Pecans lower low-density lipoprotein cholesterol in people with normal lipid levels

WANDA A. MORGAN, PhD, RD; BEVERLY J. CLAYSHULTE, MS

ABSTRACT

Objective To compare serum lipid profiles and dietary intakes of people with normal lipid levels who consumed pecans and those who did not consume nuts.
Design Eight-week, randomized, controlled study of pecan treatment group vs control group.
Subject Nineteen people with normal lipid levels completed the study; 10 had been randomly assigned to the pecan treatment group (7 women, 3 men, mean age=45±10 years) and 9 to the control group (8 women, 1 man, mean age=37 ±12 years).
Intervention The pecan treatment group consumed 68 g pecans per day for 8 weeks plus self-selected diets. The pecans contributed 459 kcal and 44 g fat daily. The control group avoided nuts and consumed self-selected diets.
Main outcome measures Total serum cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and total triglyceride levels were measured at the time of entrance to the study (baseline), week 4, and week 8. Computer analyses were done on five 3-day food records.
Statistical analysis Comparisons were made using analysis of variance or paired *t* test.
Results LDL-C was lowered in the pecan treatment group from 2.61±0.49 mmol/L at baseline to 2.35±0.49 at week 4 ($P<.05$) and to 2.46±0.59 at week 8 ($P<.05$). At week 8, total cholesterol and HDL-C in the pecan treatment group were significantly lower ($P<.05$) than in the control group (total cholesterol: 4.22±0.83 vs 5.02±0.54 mmol/L; HDL-C: 1.37±0.23 vs 1.47±0.34 mmol/L). Dietary fat, monounsaturated fat, polyunsaturated fat, insoluble fiber, magnesium, and energy were significantly higher in the pecan treatment group than in the control group. Body mass indexes and body weights were unchanged in both groups.
Applications Pecans can be included in a healthful diet when energy intake and potential weight gain are addressed.
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During the 1990s, tree nuts received attention as foods having a protective effect against coronary heart disease (CHD) and having other potential health benefits (1-5). Development of CHD has been linked to many risk factors, including age, gender, smoking habits, hypertension, obesity, lack of physical exercise, family history of heart disease, elevated levels of total blood cholesterol and low-density lipoprotein cholesterol (LDL-C), depressed level of high-density lipoprotein cholesterol (HDL-C), and nutritional status (6). Reports and evaluations of the eating habits in the Mediterranean region of the world have linked diets, although high in fat, to lower rates of CHD when diets are high in monounsaturated fats from such sources as olive oil (7-9). Controlled studies of diets high in monounsaturated fats have yielded favorable blood lipid profiles (10-18). The type of fat in the diet, rather than total fat intake, appears to be an important consideration (19).

Interest in the role of nut consumption and CHD started with the Adventist Health Study (20). Results of the study sug-

W. A. Morgan (corresponding author) is an associate professor and B. J. Clayshulte is a graduate research assistant in the Department of Family and Consumer Sciences, New Mexico State University, Las Cruces, NM 88003.

gested that frequent consumption of nuts (>4 times per week) had a protective effect against CHD events. The Nurses' Health Study also found that recurring consumption of nuts (>5 oz nuts per week) was associated with reduced risks of fatal CHD and nonfatal myocardial infarction (21). Several studies followed in which subjects were given nut supplementation and effects on blood lipids were monitored. In a study by Sabaté et al (22), subjects who ate 84 g walnuts daily for 4 weeks in conjunction with a low-fat diet showed significant declines in levels of total cholesterol, LDL-C and HDL-C. In 3 studies involving the use of almonds (11,23,24), subjects who consumed 100 g almonds per day with low-fat diets had significant declines in total cholesterol and LDL-C levels. Abbey et al (25) compared a monounsaturated-fat diet supplemented with almonds with a polyunsaturated-fat diet supplemented with walnuts. The greatest decline in total cholesterol and LDL-C levels was seen in the subjects who consumed walnuts. A comparison of diets supplemented with macadamia nuts (40% of energy as fats) and low-fat diets (20% of energy as fats) with no nut supplementation showed no significant effects of nut consumption on total cholesterol and LDL-C levels (26). The group supplemented with macadamia nuts did experience a significant decline in total plasma triglyceride level.

Tree nuts have high fat content by weight and are excellent sources of monounsaturated fats. Pecans are 53% fat by weight, and 28 g pecans contain 12 g monounsaturated fats. Tree nuts are also good dietary sources of fiber, vitamin E, copper, and magnesium (27). Dietary fiber, vitamin E, and minerals such as copper and magnesium have also been identified as having protective effects against CHD (28-32).

To our knowledge, there have been no published studies to date on the effects of pecan ingestion on blood cholesterol and triglyceride levels. The purpose of this study was to examine the effects of ingestion of pecan nut meats on the serum lipid profiles and dietary intakes of people with normal lipid levels who consumed self-selected diets.

METHODS

Study Design

An 8-week randomized, controlled study was conducted in adults with normal lipid levels. Subjects were randomly assigned to either a treatment group who consumed 68 g pecans (approximately ¾ cup of large halves) daily during the 8 weeks of the study or to a control group who avoided nut consumption. Because of the 8-week treatment period, the design of a pecan treatment group vs control group was selected rather than a crossover design.

Subjects

To investigate the possible effects of ingestion of pecan nut meats on blood lipid levels, 23 subjects with normal lipid levels (5 men and 18 women) were recruited from southern New Mexico and west Texas. Study participants were recruited by use of posted flyers, referrals from local health care clinics, and announcements before community groups. People who entered the study were confirmed as having normal lipid levels by laboratory analyses during the recruitment phase of the study and were healthy. Exclusionary criteria included an active disease process, pregnancy and lactation in women, drug or alcohol abuse, food allergy to nut consumption, and ingestion of lipid-lowering medications. Normal lipid levels were defined as total plasma cholesterol less than 5.17 mmol/L[1], LDL-C less than 3.36 mmol/L, and total triglyceride less than 2.82 mmol/L[2] (6).

The study protocol, approved by the New Mexico State University Human Subjects Review Committee, was explained to each subject. Informed consent was obtained from all participants.

Controlled studies of diets high in monounsaturated fats have yielded favorable blood lipid profiles

All study participants met biweekly with the nutritionist during the 8-week study. Subjects were randomly assigned to either the control group (8 women, 2 men) who consumed self-selected diets or the pecan treatment group (10 women, 3 men) who consumed self-selected diets plus 68 g pecan nut meats per day for 8 weeks. Heights of subjects were recorded at the time of entrance to the study, and weights were recorded at entrance and exit from the study. Body mass index (BMI) was calculated (weight [kg]/height [m^2]) to monitor weight changes during the course of the 8-week study.

Diets

Participants assigned to the control group were instructed to consume self-selected diets during the 8-week study, with the exception of not consuming nuts. Subjects in the pecan treatment group were also instructed to eat self-selected diets, with the exception of not consuming any nuts except the 68 g pecans per day that was provided. Each subject recorded 3-day food diaries (1 weekend day+2 weekdays) at 2-week intervals throughout the study for a total of five 3-day food records (baseline, week 2, week 4, week 6, and week 8 of the study). The nutritionist explained guidelines for recording food items in the food diaries and reviewed food records for completeness and accuracy. When they entered the study, subjects also completed food frequency checklists, which were used to verify that food diaries were not dissimilar from usual dietary intakes of the participants. Computerized nutrient analyses were conducted on the food records (Nutritionist IV, version 4.1, 1994, N-Squared Computing, San Bruno, Calif).

Subjects in the pecan treatment group received a 2-week supply of pecans at each biweekly visit. Shelled pecan halves were packaged in 68-g, individually portioned and labeled, plastic bags. All the bags were organized in a box for each

[1]To convert mmol/L cholesterol to mg/dL, multiply mmol/L by 38.9. To convert mg/dL cholesterol to mmol/L, multiply mg/dL by 0.026. Total cholesterol of 5.00 mmol/L=193 mg/dL.

[2]To convert mmol/L triglyceride to mg/dL, multiply mmol/L by 88.6 To convert mg/dL triglyceride to mmol/L, multiply mg/dL by 0.0113. Total triglyceride of 1.80 mmol/L=159 mg/dL.

Table 1
Analysis of pecans used in the study (68 g/d)[a]

Energy and nutrients	Amount
Cholesterol (mg)	0
Total fat (g)	44
Saturated fat (g)	4
Monounsaturated fat (g)	29
Polyunsaturated fat (g)	11
Protein (g)	5
Carbohydrate (g)	13
Fiber (g)	5
Energy (kcal)	459
Vitamin E (mg)	2
Copper (mg)	0.8
Magnesium (mg)	36

[a]From Pennington (27).

participant. Subjects in the pecan treatment group were instructed to eat their daily ration of pecans at any time during the day and were provided with ideas and suggestions for using pecans at meals and for snacks. Pecans were from the 1995-1996 harvest from orchards in the Mesilla Valley of New Mexico; 81% of the pecan cultivars were Western Schley, 10% were Wichita cultivars, and 9% were other varieties (33,34). Selected nutrients found in 68 g of the daily pecan ration are shown in Table 1. The daily pecan supplement ingested by the pecan treatment group contributed 459 kcal energy, 44 g total fat, and 29 g monounsaturated fat. Compliance with the dietary protocol was monitored by interviewing participants at each study visit; reviewing food records; and, for people in the pecan treatment group, inspecting pecan ration boxes.

Serum Lipid Analyses

Blood samples were obtained from subjects at the time of entrance to the study (baseline), at 4 weeks, and at 8 weeks. All subjects reported for each blood drawing after a 12- to 14-hour fast; a 10-mL blood sample was drawn into a vacutainer tube. Serum specimens were shipped by overnight air carrier under refrigeration to SmithKline Beecham Clinical Laboratories (Dallas, Tex). Serum samples were never frozen. All analyses were done the day after blood sampling, and control samples were analyzed each time to establish reliability. After LDL-C and very-low–density lipoprotein cholesterol were separated from the serum by phosphotungstic acid, HDL-C level was determined by enzymatic method. Total cholesterol and total triglyceride fractions were also measured by enzymatic methods. LDL-C was calculated from the directly measured analytes. These analytic procedures were certified by the Northwest Lipid Research Laboratories (Seattle, Wash), with traceability according to the guidelines of the National Reference System for Cholesterol (35,36).

Statistical Methods

Analysis of variance was conducted at each time point to assess between-subject differences in serum lipid parameters and in energy and nutrient intake. Paired t tests were conducted to assess within-subject differences. The serum lipid values examined were total cholesterol, LDL-C, HDL-C, and total triglycerides. Dietary intake analysis of the five 3-day food records included cholesterol, total fat, saturated fat, monounsaturated fat, polyunsaturated fat, protein, carbohydrate, total fiber, soluble fiber, insoluble fiber, vitamin E, magnesium, copper, and energy. The within-subject factor was week of the study and the between-subject factor was pecan supplementation vs control. For the serum lipid parameters, values at baseline vs week 4, week 4 vs week 8, and entrance vs week 8 were analyzed. For the dietary intake factors, values at baseline vs week 2, baseline vs week 4, baseline vs week 6, baseline vs week 8, week 2 vs week 4, week 2 vs week 6, week 2 vs week 8, week 4 vs week 6, week 4 vs week 8, and week 6 vs week 8 were analyzed. All comparisons that met the $P<.05$ level were considered significant.

RESULTS

Subject Characteristics and Dietary Intakes

Nineteen subjects (9 in the control group and 10 in the pecan treatment group) completed the study. Four subjects did not complete the study because they were not able to conform to the study protocols; their data were not included in the statistical analyses. The control group consisted of 8 women and 1 man; mean age±standard deviation (SD) was 45±10 years. The pecan treatment group consisted of 7 women and 3 men; mean age±SD was 37±12 years. Body weights for the subjects were standardized by using the BMI, and values did not change during the study. Mean BMI±SD was 24±5 for the pecan treatment group at the beginning of the study and 24±5 at the end of the study. Mean BMI for the control group was 24±4 at the beginning of the study and 24±4 at the end of the study. Two of the women in the pecan treatment group experienced an increase in body weight by the end of the study (<1 kg), but this did not alter the group mean.

Analyses of the food diaries are shown in Table 2. Dietary intake is reported as nutrient per kilogram of body weight (mean±SD). This was done to take into account differences in dietary intake between male and female subjects. Energy intake is reported as kilocalories per kilogram and as total intake in kilocalories. No significant differences were noted between the baseline dietary intakes of the pecan treatment group and the control group, with the exception of copper intake. Intake of copper was significantly higher ($P<.05$) in the pecan treatment group than in the control group during the baseline period.

Because of the high proportion of female study participants, dietary variables were analyzed for women only to examine if differences occurred by gender. The comparisons between women in the control group and women in the pecan treatment group were the same as those for the total sample. Across time values for the comparisons of dietary variables for women were identical to comparisons for the entire sample on energy, protein, carbohydrate, cholesterol, and fiber. Some of the significant differences in comparisons between baseline and the nut ingestion phase that were present in the entire sample were not present at 1 or 2 time points for the women in the pecan treatment group for total fat, monounsaturated fat, polyunsaturated fat, vitamin E, magnesium, and copper. Overall, dietary analyses were not confounded by gender.

Serum Lipid Analyses

The results of serum lipid analyses are shown in Table 3. No serum lipid values were significantly different between the 2 groups at baseline. Total cholesterol level (mmol/L) in the pecan treatment group was 4.37±0.59 at baseline, 4.16±0.67 at

Table 2
Analysis of food diaries of subjects with normal lipid levels: pecan treatment group (n=10) vs control group (n=9)[a]

Energy and nutrient	Weeks of study				
	Baseline	2	4	6	8
	← mean±standard deviation →				
Cholesterol (mg/kg)					
Pecan treatment group	3.1±2.3	3.0±1.4	2.5±0.9[r*]	3.1±1.3	2.9±1.5
Control group	5.1±2.6	4.3±1.6	4.0±1.3[r*]	3.9±1.2	3.7±1.3
Total fat (g/kg)					
Pecan treatment group	0.7±0.2[r-u*]	1.5±0.4[r*,v**]	1.6±0.4[s*,w**]	1.4±0.3[t*,x**]	1.4±0.4[u*,y**]
Control group	1.1±0.3	0.9±0.2[v**]	0.9±0.3[w**]	0.9±0.1[x**]	0.9±0.2[y**]
Saturated fat (g/kg)					
Pecan treatment group	0.3±0.1	0.3±0.1	0.4±0.1	0.3±0.1	0.3±0.1
Control group	0.4±0.2	0.3±0.1	0.3±0.1	0.3±0.0	0.3±0.1
Monounsaturated fat (g/kg)					
Pecan treatment group	0.3±0.1[r-t*]	0.7±0.1[r*,u***]	0.7±0.1[s*,v***]	0.6±0.1[w***]	0.7±0.2[t*,x***]
Control group	0.3±0.2	0.3±0.1[u***]	0.3±0.1[v***]	0.3±0.1[w***]	0.3±0.1[x***]
Polyunsaturated fat (g/kg)					
Pecan treatment group	0.1±0.1[r-u*]	0.3±0.1[r*,v**]	0.3±0.1[s*,w**]	0.3±0.0[t*,x***]	0.3±0.1[u*,y***]
Control group	0.2±0.1	0.2±0.1[v**]	0.2±0.1[w**]	0.1±0.0[x***]	0.1±0.0[y***]
Protein (g/kg)					
Pecan treatment group	1.1±0.3	1.1±0.5	1.0±0.3	0.9±0.2	0.9±0.4
Control group	1.2±0.3	1.2±0.2	1.1±0.3	1.0±0.2	1.0±0.3
Carbohydrate (g/kg)					
Pecan treatment group	3.4±1.7	3.7±1.2[z*]	4.1±1.6[r*]	3.0±0.8	3.3±1.0
Control group	2.9±1.0	2.7±1.0[z*]	2.7±1.1[r*]	2.7±0.6	2.6±0.7
Total fiber (g/kg)					
Pecan treatment group	0.2±0.3	0.2±0.1	0.3±0.1[z*]	0.2±0.1[r*]	0.2±0.1
Control group	0.2±0.1	0.2±0.1	0.2±0.0[z*]	0.1±0.0[r*]	0.2±0.1
Soluble fiber (g/kg)					
Pecan treatment group	0.003±0.002[r-t*]	0.008±0.005[r*]	0.009±0.006[s*]	0.008±0.005[t*]	0.007±0.005
Control group	0.003±0.001	0.005±0.004	0.004±0.003	0.006±0.004	0.004±0.003
Insoluble fiber (g/kg)					
Pecan treatment group	0.02±0.02[r-t*]	0.10±0.02[r*,u**]	0.10±0.04[s*,v**]	0.10±0.02[t*,w**]	0.08±0.02[x*]
Control group	0.02±0.01	0.02±0.01[u**]	0.02±0.01[v**]	0.02±0.02[w**]	0.02±0.01[x*]
Energy (kcal/kg)					
Pecan treatment group	24±9[r,s*]	32±9[r,t*]	33±9[s,u*]	28±6[v*]	29±7[w*]
Control group	23±6	23±5[t*]	23±7[u*]	22±3[v*]	22±5[w*]
Energy (kcal)					
Pecan treatment group	1,536±348[r,s*]	2,018±402[r,t*]	2,065±468[s,u*]	1,786±314[v*]	1,856±452[w*]
Control group	1,514±538	1,572±344[t*]	1,598±517[u*]	1,496±150[v*]	1,447±291[w*]
Vitamin E (mg/kg)					
Pecan treatment group	0.1±0.1[r-u*]	0.3±0.0[r,v*]	0.3±0.1[s*]	0.3±0.0[t*]	0.3±0.1[u*]
Control group	0.1±0.1	0.1±0.2[v*]	0.4±1.5	0.3±0.5	0.4±0.8
Magnesium (mg/kg)					
Pecan treatment group	3.8±2.8[r,s*]	4.6±0.7[r,t*]	4.7±1.0[s,u*]	4.2±0.8[v*]	4.5±1.3[w**]
Control group	3.2±1.3	3.6±0.8[t*]	3.4±0.9[u*]	2.8±0.2[v*]	3.1±0.6[w**]
Copper (mg/kg)					
Pecan treatment group	0.03±0.02[r*]	0.03±0.00[s*]	0.03±0.01	0.03±0.01[t*]	0.03±0.01
Control group	0.02±0.00[r*]	0.02±0.01[s*]	0.02±0.01	0.02±0.00[t*]	0.02±0.01

[a]Body weights in kilograms for pecan treatment group: baseline=64±12, week 2=63±10, week 4=63±9, week 6=64±11, week 8=64±12. Body weights in kilograms for control group: baseline=66±12, week 2=67±11, week 4=66±9, week 6=67±10, week 8=66±11.
[r-z]Values sharing the same superscript within variables are significantly different (analysis of variance for between-subject factors; *t* test for within-subject factors).
*$P<.05$.
**$P<.01$.
***$P<.001$.

Table 3
Serum lipid effects of pecan consumption in subjects with normal lipid levels[a]

Serum lipid values (mmol/L)[b]	Weeks of pecan supplementation		
	0	4	8
	← mean±standard deviation →		
Total cholesterol			
Pecan treatment group	4.37±0.59	4.16±0.67	4.22±0.83[t]
Control group	4.68±0.26	4.64±0.44[u]	5.02±0.54[t,u]
LDL-C[c]			
Pecan treatment group	2.61±0.49[v,w]	2.35±0.49[v,x]	2.46±0.59[w,y]
Control group	2.74±0.26	2.72±0.43[x]	3.03±0.57[y]
HDL-C[d]			
Pecan treatment group	1.29±0.10	1.32±0.23	1.37±0.23[z]
Control group	1.40±0.28	1.45±0.26	1.47±0.34[z]
Total triglycerides[e]			
Pecan treatment group	1.04±0.45	1.14±0.62	0.90±0.52
Control group	1.19±0.60	1.12±0.53	1.14±0.50

[a]n=10 for pecan treatment group; n=9 for control group.
[b]To convert mmol/L cholesterol to mg/dL, multiply mmol/L by 38.7. To convert mg/dL cholesterol to mmol/L, multiply mg/dL by 0.026. Cholesterol of 5.00 mmol/L=193 mg/dL.
[c]LDL-C=low-density lipoprotein cholesterol.
[d]HDL-C=high-density lipoprotein cholesterol.
[e]To convert mmol/L triglycerides to mg/dL, multiply mmol/L by 88.6. To convert mg/dL triglycerides to mmol/L, multiply mg/dL by 0.0113. Triglycerides of 1.80 mmol/L=159 mg/dL.
[t,x-z]Significant difference between groups at $P<.05$ (analysis of variance).
[u-w]Significant difference over time within group at $P<.05$ (t test).

4 weeks, and 4.22±0.83 at 8 weeks. In comparison, values for the control group were 4.68±0.26 total cholesterol at baseline, 4.64±0.44 at 4 weeks, and 5.02±0.54 at 8 weeks. Total cholesterol values were significantly different between the pecan and control groups at week 8 ($P<.05$) due, in part, to the increase in cholesterol level in the control group.

LDL-C (mmol/L) was lower in the pecan treatment group by the fourth week of the study from the baseline value of 2.61±0.49 to 2.35±0.49, and the decline continued through the eighth week when the LDL-C value was 2.46±0.59. This represented a 10% decline in LDL-C by week 4 ($P<.05$) and a 6% decline at week 8 ($P<.05$) for subjects consuming pecans. LDL-C (mmol/L) of the control group was 2.72±0.43 at week 4 and 3.03±0.57 at week 8. LDL-C level was significantly lower in the pecan treatment group compared with the control group at weeks 4 and 8 ($P<.05$). This was due to the decrease in LDL-C over time in the pecan treatment group and the increase in LDL-C in the control group over time.

HDL-C level was significantly different ($P<.05$) between the control group and pecan treatment group at week 8 (1.47±0.34 vs 1.37±0.23 mmol/L) but not at other time points. Changes in triglyceride values were not significant over time. Serum lipid results were also analyzed for gender differences. Analyses of serum lipid values of the female participants agreed with the results of the entire sample.

DISCUSSION

This study compared the serum lipid levels and dietary intakes of subjects with normal lipid levels who consumed self-selected diets plus 68 g pecans per day for 8 weeks with subjects who consumed self-selected diets but avoided nuts. Previous studies (11,22-25) of the effects of almonds and walnuts on blood lipid levels used strict dietary regimens to control nutrient intake in addition to nut supplementation. In this study, subjects consumed self-selected diets except for controlling nut consumption. The amount of pecans incorporated into study participants' diet (68 g/day) was lower than the 100 g/day supplemented in the almond studies and the 84 g/day in the walnut study. Inclusion of almonds in the previous studies with strict dietary controls lowered total cholesterol 8% to 9% and lowered LDL-C 12% to 14% (11,23,24). In the walnut study (22), which also had controlled dietary intakes, nut consumption lowered total cholesterol by 12% and lowered LDL-C by 16%. In our study in which subjects consumed self-selected diets and smaller quantities of nuts, pecan consumption lowered LDL-C by 10% at week 4 and 6% at week 8 while total cholesterol declined by 5% by week 4 and 4% by week 8 (both nonsignificant) when compared to baseline measurements. Changes in HDL-C levels were not significant in the almond studies and decreased by 5% in the walnut study. In the present study, HDL-C levels were not affected by pecan consumption. Any alterations in the blood lipid profiles in the present study were not due to weight changes, as BMI for both study groups remained unchanged during the course of the study. Pecan consumption (68 g/day) consistently and significantly raised total dietary fat, monounsaturated fat, polyunsaturated fat, insoluble fiber, energy, and magnesium contents of the diets of subjects in the pecan treatment group.

The polyunsaturated fat intake of the pecan treatment group constituted 9% to 12% of energy intake; in contrast, polyunsaturated fat intakes were 5% to 6% of energy in the control group. As discussed by Grundy (9,14) and Katan et al (19), diets high in polyunsaturated fats are effective in lowering LDL-C level but may have unfavorable actions, that is, possibly forming free radicals and increasing risk of cancer in human beings. Grundy (9) has recommended an upper limit of polyunsaturated fat intake of 7% of total energy, and for monounsaturated fats such as oleic acid Grundy recommends

15% to 16% of total energy. Also cited by investigators are epidemiologic observations of diets of persons who live in the Mediterranean region. Diets in that region are high in monounsaturated fats, and longevity of the population is associated with decreased risks of CHD and cancer (19). Future investigations could include pecans and other tree nuts in test diets to increase monounsaturated fat intake while lowering polyunsaturated fat and total fat intakes. The purpose would be to determine if the benefits of a high intake of monounsaturated fat could be realized without the potentially adverse effects of a diet high in polyunsaturated fat and total fat.

Body weights as measured by BMI remained unchanged in spite of increases in energy intakes in the pecan treatment group. This is surprising and would not be expected to continue if the higher energy intakes were sustained by pecan consumption over an extended period of time. Had the study continued for a longer time, weight gain could have emerged as a result of the higher energy intakes associated with pecan supplementation. Exercise was not measured for duration and intensity. Differences in energy expenditure may have been a contributing factor to the stable BMI observed in the pecan treatment group during the course of the study.

Pecan supplementation caused few or no significant alterations in the dietary intakes of cholesterol, saturated fat, total fiber, soluble fiber, and copper. In spite of higher energy and total fat intakes, the pecan treatment group exhibited lowered serum LDL-C and total cholesterol levels compared with the control group. These findings tend to support the hypothesis that the kind of fat in the diet (monounsaturated and polyunsaturated fat vs saturated fat) is more important than total fat intake (19). If dietary monounsaturated fat is kept at a higher level, an appropriate intake of protective nutrients such as antioxidants would be a prudent recommendation. The level of intake of protective nutrients needed to accompany the higher levels of fat intake associated with increased nut consumption needs further investigation. An important consideration would be whether protective nutrients could be provided adequately from food sources.

APPLICATIONS/CONCLUSIONS

A growing body of scientific evidence suggests potential beneficial effects from the ingestion of tree nuts such as pecans, walnuts, and almonds. A possible mechanism for the action of pecans and other tree nuts is their high content of monounsaturated fat in the form of oleic acid. Although fiber and vitamin E intake were not consistently higher in the pecan treatment group in our study, other investigators have postulated that the presence of these nutrients in nuts might have a protective mechanism in the prevention of heart disease (1,28,32). Likewise, the mineral content of nuts, particularly magnesium and copper, may be a mechanism to protect against CHD (29-32). In our study, magnesium intake was significantly higher in the pecan treatment group compared with the control group, although copper was not.

- Tree nuts such as pecans, walnuts, and almonds can be included in a healthful diet. Some nutrition counselors have recommended avoidance of tree nuts because of their fat content and concerns about total fat intake and excessive energy intake. Results of our study and other investigations indicate that tree nuts such as pecans can have beneficial effects and contribute important nutrients.

- The monounsaturated and polyunsaturated fats found in nuts need to be accompanied by an appropriate intake of protective nutrients such as food sources of antioxidants.

- Registered dietitians need to balance the beneficial contributions of nuts with the issues of increased energy intake and potential weight gain when making recommendations to the general public and to individual clients.

- The US Dietary Guidelines for Americans (37) encourage people to eat a variety of foods and to balance foods with activity to maintain or improve weight. Nut consumption can be part of the balance and variety of a healthful diet.

- Pecans are tied with walnuts as the second most frequently consumed tree nut in the United States (38); thus, further studies on the effects of pecan consumption on blood lipid levels are needed to confirm and duplicate our results. Additional scientific investigation is needed to clarify the mechanisms of action and possible protective effects of the consumption of pecan and other nuts against CHD.

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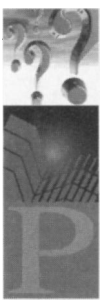

QUESTION OF THE MONTH

What are the nutritional guidelines for women expecting a multiple birth?

The increase in use of fertility drugs, for better or worse, is leading to an increase in multiple births around the country. Twins, triplets, and even quadruplets and quintuplets are no longer unusual events. This leaves dietetics professionals with a unique dilemma: How much weight should a woman pregnant with multiple fetuses gain? And what other nutrition issues should be addressed when counseling expectant mothers of multiples?

New information on this topic is becoming available every day. A recent article written by **Barbara Luke**, ScD, MPH, RD, and published in *Women & Reproductive Nutrition Report*, a quarterly publication of the Women and Reproductive Nutrition dietetic practice group's newsletter, addresses these very questions. The article concludes: "The general consensus among researchers is that total weight gain in twin gestation should be at least 40 to 45 lb with an emphasis on adequate early weight gain."

And in case you missed the Practitioner's Bookshelf section in the November 1999 *Journal*, it contains a review of the book *When You're Expecting Twins, Triplets, or Quads: A Complete Resource,* by Barbara Luke, and **Tamara Eberlein** (p 1476).

*This article was written by **Eleese Cunningham**, RD, of The American Dietetic Association's Knowledge Center in Chicago, Ill.*