

Effects of Garlic (*Allium Sativum*) on Lipid Profile Status in Type 2 Diabetes Mellitus Patients Treated with Metformin

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Dyslipidemia is a major risk factor for diabetes mellitus. Lipid lowering drugs are available but may produce side effects. Garlic due to some of its active component can improve lipid profile status. To observe the effect of garlic (*Allium sativum*) on lipid profile status in patients of type 2 diabetes mellitus treated with metformin. This prospective interventional study was carried out in the Department of Pharmacology, Sir Salimullah Medical College (SSMC), Dhaka from July 2014 to June 2015. Total number of sixty (60) type 2 diabetes mellitus with obesity subjects of both sexes with age range 40 to 60 years was included in this study. They were selected from Out Patient Department of BIRDEM hospital, Dhaka. The subjects were divided into two groups by simple random sampling. One was group A and another was group B. The subjects (30) of group A were supplemented only metformin at a dose of (1000 mg) per day. The subjects (30) of group B were supplemented metformin at a dose of (1000 mg) and garlic in capsule form at a dose of (500mg) per day. They were studied two times i.e. on day-1(1st day of metformin treated, Group A₁), on 12 weeks (After 12 weeks of metformin treated, Group A₂), on day-1(Before supplementation of garlic, Group B₁) and on 12 weeks (After 12 weeks supplementation of garlic and metformin, Group B₂). Serum lipid profile (TC, TAG, LDL-C and HDL-C) of all subjects were estimated by enzymatic method. The statistical analysis was done by using paired and unpaired sample 't' test. In this study, serum TC, TAG and LDL-C levels were non significantly decreased ($p>0.05$) and HDL-C level increased non significantly ($p>0.05$) after 12 weeks treated of metformin in comparison to 1st day of metformin treated. Again, the mean serum TC, TAG and LDL-C levels were decreased significantly and HDL-C level increased significantly after 12 weeks supplementation of metformin and garlic in compared to before supplementation of garlic ($p<0.001$) and after 12 weeks treated of metformin. **Conclusion:** The present study revealed that, garlic (*Allium sativum*) has significant effect on improvement of lipid profile status due to its active component.

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Key words: Diabetes mellitus, garlic and lipid profile

Introduction

Diabetes mellitus (DM) is as defined as chronic or persistent hyperglycaemia, due to deficiency of insulin secretion or of insulin action, or both.¹ Diabetes mellitus is known as the most growing metabolic disease that characterized by altered carbohydrate, lipid and protein metabolism.² Dyslipidemia is a

disorder of lipoprotein metabolism, which includes increase blood concentrations of total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), triacylglycerol (TAG) and decrease in high-density lipoprotein cholesterol (HDL-C) and is directly associated with the development of cardiovascular diseases (CVD).³

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Dyslipidemia become one of the leading causes of death in most developed countries as well as in developing countries, including Bangladesh.⁴ However, recently a study showed, dyslipidemia and obesity two important risk factors of Diabetes mellitus were found in some employers of Bangladesh secretariat who had sedentary life style.⁵

Metformin is currently being used in type 2 diabetes as the first-choice oral agent, along with appropriate diet control and modification of lifestyle⁶. Metformin acts primarily by reducing the hepatic glucose output and improving insulin sensitivity in the liver and muscle.⁷ Metformin has pleiotropic vascular effects that act on endothelial imbalance, probably increasing nitric oxide bioavailability, decreasing atheroma plaque growth, improving the atherogenic lipid profile, and inhibiting lipid incorporation into vessel walls, thereby inhibiting vascular smooth muscle cell proliferation.⁸ The World Health Organization Expert Committee on diabetes has recommended that traditional medicinal herbs can be further investigated for the treatment of diabetes mellitus. The most commonly used medicinal herbs: *Allium sativum* (garlic), Ginseng species, *Momordica charantia* (bitter melon), *Trigonella foenum-graecum* (fenugreek) and *A. cepa* (onion).⁹

Allium sativum, commonly known as garlic is widely used around the world with a history of human use of over 7,000 years for culinary and medicinal purpose.¹⁰ Recently, garlic has used in the form of garlic oil, garlic powder and pills are widely used for certain therapeutic purposes.¹¹ Garlic has a reputation in particular because of its widespread health use around the world as a dietary as well as therapeutic supplement.¹² Garlic contains a variety of effective compounds, such as allicin, a sulfur-containing compound that exhibits anti-diabetic effect,¹³ hypocholesterolemic effect,¹⁴ antioxidant

effect,¹⁵ hypotensive, anticoagulant and antithrombotic effect.¹⁶ Garlic extracts are believed to possess beneficial effects for the prevention of cardiovascular diseases.¹⁷ It has been observed that, consuming 10 g of raw garlic per day in two meals for six weeks can reduce blood glucose and HbA_{1c} level in patients with diabetes mellitus¹⁸. Some other researchers showed that, daily 40 mg garlic consumption may improve blood HDL-cholesterol levels.¹⁹

Methods

This prospective interventional study was carried out in the Department of Pharmacology, Sir Salimullah Medical College (SSMC), Dhaka between 1st July 2014 and 30th June 2015. According to selection criteria all the study subjects were selected from Out Patient Department of Bangladesh Institute of Rehabilitation of Diabetic, Endocrine and Metabolic disorder (BIRDEM) hospital, Dhaka. After proper counseling, the aim, objectives, risk and the procedure of the study were explained in details to the subjects. Only positive respondents were recruited as research participants and were allowed to withdraw themselves from the study even after participation whenever they like. Ethical permission was taken from the Institutional Ethics Committee (IEC) of Sir Salimullah Medical College. The subjects were divided into two groups by simple random sampling. One was group A and another was group B. The subjects (30) of group A were supplemented only metformin at a dose of (1000 mg) per day. The subjects (30) of group B were supplemented metformin at a dose of (1000 mg) and garlic in capsule form at a dose of (500 mg) per day. They were studied two times i.e. on day-1(1st day of metformin treated, Group A₁), on 12 weeks (After 12 weeks of metformin treated, Group A₂), on day-1(Before supplementation of garlic, Group B₁) and on 12 weeks (After 12 weeks

supplementation of garlic and metformin, Group B₂). Subjects having type-1 diabetes mellitus, hypertension, heart disease, kidney disease, liver disease, thyroid disease, infectious disease etc were excluded from the study. Informed written consent was taken from each subject. Then their general information and data were collected and all the information was recorded in a prefixed questionnaire.

With all aseptic precautions, five (5) ml of venous blood was drawn from median cubital vein by sterile disposable syringe. To assess their lipid profile serum level of TAG, LDL-C, HDL-C and TC of all subjects were estimated by enzymatic method in the laboratory of Department of Biochemistry of BSMMU, Dhaka. These parameters were studied 2 times among all subjects, i. e. on day-1 and after 12 weeks. Data were analyzed by Paired sample 't' test as applicable for statistical analysis. P value < 0.05 was taken as level of significance.

Garlic Supplementation

All the subjects of group B of this study were supplemented with garlic capsule containing (250mg) garlic two times daily for 12 weeks¹³. These subjects were taken from Out Patients department of Bangladesh Institute of Rehabilitation of Diabetic, Endocrine and Metabolic disorder (BIRDEM) hospital, Dhaka.

Results

In this study, serum TC, TAG and LDL-C levels were non significantly decreased and HDL-C level increased non significantly after 12 weeks treated of metformin in comparison to 1st day of metformin treated. Again, the mean serum TC, TAG and LDL-C levels were decreased significantly and HDL-C level increased significantly after 12 weeks supplementation of metformin and garlic in

compared to before supplementation of garlic and after 12 weeks treated of metformin.

Table I: Age, body mass index (BMI) and fasting blood glucose (FBG) in different groups (n=60)

Parameters	Group A ₁ (n=30)	Group B ₁ (n=30)
Age (years)	48.23 ± 4.59	47.83 ± 4.71
BMI (kg/m ²)	31.18 ± 1.32	31.17 ± 1.43
FBG (mmol/l)	8.52 ± 0.29	8.49 ± 0.24

Data are expressed as mean ± SD. For statistical analysis, Independent sample 't' test was done for comparison between the groups. Figures in parentheses indicate ranges. **Group A₁**: Metformin treated (on day-1); **Group B₁**: Before supplementation of garlic (on day-1); n = total number of the subject.

Table II: Serum TC, TAG, LDL-C and HDL-C level in different groups (n=60)

Groups	Serum TC (mg/dl)	Serum TAG (mg/dl)	Serum LDL-C (mg/dl)	Serum HDL-C (mg/dl)
A ₁ (n=30)	255.23 ± 8.18 (238-270)	186.93 ± 7.33 (176-204)	198.70 ± 5.87 (190-215)	39.23 ± 2.61 (35-44)
A ₂ (n=30)	253.91 ± 8.32 (237-268)	185.77 ± 7.28 (175-203)	197.53 ± 5.85 (188-213)	40.50 ± 2.7 (35-45)
B ₁ (n=30)	256.10 ± 8.23 (240-268)	187.60 ± 7.22 (178-205)	200.80 ± 5.93 (191-215)	39.40 ± 2.81 (35-45)
B ₂ (n=30)	245.77 ± 8.60 (229-258)	175.30 ± 7.54 (166-193)	190.57 ± 5.97 (180-205)	43.47 ± 2.09 (40-48)
P				
A ₁ vs A ₂	1.000 ^{ns}	1.000 ^{ns}	1.000 ^{ns}	1.000 ^{ns}
A ₂ vs B ₂	.000***	.000***	.009**	.000***
B ₁ vs B ₂	.000***	.000***	.000***	.000***

Data are expressed as Mean ± SD. For statistical analysis, paired-samples t test within the group were performed. **Group A₁**: Metformin treated (on day-1), **Group A₂**: After 12 weeks treated of Metformin, **Group B₁**: Before supplementation of garlic (on day- 1). **Group B₂**: After 12 weeks supplementation of Metformin plus garlic. * = Significant at p < 0.05; ** = Significant at p < 0.01; *** = Significant at p < 0.001; ns = Non significant; n = total number of the subject

Discussion

Anti-diabetic medications have significant side effects that are not familiar with patients, have limited effectiveness or lack evidence of impacting the course of the disease. An increasing interest in herbal and complementary medicine has led to a search for effective natural therapies that have significant effects on blood glucose level.²⁰ Herbal treatment can be a safe and cost effective way to combat diabetes mellitus.

The present study has been undertaken to observe the effect of garlic (*Allium sativum*) on lipid profile status in type 2 diabetes mellitus subjects. For this, the levels of serum total cholesterol (TC), triacylglycerol (TAG), low density lipoprotein cholesterol (LDL-C)

and high density lipoprotein cholesterol (HDL-C) were measured.

In this study, total 60 type 2 diabetes mellitus with obesity subjects of both sex, age ranged from 40 to 60 years were taken. All the subjects were divided randomly into two groups. Each group consists of 30 subjects. Group A was given only metformin tablets (500mg) two times per day and Group B was given garlic capsule (250mg) two times along with metformin tablets (500mg) two times per day for 12 weeks. All the subjects of both groups were studied 2 times, on day-1 (1st day of metformin treated, Group A₁), on 12 weeks (After 12 weeks treated of metformin, Group A₂), on day-1 (Before supplementation of garlic, Group B₁) and on 12 weeks (After 12 weeks supplementation of garlic and

metformin, Group B₂). In this study, the mean serum lipid profile levels were almost similar and the differences were not statistically significant between the group A and group B on day-1. The dose of garlic and methodology were followed from.¹³

In the study, serum TC, TAG, LDL-C levels decreased and HDL-C level were increased non significantly ($p > 0.05$) after 12 weeks treated of metformin in comparison to that of metformin treated (on day-1). Again, serum TC, TAG, LDL-C levels decreased and HDL-C level were increased significantly ($p < 0.001$) after 12 weeks supplementation of metformin plus garlic compared to that of before supplementation of garlic (on day-1). Moreover, serum TC, TAG, LDL-C levels decreased and HDL-C level were increased significantly ($p < 0.001$) after 12 weeks supplementation of metformin plus garlic compared to that of after 12 weeks treated of metformin. This finding is in agreement with that of some other researcher.²¹ In this study, garlic capsule was given for 12 weeks at (600 mg) doses daily in 40 type 2 diabetes mellitus with obesity subjects taking metformin. This finding is similar with that of some other investigators.^{19, 22, 13} This could be due to presence of flavonoids and sulfur containing compounds in garlic.

In the present study, improvement of lipid profile is found in subjects with type 2 DM as evidenced by decreased levels of serum TC, LDL-C, TAG and increased level of HDL-C after 12 weeks supplementation of garlic.

Conclusion

From this study, it can be concluded that, garlic (*Arachis hypogoea* L.) has got significant effect on improvement of lipid profile status with lowering serum level of TAG, LDL-C, TC and increasing serum HDL-C level. This lipid lowering effects of garlic may be due to its active components.

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