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Effect of *Agaricus bispours* and *Pleurotus ostreatus* on allaxon induced hyperglycemic animals

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ABSTRACT

Mushrooms have been valued throughout the world as both food and medicine for thousands of years. In the present study we report the anti-hyperglycemic effects of two edible mushrooms, *Agaricus bispours* and *Pleurotus ostreatus* in allaxon induced hyperglycemic rats. Dried powders of mushrooms *A.bisporus* and *P.ostreatus* were administered separately to different set of animals orally in suspension form at the dose of 1000mg/day, in equally divided doses, twice a day, for 30 days (normal and allaxon treated hyperglycemic rats) and serum glucose level were measured. Oral administration of dried mushroom powders in suspension form reduced serum glucose level of allaxon induced hyperglycemic rats. The results suggest that the mushrooms *A.bisporus* and *P.ostreatus* have shown significant anti hyperglycemic activity.

KEY WORDS: *Agaricus bispours*, Anti-hyperglycemic, *Pleurotus ostreatus*

INTRODUCTION

Mushrooms are group of fleshy macroscopic fungi that have been valued throughout the world as both food and medicine for thousands of years (1-3). Nutritionally they are a valuable source of health food, which is low in calories and rich in carbohydrates, essential amino acids, fibers, important vitamins and minerals (4, 5). With no starch and very low in sugars they can serve as medicinal food for diabetics (6). Earlier studies have reported insulin release and insulin like activities of some mushroom species like *Agaricus campestris* (7-9) and hypoglycemic effects of *Pleurotus pulmonarius* (10).

Diabetes mellitus is a metabolic disorder affecting around 250 million people world wide. It is characterized by hyperglycemia, altered metabolism of lipids, carbohydrates and proteins. It increases the risk of complication from vascular disease (11). Impairment in the glucose metabolism during diabetes mellitus causes glycation of body proteins that in turn leads to secondary complication affecting eyes, kidneys, nerves and arteries (12). Now-a-days there is an increase in the awareness among people about limitations of currently available drugs and need for changing the life-style for better management of diabetes mellitus (6). In past many plants used either vegetables or grains reported to have beneficial effect in hyperglycemic conditions in experimental animals (13, 14). In adequate quantities and being low in sugars mushrooms serve as medicinal food for diabetics (15).

In this context it was decided to evaluate the anti-hyperglycemic effect of two edible mushrooms, *A.bisporus* and *P.ostreatus* on allaxon induced hyperglycemic animals.

MATERIALS AND METHODS

Raw material

Authenticated samples of two mushroom species *Agaricus bispours* (J.Lange) Imbach (Agricaceae) and *Pleurotus ostreatus* (Jacq.: Fr.) P. Kumm. (Pleurotaceae) were collected from GKVK, University of Agricultural Sciences, Bangalore. The voucher specimens were deposited at department of Pharmacognosy, Al-Ameen College of Pharmacy, Bangalore. The raw materials were shade dried, powdered and stored in an air tight container for further use.

Animals used

Male *Wister* albino rats, weighing 170-180gms were used in the present study. They were acclimatized to laboratory environment for one full week and were maintained on standard laboratory rat feed and clean tap water. Institutional animal ethical committee clearance at Al-Ameen College of Pharmacy, Bangalore, was obtained to conduct the experiment.

Preparation of the raw material

Uniform suspensions of the 500mg of both the mushroom powders were prepared separately using 4ml distilled water in mortar and pestle.

Hypoglycemic activity

Experimental animals were distributed at random in six groups, containing six animals each. Animals were fasted over night during the experiment.

a. Normoglycemic animals.

Group I received normal diet and Group II and III received normal diet along with 500mg of mushroom, in suspension form, *A.bisporus*, and *P.ostreatus* respectively twice a day from day one of the experiment to day 30. The serum glucose level of all the groups were measured on 1st, 15th, and 30th day.

b. Hyperglycemic animals.

The animals were injected with allaxon monohydrate dissolved in distilled water at a dose of 150mg/kg body weight intraperitoneally to induce hyperglycemia (16). After two days of injecting allaxon monohydrate, hyperglycemia was confirmed by measuring serum glucose concentration 72h after allaxon treatment. The animals with a serum glucose level above 175mg/dl were selected for the study and were divided into group IV, V and VI (17).

Group IV received normal diet and Group V and VI received normal diet along with 500mg of mushroom, in suspension form, *A.bisporus*, and *P.ostreatus* respectively twice a day from day one of the experiment to day 30. The serum glucose level of all the groups were measured on 1st, 15th, and 30th day.

Estimation of blood glucose level

Blood glucose was estimated by Nelson-Somogyi method (18). Rats were anaesthetized using anesthetic ether. 0.5ml of blood was withdrawn by heart puncturing method. 0.5ml of blood sample deprotienized by placing in 25ml volumetric flask containing 4.5ml Barium hydroxide solution and 4.5ml zinc sulfate solution was added to it. Contents in the flask were filtered on dry filter papers and filtrates were collected in dry flask. 0.5ml of filtrate was diluted to 10ml. 1ml of alkaline copper reagent was added and heated for twenty minutes on water bath. 1ml of arsenomolybdate reagent was added and after cooling, and contents diluted to 10ml with distilled water. The absorbance of the colour developed measured at 540nm against reagent blank. The concentration of glucose in the sample was measured graphically by using standard curve prepared by standard glucose solution.

Statistical Analysis

All the values were expressed as Mean ± S.E.M. The results were compared using one way analysis of variance (ANOVA). p values <0.001 were considered as significant.

RESULTS

The effect of feeding of *A.bisporus* and *P.osteautus* on serum glucose level in normal and allaxon induced hyperglycemic animals was assessed on different days (Table 1). Group IV and Group V animals which received *A.bisporus* and *P.ostreatus* respectively, has shown significant anti-hyperglycemic activity as compared with Group IV animals (control). On day one of the experiment there were no significant differences in the serum glucose level among Group IV, V and VI. The serum glucose level was lower in the Group V and Group VI when compared to Group IV on 15th day. Continuation of treatment of mushroom for 30 days also found to decrease the serum glucose level further as compared to control group. However, Group II and Group III animals which received *A.bisporus* and *P.ostreatus* respectively did not show any significant reduction in normal serum glucose levels as compared to Group I.

DISCUSSION

In past, many mushroom varieties have been reported to possess hypoglycemic activities in animals (7, 9) as well as in diabetic patients (19). Studies in normal and streptozocin diabetic mice treated with mushroom variety, *A.bisporus*, retards the development of hyperglycemia, hyperphagia, polydipsia in streptozocin treated mice (20) by counteracting reduction in plasma and pancreatic insulin concentration and by improving hypoglycemic effect of exogenous insulin.

Anti hyperglycemic effects observed in allaxon induced rats can be attributed to several mechanisms like glucose/insulin metabolism and /or by enhancing peripheral insulin sensitivity (8, 20) or by enhancing insulin release by islets of langerhans (7, 21).

Insulin releasing and insulin like activity in *A. campestris* is reported earlier (7). Lectins from *A. bisporus* and *A. campestris* stimulate insulin and glucagon release from isolated rat islets in the presence of glucose and specific interaction between mushroom lectins and its receptors (21). This may be responsible for anti-hyperglycemic effect of *A.bisporus*. Guanide, a known hypoglycemic substance related to biguanide class of oral anti diabetic drug, has been detected in edible mushrooms of pleurotus (22) species and might be responsible for anti

Table 1. *Effect of Agaricus bispours and Pleurotus ostreatus on serum glucose level of normal and Allaxon induced hyperglycemic animals*

	Blood glucose level (mg/dl)			
	Pre treated	1st day	15th Day	30th Day
Group I	79.87±2.55	77.58±5.03	79.55±2.06	76.72±2.86
Group II	76.52±2.36	75.17±2.16	78.46±4.09	80.13±2.54
Group III	77.35±2.49	77.59±3.39	79.57±2.57	75.12±2.12
Group IV	76.76±2.36	179.6±4.02	176.25±3.40	175.72±2.74
Group V	81.83±3.34	178.51±2.45	157.75±1.90*	143.5±4.9*
Group VI	76.94±1.67	179.2±3.03	162.64±2.95*	148.5±3.09*

*Values represents Mean ± SEM (n = 6) ; *p<0.001, significant as compared to corresponding data of the control.*

hyperglycemic effect. The mushroom *A.bisporus* has shown more anti-hyperglycemic activity than *P.ostreatus*. Though both the tested mushroom *A.bisporus* and *P.ostreatus* have shown significant decrease in the elevated serum glucose level of hyperglycemic animals, the same did not show any effect on normal animals. These two edible mushrooms may provide us with good anti-hyperglycemic agent in future.

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