



Research Article

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Medicinal Benefits of Garlic and Coriander against Hypertensive-Diabetic Patients



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Abstract

Diabetes mellitus is a chronic metabolic disorder affecting millions of people worldwide. Garlic and coriander have been in use traditionally and therapeutically safely for managing the disorder. A randomized, single-blind, placebo-controlled, parallel trial was performed on diagnosed type 2 diabetic patients (40-70 years old, random blood glucose level of >200mg/dl and blood pressure >140/90mmHg) at the city of Peshawar and its vicinity to evaluate the effect of garlic and coriander powder capsules on blood pressure and glucose level of hypertensive-diabetic patients. The results indicated that in G group, a significant ($p<0.05$) decrease in RBS, SBP, and DBP. In C group, RBS, SBP, and DBP were also significantly ($p<0.05$) decreased. In GC group, there was a significant ($p<0.05$) decrease in RBS, SBP, and DBP. All the doses, when compared with placebo, there was a non-significant difference in RBS, SBP and DBP ($p<0.05$). Consumption of 2g/day garlic, coriander and their mixture for 40 days has significant anti-diabetic and anti-hypertensive effect. However, garlic is relatively more effective as compared to coriander and their mixture. We suggest that 2g/day garlic is an effective remedy for managing blood pressure and blood glucose in hypertensive-diabetic patients.

Keywords: Diabetes mellitus; Garlic; Coriander; Blood pressure; Systolic blood pressure; Diastolic blood pressure; Random blood glucose

Abbreviations: DM: Diabetes Mellitus; BP: Blood Pressure; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; RBG: Random Blood Glucose; IDF: International Diabetic Federation

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia and glycosuria produced by complete or relative insulin deficiency or insulin resistance by peripheral cells or both [1]. The classic symptoms of diabetes are polydipsia, polyuria, ployphagia and weight loss. In its most severe forms, non ketotic hyperosmolar state or ketoacidosis may develop and lead to unconsciousness and death may occur, if left untreated. The long term complications of diabetes mellitus include nephropathy which may lead to kidney damage, retinopathy which may cause blindness and neuropathy that may cause foot ulcers, amputation, Charcot joints, and some autonomic dysfunction. The diabetic patients are at higher risk of developing other disorders like cardiovascular, cerebrovascular and peripheral vascular disease. Diabetes is definitely to be one of the most challenging health problems in the 21st century [2]. More than 220 million people are suffering from diabetes worldwide, 80% diabetic patients are from developing countries and every year 5% of deaths attribute to diabetes [3]. International Diabetic Federation (IDF) data reveals that Pakistan

presently is at number seven among the top ten countries with the highest number of Diabetic prevalence. In 2007 the diabetic population in Pakistan was estimated as 6.9 million while in 2025 it is expected to reach up to the level of 11.5 million, and thus Pakistan will rank 5th in the IDF list.

Hypertension is a well-known risk factor responsible for cardiovascular mortality and morbidity which affects about 1 billion people globally [4]. The occurrence of hypertension is higher in males as compare to females and increases with advancing age. However it is slightly higher in females after the menopause [5]. In the old age, systolic blood pressure is one of the most powerful markers for cardiovascular risk [6]. In males and people having lower socioeconomic levels the hypertension and type 2 diabetes coexistence is more common [7].

Several strategies have been adopted for the control and management of diabetes. The most common strategies are medicinal therapy, dietary approach, life style modifications and phytotherapy etc. Phytotherapy i.e. the use of plants/herbs have

been used since the time immemorial. It has been shown promising results in controlling and managing diabetes and hypertension as well. Among other plants garlic (*Allium sativum L.*) and coriander (*Coriandrum sativum L.*) have been reported to have anti-diabetic and anti-hypertensive effect. The anti-hypertensive effect of garlic has been linked to its hydrogen sulfide (H₂S) gas production [8] and allicin content [9]. The biologically active compounds of garlic, like S-allyl cysteine sulphoxide and methiin [10] have been shown to have anti-diabetic property. Coriander has been studied to have insulin releasing and insulin like activity [11]. The anti-hypertensive effect of coriander is ascribed to its diuretic, Ca²⁺ channel blocker and cholinergic property [12]. Therefore, this research study was designed to find out the effect of coriander and garlic on blood pressure and blood glucose level in hypertensive-diabetic patients.

Materials and Methods

Location of the study

The study was carried out in the city of Peshawar, KPK, Pakistan. The hypertensive-diabetic patients were registered from hospitals, clinics, University campus and its vicinity.

Sample size

Thirty two hypertensive-diabetic patients of both sexes and >40 year of age were registered for the study. Four groups were made, each consisting of 8 individuals. As it was an intervention study in human subjects, we went for convenient sampling technique.

Inclusion criteria and exclusion criteria

All those volunteer hypertensive-diabetic patients were included in the study having BP greater than 140/90mmHg and RBS greater than 200mg/dl. All other subjects who did not fulfill the mentioned criteria were excluded from the study. Pregnant and lactating women, patients with other chronic diseases were also excluded from the study.

Identification of the target group

The target group was identified from hospitals, clinics, and the university, through some personal references and via secondary data from their respective hospitals. Those fulfilling the criteria were asked to participate.

Consent form

Although the spices selected for intervention were already being used by the population for their anti-diabetic and anti-hypertensive effects. Moreover the participants were made clear about the research, regarding the dose per day, amount and frequency of blood collection, duration of the intervention and its expected pros and cons before signing the consent form (Appendix-I).

Grouping of the hypertensive-diabetic individuals

According to the criteria 32 hypertensive-diabetic patients were selected for the study i.e. the effect of garlic and coriander on blood pressure and blood glucose level. The demographic

information, medical history and biochemical data were recorded on a proforma (Appendix-II). The 32 hypertensive-diabetic patients were divided into 4 groups. The 1st group was given garlic powder (G), the 2nd group was given coriander seed powder (C), the 3rd one was given garlic and coriander powder mixture (GC) and the last one was placebo. Dose was 2 g for each group per day [13].

Preparation of doses and capsules

Garlic and coriander were purchased from the local market. First of all garlic cloves were crushed down properly and then left in shade to dry for about 2-3 weeks. After this, the dried garlic was finely powdered. Coriander seeds were washed well with tap water, then dried at room temperature and finally powdered in an electric grinder. The required amount was packed in 500mg capsule shells carefully with the help of technical experts in the lab of Human Nutrition department. Capsules were then packed in labeled air-tight plastic bottles. Each bottle was having a dose for 20 days and stored in cold and dry place till the start of intervention.

Experimental design

The blood pressure was determined and blood sampling was done to find out RBS at day 0 i.e. before starting the intervention, at days 20, 40 and 60. The duration of the study was 2 months. Each group was given the prescribed dose twice a day for a period of 40 days and then the treatment was stopped for the last 20 days to find out the effect of non-intervention period. The given dose (2g/day) was used as 2 capsules after the breakfast and 2 capsules after the dinner along with water.

Blood Collection and storage

Blood samples were collected before starting the intervention, and at day 20, 40, 60 i.e. the last day of the study. About 3ml random blood sample was collected from each individual in EDTA tubes. The blood was slowly mixed with EDTA by inverting the tubes. After the collection of blood, the samples were temporarily stored in an ice-containing chest and transported to the Department of Human Nutrition Laboratory for analysis. The sample were centrifuged at about 4000 rpm for 5-7 min at 19 °C and serum was transferred to polypropylene tubes and kept frozen at -20 °C until analysis [14]. The RBS was determined in the blood serum using instrument Micro Lab 300.

Determination of glucose

Glucose was determined by the enzymatic colorimetric method with standard kit (SBio GLUCOSE KIT) by using Micro Lab 300.

Determination of blood pressure

Blood pressure was determined by conventional method using mercury sphygmomanometer.

Statistical analysis

Data regarding RBS and BP were entered into computer. The data was analyzed by using the Statistic 8.1 software at 5% level of significance.

Results and Discussion

The effect of garlic and coriander, on diabetic hypertensive patients to monitor their glucose level and blood pressure, for this study, 32 peoples were selected and equally divided in to four groups. Each group received its respective dose 2g/day, i.e.

first group (G) received only garlic, second group (C) received only coriander, third group (GC) received garlic and coriander mixture and fourth group was on placebo. The measurement of the parameters were done on 20 days intervals, like- 1 (just one days before the dose), 20, 40 and 60 days.

Table 1: Effect of garlic and coriander on blood glucose level of diabetic hypertensive patients.

Groups/Dose (2g/day)	Duration (Days)			
	Day 1	Day 20	Day 40	Day 60
G (Garlic)	227.63±48.49 ^{bcd}	216.62±48.61 ^{cde}	185.38±42.59 ^e	204.38±42.39 ^{de}
C (Coriander)	249.25±48.49 ^{abc}	234.63±72.48 ^{bcd}	203.88±73.94 ^{de}	207.25±53.18 ^{cde}
GC (Mixture)	281.25±37.73 ^a	267.50±39.98 ^{ab}	231.13±43.90 ^{bcd}	241.13±42.35 ^{abcd}
P (Placebo)	218.13±17.57 ^{cde}	211.88±19.01 ^{cde}	205.88±17.97 ^{cde}	209.12±17.84 ^{cde}

LSD for Group*Duration = 5.86; Means±SD with different letters in rows are statistically significant at p<0.05

Table 1 indicates that (i.e. before starting the dose), the mean blood glucose levels of the four groups after 1, 20, 40, and 60 days. The garlic group (G), after 20 and 40 days consumption of 2 g/day garlic powder capsules the mean value for blood glucose level was non-significantly decreased. After 60 days, when the dose was stopped for the last 20 days and the subjects were not receiving the treatment, the mean blood glucose level was 204.38±42.39 which was non-significantly increased. The study conducted by Sheela, showed that consuming 2 capsules of the coriander seed powder per day for a period of 6 weeks with diabetic (type 2) patients significantly reduced plasma glucose at p< 0.001. Our present study is sparingly in accordance with these results [10].

The coriander group (C), after 20 days the mean blood glucose was 234.63±72.48 which was non-significantly increased. While after 40 days of dose the mean value for blood glucose level was 203.88±73.94 which was significantly decreased from 0 and 20 days. After 60 days when the dose was stopped for the last 20 days the mean value for blood glucose level was 207.25±53.18, which was non-significantly increased. The present study is relatively in line with the study performed by Aissaoui et al [15] who concluded that sub-chronic administration of coriander seed-extract in OHH Meriones shawi rats stabilized glycemia and decreased the increased levels of insulin.

The garlic and coriander mixture group (GC), after 20 days the mean value of glucose was 267.5±39.98, which was non-significantly decreased. While after 40 days of the treatment the mean value of glucose was 231.13±43.90, which was significantly decreased as compared to day the mean value of day 0 and 20 days. After 60 days when the treatment was stopped and the patients were not receiving the dose the mean value of blood glucose level was 241.13±42.35, which was non-significantly increased. The significant decrease in mean glucose levels may

be due to the synergetic effect of the garlic and coriander seed mixture powder. The increase after the intervention may be due several factors like unhealthy dietary habits as the data was taken after the Eid festival.

The placebo or control group (P), after 20 days consumption of placebo the mean value of glucose was 211.88±19.01. Which was non-significantly decreased, while at day 40 the mean value of glucose was 205.88±17.97 which was also non-significantly decreased? After 60 days, the mean value of glucose was 209.12±17.84, which non-significantly increased. The non-significant results in the control group may be due their irregularity in diet or medications or lack of physical activity.

Table 2 indicates that at day 0 (i.e. before starting the dose), the mean value of systolic blood pressure of all the four groups were 171.88± 12.52, 175.63±18.21, 176.88±14.38 and 163.75±12.17 respectively. The garlic group (G), after 20 days consumption of 2 g/day garlic powder capsules the mean value of blood pressure was 160.63±11.78, which was non-significantly decreased. While after 40 days of the intervention the mean value of systolic blood pressure was 138.75±9.91, which was significantly decreased from the days 20 and 0 day mean value. After 60 days, when the dose was stopped for the last 20 days and the subjects were not receiving the treatment, the mean value of systolic blood pressure was observed like 146.88±19.98, which was non-significantly increased from the mean values of day 40 and significantly increased from day 20. Our present study is also somewhat in accordance with the meta-analysis conducted by Reinhart et al. [16] to identify randomized controlled trials in humans evaluating garlic’s effect on blood pressure. They concluded that garlic reduced systolic blood pressure by 16.3 mm Hg (95% CI 6.2 to 26.5) compared with placebo in patients with elevated systolic blood pressure.

Table 2: Effect of garlic and coriander on blood pressure (systolic and diastolic) of hypertensive diabetic patients.

Groups/Dose (2g/day)	Duration (Days)			
	Day 0	Day 20	Day 40	Day 60
G (Garlic)	171.88±12.52 ^{ab} 106.88±7.99 ^a	160.63±11.78 ^{bcd^e} 89.38±6.78 ^{def}	138.75±9.91 ^g 78.75±9.91 ^g	146.88±19.98 ^{fg} 87.5±8.86 ^{def}
C (Coriander)	175.63±18.21 ^a 100±7.071 ^b	168.13±15.10 ^{abcd} 88.75±3.53 ^{def}	156.88±14.37 ^{def} 83.75±4.43 ^{fg}	166.88±13.87 ^{abcd} 90±4.62 ^{de}
GC (Mixture)	176.88±14.38 ^a 96.25±4.43 ^{bc}	158.13±16.02 ^{cdef} 90.63±3.20 ^{cde}	148.13±9.61 ^{efg} 86.25±6.94 ^{ef}	157.5±13.09 ^{cdef} 91.88±5.94 ^{cde}
P (Placebo)	163.75±12.17 ^{abcd} 98.75±3.53 ^b	160.63±9.42 ^{bcd^e} 92.5±3.78 ^{cd}	163.75±12.75 ^{abcd} 90.63±4.955 ^{cde}	170.62±12.37 ^{abc} 91.88±2.58 ^{cde}

LSD for Group*Duration = 13.63; Means±SD with different letters in rows are statistically significant at p<0.05. LSD for Group*Duration = 5.86; Means±SD with different letters in rows are statistically significant at p<0.05

The coriander group (C), after 20 days consumption of 2g/day coriander powder capsules the mean value of systolic blood pressure was 168.13±15.10, which was non-significantly decreased. While after 40 days of the treatment the mean value of systolic blood pressure was 156.88±14.37, which was non-significantly decreased as compared with mean value of day 20 but significantly decreased from mean value of day 0. After 60 days when the treatment was stopped for 20 days follow up period, at day 40 the mean value of systolic blood pressure was 166.88±13.87, which was non-significantly increased compared to mean values of day 40 and day 20. Study conducted by Jabeen et al. [12] also confirmed our findings up to some extent [12]. They concluded that coriander fruit shows anti-hypertensive effects possibly via Ca²⁺ antagonist mechanism and diuretic property.

The garlic and coriander mixture group (GC), after 20 days consumption of 2g/day garlic and coriander mixture powder capsules the mean value of systolic blood pressure was 158.13±16.02, which was significantly decreased. While after 40 days of the treatment the mean value of systolic blood

pressure was 148.13±9.61, which was significantly decreased as compared to the mean value of day 0, but non-significantly decreased from day 20 mean value. After 60 days when the treatment was stopped for 20 days the mean value of systolic blood pressure was 157.5±13.09, which was non-significantly increased relative to the mean value of day 40. The significant decrease in mean values of systolic blood pressure may be due to the synergetic effect of the garlic and coriander seed mixture powder. The increase after the intervention may be due several factors like unhealthy dietary habits as the data was taken after the Eid festival.

The placebo or control group (P), after 20 days consumption of placebo the mean value of systolic blood pressure was 160.63±9.42, which was non-significantly decreased. While at day 40 the mean value was 163.75±12.75, which was non-significantly increased. After 60 days the mean value of systolic blood pressure was 170.62±12.37 which was somewhat but non-significantly increased. The non-significant results in the control group may be due their irregularity in diet or medications or lack of physical activity.

Table 3: Effect of garlic and coriander on diastolic blood pressure of hypertensive-diabetic patients.

Groups/Dose (2g/day)	Duration (Days)			
	Day 0	Day 20	Day 40	Day 60
G (Garlic)	106.88±7.99 ^a	89.38±6.78 ^{def}	78.75±9.91 ^g	87.5±8.86 ^{def}
C (Coriander)	100±7.071 ^b	88.75±3.53 ^{def}	83.75±4.43 ^{fg}	90±4.62 ^{de}
GC (Mixture)	96.25±4.43 ^{bc}	90.63±3.20 ^{cde}	86.25±6.94 ^{ef}	91.88±5.94 ^{cde}
P (Placebo)	98.75±3.53 ^b	92.5±3.78 ^{cd}	90.63±4.955 ^{cde}	91.88±2.58 ^{cde}

LSD for Group*Duration = 5.86; Means±SD with different letters in rows are statistically significant at p<0.05

Table 3 indicates that at day 0 (i.e. before starting the dose), the mean value of diastolic blood pressure of all the four groups were 106.88±7.99, 100±7.071, 96.25±4.43 and 98.75±3.53 respectively. The garlic group (G), after 20 days consumption of 2 g/day garlic powder capsules the mean value of diastolic blood pressure was 89.38±6.78. Which was significantly decreased while after 40 days of the treatment the mean value of diastolic blood pressure was 78.75±9.91, which was also significantly decreased from the mean value of day 20 and day 0. After 60

days, when the treatment was stopped for last 20 days, the mean value was 87.5±8.86 which was significantly increased as compared to the mean value of day 40. Our present study is also somewhat in accordance with the meta-analysis conducted by Reinhart et al. [16] to identify randomized controlled trials in humans evaluating garlic's effect on blood pressure. They concluded that garlic reduced diastolic blood pressure by 9.3 mm Hg (95% CI 5.3 to 13.3) compared with placebo in patients with elevated systolic blood pressure.

The coriander group (C), after 20 days consumption of 2g/day coriander powder capsules the mean value of diastolic blood pressure was 88.75 ± 3.53 , which was significantly decreased. While after 40 days of the treatment the mean value of diastolic blood pressure was 83.75 ± 4.43 , which was significantly decreased as compared to day 0 while non-significantly decreased relative to day 40. After 60 days, when the treatment was stopped at day 40, the mean value of diastolic blood pressure was 90 ± 4.62 , which was significantly increased relative to day 40 mean value.

The garlic and coriander mixture group (GC), after 20 days consumption of 2g/day garlic and coriander mixture powder capsules the mean value of diastolic blood pressure was 90.63 ± 3.20 , which was significantly decreased. While after 40 days of the treatment the mean value of diastolic blood pressure was 86.25 ± 6.94 , which was non-significantly decreased. After 60 days, when the treatment was stopped for last 20 days, the mean value of diastolic blood pressure was 91.88 ± 5.94 , which was non-significantly increased as compared with the mean value of day 40 and day 20. The significant decrease in mean values of diastolic blood pressure may be due to the synergetic effect of the garlic and coriander seed mixture powder. The increase after the intervention may be due several factors like unhealthy dietary habits as the data was taken after the Eid festival.

The placebo or control group (P), after 20 days consumption of placebo the mean value of diastolic blood pressure was 92.5 ± 3.78 , which was significantly decreased. While at day 40 the mean value was 90.63 ± 4.955 , which was non-significantly decreased from day 20 and significantly decreased from day 0. After 60 days the mean value was 91.88 ± 2.588 , non-significantly increased. The non-significant results in the control group may be due their irregularity in diet or medications or lack of physical activity.

Conclusion

Garlic and coriander powder significantly reduced blood glucose level and blood pressure of hypertensive-diabetic patients with an increase in duration. A mixture of both also reduced but lower as compared to individuals one. Being cheap and locally available, hypertensive-diabetic individuals may use garlic, coriander, and a mixture of both to manage their blood glucose level and blood pressure. Use of garlic and coriander powder mixture may be used to have a cumulative effect on blood glucose level and blood pressure. Further research can be conducted, to know the effectiveness of these spices in various form and doses.

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