerator.

**Preparation of Diabetic Rabbits:** The method described by Akhtar and Ali<sup>4</sup> was adopted. A group of rabbits was made diabetic by injecting intravenously 150 mg/kg body weight of Alloxan monohydrate. Eight days after injection the blood glucose levels of the surviving rabbits were estimated. Rabbits with blood glucose levels above 200mg/100ml were considered as diabetic.

### **Grouping of Rabbits**

Normal rabbits were divided into five groups of six animals each. Group I served as control and received 15ml of 2% gum tragacanth solution. Group 2 received tolbutamide 500 mg/kg body weight. Group 3 - 5 received dried powder of *Allium cepa* dissolved in 15ml of 2% gum tragacanth in doses of 100 mg/kg, 150 mg/kg and 200 mg/kg respectively. The diabetic rabbits were also divided in 5 groups on the same pattern.

### **Preparation and Administration of Plant Solution**

The amount of powdered *Allium cepa* required for each rabbit was calculated on body weight basis and dissolved in 10 ml of 2% gum tragacanth solution and final volume made upto 15ml. The solution was administered to each rabbit by using a stomach tube attached to a standard syringe containing 15 ml of the solution. The tube was inserted into the stomach through oesophagus and the plunger was pressed slowly and steadily. Immediate sneezing and coughing indicated injection into the lung and in such condition the tube was at once withdrawn and another animal was taken instead. The tolbutamide solution was administered in a similar manner.

### **Collection of Blood**

The procedure for collection of blood was adopted as described by Akhter<sup>5</sup>. The rabbit was held in a wooden rabbit holder and immediate before administration of solution, 0.2ml of blood for glucose estimation was collected from an ear-vein. Similar blood samples were collected at 2,4,6 and 8 hours after the administration of the solution. After collection of blood the pricked site of the ear was rubbed with cotton wool soaked with 70% alcohol to protect the rabbit against infection.

### **Blood Glucose Estimation**

Blood glucose estimation was done by the method of Winckers and Jacobs<sup>6</sup>.

### **Studies on Acute Toxicity of the Solutions**

The possible toxic effects of the powdered *Allium cepa* were studied on the rabbits of local strain weighing 0.56-1.74 kg. The rabbits were divided into 4 groups ( 1-4 ) of six animals each. Group I served as control and received 15 ml of 2% gum tragacanth solution. Group 2,4 received powdered *Allium cepa* dissolved in 15 ml of 2% gum tragacanth solution in doses of 100 mg/kg, 150 mg/kg and 200mg/kg respectively. Animals were observed for 24 hours after the administration of the plant suspension to check toxic symptoms. They were kept under observation for 7 days.

---

## Results

The effects of different doses of *Allium cepa* and tolbutamide on blood glucose levels of normal and alloxan diabetic rabbits are shown in Table I and II. The observations show that gum tragacanth used as control in these experiments did not produce any significant change on blood glucose levels of normal as well as alloxan treated diabetic rabbits.

### 1. Effect of *Allium cepa* on blood glucose levels in normal rabbits.

Administration of 100mg/kg of *Allium cepa* produced a non-significant ( $P > 0.05$ ) decrease in blood glucose levels at 2,4,6 and 8 hours. The animals treated with 150mg/kg *Allium cepa* showed a non-significant ( $P > 0.05$ ) decrease in blood glucose levels at 2 and 4 hours, but there was a significant ( $P < 0.05$ ) decrease at 6 and 8 hours. The blood glucose levels of rabbits treated with 200mg/kg *Allium cepa* produced a significant ( $P < 0.05$ ) decrease at 2,4,6 and 8 hours.

### 2. Effect of Tolbutamide on blood glucose levels in normal rabbits.

The animals treated with tolbutamide (500mg/kg) showed a significant ( $P < 0.05$ ) decrease in blood glucose levels at 2,4,6 and 8 hours.

### 3. Effect of *Allium cepa* on blood glucose levels in diabetic rabbits.

Administration of 100mg/kg of *Allium cepa* produced a non-significant ( $P > 0.05$ ) decrease at 2,4,6 and 8 hours. Similarly, administration of 150mg/kg of *Allium cepa* also produced a non-significant ( $P > 0.05$ ) decrease at 2,4,6 and 8 hours.

However, the blood glucose levels of rabbits treated with 200mg/kg *Allium cepa* produced a significant ( $P < 0.05$ ) decrease at 2,4,6 and 8 hours.

### 4. Effect of Tolbutamide on blood glucose levels in diabetic rabbits.

Administration of tolbutamide (500mg/kg) produced a non-significant ( $P > 0.05$ ) decrease in blood glucose levels at 2,4,6 and 8 hours.

TABLE-I  
EFFECT OF ALLIUM CEPA AND TOLBUTAMIDE ON  
BLOOD GLUCOSE LEVELS OF NORMAL RABBITS.

Time Interval Hours	Blood Glucose in mg/dl				
	Control	Tolbutamide (500mg/kg)	100mg/kg	Allium cepa 150mg/kg	200mg/kg
0	88.30±6.2 (6)	103.7±1.2 (6)	84.16±2.3 (6)	85.61±1.21 (6)	90.17±1.75 (6)
2	86.62±7.8 (6)	89.6±1.5 (6)	82.3±1.2 (6)	82.72±1.50 (6)	78.16±2.3* (6)
4	79.21±4.6 (6)	75.4±0.81* (6)	80.4±0.82 (6)	80.51±1.28 (6)	72.72±1.50* (6)
6	78.42±3.4 (6)	78.8±2.2* (6)	79.0±1.7 (6)	76.34±1.32* (6)	68.74±0.81* (6)
8	80.21±2.7 (6)	80.9±0.65* (6)	80.5±2.4 (6)	77.6±2.2* (6)	70.62±0.7* (6)

Figures in parenthesis indicate number of animals.

Each value represents the mean ± standard error.

\*Significant decrease as compared to zero hour level (P 0.05).

All other values Non-significant (P 0.05) from zero level.

TABLE-II  
EFFECTS OF ALLIUM CEPA AND TOLBUTAMIDE ON BLOOD  
GLUCOSE LEVELS OF ALLOXAN - DIABETIC RABBITS.

Time Interval (Hours)	Blood glucose in mg/dl				
	Control	Tolbutamide 500mg/kg	Allium cepa 100mg/kg	Allium cepa 150mg/kg	Allium cepa 200mg/kg
0	424.42±7.4 (6)	445.1±3.6 (6)	414.81±4.31 (6)	419.65±6.7 (6)	418.83±5.2 (6)
2	421.1±6.82 (6)	444.0±4.1 (6)	416.62±5.21 (6)	417.41±5.3 (6)	395.71±4.5* (6)
4	422.51±5.7 (6)	443.6±5.2 (6)	417.41±3.5 (6)	415.61±3.4 (6)	390.61±6.1* (6)
6	421.60±4.3 (6)	443.0±3.1 (6)	412.45±7.6 (6)	414.22±7.3 (6)	383.72±7.3* (6)
8	418.7±3.7 (6)	442.5±7.3 (6)	415.51±6.4 (6)	415.0±4.8 (6)	388.61±6.2* (6)

Figures in parenthesis indicate number of animals.

Each value represents the mean ± standard error.

\*Significant decrease as compared to zero hour level (P 0.05).

All other values are Non-significant (P 0.05) from zero level.

### **Acute Toxicity Study**

The rabbits receiving 100mg/kg, 150 mg/kg and 200mg/kg of powdered suspension of *Allium cepa* did not show any visible signs of toxicity e.g. excitement, restlessness, respiratory distress, convulsion or coma. Moreover, they remained alive for upto 7 days.

### **Discussion**

The observations show that the gum tragacanth solution used as vehicle in these experiments did not produce any significant change on blood glucose levels of normal as well as on that of alloxan induced diabetic rabbits. This finding is in accordance with the observation of Marquis et al<sup>7</sup> and Akhter et al<sup>8</sup>.

It was also observed that *Allium cepa* suspension produced a significant ( $P < 0.05$ ) hypoglycaemic effect in both normal and alloxan diabetic rabbits. For comparison the effect of the standard hypoglycaemic drug tolbutamide (500 mg/kg) was observed on the blood glucose levels of normal and alloxan treated diabetic rabbits. Tolbutamide produced a significant ( $P < 0.05$ ) hypoglycaemia in normal rabbits but not in alloxan treated rabbits. This finding is in accordance with the observation of Noreen et al<sup>9</sup> and Akhter et al<sup>5</sup>.

Sulphonylureas including tolbutamide have been reported to produce hypoglycaemia by stimulating pancreatic B. cells to release more insulin into the blood stream, thus increasing glycogen deposition in the liver, causing a reduction of glycogen levels, and having an extra pancreatic effect to possibly increase the number of insulin receptors<sup>10</sup>. These drugs, however, do not cause hypoglycaemia in alloxan diabetic rabbits<sup>11</sup>. Administration of insulin, on the other hand, causes hypoglycaemia in both normal and alloxan treated diabetic rabbits<sup>12</sup>.

The observations also revealed that hypoglycaemic effect of *Allium cepa* was more pronounced in normal rabbits than in alloxan-diabetic rabbits. It can be concluded that *Allium cepa* contains one or more hypoglycaemic principles which have hypoglycaemic activity. These active principles reduce

blood glucose in diabetic rabbits by a direct mechanism similar to insulin. In addition, these active principles reduce blood glucose levels in normal rabbits by an indirect mechanism i.e. by stimulating the secretion of insulin from pancreatic B. cells. A similar mechanism has also been proposed to explain the hypoglycaemic effects of *Ficus glomerata*<sup>13</sup>, *Coccinia indica*<sup>14</sup>, *Momordica charantia*<sup>15</sup>, *Bergenia lingulata*<sup>4</sup>, *Grewia asiatica*<sup>16</sup> and *Gossypium perbaccium*<sup>16</sup>. Further comprehensive pharmacological and chemical investigations are needed to determine the exact mechanism of action of *Allium cepa*. At this stage the only conclusion is that the plant can be effective in the control of diabetes mellitus. Chronic toxicity studies in animals must also be carried out to declare its total safety for prolonged use in human beings. Of course, clinical trials would be needed to further establish its antidiabetic efficacy, its duration of action and various effects on intermediary metabolism in human beings.

#### Acknowledgements

Thanks are due to Mr. Misri Khan (Senior Technician) and Mr. Jamil Khan (technician) for technical help. Authors are also grateful to Mr. Burhan ud Din for typing this manuscript.

#### References

1. Ahmad, Y.S.; (1984): A note on the plants of medicinal value found in Pakistan, Printing Corporation of Pakistan Press, Islamabad, PCPP; 4.
2. Muzaffar; (1986): A.H. Kitabul-Mufrah-e-dat Lahore. Sh. Ghulam Ali; 169.
3. Said; (1970): M. Hamdard's Pharmacopoea of eastern medicine, Karachi, Hamdard National Foundation; 54.
4. Akhter, M.S. and Ali, M.R.; (1984): Study of antidiabetic effect of a compound medicinal plant prescription in normal and diabetic rabbits. J.P.M.A; 239-44,



5. Akhter, M.S., Qaiser, M.K. and Tanweer, K.; (1985): Effect of *Portulaca* (Kulfa) and *Taraxacum officinale* (Dhudhal) in normoglycaemic and alloxan treated hyperglycaemic rabbits. *J.P.M.A.*; 207-10.
6. Winckers and Jacobs; (1980): Blood glucose and its determination. In practical and clinical Biochemistry, 5th ed. London William Heinemann; 396.
7. Marquis, V.O., Andanlow, T.A. and Olaniyi, A.A.; (1977): Effects of foetidin from *Momordica foetida* on blood glucose levels of albino rats. *Planta Med.*; 31: 374-76.
8. Akhter, M.S., Khan, Q.M. and Khaliq, T; (1984): Effect of *Euphorbia Porstrata* and *Fumaria parviflora* in normo-glycaemic and alloxan treated hyperglycaemic rabbits. *Planta Med*, 66: 138-42.
9. Noreen, W., Wadood, A., Hidayat, H.K. and Wahid, S.A.W.; (1988): Effect of *Eribotryia japonica* on blood glucose levels of normal and alloxan diabetic rabbits. *Planta Med*. 3: 196.
10. Karam, J.H.; (1982): Pancreatic hormones and antidiabetic drugs, in *Basic and Clinical Pharmacology* by Bertram G. Katzung, Maruzen, Asian ed. Huntsman, offset Printing Pre. Ltd. Singapore; 458-468.
11. Goth, A.; (1981): Insulin, Glucagen and oral hypoglycaemic agents. Chapter 42 in *Medical Pharmacology*, 10th ed. The C.V. Mosby company, St. Louis, Louis: 1490-1516.
12. Goodman, G. and Gilman, A.; (1985): Insulin and oral hypoglycaemic drugs. Chapter 64 in the *Pharmacological basis of Therapeutics*, 7th ed. Macmillan Publishing Co. Inc. New York: 1490-1516.
13. Oliver, B.B.; (1980): Oral Hypoglycaemic plants in West Africa. *J. Ethnopharmacol*, 2: 11-127.

---

14. Mukherjee, K., Patr, B., Sikder, S. and Dasgupta, S.R.; (1972): Preliminary observation on the Pharmacological properties of a water soluble alkaloid of *Coccinia indica* Linn. *Indian J. Pharmacol*; 4: 114.

15. Akhter, M.S., Ather, M.A. and Yaqoob, M.; (1981): Effect of *Momordica charantia* on blood glucose levels of normal and alloxan diabetic rabbits. *Planta Med.* 42: 205-212.

16. Iftikhar, A.D., Ali, M. and Yaqoob, M.; (1988 ): Effect of *Grewia asiatica*, *Gossypium perbacium* and *Gymnema sylvestre* on blood glucose, cholesterol and triglyceride level in normoglycaemic and alloxan diabetic rabbits. *J.P.M.A.* 38: 289- 295.