

Clinical Hypoglycemic Effects of *Allium cepa* (Red Onion) in Type 1 Diabetic Patients

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Abstract

Background: Type 1 diabetes mellitus is an autoimmune disease caused by destruction of pancreatic islet beta cells and characterized by defect in insulin secretion.

Objectives: The present study was carried out to investigate the hypoglycemic effects of *Allium cepa* in patients with type 1 diabetic patients.

Results: In the assessment of the hypoglycaemic activity of *Allium cepa* in type 1 diabetic patients (n=21), crude *Allium cepa* (100g) caused a considerably lowered value in the fasting blood glucose levels by about 89 mg/dl in relation to insulin (145 mg/dl) after 4 hours. Also the ingestion of crude *Allium cepa* by type 1 diabetic patients produced a significant reduction in the induced hyperglycemia (GTT) by about 120 mg/dl in relation to water (77 mg/dl) and the standard drug insulin (153 mg/dl).

Conclusion: Crude *Allium cepa* produced hypoglycemic effects, thus it could be used as a dietary supplement in management of diabetes.

Key words: *Allium cepa*, hypoglycemia, type 1 diabetes.

Based on its etiology, diabetes mellitus is generally divided into three classifications: type 1, type 2 and gestational¹. Type 1 is an autoimmune disease characterized by a defect in insulin secretion such that the pancreas produces little or no insulin. It occurs most often in children and young adults and accounts for 5-10% of cases of diabetes². Type 2 diabetes is a metabolic disorder characterized by a defect in insulin secretion and/or the tissues are resistant to its uptake. Type 2 accounts for 90-95% of cases of diabetes^{1,2}. The chronic hyperglycemia that characterizes diabetes mellitus results from defects in insulin secretion, insulin action, or both¹. When left unchecked hyperglycemia can result in micro-macrovascular complications including: cardiovascular disease, nephropathy, neuropathy, and retinopathy².

Insulin and oral hypoglycemic agents are used in the management of type 1 and type 2 diabetes mellitus respectively¹.

Medicinal plants continue to provide valuable therapeutic agents, in both modern medicine and traditional systems³. *Allium* species such as onion has attracted particular attention of modern medicine because of its widespread health use around the world, and the cherished belief that it helps in maintaining good health, warding off illnesses and providing vigor⁴. Onion is rich in flavonoids such as quercetin and sulphur compounds, such as allyl propyl disulphide that have perceived benefits to human health⁵. These compounds possess antidiabetic, antibiotic, hypocholesterolaemic, fibrinolytic, and other various beneficial biological effects⁶.

Materials and Methods

Ethical approval

The ethical approval for this study was obtained from the Ethical Committee/ University of Gezira/ Gezira State, Ministry of Health, Wad Medani-Sudan. Consent forms were signed by participants, being interested in joining the study completely voluntary.

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Plant material

Fresh and recently cropped *Allium cepa* harvested at the optimal maturity was purchased from the local market in Wad Medani city, Central Sudan. The fresh onion was cut into small slices to be taken orally by type 1 diabetic patients.

Criteria for selecting patients

For patients with type 1 diabetes mellitus, the following criteria of selection were considered: age \leq 50 years, the duration of diabetes was between 2-5 years. Patients who are taking medicines for other health condition, taking vitamins or other supplements, smoking or consuming alcohol and those suffering from any of diabetes complications were excluded from the study.

Type 1 diabetic patients

Two groups of diabetic patients were used in this clinical trial to assess the hypoglycaemic effects of *Allium cepa* in type 1 diabetic patients. Participants of the first group (n=21)

of both sexes were subjected to fasting blood glucose levels determination and subdivided into three subgroups each consisted of 7 registered patients. Subgroup I participants were considered as negative control and received drinking water, while those in subgroup II were administered standard positive control treatment of regular insulin (5 IU/prescribed doses). Subgroup III received 100g of the crude fresh slices of *Allium cepa* as a test or investigational group.

Determination of fasting blood glucose levels in type 1 diabetic patients

As designed for subgroup I, II and III and after the oral administration of water or regular insulin (5 IU/prescribed dose) and/or ingestion of the crude fresh *Allium cepa* slices (100g), fasting blood glucose levels were determined at 0, 1, 2 and 4 hours using electronic glucometer after the administration of the tested materials. (Table 1).

Table 1: Fasting blood glucose levels in type 1 diabetic patients receiving water (5ml), insulin (5 IU/prescribed dose) and *Allium cepa* (100g)

Preparations	Blood glucose level (mg/dL, mean±S.E.M)				P.value
	0 h	1 h	2 h	4 h	
Water	266±7.22	254.33±7.68	236±8.39	211±11.85	0.03
Insulin	243± 8.08	204±8.72	165±4.583	98.67±2.90	0.001
<i>Allium cepa</i>	232±7.72	241±10.045	198.25±14.64	143.38± 14.182	0.005

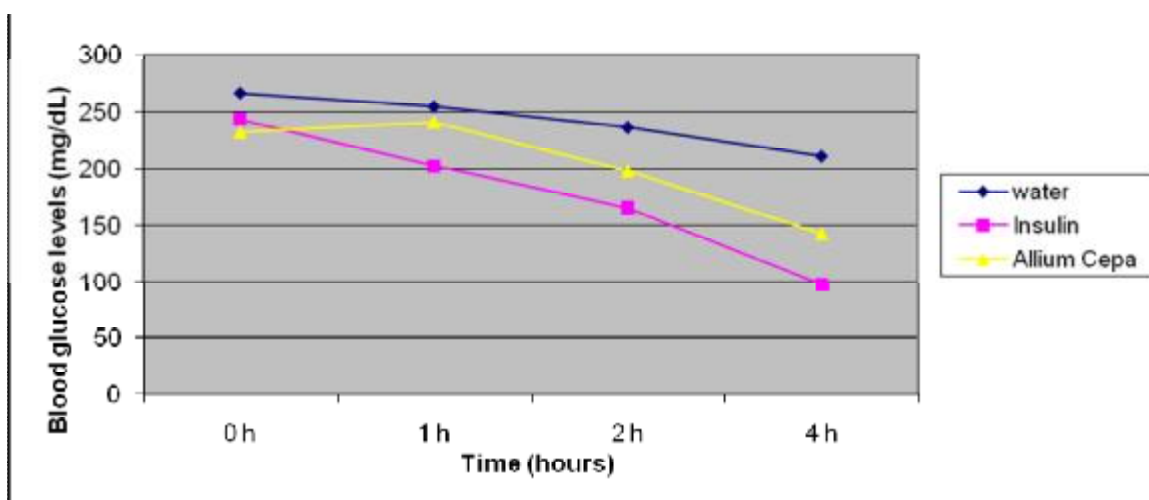


Figure 1: Fasting blood glucose levels in type 1 diabetic patients receiving water (5ml), insulin (5 IU/prescribed dose) and *Allium cepa* (100g)

Determination of glucose tolerance tests in type 1 diabetic patients

Another group of 21 type I diabetic patients, were subjected to glucose tolerance tests. They received 75 grams of dextrose dissolved in water orally. As designed in all subgroups, and after administration of water (subgroup I) or regular insulin (subgroup II) and/or ingestion of fresh slices of 100g *Allium cepa* (subgroup III), blood glucose levels were

determined at 0, 1, 2 and 4 hours using electronic glucometer after the administration of the tested materials. (Table 2).

Statistical Analysis

All the data were expressed as means ± standard error of means (SEM) and analyzed by analysis of variance (ANOVA). Comparisons with the control group were made using One-way ANOVA. Differences were considered significant if P < 0.05.

Table 2: Glucose tolerance tests in type 1 diabetic patients receiving water (5ml), insulin (prescribed doses) and *Allium cepa* (100g)

Preparations	Blood glucose level (mg/dL, mean±S.E.M)				P.value
	0 h	1 h	2 h	4 h	
Water	259±17.12	405±16.34	368.5±15.11	328±14.33	0.03
Insulin	205± 21.37	304.33±16.19	208±24.269	152.67±15.69	0.001
<i>Allium cepa</i>	291±14.48	398.8± 14.23	328.6±13.47	278.2±16.04	0.004

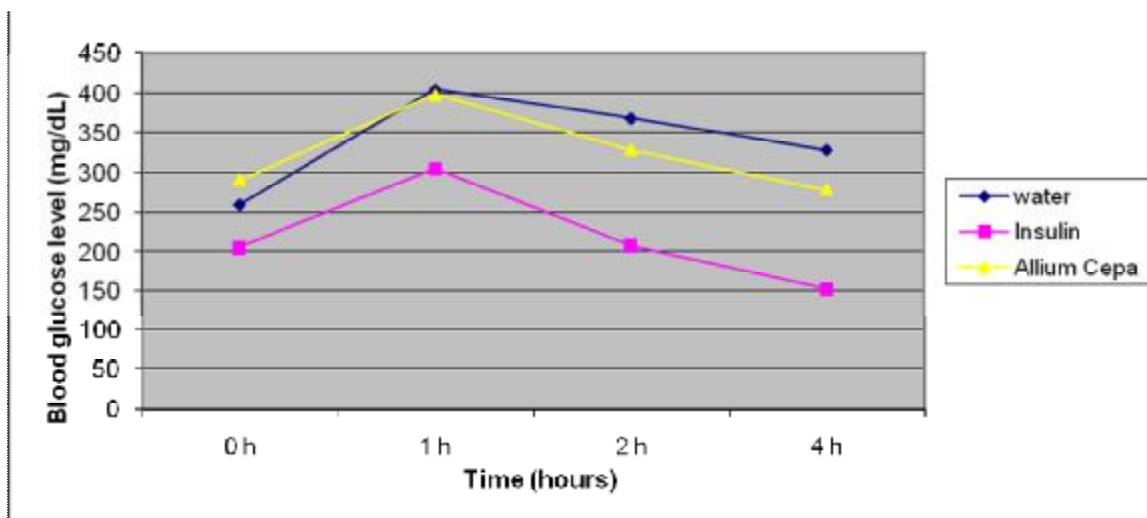


Figure 2: Glucose tolerance test curves in type 1 diabetic patients receiving water (5ml), insulin (prescribed doses) and *Allium cepa* (100g)

Results and Discussion

Fasting blood glucose levels in type 1 diabetic patients

Results obtained are shown in Table 1 and Figure 1. The blood glucose values in the subgroup I (negative control group) did not

show much variations and the slight reduction in the blood glucose levels could be attributed to fasting. After the administration of insulin (prescribed dose) a significant reduction in the fasting blood glucose levels in subgroup II diabetic patients (positive control group) by

145 mg/dl was observed 4 hours later. While the administration of *Allium cepa* (100g) caused a considerably lowered value in the fasting blood glucose levels in subgroup III of diabetic patients (test group) by about 89 mg/dl after 4 hours compared to reduction seen in subgroup I. Such effect was also evidently noted in a previous clinical study where the juice of *Allium cepa* (50 mg) was administered orally to diabetic patients despite the low dose taken by them⁷.

Allium cepa acts as a hypoglycemic agent by mechanisms rather than increasing insulin levels. *Allium cepa* may have extra pancreatic effects, by acting directly on tissues, liver, muscles etc. and alter favourably the activities of the regulatory enzymes of glycolysis, gluconeogenesis and other pathways⁸⁻¹⁰.

Glucose tolerance tests in type 1 diabetic patients

Blood glucose levels for the three subgroups I, II, and III were determined at 0, 1, 2, and 4 hours using glucometer. Results obtained showed that the administration of 75grams dextrose caused high increase in the blood glucose levels in the three subgroups after the first hour (hyperglycaemic peak). It has been also observed that the administration of *Allium cepa* produced a significant reduction in the induced hyperglycemia by about 120 mg/dl in relation to water (77 mg/dl) and the standard drug insulin (152 mg/dl) four hours later. While for the same period of time the effect of the oral administration of *Allium cepa* demonstrated a relatively slight and gradual decrease in fasting blood glucose levels by 13 mg/dl when compared to insulin (53 mg/dl) as shown in Table 2 and Figure 2. Similarly a clinical study performed by others, described such a decrease in glucose-induced hyperglycemia in human adults⁸.

The observed increase in fasting blood glucose levels during the first hour and after ingestion of *Allium cepa* is attributed to the

glucogenic effects of cysteine present in *Allium cepa*¹¹, a result that can counteract the common side effect of oral hypoglycemic agents currently used if *Allium cepa* is taken concurrently as food supplement.

The number of study group is very small to reach concrete conclusions. Nevertheless, it was evident that, *Allium cepa* has hypoglycemic effects that may be beneficial in management of diabetes in addition to its other values. Other large scale double blinded studies will deal better with this challenge.

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