

Comparison on hypoglycemic effect of Oyster (*Pleurotusosteratus*) and Reishi (*Ganodermalucidum*) Mushroom in alloxan induced diabetic mice

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Abstract

Pleurotusosteratus (family: Pleurotaceae) and *Ganodermalucidum* (family: ganodermataceae) are common edible mushrooms in Bangladesh. Ethyl acetate extract of *Pleurotusosteratus* and *Ganodermalucidum* were used to find out their hypoglycaemic activity in alloxan induced diabetic mice. Ethyl acetate extract of *Pleurotusosteratus* and *Ganodermalucidum* reduced blood glucose level of 39.56% and 43.27% respectively at 24 hours after intraperitoneal administration (P<0.005) in alloxan induced diabetic mice. The possible mechanism of hypoglycemic action is due to the increased glucose uptake in liver cells because it markedly lowers the blood glucose levels in alloxan induced diabetic mice.

Keywords: hypoglycaemic; Alloxan induced diabetic mice; blood glucose; liver cell.

1.Introduction

Diabetes mellitus is considered a “modern day epidemic” and is rightly recognized as a global public health issue [1]. In this world the number of diabetic people is expected to rise from present estimate of 150 million to 230 million in 2025[2].

Bangladesh currently has over three million people with diabetes and this number will reach 11 million by the year 2030[3]. Diabetes is a chronic disorder in metabolism of carbohydrates, proteins and fat due to absolute or relative deficiency of insulin secretion with / without varying degree of insulin resistance [4,5]. Elevated serum triacyl glycerol concentrations and hyper secretion of very low-density-lipoprotein (VLDL) cholesterol are also frequently associated with the development of coronary atherosclerosis, mainly in patients with diabetes [6]. Drug treatment is not completely successful in the people with diabetes and there is a compelling need for better prevention and treatment strategies [7]. The major mode of controlling diabetes can be achieved by diet, exercise, and insulin replacement therapy and/or by different oral hypoglycemic drugs. However, treatment with sulfonylureas and biguanides is associated with side effects and fail to alter the course of diabetic complicationssignificantly [8]. In modern medical system, managing diabetes without side effects is still a challenge.The search for new pharmacologically active agents obtained by screening natural sources such as medicinal plants or their extracts has led to the discovery of many clinically useful drugs that play a major role in the treatment of human diseases [9]. Nowadays herbal medicines are highly recommended for the treatment of diabetes

in spite of the therapeutic options [10]. Since antiquity people have used different medicinal herbs as anti-diabetic remedy because it is considered to be less toxic and induce fewer side effects than synthetic ones [11]. Mushrooms are edible fungi which have been used as an anti-diabetic drug since ancient time. Mushrooms are nutritive and are richer in protein than cereals, pulses, fruits and vegetables on dry weight [12].

Pleurotus ostreatus, the oyster mushroom, is increasingly being recognized as an important food product with a significant role in human health and nutrition [13]. On the other hand, there has been great interest in the hypoglycemic and lipid-lowering properties of medicinal mushrooms including *Ganoderma lucidum* [14]. Fruiting bodies of *G. lucidum*, a basidiomycete belonging to the Ganodermataceae family, have long been used in folk medicine to treat diabetes, hepatopathy, hypertension, arthritis, asthma, cancer, and other diseases in Eastern countries [15]. So we can say both mushrooms are not only sources of nutrients but have also been reported as therapeutic foods, useful in preventing diseases such as hyperglycemia, hypertension, hypercholesterolemia and cancer [16].

The aim of study was to evaluate and compare the efficacy of oyster mushroom (*Pleurotus ostreatus*) and Reishi mushroom (*Ganoderma lucidum*) on diabetic quality.

2. Materials and Methods

2.1. Sample collection and processing

The dried mushrooms, *P. ostreatus* and *G. lucidum*, were collected from the National Mushroom Development and Extension Centre at Savar in Dhaka. The cleaned mushrooms were dried. Therefore the whole dried mushrooms (i.e. pileus + stipe) were powdered to pass through a 40 mesh sieve and the powder was used for cold extraction.

2.2. Preparation of crude extracts

The coarse powders from these mushrooms were soaked in 95% Ethyl acetate solution for 7 days and were kept at room temperature with occasional shaking and stirring. When the solvent became concentrated, the liquid Ethyl acetate contents were filtered through cotton and then through filter paper (Whatman filter paper no. 1). The Ethyl acetate solution was allowed to evaporate using rotary evaporator. Thus the highly concentrated Ethyl acetate extracts were obtained which were further dried completely under mild sun and by freeze-drying. The dried extracts were then preserved in the refrigerator for the experimental use.

2.3. Drugs and chemicals

Compounds were purchased from commercial sources as alloxan monohydrate; Loba Chemie, Mumbai, India. The active drug, metformin hydrochloride was the generous gift from Square Pharmaceuticals Ltd. Pabna Bangladesh.

2.4. Induction of diabetes

Swiss albino female mice were purchased from Animal House of International Centre for Diarrheal Disease Research, Bangladesh (ICDDR, B). Prior to the commencement of experiment, the mice were acclimatized in a well-ventilated animal house at 25° room temperature for a period of one week with adequate food and water *ad libitum*. For the development of diabetic model, mice were grouped into seven groups. Each group contains four mice. After overnight fasting, a freshly prepared solution of alloxan monohydrate (120 mg/kg body weight in normal saline) was administered intraperitoneally into group II-V. Group I kept as normal control group that did not receive the chemical. Group VI and VII were also kept normal to treat by these extract. After 48 hours their blood glucose content was measured by glucometer (Clever Check, Germany) according to the manufacturer's protocol. Mice with blood glucose levels above 11.1 mM/L were selected for the study [17]. Their base line blood glucose level was also measured just prior to the administration of alloxan.

2.5. Treatment of the animal

Group I and II served as non-diabetic and diabetic control group, respectively. Group III stands for metformin control group in which metformin was administered as a single intraperitoneal dose of 150mg/kg body weight. Group IV (Diabetic) and VI (Non diabetic) received *Pleurotus ostreatus* extracts. On the other hand group V (Diabetic) and VII (Non diabetic) received *Ganoderma lucidum* extract respectively as a single intraperitoneal dose of 200 mg/kg body weight. The blood samples were analyzed for blood glucose content at 0, 4, 8, 12, 16 and 24 hours respectively.

2.6. Statistical analysis

Data were expressed as mean ± standard error of mean (SEM). Statistical comparisons were performed by one-way analysis of variance (ANOVA), or students paired or unpaired *t*-test where appropriate. Results are considered to be significant when *p* values were less than 0.05 (*p*<0.05).

3. Results

Effect of *Pleurotusosteratus* and *Ganodermalucidum* on fasting blood glucose (FBG) level in alloxan induced diabetic mice

After single intraperitoneal injection of *Pleurotusosteratus* and *Ganodermalucidum* extracts (200 mg/kg body weight), their fasting blood glucose (FBG) levels were measured at 0, 4, 8, 12, 16 and 24 hours, respectively. The *P.osteratus* extracts reduced FBG level to 66.52, 49.35, 47.47, 42.46 and 39.56% at 4, 8, 12, 16 and 24 hours, respectively. Whereas, *G.lucidum* reduced FBG level to 71.14, 54.14, 49.33, 40.04 and 43.27% and metformin HCl to 58.91, 52.07, 37.35, 35.82 and 35.13% at 4, 8, 12, 16 and 24 hours, respectively. In each case the effects were significantly different (*P*< 0.05) at 8,12 and 16 hours from the diabetic control group and maximum reduction of FBG level was achieved at 16 hours by 42.46 and 40.04%, for *P.osteratus* and *G.lucidum* .On the other hand maximum reduction occurred by metformin HCl, 37.35% at 12 hours. The results are shown in Table 1 and figure 1.

Table 1: Effects of oyster and Reishi extracts on blood glucose level in alloxan induced diabetic mice.

Time in hour	Blood glucose in mM				
	No-diabetic mice	Diabetic mice			
	Normal group	Diabetic control group	Standard Metformin diabetic group	oyster diabetic group	Reishi diabetic group
0	8.24±0.12	18.54±0.13	17.11±0.12	18.58±0.11	18.12±0.01
4	8.03±0.13	18.19±0.09	10.08±0.08	12.36±0.10	12.89±0.12
8	8.23±0.11	18.02±0.01	08.91±0.09	09.17±0.08	09.81±0.11
12	7.76±0.24	17.88±0.12	06.39±0.08	08.82±0.14	08.94±0.13
16	8.04±0.08	18.10±0.09	06.13±0.23	07.89±0.13	07.98±0.12
24	8.10±0.09	18.15±0.11	06.01±0.08	07.35±0.13	07.84±0.14

Values are expressed as mean ± SEM of the experiments

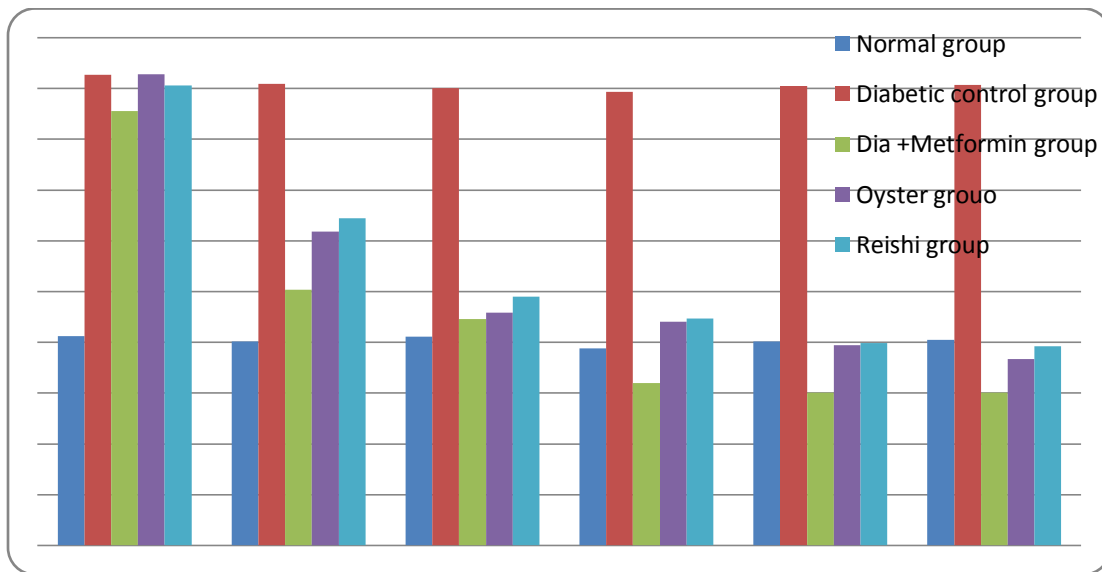


Figure 1: Effect of *Pleurotusosteratus* and *Ganodermalucidu* methyl acetate extract on FBG levels in Alloxan induced diabetic mice.

4. Discussion

Globally diabetes is the fourth biggest cause of death [18]. Diabetes is a chronic non communicable disease having serious health, economic and social consequences [19]. Numerous oral hypoglycaemic drugs exist alongside insulin; still there is no promising therapy to cure diabetes [20]. The study of such medicines might offer a natural key to unlock a diabetologist's pharmacy for the future. In the light of the literature on oyster and Reishi mushrooms we made an attempt for first time the study of comparison on hypoglycaemic effect of ethyl acetate extract of oyster and Reishi mushrooms in alloxan induced diabetic mice. It can be conceived that these mushrooms extract may also contain some bio molecules that may sensitize the insulin receptor to insulin or stimulates the β cells of islets of Langerhans to release insulin which may finally lead to improvement of carbohydrate metabolizing enzymes towards the reestablishment of normal blood glucose level. Hypoglycemic study has been showed both mushrooms extract decreased blood glucose level but better reduction observed by Oyster than Reishi mushrooms.

5. Conclusions

This study is unique because we evaluate and compare hypoglycemic activity of ethyl acetate extract of oyster and Reishi mushroom in alloxan induced diabetic mice. The significant comparison of antidiabetic activity of oyster and Reishi mushrooms as shown in Fig. (1). However, further study is necessary for the screening of chemical compounds and structure elucidation of the respective anti diabetic leads as well as their exact mechanism.

Acknowledgements

We thank Pharmacy Department of Rajshahi University for providing necessary facilities to carry out this research work. The present work was supported by the National mushroom development and extension centre, Savar, Dhaka-1213, Bangladesh for giving me the selected desired mushrooms for research work and the authors would like to extend their gratitude to the Director, Animal Research Centre (ARC), ICDDR,B for providing necessary facilities.

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