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EFFECT OF BITTER MELON AND GARLIC ON BLOOD GLUCOSE LEVEL AND BLOOD CHOLESTEROL LEVEL IN RATS IN DIABETIC CONDITION

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ABSTRACT

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The aim of this research was designed to investigate the single and combine effect of bitter melon and garlic on blood glucose level and blood cholesterol level in rats in diabetic condition. In this study 60 rats (12 normal rats and 48 alloxan induced diabetic rats) was used for trials. The rats were divided into 5 groups for each trial, each containing 12 individuals as follows: First group was normal control (A), Second group was diabetic control (B), third group was alloxan with bitter melon treated (C). Group D was alloxan and Garlic treated and Group E was alloxan, bitter melon, garlic treated. Then alloxan injection was injected at the dose rate of 100mg/kg body weight intraperitoneally to each rate to induce diabetes in groups B, C, D and E. On 10th day blood glucose level, blood cholesterol level and the body weights were measured for the first time to ensure diabetic induction as well as hypercholesterolemia. Then all the rats of that group were kept for more 21 days for the treatment of hyperglycemia and hypercholesterolemia. During that period on Day 0, 7, 14 and 21st the body weight, blood cholesterol level and blood glucose level were measured. Aqueous extract of bitter melon and garlic were fed at a dose rate of 300mg/kg and 500 mg/kg body weight for 21 days in group C and D respectively and combine in group E. The blood sugar level and blood cholesterol level were reduced in bitter melon, garlic & combine treatment groups compare with untreated group. From these findings it is concluded that the combination of bitter melon and garlic can be used as anti-hyperglycemic and anti- hypercholesterolemic agent.

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INTRODUCTION

Diabetes mellitus is the most common endocrine disease. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030 (Roglic et al., 2000). The common side effects associated with oral hypoglycemic agents are hypoglycemia, weight gain, gastrointestinal disorders, peripheral edema and impaired liver function, in addition to the cost of treatment (Mallare et al., 2005). Since natural remedies are somehow safer and more efficacious than pharmaceutically derived remedies, herbalism has become mainstream worldwide (Murphy, 2000). *Momordica charantia*, also known as bitter melon, bitter gourd, or balsam pear, is a plant widely cultivated in many tropical and subtropical regions of the world and is frequently used in South Asia and the Orient as a food stuff and medicinal plant. Extracts from various components of this plant have been reported to possess hypoglycaemic activity (Karunanayake and Tennekoon, 2003). Thus bitter melon can be an alternative therapy used for lowering glucose level in diabetic patients (Jayasuriya et al., 2000). The hypoglycemic activity of *Momordica charantia* fruit juice is demonstrated in animals with experimental diabetes and also in humans in both type 1 and type 2 diabetes mellitus (Welihinda et al., 2006). Scientists have identified 3 groups of constituents thought to be responsible for blood sugar lowering action of bitter melon; one of these, a compound called charantin which is composed of sitosterol glucoside and stigmasteryl glucoside and can potentially replace treatment by insulin (Pitipanapong et al., 2007). Another compound, polypeptide p (plant insulin) found in seeds and fruits of bitter melon is similar to insulin in composition, so it can be of a great benefit in therapy of type 1 diabetes (Pauland Raychaudhuri, 2010). Third compound is alkaloids which have also been noted to have a blood sugar lowering effect. Compounds known as oleanolic acid glycosides have been found to improve glucose tolerance in type 2 diabetes (Cheng, 2008). Although garlic has been used for centuries, and even nowadays is part of popular in many cultures, but until recently there has been little scientific support of its therapeutics and pharmacological properties. In the past decade, some protective effects of garlic have been well established by epidemiological studies and animal experiments. Commercially available garlic preparations in the form of garlic oil, garlic powder, and pills are widely used for certain therapeutic purposes, including lowering blood pressure and improving lipid profile (Elkayam et al., 2003). The objective of the present research was to investigate the single and combine effect of bitter melon and garlic on blood glucose level and blood cholesterol level in rats in diabetic condition.

MATERIALS AND METHODS

This research work was conducted in the Laboratory of Anatomy, Histology and Physiology, Faculty of Animal Science and Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka for a period of 12 months to evaluate the single and combined efficacy of bitter melon and garlic on alloxan induced diabetic rats.

Collection and acclimatization of rats

Total 60 mixed male albino rats (aged 2-3 months) and weighing (200-300g) were collected from Jahangirnagar University, Savar, Bangladesh. For five experimental trials, all the rats were grouped into 5 groups each containing 12 rats. Each group of rats was housed at serene bottomed wire cages arranged in rows and kept in the animal house of this department. The animals were fed with pellet at a recommended dose of 100 g/kg body weight. Drinking water was supplied *ad libitum*. The rats were reared in this condition for a period of two weeks to acclimatize them prior to experimental uses.

Induction of diabetes

Diabetes mellitus was induced, Alloxan injection were injected through intraperitoneal route which increases the blood glucose level and at the same time body weight were decreased also. Single dose of alloxan administered intraperitoneally @ 100 mg/kg body weight (Junod et al., 1969). In this experiment, polyuria, polydipsia and polyphagia after 24 hours of alloxan injection were observed. Rats with serum glucose level ranging between 150mg/dl or above considered as hyperglycemic. At the same time the rats with cholesterol level above 200 mg/dl were considered as hypercholesterolemic (Ojewole et al., 2006).

Experimental design

In this study, a total of 60 rats (12 normal rats and 48 alloxan induced diabetic rats) were used for each trial. The rats were divided into 5 groups each containing 12 individuals as follows:

- Group A: Normal control
- Group B: Diabetic control
- Group C: Alloxan+ bitter melon treated
- Group D: Alloxan+ Garlic treated
- Group E: Alloxan + Bitter melon + Garlic treated

After 18 hours of starvation, body weights and blood glucose level were measured after acclimatization of rats. Then alloxan injected at a dose rate of 100 mg/kg body weight in intraperitoneal route to each rat to induce diabetes in groups B, C, D and E. All the group of rats was reared under normal diet and water *ad libitum* from Day 1-10, on 10th day blood glucose level, blood cholesterol level and body weights were measured for the first time to ensure diabetic induction as well as hypercholesterolemia. Then all the rats of that group were kept for more 21 days for the treatment of hyperglycemia and hypercholesterolemia. During that period on day 0,7,14 and 21st the body weight, blood cholesterol, blood glucose level were measured. Aqueous extract of bitter melon and garlic were fed at a dose of 300 mg/kg and 500 mg/kg body weight daily for 21 days in groups C and D respectively and combine in group E. Changes in body weight, blood glucose level and blood cholesterol level of rats were compared statistically by means of one way analysis of variance (ANOVA) test. *P*-values less than 0.05 were considered significant.

RESULT AND DISCUSSION

Changes in body weight and blood glucose level of rats were summarized in the Table 1.

Table 1 Descriptive statistics of mean values of body weight (gm) and blood glucose level (mg/dl) with standard deviation in different rat groups

Grps	Day 0		Day 7		Day 14		Day 21	
	Avg. B. Wt. (gm)	Avg. BSL (mg/dl)	Avg. B. Wt. (gm)	Avg. BSL (mg/dl)	Avg. B. Wt. (gm)	Avg. BSL (mg/dl)	Avg. B. Wt. (gm)	Avg. BSL (mg/dl)
A	270.6 ± 9.65	94.5 ± 3.37	290.5 ± 9.42	96.4 ± 2.28	307.33 ± 8.24	96.33 ± 1.86	308.67 ± 7.0	96.17 ± 2.23
B	260.83 ± 8.11	177.0 ± 10.53	237.5 ± 8.22	210.67 ± 9.42	220.5 ± 6.75	234.5 ± 6.57	210.54 ± 6.42	247.32 ± 6.13
C	257.67 ± 6.35	177.5 ± 10.65	267.33 ± 5.5	160.5 ± 5.01	277.67 ± 4.63	130.33 ± 6.35	288.17 ± 2.56	96.17 ± 2.48
D	281.63 ± 5.13	154.5 ± 3.98	284.4 ± 2.37	146.25 ± 3.65	289.13 ± 2.79	132.17 ± 4.22	292.11 ± 3.57	120.35 ± 4.21
E	281.21 ± 5.65	156 ± 4.11	286.2 ± 1.89	139.5 ± 3.78	292.27 ± 3.59	123.17 ± 3.56	296.49 ± 4.56	110.21 ± 3.98

Legends: Grps: Groups, Group A: Normal Control; Group B: Diabetic control; Group C: Alloxan + bitter melon treated; Group D: Alloxan +garlic treated; Group E: Alloxan + bitter melon + garlic treated; Avg. B. Wt: Average body weight; Avg. BSL: Average blood sugar level.

Table 1 show that treatment of diabetic rats with BM, garlic & combine treatment induced a significant increase in body weight & decrease in fasting blood glucose levels compare with diabetic untreated group.

Table 2. Descriptive statistics of mean values of body weight (gm) and blood cholesterol level (mg/dl) with standard deviation in different rat groups

Grps.	Day 0		Day 7		Day 14		Day 21	
	B. Wt (gm)	BCL ^{**} (mg/ dl)	B. Wt (gm)	BCL (mg/ dl)	B. Wt (gm)	BCL (mg/ dl)	B. Wt (gm)	BCL (mg/ dl)
A	270.6 9.65	120.33 ±5.67	290.5 9.42	118.31 ±6.45	307.33 8.24	109.33 ±6.77	308.67 7.0	116.65 ±6.55
B	260.83 8.11	205.12 ±5.34	237.5 8.2	224.34 ±6.33	220.5 6.75	232.13 ±6.57	210.54 6.42	240.76 ±5.78
C	257.67 6.35	209.11 ±5.24	267.33 5.5	180.51 ±5.78	277.67 4.6	155.44 ±6.34	288.17 2.56	126.66 ±6.58
D	281.63 ±5.13	213.43 ±6.21	284.4 ±2.37	183.12 ±5.89	289.13 ±2.79	158.32 ±5.99	292.11 ±3.57	128.76 ±6.98
E	281.21 ±5.65	218.12 ±6.34	286.2 ±1.89	176.23 ±6.21	292.27 ±3.59	147.34 ±6.54	296.49 ±4.56	113.81 ±6.13

Legends: Group A: Groups: Groups, Normal Control; Group B: Diabetic control; Group C: Alloxan + bitter melon treated; Group D: Alloxan + garlic treated; Group E: Alloxan + bitter melon + garlic treated; Avg.B.Wt: Average body weight; Avg. BCL: Average blood Cholesterol level

Total cholesterol were significantly increased in alloxan induced diabetic rats, these figures were significantly decrease after BM, garlic and combine treatment (Table 2).

Diabetes mellitus is probably the fastest growing metabolic disease in the world and as knowledge of multifactorial/heterogenous nature of the disease increases so does the need for more challenging and appropriate therapies. Alloxan is known for selective pancreatic islet β -cell cytotoxicity and has been extensively used to induce diabetes mellitus in animals. Generalized increase in the level of blood glucose during diabetes have been consistently reported both in animal models and humans especially those suffering from insulin dependent diabetes mellitus.

In the present study we found that, both bitter melon and garlic extract reduced the blood glucose, and cholesterol in diabetic rats. Regarding serum glucose level (OGTT), treatment of diabetic rats with bitter melon caused significant decreases in fasting and post- prandial serum glucose levels as compared to the diabetic untreated group. These results are in accordance with the findings of Jayasuriya et al. (2000), Fernandes et al. (2007) Yuan et al. (2008) and Chatuvedi et al. (2004). The present finding disagrees with the finding of Dans et al. (2007) who reported that bitter melon had no significant hypoglycemic effect in alloxan diabetic rats. The present results elucidated a significant increase of total cholesterol, triglycerides and LDL cholesterol concentrations in the serum of diabetic control rats as compared to normal control group. These results are in agreement with Newairy et al. (2002).

CONCLUSION

In conclusion, the present study calls attention to the therapeutic use of bitter melon & garlic in diabetes mellitus. The results of the current study demonstrated that bitter melon & garlic has numerous anti-diabetic effects such as, decreasing serum glucose concentration. In addition, it showed hypolipidemic and thus cardiac protective effects. It was shown in this study that bitter melon did not cause hypoglycemia when given for normal rats, this indicates that it is safe if utilized by normoglycemic persons for its other beneficial effects.

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CONFLICT OF INTEREST

Statement none of the authors has any financial or personal relationship.

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