ORIGINAL ARTICLE

Atherosclerosis May Be Prevented by Using Psyllium Husk

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ABSTRACT

Research study was conducted to examine the effects of psyllium husk on lipid profile of primary hyperlipidemic patients. It was single blind placebo controlled research study, which was conducted in Jinnah Postgraduate Medical Centre, Karachi, Pakistan, from December 2008 to June 2009. Forty volunteer primary hyperlipidemic patients were included, in the research. Twenty patients were on placebo as control group, and twenty were on psyllium husk, 10 gram daily, in divided doses, TID, for the period of three months. Patients with hypothyroidism, alcoholism, renal and hepatic disease were excluded from the study, as these pathological conditions mask primary hyperlipidemia. Triglycerides and serum cholesterol were estimated by the enzymatic calorimetric method. Serum HDL-Cholesterol was determined by direct method, at day one and at last day of the treatment. LDL-Cholesterol was calculated by Friedwald formula (LDL= Tc- (TG/5 + HDL-C). Data were expressed as the mean ± SD and "t" test was applied to determine statistical significance of results. P value lesser than 0.05 was the limit of significance. When results compiled it was observed that two patients discontinued to take drug given, due to metallic test of psyllium husk. Psyllium decreased serum total cholesterol from 228.27±4.89 mg/dl to 199.22 ± 2.30 mg/dl, triglycerides from 169.27± 9.92 mg/dl to 164.5±8.56 mg/dl, LDL-Cholesterol from 159.72 ± 5.70 to 129.55± 2.81mg/dl, and increased serum HDL-Cholesterol from 34.61±1.85 to 36.77±1.96 mg/dl in three months of treatment. Results of all parameters were significant when paired 't' test was applied for result analysis. At end of the research work we concluded that psyllium is very effective agent to maintain lipid profile parameters at normal limits in hyperlipidemic patients.

Key words: Primary hyperlipidemia, Coronary heart disease. Atherosclerosis. Psyllium husk. Cholesterol. Triglycerides. Lipoproteins.

INTRODUCTION

There are five types of primary hyperlipidemia, (a) Type I is known as hyperchylomicronemia (b) Type II-a is known as hypercholesterolemia (c) Type II-b is known as combined hyperlipidemia (d) Type III is known as remnant hyperlipidemia or broad-beta disease and (e) Type IV is called endogenous hyperlipidemia or familial hyper pre-beta lipoproteinemia. All five types of primary hyperlipidemia are due to genetic reasons[1].

Elevated lipids and lipid carrying lipoproteins can cause atherosclerosis, especially low density lipoprotein cholesterol (LDL-C) which cause oxidation and formation of foamy cells (atheromas) at the wall of blood vessels, leading to narrowing of vessels and atherosclerosis[2].

Elevation of LDL-Cholesterol is particularly associated with risk of coronary artery disease risk, but it is increasingly clear that moderately raised triglycerides or VLDL or remnants in the presence of low HDL-Cholesterol may also be atherogenic[3].

It is well defined that atherosclerosis, if not stoped at earlier steps may lead to development of myocardial infarction or heart attack[4].

Keys to prevention and treatment of hyperlipidemia are the elimination or modification of risk factors, if possible, in conjunction with treatment of the specific lipid disorder[5].

For treating primary hyperlipidemia, statins, nicotinic acid, bile acid binding resins, psyllium husk and fibrates are main drug groups used. For many years psyllium husk has been used as an agent for gastrointestinal disturbances but it has remarkable hypolipidemic effects too[6].

Psyllium husk binds bile acids in the intestine, thereby interrupting the enterohepatic circulation of bile acids and increasing the conversion of cholesterol into bile acids in the liver. Hepatic synthesis of cholesterol is also increased, which in turn increases the secretion of VLDL into the circulation, raises serum triglyceride concentrations, and limits the effect of the drug on LDL cholesterol concentrations. HDL-Cholesterol concentrations increase by about 0.5 mg/dl, when psyllium is added

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to the treatment regimen of patients who are already receiving statin or nicotinic acid.[7]

PATIENTS AND METHODS

The research was conducted at department of Pharmacology and therapeutics, Basic Medical Sciences Institute, Jinnah Postgraduate Medical Centre, Karachi, from December 2008 to June 2009. Forty patients of primary hyperlipidemia were initially enrolled in this study, selected from ward and OPD of Jinnah Hospital, Karachi, Pakistan. Untreated primary hyperlipidemic male and female patients, age range from 21 to 65 years, were randomly selected. Patients with diabetes mellitus, peptic ulcer, renal disease, hepatic disease, hypothyroidism and alcoholism were excluded from the study by laboratory investigations, history and clinical examination. Written consent was obtained from all participants and was approved by ethical committee for research, JPMC, Karachi, Pakistan. The study period consisted of 3 months with fortnightly follow up visits. The required information like name, age, sex, occupation, address, previous medication, date of follow up visit and laboratory investigations, etc of each patient was recorded on a Performa. Initially medical history and physical examination of all patients were carried out. All the base line assessments were taken on the day of inclusion (Day-0) in the study and a similar assessment was taken on Day-90 of research design. After fulfilling the inclusion criteria patients were randomly divided into two groups, i.e.Drug-1(Psyllium husk 10gm/day) and Drug-2 (placebo capsules, containing equal amounts of partly grinded wheat) groups. Patients of drug-1 group were advised to take psyllium husk (ISPAGHULA) 10gm daily in three divided times after or before each meal. Patients of drug-2 group were provided placebo capsules, i.e. one capsule, TID, after meal for 90 days. Patients were called every 2 weeks for follow up to check blood pressure, weight, pulse rate and general appearance of the individual. Drug compliance to the regimen was monitored by interview and counseling at each clinical visit.

Serum total cholesterol and triglycerides were estimated by the enzymatic calorimetric Method[8].

Serum LDL-Cholesterol was calculated by Friedwald formula (LDL-Cholesterol=Total Cholesterol- (Triglycerides/5 +HDL-Cholesterol)[9]. Serum HDL-cholesterol was determined by direct method, at day-0 and day-90.

Data were expressed as the mean ± SD and "t" test was applied to determine statistical significance as the difference. A probability value of <0.05 was the limit of significance.

RESULTS

Used psyllium husk in 18 hyperlipidemic patients for the period of 3 months, mean total serum cholesterol decreased from 228.2±4.8 mg/dl on day-0 to 199.2±2.3 mg/dl on day-90. This reduction in total cholesterol was highly significant (P <0.001) when levels on day-0 and those on day-90 were compared. The average percentage reduction in total cholesterol was −12.7%. The mean serum triglycerides level of 18 patients treated with psyllium husk was 169.2±9.9 mg/dl on day-0 which reduced to 164.5±8.5 mg/dl on day-90. The mean value differences were highly significant (P <0.001) when levels on day-0 and those on day-90 were compared. The percentage change between day-0 to day-90 was −2.81. In 18 primary hyperlipidemic patients, when started treatment with psyllium husk, their mean serum LDL-C level at day-0 was 159.7±5.7 mg/dl. This level reduced to 129.5±2.8 mg/dl at day-90. When compared between day-0 to day-90, this change was highly significant (<0.001). The percentage change was -18.88. In 18 patients treated with psyllium husk, the mean HDL-C at day-0 was 34.6±1.8 mg/dl, which increased to 36.7±1.9 mg/dl on day-90. The result was highly significant (P <0.001) when values were compared at day-0 to day-90. The percentage increase in HDL-C from day-0 to day-90 was +6.24. Result of all parameters is shown in table 1, 2 and 3.

Table 1: Changes in lipid profile in psyllium husk group of patients (n=18)

Parameter	At day-0	At day-90	% Change
T-C	228.27±4.89	199.22±2.30	-12.72
TG	169.27±9.92	164.50±8.56	-2.81
LDL-C	159.72±5.70	129.55±2.81	-18.88
HDL-C	34.61±1.85	36.77±1.96	+6.24

Key:

- ± indicates standard error of mean
- (-) indicates decrease in percentage
- (+) indicates increase in percentage
- T-C stands for total cholesterol
- TG stands for triglycerides
- LDL-C stands for low density lipoprotein cholesterol
- HDL-C stands for high density lipoprotein cholesterol
- All observations are measured in mg/dl
- Figures in parentheses indicate number of patients

Table 2: Changes in lipid profile of patients on placebo group (n=20)

Parameter	At day-0	At day-90	% Change
T-C	215.95±2.47	208.70±5.38	-3.35
TG	148.45±4.80	146.20±4.20	-1.51
LDL-C	150.75±2.67	148.80±2.28	-1.29
HDL-C	35.50±1.13	35.75±1.07	+0.70

Key:

- ± indicates standard error of mean
- (-) indicates decrease in percentage
- (+) indicates increase in percentage
- TC stands for total cholesterol
- TG stands for triglycerids
- LDL-C stands for low density lipoprotein cholesterol
- HDL-C stands for high density lipoprotein cholesterol
- All observations are measured in mg/dl
- Figures in parentheses indicate number of patients

Table 3: Comparison of changes in lipid profile parameters between placebo and psyllium group of patients in 90 days of treatment.

PLACEBO GROUP (n=20)				PSYLLIUM HUSK GROUP (n=18)			
Parameter	**Baseline**	**Post Treatment**	**P Value**	**Baseline**	**Post Treatment**	**P Value**	**%Difference in groups**
TC	215.95±2.47	208.70±5.38	<0.05	228.27±4.89	199.22±2.30	<0.001	9.37
TG	148.45±4.80	146.20±4.20	<0.05	169.27±9.92	164.50±8.56	<0.001	1.30
LDL-C	150.75±2.67	148.80±2.28	<0.05	159.72±5.70	129.55±2.81	<0.001	17.59
HDL-C	35.50±1.13	35.75±1.07	<0.05	34.61±1.85	36.77±1.96	<0.001	5.54

Key: (±indicates standard error of mean, T-C stands for total cholesterol, TG stands for triglycerides, LDL-C stands for low-density lipoproteins, HDL-C stands for high-density lipoproteins, P Value >0.05 indicates non significant, P Value <0.001 indicates highly significant, Figures in parentheses indicate number of patients)

DISCUSSION

When analyzed statistically, it was observed that psyllium fibers has reduced triglycerides 2.81%, LDL-cholesterol 18.88% and serum total cholesterol 12.72% in treatment period; i.e., three months. High density lipoprotein cholesterol was increased 6.24%.

These results match with the study of MacMahon et al[10] who observed almost same changes in lipid profile of 26 male patients, treated with 3.4 gram of psyllium thrice daily for eight weeks. Results also match with the study of Dennison B.A et al[11] in all parameters of lipid profile except change in LDL-Cholesterol level which was higher than ours. This difference may be due to genetic variation in patients suffering from primary hyperlipidemia. There are five well recognized types of primary hyperlipidemia, so different type of primary hyperlipidemia could respond in different manners with different drug regimen and duration of the treatment. Results of the study also match with results of Reid R et al[12], in which 60 primary hyperlipidemic patients were treated by psyllium husk 8 gram daily in divided doses for the period of 4 months. In their observation triglycerides reduction was −2.9%, LDL-C was reduced to −24.1%. HDL-C and total cholesterol estimation was not included in their research work. Another study was conducted by Jenkins DJ et al[13] on placebo based trials, in which 13 male primary hyperlipidemic patients of either sex were treated with 8 gram psyllium husk in divided doses, thrice daily for the period of two months. Results of the trial almost match with our results. In their results total-cholesterol reduction was 12.1%, triglycerides reduced from 161.12±7.77 mg/dl to 155±2.12 mg/dl (P value <0.001). In percentage it was −2.9%. Observed LDL-C and VLDL-C reduction was −18.01% and −12.31%, respectively. Parameter of VLDL-C was not included in our study and HDL-C was not included in their trial. Our study is in contrast with the study of Raj J and Singh J[14] who observed less percentile changes in LDL-C, HDL-C, and total cholesterol. Only change in triglycerides match with our study. They even observed 1% increase in HDL-C in placebo group but by psyllium treatment, HDL-C was decreased upto 0.3%. They did not mention the mechanisms by which psyllium decreased cholesterol. One of the well accepted mechanisms is that psyllium stimulate bile acid synthesis through 7α-hydroxylase activity. Another mode of action of psyllium fibers to reduce cholesterol is diversion of hepatic cholesterol synthesis to bile acid production. Effect of psyllium on absorption of cholesterol and fat appeared minimal but it is small contribution to cholesterol lowering effect. Other mode of actions of psyllium to reduce cholesterol synthesis such as inhibition of hepatic cholesterol synthesis by propionate and secondary effects of slowing glucose

absorption may also contribute. Results of our study are in contrast with research work results of Garsetti M et al[15] who observed much more increase in HDL-Cholesterol and very less decreased levels of plasma total cholesterol, LDL-Cholesterol and triglycerides. They observed 12.03% increase levels of HDL-C. Total cholesterol, LDL-C and triglycerides reduced −19.23%, −34.01%, and −5.01% respectively. This difference may be due to large sample size and long period of drug trial in their study. In that study, sample size was 98 male and female primary hyperlipidemic patients who used psyllium husk 7 gram daily, in divided doses, twice daily for the period of one year. Large sample size, research study design, well controlled follow up, counseling on psyllium husk intake and so the compliance of the drug to be used may change the results in different research works. William CL et al[16] researched on use of psyllium husk in 29 male and female primary hyperlipidemic patients, with age range from 35 to 65 years for the period of two weeks. They used psyllium husk 10 gram daily, in divided doses with step I diet. They observed that psyllium husk has reduced LDL-cholesterol 22.11%, serum total cholesterol 21.21%, triglycerides 5.85%, and increased HDL-cholesterol 3.29%. These results are in contrast with our research work observations. The obvious reason for this contrast is step I diet, which was strictly followed by their patients enrolled and stayed at research residential centre. That is very scientific approach to conduct environment controlled research work on nutrition and nutrition related titles like effects of exercise, diet, fats, placebo, yoga and mind-stabilizing exercises in healthy and diseased individuals.

CONCLUSION

We concluded from results of this research work that psyllium husk fibers decreases serum total cholesterol, LDL-Cholesterol, triglycerides and increase HDL-Cholesterol significantly, and lowering LDL-Cholesterol/increasing HDL-Cholesterol are main preventing factors in atherosclerosis, myocardial infarction and heart attack.

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