Cholesterol-Lowering Effect of "Soluble Fiber" as an adjunct to "Low Calories Indonesian Diet" In Patients with Hypercholesterolemia

Fadilah Supari, Otte J Rachman

Abstrak

Latar Belakang : *Hiperkolesterolemia merupakan salah satu faktor risiko mayor penyakit jantung koroner. Modifikasi diet saat ini telah terbukti bermanfaat sebagai terapi inisial dalam penatalaksanaan hiperkolesterolemia. Penelitian* **double blind contolled studi** *ini bertujuan untuk menilai efektifitas "soluble fiber" (serat larut) sebagai terapi tambahan diet rendah kalori pada populasi Indonesia dengan hiperkolesterolemia. Pasien pria/wanita dengan kadar kolesterol 200-300mg% dilibatkan dalam penelitian ini. Setelah 1 minggu periode adaptasi, pasien dirandomisasi untuk dimasukkan ke dalam kelompok terapi (soluble fiber 8.4 g/hari) atau kelompok kontrol. Penelitian dilakukan selama 8 minggu dengan tetap melanjutkan terapi diet.* **Hasil :** *Kadar kolesterol total turun 5.59% pada kelompok terapi sedangkan penurunan pada kelompok kontrol hanya 0.6% (p < 0.05). Kolesterol LDL pada kelompok terapi turun sebesar 4.22% pada kelompok terapi. Sementara pada kelompok kontrol justru meningkat sebesar 2.58% (p< 0.05). Terdapat pula penurunan kadar kolesterol HDL dalam 8 minggu (16% vs 8%) (p = 0.005). Tidak terdapat perbedaan yang bermakna pada indikator-indikator lain di antara kedua kelompok.* **Kesimpulan :** *Pemberian soluble fiber 8.4 g/hari dapat menurunkan kadar kolesterol total, kolesterol LDL dan kolesterol HDL pada pria dan wanita dengan hiperkolesterolemia primer. Tidak terdapat perubahan kadar glukosa maupun elektrolit akibat konsumsi soluble fiber.*

Abstract

Background: *Hypercholesterolemia is a major risk factor for coronary heart disease. It has been proven that nutrition management is the initial therapeutic approach in hypercholesterolemic cases. This double blind controlled study evaluated the effectiveness of "soluble fiber" as an adjunct to low energy Indonesian diet in the treatment of persons with hypercholesterolemia. Male and female with hypercholesterolemia were recruited. After run in period for one week (dietary adaptation phase), eligible subjects with serum cholesterol concentrations between 200 mg% and 300 mg% were randomly assigned to receive either 8.4 g/day "soluble fiber" or a cellulose placebo for 8 wk while continuing diet therapy.* **Results:** *Serum total and LDL-cholesterol concentrations were decreased 5.59 % and 4.22 %. Serum total in the placebo group were decreased 0.60 %, and LDL-cholesterol were increased 2.58 % after eight wk (P < 0.05). Other outcome measures did not differ significantly between groups.* **Conclusions:** *Treatment with 8.4 g "soluble fiber" per day produces significant net reductions in serum total (5,59%) and LDL-cholesterol concentrations (4,22%), but also reduced HDL Cholesterol level significantly in male and female with primary hypercholesterolemia.*

Keywords: soluble fiber, cholesterol, low calories Indonesian diet, side effect

Despite substantial medical progress in the past two decades, coronary heart disease (CHD) remains a major health problem in most industrialized countries.[1] Elevated serum total and LDL-cholesterol concentrations are powerful risk factors for CHD,[2,3] Furthermore, in primary and secondary prevention trials, a reduction in total and LDL cholesterol concentrations decreased the risk of CHD. ATP III confirms diet therapy as the primary intervention for lowering serum cholesterol concentrations; drug therapy is reserved for persons at high risk of CHD who do not respond adequately to diet.[2] Consumption of viscous soluble fibers significantly lowers serum total and LDL cholesterol concentrations.[4,5] Short-term or long term placebo-controlled studies showed that consumption of 7–10 g "plantago ovata husk fiber"/d lowers serum total cholesterol concentrations 4–11% and serum LDL cholesterol concentrations 6–18% below placebo control concentrations in American low fat diet.[6,7,8] Fiber intake in Indonesian population is very low, despite the Indonesian dietary

Department of Cardiology, Faculty of Medicine, University of Indonesia, and National Cardiovascular Center Harapan Kita Hospital Jakarta Indonesia

pattern almost ideal such as provided 55-60% of total energy as carbohydrate, 15% of energy as protein, 30-35% of energy as fat but <20% of energy as a saturated fatty acids and 200mg Cholesterol daily. The purpose of this study was to compare the effectiveness and safety of "soluble fiber" as an adjunct to an Indonesian low calories diet in the treatment of men and women with hyper-cholesterolemia.

SUBJECTS AND METHODS

Subjects

Men and women with hypercholesterolemia were recruited for study. The protocol and consent form for the study were approved by the institutional review boards at each study site and subjects gave written, informed consent after the study procedures had been fully explained to them. Eligible subjects were aged 25–70 y and were free of significant organic disease. Persons who had had a myocardial infarction or major surgery $\leq$6 mo before the study were excluded, as were those with a history of allergies to "plantago ovata husk fiber" or aspartame. Women who became pregnant were excluded or dropped from the study. Persons who had taken corticosteriods, androgens, phenytoin, thyroid hormones, oral contraceptives, antibiotics, fiber supplements, calcium supplements, or oral hypolipidemic agents $\leq$3 mo before the study were also excluded.

Subjects were randomly assigned to the "soluble fiber" or placebo group after the dietary adaptation phase if their serum cholesterol concentrations were between 200mg% and 300mg%, . The study protocol specified that subjects maintain a constant body weight (±5%), consume >75% of the test product they received, and comply with the diet throughout the study.

Study design

This double-blind, placebo-controlled, study consisted of an one-week dietary adaptation phase followed by a 8 weeks treatment phase. During the dietary adaptation phase, subjects with primary hyper-cholesterolemia received on going dietary counseling regarding an low calories Indonesian diet. Subjects who met the entry criteria at the end of the dietary adaptation phase were then stratified by sex and randomly assigned to the treatment or placebo group.

Subjects were randomly assigned to groups independently at each study. The study was designed to have 140 subjects complete the protocol, 70 in the "soluble fiber" group and 70 in the placebo group. Power calculations were based on a two-sided α risk of 0.05. On the basis of the stated sample sizes and variance estimates from previous studies, this study was designed to have 95% power to detect a 10% difference in serum total cholesterol concentrations and a 10% difference in serum LDL-cholesterol concentrations between groups.

Subjects in the treatment group received 2,8 g "soluble fiber" three times daily and subjects in the placebo group received 2,8 g microcrystalline cellulose three times daily for 8 weeks adjunctive to the low calories Indonesian diet. Subjects returned at weeks 0, 2, 4, 6, 8 for dietary counseling and at weeks 0, 4, 8 for lipid measurements

Diets and test products

All subjects were instructed to consume an calories Indonesian diet at enrollment and to continue that diet throughout the dietary adaptation and treatment phases. The Low calories Indonesian diet provided 30 cal/kg bodyweight as a total energy intake, where 55-60 % of total energy as carbohydrate, 15% of total energy as protein, 30-35 % of total energy as fat, more than 10% of energy as saturated fatty acids (<20%), and 200 mg cholesterol daily. Registered dietitians reviewed dietary information and provided dietary counseling.

During the treatment phase, subjects in the "soluble fiber" group received orange-flavored, sugar-free water soluble fiber (5.52 g *Psyllium husk* dan 2.88 g Inulin chicory from vegeta , PT. Sari Enesis Indah), where as subjects in the placebo group received microcrystalline cellulose. Both groups received 3-6 packets daily; each packet provided 2.8 g "soluble fiber" or cellulose placebo. The products were packaged in identical foil packets with identical information and instructions. Both products were orange-flavored powders that were similar in taste, texture, and appearance. The subjects were instructed to mix each packet in 240 mL liquid and to drink the mixture immediately before breakfast and lunch and dinner. Compliance was monitored by interviewing the subjects and counting unopened packets returned at each follow-up visit.

Variables measured

Subjects underwent a complete physical examination at weeks 0 and 8 of the study. At weeks 0, 4, 8, of the treatment phase, serum lipids, Blood Glucose level, body weight, blood pressure, and heart rate were measured. Clinic visits occurred in the morning after a minimum 12-h fast and subjects did not consume the test products on these mornings. Serum lipid profiles included enzymatic measurement of total cholesterol, HDL-cholesterol, and triacylglycerol concentrations[9]. LDL-cholesterol concentrations were calculated from total and HDL-cholesterol concentrations by using the Friedewald equation[10] . Because the equation has not been validated for triacylglycerol concentrations >4.52 mmol/L, LDL cholesterol was not calculated when triacylglycerol concentrations were >4.52 mmol/L.

Adverse events related to the test products were record during the treatment phase. Subjects were asked an open-ended question about the occurrence of any unusual symptoms Subjects were also telephoned by the investigator's staff at 4-wk intervals between clinic visits (weeks 2, 6, 8,) and asked about potential adverse events and study compliance.

The subjects provided 3-d food records (2 weekdays and 1 weekend day) at weeks 0,2,4,6,8,. A registered dietitian reviewed all food records for completeness. Food records were analyzed by the Nutritionist in Nasional Cardiovascular Center Harapan Kita, and Nutrition Research Center, Bogor for evaluation of total energy, percentages of energy from fat, protein, and carbohydrate as swell as fat intake composition.

Statistical analyses

Comparability of the "soluble fiber" and placebo groups at baseline was determined by using a chi-square test for risk factors, and by using analysis of t-tests for baseline height, weight, and lipid concentrations. Baseline values for serum total, derived LDL, and HDL-cholesterol and plasma triacylglycerol, and blood Glucose level were defined as the average of values taken at week 0. Changes from baseline lipid concentrations and clinical laboratory data, and dietary data were compared between groups by using t-tests. Each week in which measurements were taken, comparisons of change from baseline were also made. Paired *t* tests, Wilcoxon rank-sum tests, or both were used to assess the significance of changes from baseline within

groups. All analyses were performed by using SPSS 10.1 Significance was defined as $P \leq 0.05$.

RESULT

Of the 160 subjects who began the dietary adaptation phase, 140 qualified for assignment to a study group (70 to receive placebo and 70 to receive "soluble fiber"). Major reasons for disqualification for random assignment were failure to meet the study's inclusion criteria ($n =6$, withdrawal of consent ($n = 6$), and loss to follow-up ($n = 8$). Of those who completed the entire study, 126 subjects (61 in the placebo group and 65 in the "soluble fiber" group) fully complied with the study protocol. Compliance with the regimens was excellent: the subjects consumed 95% of the "soluble fiber" and 95% of the placebo.

Baseline characteristics of subjects in the placebo and "soluble fiber" groups are shown in **Table 1**. Baseline and final dietary intakes of the "soluble fiber" and placebo groups are shown in **Table 2**. Subjects in the "soluble fiber" group had significantly higher mean cholesterol intakes at baseline than did those in the placebo group. Otherwise, dietary intakes of the groups did not differ significantly throughout the study. Subjects' body weights were also similar between groups; there were no significant differences between groups and no significant change from baseline within groups at any clinic visit. During study there were 9 persons dropped out in placebo group and 5 persons in "soluble fiber" group. At the end of the study, there were   significant differences in the baseline of serum total, LDL, as well as HDL-cholesterol; but not in triacylglycerol concentrations between groups. During the treatment phase, mean serum total cholesterol concentrations decreased an additional 5.59 % in the "soluble fiber" group and 0.60 % in the placebo group compared with baseline concentrations **(Table 3).** Mean serum LDL-cholesterol concentrations decreased an additional 4.22 % in "soluble fiber" group but increased 2.58% in placebo group. Thus, the change in serum total and LDL-cholesterol concentrations (baseline compared with final) was significantly different between group after 8 weeks of treatment. Significant differences in percentage change from baseline in serum LDL cholesterol occurred at weeks 8th.

No significant interactions between age, sex and hormonal (menopause women) in soluble fiber group

were found for any of the lipid variables measured **(Table 4, 5, 6).**

There were no significant differences in the incidence of adverse events between groups. No serious adverse events related to treatment were reported in either group. Mild gastrointestinal effects, such as flatus, bloating, indigestion, nausea, heartburn, diarrhea, and constipation, were reported by 26% of subjects taking "soluble fiber" and 31% of subjects taking placebo **(Table 7).**

Table 1. Baseline characteristics of subjects

	Group of Treatment		P
	Soluble Fiber (n=65)	Placebo (n=61)	
Age (year)	46.91 ± 1.39	46.43 ±1.42	0.809
Height (cm)	158.33 ± 0.93	158.23 ± 0.90	0.937
Weight (Kg)	62.68 ± 1.33	65.42 ± 1.38	0.155
Body Mass Index (Kg/m^2)	24.96 ± 0.45	26.06 ± 0.44	0.086
Total Cholesterol (mg/dl)	239.78 ± 4.42	227.13 ± 3.28	0.023
HDL Cholesterol (mg/dl)	53.46 ±1.32	49.13 ± 1.54	0.034
LDL Cholesterol (mg/dl)	157.14 ± 4.09	144.98 ± 2.94	0.016
Triacylglycerol (mg/dl)	149.69 ± 10.22	173.11 ± 17.01	0.241
Fasting Serum Glucose (mg/dl)	95.42 ± 2.32	105.10 ± 6.38	0.147

Risk Factor		Group of Treatment	
		Vegeta (n=65)	Placebo (n=61)
Hypertension	(+)	11.9%	20.6%
	(−)	39.7%	27.8%
Smoking	(+)	8.7%	9.5%
	(−)	42.9%	38.9%
Family History	(+)	22.2%	21.4%
	(−)	29.4%	27.0%
Diabetes Type II	(+)	6.3%	10.3%
	(−)	45.2%	38.1%

(+) positif

(−) negatif

DISCUSSION

The lipid reductions observed over 8 wk in this study were similar to those in previous, placebo-controlled studies. Sprecher et al [11] reported that total and LDL-cholesterol concentrations were lower (net differences of 3.5% and 5.1%, respectively) in the **"**soluble fiber" group than in the placebo group after 8 wk of treatment (5.1 g twice daily) in subjects consuming a low-fat diet. In other studies with an 8-wk AHA Step I diet lead-in phase, total and LDL-cholesterol concentrations were 4.8% and 8.2% lower, respectively [12], and 4.3% and 8.8% lower, respectively[13] in subjects who received "soluble fiber" (10.2 g/d) for an additional 8 wk than in subjects who received placebo.

Similar to the results of other studies[13,14] no significant interactions of sex and treatment were found in the present study for any of the lipid variables measured. Thus, "soluble fiber" use by men and women can sustain serum lipid benefits for up to 6 mo.

The very low calories intakes reported by subjects in both the "soluble fiber" and placebo group in this study suggest that subjects in both groups underreported food intakes. Underreporting of food intakes was documented in previous clinical studies [15]. Because mean energy intakes of the groups did not differ significantly at any time during the study, the reporting bias was probably similar in both groups.

The mechanism of action of "soluble fiber"'s hypocholesterolemic effects has not been fully elucidated. "plantago ovata husk fiber**"** was shown to *stimulate bile acid synthesis* (7 α-hydroxylase activity) in animal models [16,17] and in humans[18]. The diversion of hepatic cholesterol for bile acid production has long been established as a mechanism for reducing serum cholesterol**. "**soluble fiber"'s effect on the absorption of cholesterol[18,19] and fat[20] appears minimal but may make a small contribution to cholesterol lowering. Additional mechanisms, such as inhibition of hepatic cholesterol synthesis by propionate [21] and secondary effects of slowing glucose absorption[22], may also play a role.

The ATP III guidelines advocate stepwise reductions in fat, saturated fat, and cholesterol as the primary therapy for high total and LDL-cholesterol concentrations; drug therapy is reserved for persons at high risk of CHD or for those who do not respond adequately to diet [2].

In this study, dietary change and moderate term use of a low dose of "soluble fiber**"** (2.8 g three times daily) with inulin resulted in ≈ 5.59 % lower serum total cholesterol concentrations and 4.22 % lower LDL-cholesterol concentrations than did dietary changes

and placebo. But in other side the HDL cholesterol also reduced significantly in this study. Lowering HDL –cholesterol level in this study might be due to fatty acids intake composition in the diet during study beside the influence of "soluble fiber"

The effect on Blood Glucose level :
In this study reported that there was no changes in fasting serum glucose concentration during treatment phase. Also there was no changes in Body weight.
Earlier studies reported that psyllium reduced fasting serum glucose concentrations or decreased postprandial serum glucose concentrations[23] in individuals with type 2 diabetes. In a carefully controlled crossover study of the effects of psyllium taken immediately before breakfast and dinner compared with the effects of cellulose placebo supplementation in individuals with type 2 diabetes, postprandial serum glucose values were 14% lower after breakfast, 31% lower after lunch, and 20% lower after dinner with psyllium[23] The ability of soluble fibers to reduce the postprandial glucose response to meals eaten several hours after fiber ingestion was shown previously in nondiabetic individuals[23,24] . In body weights , no consistent trends in body weight were seen during this study
The conclusion of this study was the effect of soluble fiber (plantago ovata husk fiber and inulin) as adjunct diet to very low calories Indonesian diet in 8 weeks could decrease plasma total cholesterol level as well as LDL cholesterol level, but also decreased HDL Cholesterol level significantly. There were no effect on blood glucose level as well as on the plasma electrolyte level.

Conclusions:
Treatment with 8.4 g "soluble fiber" per day produces significant net reductions in serum total (5,59%) and LDL-cholesterol concentrations (4,22%), but also reduced HDL Cholesterol level significantly in male and female with primary hypercholesterolemia.

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	Group of Treatment		P
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Total Cholesterol (mg/dl)	239.78 ± 4.42	227.13 ± 3.28	0.023
HDL Cholesterol (mg/dl)	53.46 ±1.32	49.13 ± 1.54	0.034
LDL Cholesterol (mg/dl)	157.14 ± 4.09	144.98 ± 2.94	0.016
Triacylglycerol (mg/dl)	149.69 ± 10.22	173.11 ± 17.01	0.241
Fasting Serum Glucose (mg/dl)	95.42 ± 2.32	105.10 ± 6.38	0.147

Risk Factor		Group of Treatment	
		Vegeta (n=65)	Placebo (n=61)
Hypertension	(+)	11.9%	20.6%
	(−)	39.7%	27.8%
Smoking	(+)	8.7%	9.5%
	(−)	42.9%	38.9%

Family History	(+)	22.2%	21.4%
	(−)	29.4%	27.0%
Diabetes Type II	(+)	6.3%	10.3%
	(−)	45.2%	38.1%

(+) positif
(−) negatif

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Table 2. Baseline and Final Dietary Intakes of "Soluble Fiber" and Placebo groups

Nutrient		Group of Treatment[1]		P[2]
		Soluble Fiber (n=65)	Placebo (n=61)	
Calorie (kcal)	0 week	1725.10 ± 43.54	1790.86 ± 55.36	0.679
	4 week	1235.24 ± 27.98	1290.91 ± 32.18	0.193
	8 week	1265.55 ± 30.69	1271.82 ± 31.17	0.886
Carbohydrate	0 week	52.27 ± 1.05	53.48 ± 1.16	0.441
(% of Calories)	4 week	51.18 ± 0.77	52.79 ± 0.67	0.118
	8 week	51.11 ± 0.87	50.97 ± 0.74	0.901
Protein	0 week	15.70 ± 0.34	15.63 ± 0.43	0.904
(% of Calories)	4 week	16.10 ± 0.27	15.84 ± 0.26	0.485
	8 week	15.58 ± 0.29	16.01 ± 0.29	0.301
Fat	0 week	32.78 ± 1.02	31.91 ± 1.09	0.559
(% of Calories)	4 week	33.18 ± 0.71	31.87 ± 0.62	0.167
	8 week	33.64 ± 0.74	33.68 ± 0.63	0.964
Cholesterol (mg)	0 week	199.86 ± 15.17	167.02 ± 16.73	0.148

	4 week	166.31 ± 7.85	193.12 ± 11.03	0.048
	8 week	177.38 ± 11.06	185.08 ± 9.57	0.602
Fiber (g)	0 week	10.25 ± 0.55	9.26 ± 0.49	0.182
	4 week	16.45 ± 0.42	8.19 ± 0.24	0.000
	8 week	16.13 ± 0.35	8.25 ± 0.34	0.000
SFA (g) Saturated Fatty Acids	0 week	15.78 ± 0.69	16.17 ± 0.98	0.231
	4 week	22.85 ± 0.87	22.92 ± 0.97	0.955
	8 week	23.36 ± 0.68	23.53 ± 0.72	0.863
MUFA (g) Mono Unsaturated Fatty Acids	0 week	3.73 ± 0.69	12.07 ± 0.69	0.090
	4 week	11.43 ± 0.42	11.26 ± 0.43	0.784
	8 week	11.84 ± 0.54	11.34 ± 0.41	0.468
PUFA (g) Poly Unsaturated Fatty Acids	0 week	10.09 ± 0.82	10.56 ± 1.06	0.727
	4 week	7.80 ± 0.38	8.20 ± 0.48	0.514
	8 week	8.32 ± 0.52	8.90 ± 0.46	0.402

[1] mean ± SEM
[2] Independent t test
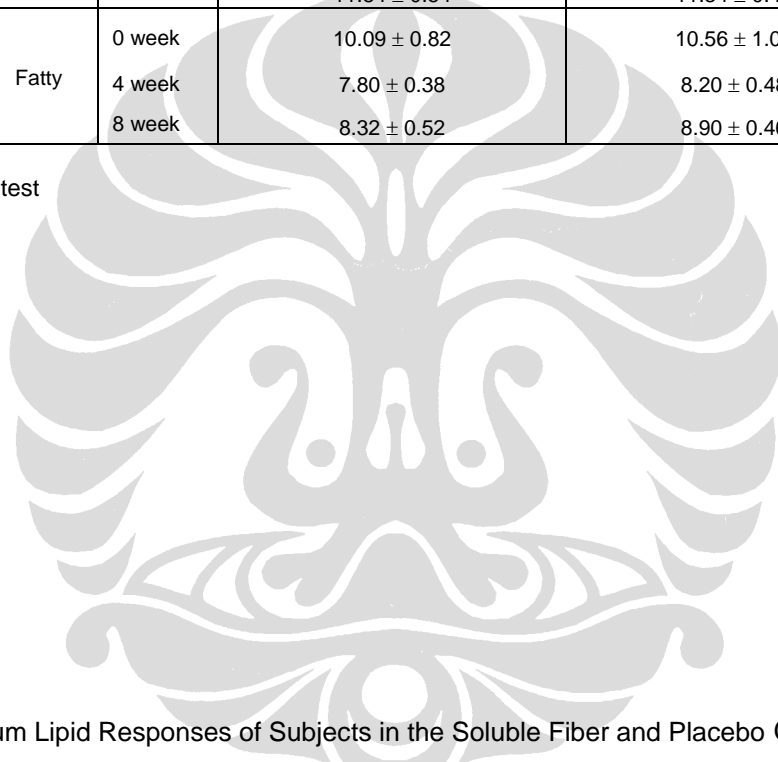
Tabel 3. Serum Lipid Responses of Subjects in the Soluble Fiber and Placebo Groups

		Group of Treatment[1]				P[2]
		Soluble Fiber (n=65)		Placebo (n=61)		
		Mean	% Change	Mean	% Change	
Total Cholesterol (mg/dl)	0 wk	239.78 ± 4.42	-	227.13 ± 3.28	-	-
	4 wk	232.92 ± 4.63	-2.56 ± 1.19	231.21 ± 4.12	1.96 ± 1.35	0.013
	8 wk	225.49 ± 4.25	-5.59 ± 1.09	225.52 ± 3.92	-0.60 ± 1.16	0.002
HDL Cholesterol (mg/dl)	0 wk	53.46 ± 1.32	-	49.13 ± 1.54	-	-
	4 wk	46.77 ± 1.26	-12.10 ± 1.44	43.74 ± 1.25	-9.60 ± 1.70	0.262
	8 wk	44.57 ± 1.16	-16.00 ± 1.42	44.11 ± 1.46	-8.82 ± 2.06	0.005

LDL Cholesterol (mg/dl)	0 wk	157.14 ± 4.09	-	144.98 ± 2.94	-	-
	4 wk	158.83 ± 4.16	1.81 ± 1.58	156.02 ± 3.50	8.69 ± 2.23	0.012
	8 wk	148.90 ± 3.75	-4.22 ± 1.47	147.39 ± 3.48	2.58 ± 2.07	0.008
Triacylglycerols (mg/dl)	0 wk	149.69 ±10.22	-	173.11 ± 17.01	-	-
	4 wk	142.42 ± 8.01	2.53 ± 3.99	162.59 ± 13.88	3.91 ± 4.54	0.819
	8 wk	168.31 ± 11.03	20.94 ± 5.24	175.00 ± 13.63	14.99 ± 5.10	0.418
Fasting Serum Glucose (mg/dl)	0 wk	95.42 ± 2.32	-	105.10 ± 6.38	-	-
	4 wk	104.42 ± 3.24	9.35 ± 1.97	115.26 ± 7.56	9.88 ± 1.69	0.841
	8 wk	98.06 ± 3.34	2.86 ± 2.34	116.23 ± 9.18	9.05 ± 4.39	0.208

[1] mean ± SEM
[2] Independent t test

Tabel 4.   Serum Lipid Responses of Subjects in the Soluble Fiber Group between Age

		Soluble Fiber Group[1]				P[2]
		Age< 55 years (n = 50)		Age > 55 years (n = 15)		
		Mean	% Change	Mean	% Change	
Total Cholesterol (mg/dl)	0 wk	235.42 ± 4.28	-	254.33 ± 12.41	-	-
	4 wk	229.20 ± 4.91	-2.52 ± 1.27	245.33 ± 11.40	-2.68 ± 3.02	0.956
	8 wk	223.26 ± 4.59	-4.93 ± 1.25	232.93 ± 10.34	-7.80 ± 2.23	0.272
HDL Cholesterol (mg/dl)	0 wk	52.88 ± 1.55	-	55.40 ± 2.46	-	-
	4 wk	46.18 ± 1.51	-12.25 ± 1.73	48.73 ± 2.17	-11.59 ± 2.45	0.849
	8 wk	44.36 ± 1.31	-15.29 ± 1.66	45.27 ± 2.55	-18.36 ± 2.64	0.364
LDL Cholesterol (mg/dl)	0 wk	154.33 ± 4.26	-	167.00 ± 10.76	-	-
	4 wk	155.14 ± 4.42	1.20 ± 1.77	171.71 ± 10.12	3.89 ± 3.53	0.483
	8 wk	146.77 ± 3.92	-3.71 ± 1.78	156.21 ± 9.79	-5.97 ± 2.36	0.526
Triacylglycerols (mg/dl)	0 wk	146.82 ± 10.88	-	159.27 ± 26.07	-	-
	4 wk	145.32 ± 9.46	4.87 ± 4.55	132.73 ± 14.79	-5.26 ± 8.24	0.288
	8 wk	170.72 ± 13.91	22.34 ± 6.36	160.27 ± 12.20	16.27 ± 8.31	0.629
Fasting Serum Glucose (mg/dl)	0 wk	92.92 ± 2.13	-	103.73 ± 6.87	-	-
	4 wk	101.30 ± 3.15	9.01 ± 2.14	114.80 ± 9.07	10.49 ± 4.85	0.754
	8 wk	95.14 ± 2.60	2.85 ± 2.08	107.80 ± 11.54	2.89 ± 7.63	0.995

[1] mean ± SEM
[2] Independent t test

Tabel 5. Serum Lipid Responses of Subjects in the Soluble Fiber Group between Sex

		Soluble Fiber Group[1]				P[2]
		Men (n = 25)		Women (n = 40)		
		Mean	% Change	Mean	% Change	

		Mean	% Change	Mean	% Change	P
Total Cholesterol (mg/dl)	0 wk	241.36 ± 7.89	-	238.80 ± 5.31	-	-
	4 wk	234.16 ± 7.11	-2.37 ± 1.91	232.15 ± 6.14	-2.67 ± 1.53	0.905
	8 wk	227.00 ± 7.40	-5.51 ± 1.91	224.55 ± 5.21	-5.64 ± 1.33	0.953
HDL Cholesterol (mg/dl)	0 wk	48.12 ± 1.56	-	56.80 ± 1.71	-	-
	4 wk	41.36 ± 1.48	-13.43 ± 2.48	50.15 ± 1.63	-11.27 ± 1.77	0.470
	8 wk	38.96 ± 1.14	-18.23 ± 2.05	48.08 ± 1.50	-14.61 ± 1.90	0.216
LDL Cholesterol (mg/dl)	0 wk	161.71 ± 8.00	-	154.33 ± 4.45	-	-
	4 wk	163.38 ± 7.09	2.56 ± 2.83	156.03 ± 5.13	1.34 ± 1.89	0.710
	8 wk	152.87 ± 6.88	-3.83 ± 2.74	146.56 ± 4.39	-4.45 ± 1.73	0.842
Triacylglycerols (mg/dl)	0 wk	170.92 ± 15.98	-	136.43 ± 12.98	-	-
	4 wk	160.32 ± 14.66	-1.67 ± 6.70	131.23 ± 8.96	5.16 ± 4.96	0.409
	8 wk	198.48 ± 23.16	21.42 ± 10.73	149.45 ± 9.73	20.63 ± 5.37	0.942
Fasting Serum Glucose (mg/dl)	0 wk	102.48 ± 5.25	-	91.00 ± 1.57	-	-
	4 wk	109.80 ± 4.94	8.00 ± 1.97	101.05 ± 4.23	10.20 ± 2.97	0.591
	8 wk	100.28 ± 5.09	-1.64 ± 2.04	96.68 ± 4.43	5.67 ± 3.54	0.130

[1] mean ± SEM
[2] Independent t test

Tabel 6. Serum Lipid Responses of Subjects in the Soluble Fiber Group between Menopause Women and not Menopause Women

		Soluble Fiber Group[1]				P[2]
		not Menopause (n= 27)		Menopause Women (n = 13)		
		Mean	% Change	Mean	% Change	
Total Cholesterol (mg/dl)	0 wk	230.78 ± 5.79	-	255.46 ± 9.81	-	-
	4 wk	222.48 ± 6.92	-3.56 ± 1.75	252.23 ± 10.60	-0.82 ± 3.05	0.411
	8 wk	218.00 ± 6.68	-5.38 ± 1.75	238.15 ± 6.88	-6.18 ± 2.00	0.782
HDL Cholesterol (mg/dl)	0 wk	55.52 ± 2.20	-	59.46 ± 2.60	-	-
	4 wk	48.96 ± 2.13	-11.35 ± 2.38	52.62 ± 2.31	-11.11 ± 2.38	0.950
	8 wk	47.26 ± 1.94	-13.90 ± 2.64	49.77 ± 2.30	-16.08 ± 2.11	0.598
LDL Cholesterol (mg/dl)	0 wk	150.78 ± 5.26	-	162.33 ± 8.17	-	-
	4 wk	149.93 ± 5.77	-0.11 ± 2.32	169.75 ± 9.67	4.59 ± 3.15	0.255
	8 wk	143.11 ± 5.39	-4.40 ± 2.33	154.33 ± 7.30	-4.56 ± 2.15	0.965
Triacylglycerols (mg/dl)	0 wk	122.37 ± 12.30	-	165.62 ± 29.99	-	-
	4 wk	118.22 ± 9.77	1.38 ± 4.68	158.23 ± 16.85	13.00 ± 11.83	0.278
	8 wk	138.07 ± 11.96	19.82 ± 6.49	173.08 ± 15.31	22.32 ± 9.93	0.831
Fasting Serum Glucose (mg/dl)	0 wk	88.96 ± 1.78	-	95.23 ± 2.84	-	-
	4 wk	94.19 ± 2.39	5.93 ± 1.84	115.31 ± 11.32	19.06 ± 7.94	0.131
	8 wk	92.15 ± 2.74	3.93 ± 2.78	106.08 ± 12.32	9.30 ± 9.42	0.593

[1] mean ± SEM
[2] Independent t test

Table 7. Incidence of Adverse Events between Groups

	Group of Treatment	
	Soluble Fiber (n=65)	Placebo (61)
1. Epigastric pain	4	5
2. Abdominal pain	12	15
3. Abdominal Disfonfort	18	17
4. Nausea	10	9
5. Flatulence	6	3
6. Hunger	3	-
7. Obstipation	2	2
8. Diarhea	6	8

Table 8. Liver and Renal Function during Study

	Group of Treatment						P^2
	Soluble Fiber (n=65)			Placebo (n=61)			
	Baseline	After Treatment	Change (mg/dl)	Baseline	After Treatment	Change (mg/dl)	
SGOT	25.08 ± 1.47	23.28 ± 1.35	-1.80 ± 0.76	24.61 ± 1.27	25.20 ± 1.39	0.59 ± 1.22	0.094
SGPT	29.72 ± 2.94	26.16 ± 2.50	-3.56 ± 1.39	29.92 ± 2.57	28.79 ± 2.43	-1.13 ± 1.58	0.248
Ureum	24.48 ± 0.65	22.38 ± 0.75	-2.11 ± 0.68	26.36 ± 1.28	23.98 ± 1.35	-2.38 ± 0.86	0.807
Kreatinin	0.82 ± 0.03	0.83 ± 0.03	0.003 ± 0.02	0.89 ± 0.05	0.88 ± 0.04	-0.01 ± 0.02	0.618
Asam Urat	5.66 ± 0.19	6.06 ± 0.22	0.39 ± 0.15	5.81 ± 0.20	6.48 ± 0.26	0.68 ± 0.18	0.227
Kalium	4.18 ± 0.04	4.36 ± 0.07	0.18 ± 0.08	4.20 ± 0.06	4.31 ± 0.08	0.10 ± 0.08	0.521
Magnesium	2.16 ± 0.02	2.14 ± 0.02	-0.02 ± 0.03	2.08 ± 0.02	2.10 ± 0.03	0.02 ± 0.03	0.306
Kalsium	9.62 ± 0.07	9.11 ± 0.06	-0.50 ± 0.08	9.70 ± 0.08	9.19 ± 0.07	-0.52 ± 0.08	0.906
Natrium	141.30 ± 0.23	140.63 ± 0.23	-0.67 ± 0.23	141.05 ± 0.26	140.85 ± 0.34	-0.20 ± 0.29	0.205

[1] rata-rata $\pm$ SEM
[2] Independent t test

Table 9. Defecation during Treatment

		Frekuensi Buang Air Besar				P[1]
		2-4x/week	1-2x/day	1-3x/day	> 3 x/day normal stool	
Beffore Treatment	Soluble Fiber	4	59	1	1	0.298
	Placebo	1	60	0	0	
During Treatment	Soluble Fiber	2	51	9	3	0.410
	Placebo	2	50	9	0	

[1] Pearson Chi-Square

Table 10. Consistency of Defecation

		Consistency				P[1]
		Padat	Agak Lembek	Lembek	Encer	
Before Treatment	Soluble Fiber	9	35	19	2	0.127
	Placebo	8	22	30	1	
During Treatment	Soluble Fiber	10	36	18	1	0.782
	Placebo	11	33	17	0	

[1] Pearson Chi-Square

Table 11. The Change of Defecation

	Group of Treatment		P[1]
	Soluble Fiber (n= 65)	Placebo (n = 61)	
More fast	52	27	0.000
No change	13	34	