ORIGINAL ARTICLE

Effect of Almond Consumption on Serum Lipid Profile in Dyslipidemic Adults

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ABSTRACT

Aim: Cardiovascular disorders (CVDs) constitute a serious global health problem. Dyslipidemia is known to alter the risk of development of CVDs. Dyslipidemia may be associated with poor dietary habits and inclusion of nuts in diet has been shown to improve blood lipid levels. The present study evaluated the effect of almond intake on dyslipidemic subjects from the local population.

Methods: A prospective non-randomized study design was employed. Dyslipidemic individuals (n=21) with an age range from 21 to 60 years were recruited for the study.Baseline fasting blood samples were drawn from each subject and stored. Then subjects were asked to consume 50g/day almonds (without peel) for 30 days. On the 31st day, blood samples wereagain collected from each subject after an overnight fast. Both baseline and post-treatment serum samples were subjected to lipid profile analysis.

Results: Consumption of almonds significantly decreased the serum cholesterol, serum low-density lipoproteins (LDL)and serum triglyceride levels. Serum high-density lipoproteins (HDL) levels were increased but the increase was not statistically significant.

Conclusion: Almond intake was shown tobeneficially alter key aspects of lipid profile of dyslipidemic individuals towards the desired values. Almonds may be used as a simple dietary strategy to prevent dyslipidemia and CVDs.

Keywords: Dyslipidemia, Cardiovascular disorders, Lipid Profile, Coronary Heart Disease

INTRODUCTION

Cardiovascular disorders (CVDs) including coronary heart disease (CHD) and stroke are considered a major health concern all over the world[1]. There are several factors that trigger the development of CVDs such as sedentary lifestyle, smoking, excessive alcohol consumption, obesity, poor dietary habits and other co-morbidities. These risk factors negatively modify the metabolic milieu and lead to CVDs[2].

Dyslipidemia is acommon adverse metabolic change that contributes to the development of CVDs.It is defined as an elevated level of total cholesterol or low-density lipoprotein (LDL) or a decreased level of high-density lipoprotein (HDL) or both. In the United States, more than one-quarter of adults are dyslipidemic or are taking lipid-lowering medication(3). Patients with CVDs receive pharmacotherapy with statins and are advised lifestyle modifications like increased physical activity, cessation of smokingand dietary changes as secondary prevention measures to protect against recurrent cardiac events and all-cause mortality[2].

The American Heart Association (AHA) recommends a diet rich in nuts, fruits and vegetables and low in saturated fats for both primary and secondary prevention of CVDs (4). Nut intake (such as pistachios, peanuts, walnuts, almonds) causes in improvements in serum levels of total cholesterol, triglycerides, and LDL, thereby reducing the risk of CVDs[5,6,7,8].

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Almonds (Prunus dulcis) contain a high amount of monounsaturated fat, α-tocopherol, fiber, minerals (copper, magnesium) and phytochemicals including phytosterols and polyphenols. This nutrient distribution in almonds is associated with a decrease in the risk of CVDs among those individuals who consume themon a regular basis(9). Epidemiological studies have shown that almonds have positive effect on body weight, serum cholesterol, blood glucose, inflammation and oxidative stress[10]. To our knowledge, no adequately designed study has been conducted in the local population to observe effect of almond intake on lipid profile in dyslipidemic individuals. The present study was aimed at determining the potential positive impact of almond consumption on the lipid profile of dyslipidemic patients.

MATERIALS AND METHODS

A prospective non-randomized within subject study design was used.The study was carried out at IMBB, UOL in collaboration with Jinnah hospital Lahore, Akram Hospital and Central Park Medical College, Lahore. The study was conducted between April to September 2016. The study was approved by Ethical Committee, Institute of Molecular Biology and Biochemistry (IMBB), University of Lahore (UOL). A total of 21 participants were recruited for the study based on the predefined eligibility criteria. Written informed consent was obtained from each participant after providing detailed information about the study.Male and female individuals havingserum total cholesterol > 200mg/dl, serum HDL < 40mg/dl, serum LDL > 130mg/dl, serum fasting triglycerides > 150mg/dl were included for the study. Individuals with hypertension, diabetes mellitus, hypersensitivity to almonds, peptic ulcer, kidney disease, CVD, malignancy, urinary tract infections or taking lipid-lowering medications were excluded from the study.Pregnant females were also excluded.

After recruitment, instructions were given to each subject about the dose and intake of almonds (50 grams per day). American almonds packaged in plastic bags weighing 50 grams each were given to each subject, Subjects were advised to take one packet of almonds everyday (for a dose of 50grams/day) before breakfast.Lipid lowering medicines were stopped for individuals taking them. Other potential lipid lowering ingredients like garlic, ginger etc. were also stopped for the period of one month. The subjects were asked to continue with their usual diet and physical activity.

Blood samples were collected at two separate time-points; once at baseline i.e. before starting on almonds and then on the 31st day after the start of almond intake.For blood sample collection, the subjects were advised not to eat or drink anything except water for a period of 12 hours before sample collection. 5ml blood was obtained through sterile venipuncturein a vacutainer tube not containing any anticoagulant. Samples were incubated at room temperature for 30-40 minutes in upright position. The tubes were then centrifuged for 15 minutes at 2000 RFC. The supernatant containing serum was collected in a clean tube and stored at 4 C. Lipid profile assays were performed for serum cholesterol, LDL, HDL, VLDL and triglycerides using commercially available kits.

Sample size was calculated by keeping the power of study at 90%and level of significance at less than 5%.Descriptive data were presented as percentages and frequencies. Mean + SEM was calculated for quantitative variables. Paired sample T-test was performed to observe group mean differences. P-values <0.05 were considered significant.

RESULTS

The age range of the study subjects (n=21) was 21-60 years. Of the 21 subjects, 9 were females (42.85%) and 12 were males (57.14). 5 (23.8%) of the 21 subjects had a family history of diabetes mellitus. Mean serum cholesterol level before treatment was 242.29 mg/dl with a range of201-368mg/dl. Mean serum cholesterol after treatment was 196.67 mg/dl with a range of148-290 mg/dl. Serum cholesterol was significantly decreased after treatment ($p<0.001$) (Table 1). Mean serum LDL level before treatment was 153.24 mg/dl with a range of 78-199 mg/dl-Mean serum LDL after treatment was 129.10 mg/dl with a range of76-160 mg/dl. Serum LDL was significantly decreased after treatment ($p<0.001$) (Table 1).Mean serum HDL level before treatment was 41.90 mg/dl with a range of 31-60 mg/dl.Mean serum HDL after treatment was 42.42 mg/dl with a range of 26-61 mg/dl.The increase in mean serum HDL was not statistically significant ($p=0.932$) (Table 1).Mean serum triglycerides level before treatment was179.33 mg/dl with a range of 127-398-127 mg/dl. Mean serum triglycerides after treatment was 175.38 mg/dl with a range of72-381 mg/dl. Serum triglycerides was significantly decreased after treatment ($p<0.001$) (Table 1).Mean serum VLDL level before treatment was 36.19 mg/dl with a range of 22-79 mg/dl. Mean serum VLDL after treatment was 28.71 mg/dl with a range of 14-62 mg/dl. The decrease in mean serum VLDL after treatment was not statistically significant ($p=0.695$) (Table 1).

Table 1: Difference in serum lipid profile before and after treatment with almonds

Parameters	Mean Serum Level±SEM (n=21)		Mean Difference	Trend	p-value
	Before Treatment	After Treatment			
Cholesterol	242.29	196.67	45.62	↓	0.000*
LDL	153.24	129.10	24.14	↓	0.002*
HDL	41.90	42.42	- 0.24	↑	0.932
Triglycerides	179.33	175.38	3.95	↓	0.002*
VLDL	36.19	28.71	7.48	↓	0.695

*Difference is significant at $p < 0.05$

Table 2: Therapeutic efficacy of almonds in dyslipidemic subjects

Lipid Profile Range	Before	After
Desirable	0	11
Borderline	9	07
High risk	12	3

The base line lipid profile indicated that out of the 21 dyslipidemic subjects, 12 subjects were high risk whereas 9 subjects were in the border line range. After treatment with almonds, 11 out of the 21 subjects had normal lipid profile while 7 were in the border line range. Only 3 subjects had high risk dyslipidemia (Table 2).

DISCUSSION

Dyslipidemia is a metabolic disorder which predisposes affected individuals to CVDs and is associated with increased morbidity and mortality[3]. The aim of current study was to evaluate the effects of almonds in dyslipidemic patients. The results from the present study indicated that the consumption of almonds by dyslipidemic subjects led to a favorable lipid profile with a significant decrease in the serum cholesterol, serum LDL levels and serum triglycerides levels (Table 1). Regular intake of 50 grams of almonds every day for one month brought the lipid profile of 52% of the dyslipidemic subjects into the desirable range without any concomitant pharmacological therapy (Table 2). It has been shown previously that the intake of almonds 4 times in a week decreased the risk of CVDs by 38% as compared to non-consumers[4]. Almonds have been shown to reduce LDL levels by upto 10% with a consequent 2% decline in the risk of CVDs has been documented[11,12,13].

Daily consumption of almonds in the range of 25 to 168 g per day has been shown to decrease the serum cholesterol levels. In a recent study on rats, almonds were shown to improve HDL levels and normalize total cholesterol and LDL levels by inhibiting de novo cholesterol synthesis[14]. Almond intake has also been associated with a favourable fatty acid profile[15]. Almond consumption has been shown to improve alpha-tocopherol levels in patients with CHD[16]. The phytosterols, fiber, and alpha-tocopherolin almonds are suppress cholesterol absorption and increase

its excretion(8).Mechanisms responsible for the LDL reduction observed with almonds include decreased reabsorption of cholesterol and bile acids, increased excretion of cholesterol and bile acids and increased in the LDL receptor activity. Almonds also regulate de novo cholesterol synthesis and bile acid production[14]. The fibers present in almonds are also known to decrease oxidative stress, increased serum tocopherol and decrease lipid peroxidation (17, 18).Nuts are recognized as heart-healthy foods but there is a fear of weight gain with intake of nuts. Several studies have looked at the changes in weight and BMI with almonds intake but most of them reported no adverse effect in terms of weight gain[17,19,20,21]. Serum triglyceride levels are known to show short-term fluctuations in response to the type of food ingested. Our study showed a decrease in serum triglycerides following almond therapy. Previous studies have yielded mixed results in this regard but most of these studies were conducted in animal models or individuals with a normal lipid profile[22].

CONCLUSION

Regular almond intake has a beneficial impact on serum lipid profile in dyslipidemic patients which in turn can potentially reduce their risk of developing CVDs. Future research with larger sample sizes and prospective randomized controlled study designs need to be conducted to evaluate the effect of almond intake on the incidence of CVDs. The results from such studies may further highlight health benefits of almonds.

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