Effect of Ginger, Garlic, Lemon, Apple Cider Vinegar and Honey mixture on Cardio-metabolic risk factors: A Double Blinded Randomized Placebo Control Trial

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ABSTRACT

To evaluate the efficacy of ginger, garlic, lemon, apple cider vinegar and honey mixture on cardio metabolic risk factors in patients with metabolic syndrome. A double blinded Randomized control was conducted in OPD of Military Hospital, Pakistan, from 30 June 2018 to 30 Sep 2018. Eighty eight participants with positive cardio metabolic risk factors between 30 to 65 years were randomly selected and allocated into experimental and placebo Group. Equal quantities of garlic, ginger, lemon juice and apple cider vinegar were boiled at 70°C for 15 minutes. At the start, after 45th days and after 90th day anthropometric measurements, blood pressure, lipid profile and blood sugar level. Blood pressure and fasting blood sugar, TC, LDL, HDL were significantly decreased in experimental group from 155 to 132mg/dl [P<0.03]. While no remarkable change has been detected on anthropometric measurements. The findings of the study concluded that ginger, garlic, lemon, apple cider vinegar and honey mixture exhibited anti-hyperlipidemia, antihypertensive and anti-diabetic properties, while no significant change was observed in BMI and waist to hip ratio.

Keywords: Cardio metabolic risk factors, Herbal mixture, Metabolic syndrome, Atherosclerosis, Apple cider vinegar, Garlic, Ginger, Honey, Lemon

INTRODUCTION

Health data of 190 countries revealed that cardiovascular disease [CVD] is the number one universal cause of death with 17.3 million deaths every year[1]. Indo-Pakistani populations have one of the uppermost risks of coronary artery disease [CAD] in the world. In Pakistan deaths owing to CAD is 111,367 or 9.87% of total deaths. The age adjusted death rate [AADR] is 111 per 01 Lac of population[2].

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A bunch of risk factors for CAD and diabetes mellitus type 2, which mostly occurs simultaneously known as the metabolic syndrome (MetS). Approximately every third adult has been identified with MetS all over the world population[3]. Cardio metabolic risk is a condition in which there is potential of emerging diabetes mellitus and atherosclerotic CVD due to the existence of insulin resistance and atherogenic dyslipidemias. Numerous studies are proving advantageous effects of herbs like garlic, ginger, lemon, honey and apple cider vinegar in the management of CVD. Many individual studies have been conducted on these herbs individually but none of study on this novel mixture. As prevention is better than cure, this study is designed to examine the combined effects of garlic, ginger, lemon, apple cider vinegar and honey in patients with positive cardio metabolic risk factors. The implication of this study in Pakistani setup is that these herbs are easily available and generally part of every Asian cuisine. This study is intended to observe the daily consumption of these herbs in form of novel mixture on prevention of CVD and Diabetes Mellitus complications.

The Adult Treatment Panel III [ATPIII] criteria of the National Cholesterol and Education Program [NCEP] for Metabolic syndrome are the existence of three of the following distinctiveness: deglycation, dyslipidemia, low plasma high-density lipoprotein[HDL], increased triglycerides [TG], abdominal obesity [AO] and elevated blood pressure[4]. Cardiac metabolic risk is diagnosed by the recognition of waist circumference [>88cm in females and >102cm in males], along with the modifications in lipid profile, [HDL cholesterol under 50mg/dl in females and 40mg/dl in males, and serum triglycerides beyond

150mg/dl], incorporated raised blood pressure [Systolic Blood Pressure >130 mmHg and diastolic blood pressure >85 mmHg] and elevated fasting blood sugar level >100 mg/dl[5,6.]

Literature reviewed on garlic showed that cholesterol, triglycerides and LDL levels was decreased while HDL was increased when 95 mg/kg garlic was administered daily to rabbits for 14 days[7]. Another experimental study [RCT] revealed that consuming raw garlic [5g] on dyslipidemia patients confirmed considerable reduction in bad cholesterol with a noteworthy rise in HDL levels. A meta-analyses on garlic revealed considerable reduction in systolic blood pressure by 16.3 mm Hg and diastolic blood pressure by 9.3 mm Hg[8.]

A randomized, double-blind, placebo-controlled trial of ginger on diabetic patients revealed considerable reduction in BSF and HbA1C by consuming 3 gm of ginger daily[9]. Another experimental study on hyperglycemic rats disclosed that ginger drastically reduced TG and extensively increased HDL-C[10.]

An experimental study exhibited that Apple cider vinegar [ACV] consumption for about 8 week period had a favorable effect in considerable reductions in detrimental blood lipids[11]. Another double-blind clinical trial on patients with type 2 diabetes revealed that after consumption of ACV with 4% acetic acid for 8 weeks considerably reduced detrimental lipids i.e. Total Cholesterol [TC], Low density Lipoprotein [LDL] and TG[11]. Another study produced analogous findings that 10 g of ACV reduced postprandial glycaemia when ingested with high glycemic index meal[12.]

An experimental study conducted on diabetic rat fed with high cholesterol diet evaluated that the lemon and garlic extract were able to prevent atherosclerosis formation and lower blood glucose and cholesterol level[13]. In another study of lemon and garlic consumption on dyslipidemia patients showed a considerable decline in TC, LDL-C and on Body Mass Index[14].

A clinical trial on 38 patients revealed that daily consumption of honey 70g for 1 month caused noteworthy fall in TC, LDL, TG and CRP levels proving that natural honey reduces CVD risk factors. Natural honey consumption for 1.5 months produced effective anti-arrhythmic and anti-atherosclerosis effects[15]. In the light of literature gap, current study was planned with an objective to find the efficacy of combined effects of herbs (ginger, garlic, lemon, ACV and honey) in the form of mixture on reducing cardio metabolic risk factors in patients with metabolic syndrome.

METHODOLOGY

This double blinded Randomized Clinical Trial [RCT] was conducted at Out Patient Department of Military Hospital, from 30th June 2018 to 30th Sep 2018. By using simple random sampling, 88 participants between ages of 30-65 years were assessed for risk factors and dietary pattern after getting their informed consent who are visitors of the admitted patients. The inclusion criteria was set according to ATPIII criteria as the presence of at least 3 risk factors: Waist circumference (90 to 110cm) for men and (80 cm to 100 cm) for women, BMI (23 to 35 kg/m2), Elevated systolic blood pressure (130 mm Hg to 150mmhg) and diastolic blood pressure (85 to 95 mm Hg), High fasting plasma glucose (100 mg/dl to 200 mg/dl). TC and LDL-C

levels between 200-240 mg/dl and 100-160 mg/dl respectively. Subjects with all chronic diseases, including heart, liver, lung gastrointestinal diseases, rheumatoid arthritis, kidney failure, thyroid disorders and pregnant were excluded.

Selected population were randomized into Experimental group (n= 44) who received 15ml of herbal mixture once a day before morning meal for 12 weeks and Placebo group (n=44) who received 15ml of water with honey essence. The groups were matched according to the age and BMI values. Both groups were studied for anthropometric and biochemical parameters thrice via health experts i.e. before (0 Day), mid at (45th day) and at the end (at 90th day). All subjects were ensured to take herbal mixture via health experts (physician). Blood sugar fasting (BSF), triglycerides (TG), total cholesterol (TC), low density lipids, (LDL) and high density lipids (HDL) levels were determined by enzymatic colorimetric method with commercial kits on an automatic analyzer. LDL was calculated by Fried Ewald formula. BMI, Anthropometric measurements including waist Circumference and hip circumference were also recorded. Counselling to maintain normal daily activities were provided to both groups via health experts while providing mixture. Participants were advised to submit the empty bottles of herbal mixture to assure compliance. Food Frequency questionnaire were assessed at the baseline at 6th week and at the end of 12th weeks to monitor and ensure uniformity of dietary intake of volunteers. Herbal mixture were made by using the standard method [(16)] with modification in quantity of honey. Equal amount (40ml) of garlic, ginger, lemon juice and apple cider vinegar were taken and then the mixture was boiled at 70°C for about 15 minutes After cooling, 40 ml of honey was added, and stored in an air tight jar at room temperature[16].

Data Analysis: Data analysis was performed using Statistical Package for social sciences (SPSS) V.20.0. The values were articulated as mean ± standard error [SE]. Quantitative variables were analyzed via descriptive statistics as mean ± standard deviation [SD] in absolute numbers and as percentages. Paired sample's t-test on initial and final study variables were used within each group and unpaired t-test to calculate between placebo and experimental group were used to analyze statistically with probability [$p < 0.05$] was considered as statistically important.

RESULTS

Total 88 participants completed the study. There were 24 males and 20 females in placebo group whereas in experimental group they were equal in number i.e.22 males and 22 females. The mean age of subjects were 53 years in both groups. The biochemical and anthropometric parameters were analyzed thrice.

The biochemical parameters revealed that herbal mixture meaningfully reduced the BSF level [p<0.04]. At the base, mean value of BSF value was [155.3±3.2], at 45th day its mean value fall to [132.4±5.7] and at 90th day its mean value declined to [127.22±1.62] as depicted in table-I.

Table-I: Difference of Variables among subjects in placebo and intervention groups (n=88)

Variables	Placebo Group (n=44)			Experimental Group (n=44)				
	Baseline	After 45 day	After 90 day	Baseline	After 45 day	After 90 day	Difference	P Value
BMI	29.5±0.66	29.5± 0.77	29.5± 0.83	29.5±0.76	29.9± 0.78	29.4± 0.87	0.1	NS
WHR	0.847±0.01	0.846±0.01	0.847±.003	0.848±.003	0.842±.003	0.846±0.02	0.002	NS
BSF (mg/dl)	150.7±4.35	150.5±4.13	150.3±4.27	155.3±3.2	132.4±2.4	127.2±1.62	28.1	0.04
TC (mg/dl)	255.7±3.81	255.3±3.71	255.1±3.69	257.1±3.36	245.5±2.34	239.2±1.39	17.9	0.05
TGL (mg/dl)	174.2±2.12	168.4±1.87	161.6±1.48	176±2.29	175±2.32	174.9±2.36	1.1	NS
HDL (mg/dl)	35.5±0.48	35.60±0.48	35.7±0.48	35.5±0.49	40.5±0.34	44.3±1.37	8.8	0.05
LDL (mg/dl)	161.9±2.66	161.5±2.66	161.3±2.66	164.8±2.4	160.4±2.34	156.7±2.34	8.1	0.03

Herbal mixture led to a considerable [p<0.05] decrease in systolic and diastolic blood pressure in study participants from 149/90mmHg to 131/70mmHg while no significant change was observed in placebo group.

There was a statistically major decrease in mean TC at the start of study it was [257.1±3.36] and after 45 days of intervention it declined to [245.5±2.34] and after 90 days it was further declined to [239.2±1.39]. The mean value of LDL was [164.8±2.4], at the middle its mean value decreased to [160.4±2.34] and after 90 days its mean value decreased to [156.7±2.34] which showed the significant difference in LDL level. Mean HDL was considerably increased from 35.5±0.49mg/dl to 44.3±1.37mg/dl in the experimental group while no significant change [p=0.05] was observed in placebo group. The study revealed no noteworthy change in triglycerides levels as in the start mean of TGL was [176±2.29] and at the end of the study it was insignificantly declined to [174.9±2.36] as depicted in Table-I.

Herbal mixture did not considerably affect the waist to hip ratio [WHR] as in start of study the mean value of WHR was 0.84 and after 90th day herbal mixture WHR was 0.846 in experimental group. The Body Mass index [BMI] did not change significantly, which showed statistically non- significant change in BMI at the end of intervention as depicted in Figure-1, while no considerable change was observed in placebo group. This revealed that herbal mixture has no effect (P=0.05) on reduction of intra-abdominal fat accumulation. It might be due to short duration or sample size of the study as shown below in table-I.
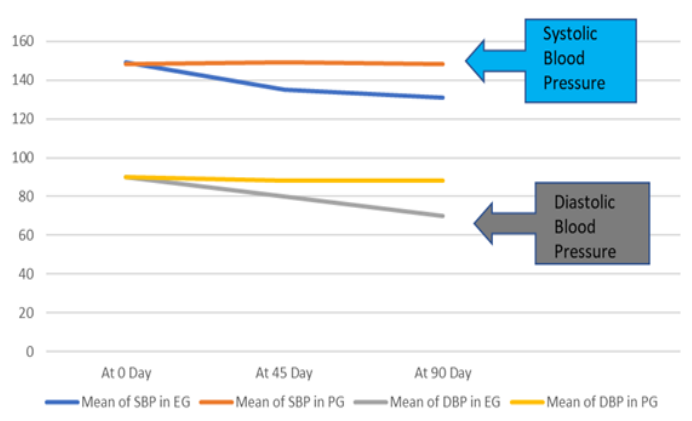

Figure-1: Comparison of effect herbal Mixture on systolic and diastolic Blood Pressure in Experimental (n=44) and Placebo Group (n=44)

Table-II: Nutrition Analysis of Herbal Mixture

Nutrient Content	Analyzed Value per tablespoon	Nutrient Content	Analyzed Value per tablespoon
Energy	59.1 kcal	Vit. A	5.4 µg
Protein	1.0 g	Vit. B6	0.1 mg
Fat	0.2 g	Tot. Folic. acid	0.2 µg
Carbohydrates.	14.6 g	Vit. C	3.7 mg
Potassium	110.6 mg	Sodium	19.6 mg
Calcium	22.3 mg	Iron	0.3 mg
Magnesium	7.8 mg	Zinc	0.2 mg
Phosphorus	19.1 mg		

*Nutrition data Analyzed by adding equal portions of ginger, garlic extract, ACV, lemon and honey in Nutrisurvey software

DISCUSSION

The current study was carried out to observe the combined effect of ginger, garlic, ACV, lemon and honey mixture on decreasing risk factors of CVD and DM. This study revealed that herbal mixture significantly reduced the blood pressure, TC, LDL-C and BSF levels but decrease in mean of total triglycerides [TG] level was insignificant[p<0.04]. Herbal extract reduced plasma TG to 27.15% [p<0.05], HDL-C increased by 29.86% and LDL-C non-significantly increased to 10.6%[16] · Similar findings has been revealed by Sahebnazar et al study on combination of garlic and lemon juice which significantly decreased serum TC, LDL-C, and blood pressure[14]. Another study of Kausar et al. proved that vinegar has anti glycemic properties when 20 ml taken with meals composed of complex carbohydrates because it significantly reduced post prandial glycaemia[12].   Another study on apple cider vinegar proved analogous results that ACV have a role in reducing post prandial hyperglycemia: 1 tablespoon of vinegar ingested twice daily was capable of reducing fasting blood glucose levels[17]. An experimental study on honey produced parallel outcomes to our study that daily consumption of honey by diminished cardio metabolic risk factors by significant reduction in BMI [1.14%], mild drop in total body weight [1.3%] and fasting blood glucose level [4.2%] in normal subjects[15,18]. An experimental trial of this dietary mixture have shown similar arthro-protective findings on rabbits by consuming [1gm /100gm of daily diet] for 15 days

and concluded that this herbal mixture can be commendably used to treat high risk cardiac patients[19]. Similar findings to our study has been narrated by Halima et al. who reported that 8 weeks of ACV consumption decreased detrimental lipids, i.e. Total Cholesterol, Low Density Lipoprotein, and triglyceride in dyslipidemia individuals because of its acetic acid content which slowed down oxidation of fatty acid, hampered lipogenesis, finally reduced triglyceride and cholesterol concentration[11]. Another RCT of Hadi et al on diabetic patients produced analogous results proved that natural honey consumption for about 2 months demonstrated that honey reduced Total Cholesterol, Low Density Lipoprotein and improved High-density lipoprotein[8,20].

In the present study herbal mixture has no considerable effect on BMI and WHR. But a study of Yagi et al on lemon produced contradictory results that decline in body weight due to presence of vitamin C, organic acid, carotenoid, flavonoids and pectin[21]. Finally in the light of above discussion it has been proved that herbal mixture could be helpful for deterrence or timely treatment of patients with risk factors of Metabolic Syndrome to prevent them from Diabetes Mellitus and CVD complications.

CONCLUSION

The findings of the study concluded that ginger, garlic, lemon, apple cider vinegar and honey mixture exhibited anti-hyperlipidemia, antihypertensive and anti-diabetic properties, while no significant change has been observed in BMI and waist to hip ratio. Further researches would be needed in this time to develop the exact mechanism of action of these bioactive molecules.

AUTHOR'S CONTRIBUTION

Aslam M: Designed research methodology, Literature review, Data analysis, Manuscript writing
Yousef N: Manuscript writing, Data compilation, Data analysis
Ahmed Z: Conceived idea, Statistical analysis, Final Proof reading
Khurshid K: Critical Review of manuscript

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