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EFFECT OF GARLIC CONSUMPTION ON HYPERLIPIDEMIA PATIENTS: OBSERVATIONAL COHORT STUDY

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Abstract

Introduction: The lipid profile has been reported high in people suffering from hyperlipidemias. Garlic can act as a shield against cancer, aging and chronic disorders like cardiovascular disorder.

Methodology: Randomized Control Trial (RCT) approach was used; patients with CVDS along with other diseases like diabetes and arthritis were excluded. 50 members were selected for each group.

Results: The mean values of lipid profile calculated for the two groups are 356.46 mg/dl and 257.46 mg/dl respectively. BMI differed significantly between the garlic ($P < 0.03$), and non-garlic ($P < 0.06$) groups. According to t-test the value of t is 5.66, and the critical values of t are 1.67 and 2.00 for t-critical (one tailed and two tailed respectively).

Conclusion: The study suggests that consuming raw garlic has a positive effect on lipid profiles in patients with hyperlipidemias. The results showed a significant reduction in blood cholesterol after consuming raw garlic for 42 days. Due to the smaller size of the study, we were unable to generalize the results. To determine optimal garlic consumption, further research is needed.

Introduction

Elevated levels of lipids (fats) increase the probability of developing cardiovascular diseases. Low density lipoproteins (LDL) in high proportion can result in formation of arterial plaque. Managing hyperlipidemias can improve overall health and well-being specially cardiovascular health as it can decrease the risk of chronic disorders (*Hyperlipidemia (High Cholesterol): Levels, Causes, Symptoms & Diagnosis*)

Garlic is a plant species in the Allium family, which also includes onions, shallots, and leeks. In ancient times, garlic was used by the Egyptians in medicine and as a flavoring agent in food. Garlic was also used in ancient India and China for its medicinal properties. Garlic was used during the Middle Ages in Europe as a treatment for various ailments, such as plague and tuberculosis. During World War I, garlic was used to prevent wound infections as topical ointment. It was also used during World War II to prevent gangrene in soldiers(www.mashed.com). Garlic contains several components that are responsible for its medicinal effect. Some of the main active compounds in garlic include Allicin, Sulfur compounds, Flavonoids, Vitamins, minerals and Enzymes (Motteshard). Garlic has been shown to decrease the proportion of the LDL as compared to HDL (high density lipoprotein) cholesterol. One important component in garlic, allicin, has been shown to inhibit the activity of the enzyme HMG-CoA reeducates, which is involved in the production of cholesterol in the liver. By inhibiting this enzyme, garlic may help to reduce the production of cholesterol in the body, which can lead to lower levels of LDL cholesterol. Garlic has been shown to inhibit the activity of the enzyme lipoprotein lipase (Jennifer Moll, 2023).

According to randomized control trial garlic consumption could significantly reduce the total cholesterol levels in individuals suffering hyperlipidemias (Gómez-Arbeláez *et al.*, 2013). Garlic extract supplements play role in a significant reduction in LDL cholesterol levels in individuals with elevated cholesterol levels (Mahdavi-Roshan, Rismanchi and Nasrollahzadeh, 2016). Consuming raw garlic daily for three months lead to significant increase in HDL in individuals with hypercholesterolemia (Aslani *et al.*, 2016). Gastrointestinal symptoms, bad breath and body odor, bleeding risk and allergic reactions are some of the side effects of continuous garlic consumption.

Methodology

The study participants for this cohort study were selected from OPD of the Cardiology Department of the Federal government Polyclinic Hospital, Islamabad. Patients diagnosed with hyperlipidemias in the age group 40 to 70 years and 27-30 kg/m^2 body mass index were selected. Patients with cardiovascular diseases (CVDs) along with comorbid like diabetes and arthritis were excluded. Populations with age groups of less than 40 and more than 70 were not considered for the study. Patients with anaphylaxis and non-tolerant patients were excluded. One hundred patients with high cholesterol (> 245 mg/dl) were selected. Laboratory investigations were performed on the blood samples to analyze the outcomes of interest. Following previous literature (Banerjee & Maulik, 2002; Kojuri, Vosoughi, & Akrami, 2007), participants were randomly assigned into two groups - an experimental group that received 5 grams of encapsulated garlic intervention twice a day for 42 days, and a controlled group that received a placebo or no intervention.

The questionnaire was distributed among participants to get demographic information, dietary information, information about physical activities, and mental health information. A difference was considered statistically significant on SPSS analysis (t-test) when the p-value was less than or equal to 0.05. The demographic data included dietary intake, physical and health information. The average values of participants' age, weight, height, and average blood pressure were focused. BMI was calculated from weight and height. The ethical certificate was obtained from the head of the Cardiology Department of the Federal government Polyclinic Hospital in written form. Cholesterol,

triglyceride, and HDL-Chol analysis was performed on a Hitachi 704 analysis; Cholesterol was evaluated based on enzyme level, with the help of a high-performance reagent of Cholesterol. Using the same reagents, triglycerides are evaluated based on enzyme level. The same method was used for HDL; the samples were kept frozen at -80^{o}C at the end of the analysis.
Blood samples were collected in red top vacutainer glass tube. Blood samples were allowed to stand still for 45 minutes at room temperature, to allow clotting. During the clotting process, the tubes were kept sealed. Centrifugation was performed at 1500 rpm and 4°C for half hour. Cell cleans 90 (NaOH solution, used to remove protein from reaction cells), Hitergent (solution containing ethanolamine 5 %) were used. All the blood samples were run by Hitachi 704 analysis. At the end of the 10 runs, values were calculated and means with standard deviations were determined for each variable in analysis and a t-test was applied to find significance.

Results

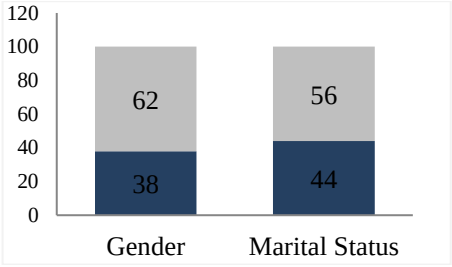

Figure 1: Demographic Findings

The average age limit was 50 years, the average weight was 70 kg, the average height was 159 cm, and median blood pressure was 140/80mmHg.The demographic data including gender and marital status is depicted in figure 1. The figure shows that 44% of participants were unmarried and 56 % were married. Similarly, 38 % of the participants were female and 62 % were male.

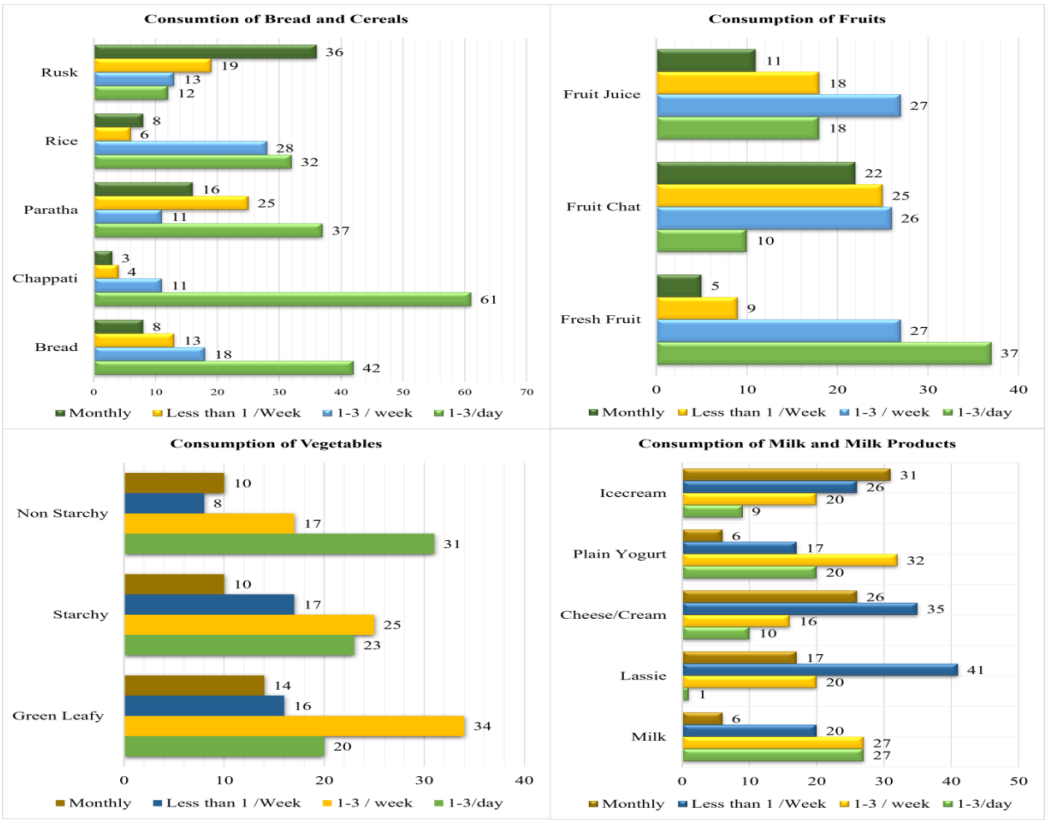

Figure 2: Dietary Habits of participants

By examining the dietary patterns of participants and analyzing their health outcomes, we can gain insight into the complex relationships between diet and health and can identify strategies for preventing and treating various conditions. The results of the study showed a relationship between these dietary patterns and BMI, suggesting that certain food groups may be associated with higher or lower body weight. We also investigated the relationship between diet and patients with hyperlipidemia. A healthy diet such as fruit, meat and vegetables were observed to have a significant effect on patients with hyperlipidemias.

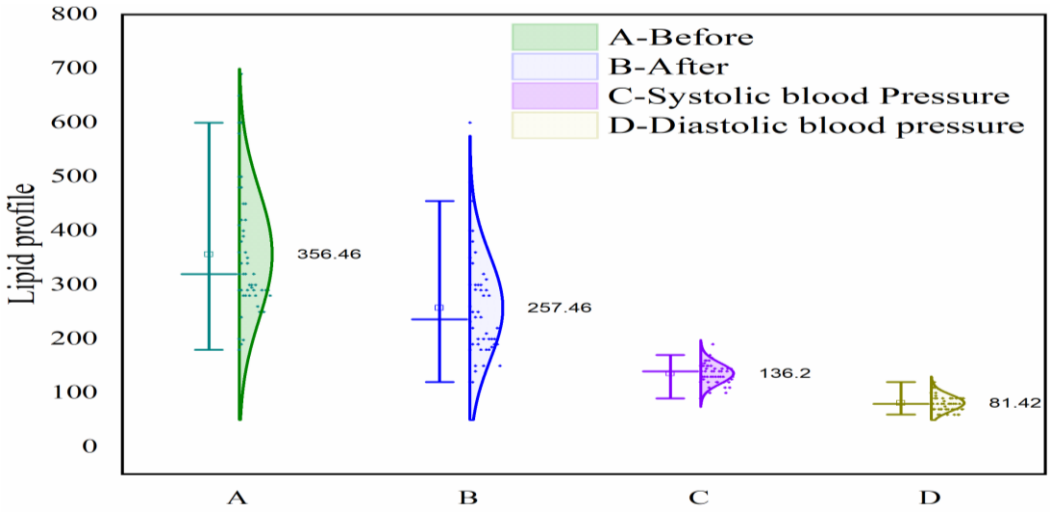

Figure 3: Lipid profile and blood pressure level of individuals

Table 1: BMI and nutritional status of patients (sig. calculated by t-test)

Lipid profile		
	Non-Garlic group	Garlic group
Observations	50	50
Mean lipid mg/dl	356.46	257.46
BMI (kg/m^2)	27.77	30
“p(T<=t) one-tail”	0.06	0.03

There was a clear difference between the groups who used garlic and those who did not. Those subjects who used fruit, meat, vegetables, and fish in their usual diet were found to be less prone than those whose usual diet was deficient in the above foods. As a result, the BMI of the latter group changed significantly (Table 1). The mean value of lipids calculated for the two groups are 356.46 mg/dl and 257.46 mg/dl respectively. BMI differed significantly between the garlic ($P < 0.03$), and non-garlic ($P < 0.06$) groups. Results show significant differences between both groups.

Table 2: Results of paired t-tests in different groups

	Non-garlic group (50)	Garlic group (50)
Mean	356.46	257.46
Variance	14349.84531	9554.539184
Pearson Correlation	0.367877149	
t stat	5.661439731	
t critical one-tail	1.676550893	
t critical two-tail	2.009575237	
P one-tail	3.87224×10^{-07}	
P two-tail	7.74449×10^{-07}	

Lipid profile changes after six weeks: t-test for paired two samples for means is demonstrated in table 4.2. According to table the value of t is 5.66, and the critical values of t are 1.67 and 2.00 for t-Critical one-tail and t-Critical two-tail respectively. The t-distributions against 49-degree of freedom

are less than the calculated value of t at 0000 % significance or 100% confidence interval. It was discovered that for p (T<=t) one-tail, the "t" Critical one-tail value was 1.6, which shows that changes in lipid levels were significantly different from other groups after the six-week intervention period. The average total cholesterol level decreased by 257.46 mg/dl in the garlic group (p-value: 3.87224×10^{-07}, which is almost equal to 0000). On the other hand, for the non-garlic group, the cholesterol level was noted as 356.46 mg/dl for (p-value: 3.87224×10^{-07}, which is almost equal to 0000). In addition, for p (T<=t) two-tail, the "t" Critical two-tail value was 2, and "p" was 3.87224×10^{-07}, which is almost equal to 0000, which again shows significant changes.

Discussion

According to our research, garlic lowers total cholesterol which confirms previous research (Adler & Holub, 1997), (TOUHIDI & Rahbani, 2001) and (Manfred Steiner et al., 1996) findings.

Garlic intake quantity and garlic consumption duration plays an important role in maintaining the lipid profile. It has been revealed that small quantity used for longer periods is more effective than high quantity for shorter periods. The clinical trial showed that less quantity of garlic used by CVD's patients has significantly reduced their lipid profile (Li et al., 2022). More intervention periods must be observed to obtain the additional effects of garlic (Zhang et al., 2020).In the past, reduced lipid profile with consuming boiled garlic has been reported ($p < 0.001$). In addition, HDL was lower in intervention group than the non-intervention group ($p<0.037$) (Ajamzibad, Beydokhti, Mohtasham, & Nematollahi, 2021). Heshmat et al (2022) conducted a case study for a group of 49 volunteers and evaluated the effect of the Allium Trifolium bulb on serum lipid profile. After 6 weeks, they get an wholesome decline in serum level of cholesterol without any side effects (Heshmat-Ghahdarijani, Soltani, Ghanadian, & Soleymani, 2022).

Dietary choices affect the management of hyperlipidemias (Chiavaroli et al., 2018).Studies have shown that poor fiber content and saturated fatty acids enriched diet can increase the risk of developing hyperlipidemias (Agarwala, Petersen, Jafari, & Kris-Etherton, 2022).

The Mediterranean diet, for example, which is rich in fiber, vegetables, fruits and healthy fats, has been shown to improve lipid profiles and reduce the risk of developing hyperlipidemias (Berná & Romero-Gomez, 2020). Similarly, the DASH diet (Dietary Approaches to Stop Hypertension) has been shown to lower blood pressure and improve lipid profiles (Chiu et al., 2016).

Therefore, adopting a healthy diet with high nutrient-dense foods can be beneficial in preventing and managing hyperlipidemias. Dietary patterns of the current study included bread, fruits, milk, and vegetables (Figure 2). There should be more clinical research investigating HDL cholesterol. As observed in the above Table 1, some high levels of the lipid profile were noted, which could be attributed to the immune potential of individuals. The overall lipid profile of all the group members was not uniform, which again can be attributed to different age factors and other blood profiles of everyone. Some little spikes in the profile of the garlic group were not concerning according to Stevinson et al. Comparable results were reported in past studies (Atkin, Laight, & Cummings, 2016; Stevinson, Pittler, & Ernst, 2000).

Atherosclerosis is a very fatal condition, and hyperlipidemias provides an etiopathological factor for atherosclerosis, which is considered the main constituent (Sukhanov et al., 2022). Atheromatous lesions in the aorta were reduced by 50% in rabbits when fed on garlic (Kamanna & Chandrasekhara, 1984). There was decreased concentration of cholesterol, triglycerides and LDL levels when garlic consumption and lipid profile in broiler chickens was observed (Rusli et al., 2022). Hyperlipidemic patients have > 200 mg/dL TCL and > 200 mg/ dL triglyceride concentration (Qasim et al., 2016). 1-4 % of garlic consumption can reduce serum cholesterol, triglycerides, and LDL cholesterol (Chi, 1982; Chi, Koh, & Stewart, 1982; Kamanna & Chandrasekhara, 1982; Mathew, Daniel, & Augusti, 1996; Qureshi et al., 1983) and is antilipidemic (Yuristo, 2022).Our investigation also supports garlic's influence on raising total cholesterol (p-value: 0000) levels in

some cases (Adler & Holub, 1997; Silagy & Neil, 1994; Stevinson et al., 2000; Warshafsky et al., 1993).The young population has a lower probability of being the victim of hyperlipidemias than the older one. Females are found more vulnerable to hyperlipidemias than males. People who had included vegetables, fruits, and meat in their diet schedule were found at the lower end of Hyperlipidemic risk. Unmarried people were found to be less susceptible to diseases than married ones. Diet can impact the management of hyperlipidemias (Chiavaroli et al., 2018).

Lifestyle modification, physical activity and smoking cessation can also have a positive impact on managing hyperlipidemias. Smoking cessation can improve HDL cholesterol levels and decrease the risk of developing cardiovascular disease (Campbell, Moffatt, & Stamford, 2008). Diet rich in saturated fats and processed carbohydrates is not good. A diet that includes omega-3 fatty acids, healthy fats and proteins pose lower risk of developing hyperlipidemias (Agarwala et al., 2022).

The Mediterranean diet, and DASH diet which is high in fruits, vegetables, whole grains, and healthy fats, has been shown to improve lipid profiles and reduce the risk of developing hyperlipidemias (Berná & Romero-Gomez, 2020), (Chiu et al., 2016). For individuals with existing hyperlipidemias, dietary patterns alone may not be sufficient to manage the condition and medical intervention such as lipid-lowering medications may be necessary. However, making healthy dietary choices can still be an important component of overall management of hyperlipidemias (Kreisberg & Oberman, 2003).Therefore, adopting a healthy dietary pattern that is rich in nutrient-dense foods can be beneficial in preventing and managing hyperlipidemias.

Conclusion

According to the study, raw garlic consumption may improve lipid profile of individuals suffering from hyperlipidemias. There was a significant drop in cholesterol after consumption of raw garlic for 42 days. In addition to garlic, a diet that includes vegetables and fruits, whole grains and proteins can positively impact overall health in patients with hyperlipidemias. Consult a healthcare worker to make changes in lifestyle and add physical activity to daily life. Smoking cessation is also good for cardiac health.

Recommendation: Consuming garlic can be used as the primary treatment for hyperlipidemias. Extensive research is needed in this field, and herbal medicines must properly be introduced. Public awareness is indispensable to preventing public health issues.

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