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CLINICAL HYPOGLYCEMIC EFFECTS OF *ALLIUM CEPA* (RED ONION) IN TYPE 2 DIABETIC PATIENTS

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ABSTRACT

Background*:* Type 2 diabetes mellitus results from defects in insulin secretion and/or insulin action or both.

Objectives: The present study was conducted to investigate the hypoglycemic effects of *Allium cepa* in patients with type 2 diabetes mellitus.

Results: In type 2 diabetic patients (n=21) the administration of crude *Allium cepa* (100g) markedly reduced fasting blood glucose levels by 40 mg/dl 4 hours later, compared to glibenclamide (81 mg/dl). Also *Allium cepa* significantly reduced the induced hyperglycemia (GTT) after ingestion of 75 grams dextrose by 159 mg/dl in the test subgroup (n=7) of type 2 diabetic patients to a point below that produced in the negative control group after 4 hours.

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 2 diabetes

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INTRODUCTION

Diabetes mellitus is generally classified into 3 classifications: type 1, type 2 and gestational (occurring during pregnancy).[1] The chronic hyperglycemia that characterized type 2 diabetes mellitus results from both defects in insulin secretion, insulin action or both coupled with resistance to the effects of insulin.[2] Some of patients with type 2 diabetes are obese. Indeed, obesity itself, in particular central adiposity, can confer some degree of insulin resistance.[3] Although the hyperglycemia symptoms of type 2 diabetes tend to develop gradually, patients with chronically elevated blood glucose levels are at increased risk of developing micro-and macrovascular complications. Nevertheless, the risk of developing complications can be reduced significantly through tight glycemic control.[5]

In some patients, glycemic control can be achieved with weight reduction, exercise and/or antidiabetic agents that promote insulin secretion or lower insulin resistance.[1] Over time, however, the beta-cell function of most patients will progressively decline, requiring treatment with combination therapy consisting of oral agents and/or exogenous insulin.[4]

Plants remedies are the mainstay of treatment in underdeveloped regions and may provide valuable clues for the development of new oral hypoglycemic agents.[6-8] This has caused an increase in the number of experimental and clinical investigations towards the validation of the antidiabetic properties which empirically attributed to these remedies. Over 400 traditional plant treatments for diabetes have been reported, although a small number of these have received scientific and medical evaluation to assess their efficacy and safety.[9] Of these, ginseng species, *Momordica Charantia* (Bitter Melon), cloves, cinnamon, *Trigonella foenum graecum* (Fenugreek) and *Allium cepa* (onion) have been used for taste and flavour development in food preparations.[10]

The use of plants especially vegetables by the population as antidiabetic remedies have added interest of joining two basic diabetes mellitus control factors: food and medication. [6-8] Plants from the genus *Allium*, particularly onions (*Allium cepa*) have been consumed for their putative nutritional and health benefits for centuries.[11-14] reports indicated that *Allium cepa* is rich in sulphides, flavonoids and cysteine phytoconstituents which were known to have hypoglycemic, hypocholesterolemic and antibacterial potentials,[15-17] and antioxidant activity with beneficial effects on cardiovascular and immune systems, inflammatory conditions and cancer prevention.[18-20] The present study was conducted to investigate the hypoglycemic effects of *Allium cepa* in patients with type 2 diabetes mellitus.

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MATERIAL 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 bearing in mind that *Allium cepa* is safe vegetable especially in the administered dose.

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 2 diabetic patients.

Criteria for selecting patients

For patients with type 2 diabetes mellitus, the following criteria of selection were considered: age ≤ 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 2 diabetic patients

Two groups of type 2 diabetic patients were used in this clinical trial to assess the hypoglycaemic effects of *Allium cepa*. 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 glibenclamide (5mg). Subgroup III received 100g of the crude fresh slices of *Allium cepa* as a test or investigational group.

2.2.6.3 Determination of fasting blood glucose levels in type 2 diabetic patients

For subgroup I, II and III, as designed and after administration of water or glibenclamide (5mg) and/or the fresh slices of *Allium cepa* (100g), fasting blood glucose levels were determined at 0, 1, 2 and 4 hours, using electronic glucometer. (Table 1)

2.2.6.4 Determination of glucose tolerance tests in type 2 diabetic patients

Another group of 21 type 2 diabetic patients were subjected to glucose tolerance tests (GTT). They received 75 grams dextrose dissolved in water orally. As designed in all subgroups and after administration of water or glibenclamide (5mg) and/or fresh slices of *Allium cepa* (100g), blood glucose levels were determined at 0, 1, 2 and 4 hours, using electronic glucometer. (Table 2)

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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 $P < 0.05$.

RESULTS AND DISCUSSION

Determination of fasting blood glucose levels in type 2 diabetic patients

Heterogeneous group of twenty one diabetic individuals of type 2 were used for this study. As shown in Table 1 and Figure 1 fasting blood glucose levels in the tested patients with type 2 diabetes were determined. The administration of 100g of *Allium cepa* markedly reduced the fasting blood glucose levels in subgroup III diabetic patients (test group) by 40 mg/dl after 4 hours.

Four hours after oral administration of glibenclamide (5mg) a significant reduction in fasting blood glucose levels in subgroup II diabetic patients by about 81 mg/dl was observed, as glibenclamide acts by direct induction of insulin release from the pancreatic beta cells, such a significant reduction in glucose levels was evident.[21]

The hypoglycemic activity of *Allium cepa* has been demonstrated in many clinical studies, presenting that, the addition of raw onion to the diet of non-insulin-dependent diabetic subjects decreased the dose of antidiabetic medication required to control the disease. [22] The probable mechanism of the hypoglycemic action of onion may be mainly due to extra-pancreatic activities on the liver, muscle etc. by enhancing the utilization and consumption of glucose peripherally.[23]

Table 1: Fasting blood glucose levels in type 2 diabetic patients receiving water (5ml), glibenclamide (5mg) 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	164.33±18.5	175±22.26	162.33±19.1	148.67±8.67	0.001
Glibenclamide	181±11.71	157.5±11.25	131±7.5	100.38±6.41	0.003
Allium cepa	155±25.29	165±26.41	150.25± 17.73	115.5±15.46	0.005

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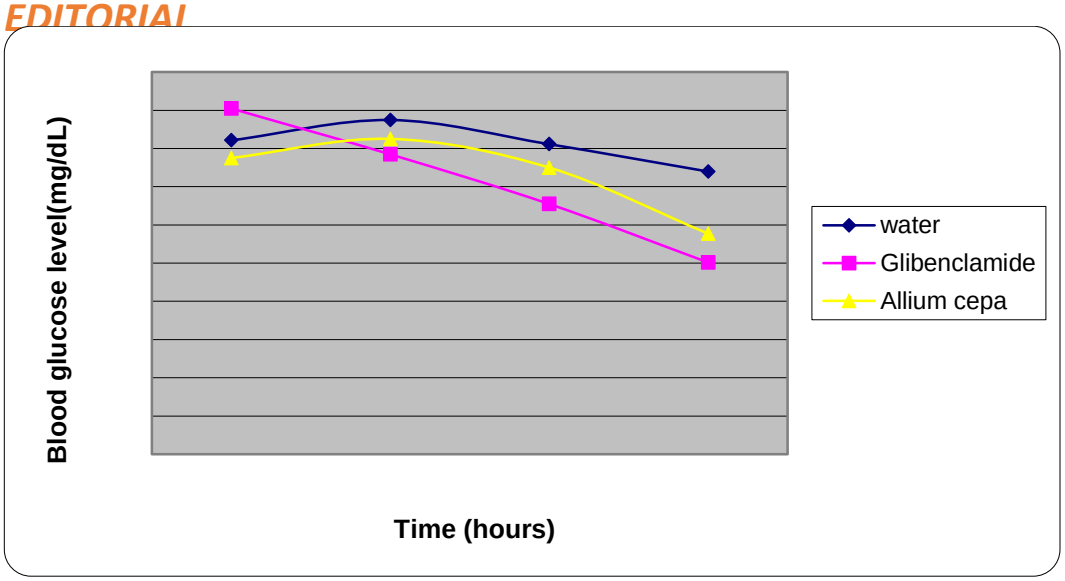

Figure 1: Fasting blood glucose levels in type 2 diabetic patients receiving water (5ml), glibenclamide (5mg) and Allium cepa (100g)

Determination of glucose tolerance tests (GTT) in type 2 diabetic patients

Twenty one of type 2 diabetic individuals of both sexes were involved in this part of study. It was noticed that, the administration of 75g dextrose caused an increase in the blood glucose levels in all subgroups after one hour (hyperglycemic peak). Among the three groups, those who had received *Allium cepa* demonstrated the highest peak compared to others, due to glucogenic effect of *Allium cepa* [24], nevertheless its administration significantly reduced the blood glucose levels in the test subgroup of type 2 diabetic patients to a point below that produced in the negative control group after 4 hours (Table 2; Figure 2). The observed increase in fasting blood glucose levels during the first hour and after ingestion of *Allium cepa* which attributed to the glucogenic effects of cysteine present in *Allium cepa* can counteract the common side effect (hypoglycemia) of antidiabetic agents currently used if *Allium cepa* is taken concurrently as food supplement.

The oral administration of glibenclamide (5mg) showed a significant reduction in the induced hyperglycemia in the positive control group by 157 mg/dl after 4 hours, compared to water, since it is known to act by direct induction of insulin release from the pancreatic beta cells.

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Table 2: Glucose tolerance test (GTT) in type 2 diabetic patients receiving water (5ml), glibenclamide (5mg) and Allium cepa (100g)

Preparations	Glucose level (mg/dL, mean±S.E.M)				P. value
	0 h	1 h	2 h	4 h	
Water	190±18.55	320±22.26	290±19.1	265±8.67	0.004
Glibenclamide	185.6±25.29	277±26.41	203.8±17.73	163.2±15.46	0.001
Allium cepa	204.63±11.7	372.5±11.25	249± 13.2	213±14.11	0.002

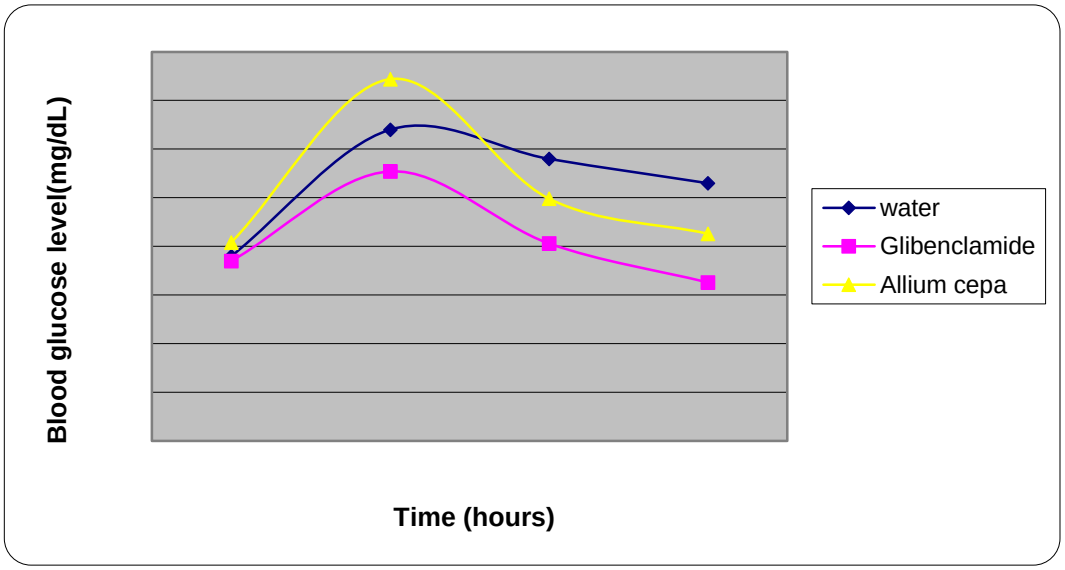

Figure 2: Glucose tolerance test curves in type 2 diabetic patients receiving water (5ml), glibenclamide (5mg) and Allium cepa (100g).

Although the number of study group is small to reach concrete conclusions, it was evident that, *Allium cepa* has hypoglycemic effects that may be beneficial in management of diabetes in addition to its other nutritional values.

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