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Abstract
The purpose of this project was to determine if the addition of a laboratory measurement, i.e., measurement of serum cholesterol, would increase the effectiveness of nutrition counseling in young men. Subjects were a random sample of 45 healthy male students from a Midwestern university, between the ages of 20 and 25 who were consuming >30% of kcal from fat. Men were randomly assigned to one of four groups; nutrition counseling and measurement of serum cholesterol (NC + SC), nutrition counseling only (NC), measurement of serum cholesterol only (SC), or control (C). At weeks 1 and 6, participants completed a 24-hour recall, a 2-day food record, and a food frequency questionnaire. Analysis of variance and least squares means were used to compare change in dietary intake (percent calories from fat) from pre- to post-assessment. Fat intake decreased by 3.2% kcal from fat in the NC + SC group ($P < 0.02$), and by 2.7% kcal from fat in the NC group ($P < 0.06$). There were no significant changes in the SC or C groups. These results suggest that measurement of serum cholesterol may enhance the effectiveness of nutrition counseling in young adult males somewhat, however, the primary impact on reducing fat intake is from the nutrition counseling alone.

Keywords: Nutrition counseling, Coronary heart disease, Male, Diet, Cholesterol

1. Introduction

Nutrition counseling (which usually includes assessment of current diet based on food records and guidance on dietary modification) and blood cholesterol screening are two methods used in nutrition intervention aimed at reducing the risk of coronary heart disease (CHD). The National Cholesterol Education Program (NCEP) recommends measur-

ing total blood cholesterol levels in all adults 20 years of age and older at least once every 5 years, followed by evaluation and treatment of those with high blood cholesterol levels (>240 mg/dl) [1]. The initial treatment is lifestyle modification (e.g., dietary modification, cessation of smoking, and increased exercise). If these measures are inadequate, treatment with cholesterol-lowering drugs is usually recommended.

One purpose of screening young adults for high blood cholesterol is to increase awareness of CHD risk factors (i.e., smoking, hypercholesterolemia, hypertension, diabetes, obesity, a sedentary lifestyle, and consumption of a high-fat diet) and to use this heightened awareness to improve eating habits [2]. However, critics question whether blood cholesterol measurements are necessary in otherwise healthy adults without evidence of coronary heart disease [3, 4].

In the United States adult males have the highest incidence rates of CHD [5]. A large cooperative multicenter study (Pathobiological Determinants of Atherosclerosis in Youth [PDAY]) [6] has shown that heart disease begins to develop early in life. Therefore, adoption of a healthy lifestyle including a low-fat diet in young men may be important in preventing or delaying the onset of disease. However, young men may not be aware of their current dietary fat intake or serum cholesterol levels [7]. Young men may also have a lack of perception of their future risk of developing CHD [8]. Dietary intervention studies have shown that eating habits are difficult to change [4]. There is a need to identify effective dietary interventions to reduce the risk of CHD that are targeted to young men. The purpose of this study was to determine whether the addition of serum cholesterol measurements would increase the effectiveness of nutrition counseling in young male university students.

2. Methods

2.1. Subject recruitment

Male students, randomly selected from a university listing, were sent letters inviting them to participate. Volunteers were then screened by telephone to identify those who met the protocol criteria: a healthy male 20 to 25 years of age, consuming at least 30% kcal from fat. Participants were randomly assigned to one of four groups, NC + SC (nutrition counseling and serum cholesterol measurement, n = 13), NC (nutrition counseling only, n = 11), SC (serum cholesterol measurement only, n = 12), and C (control, neither nutrition counseling nor serum cholesterol measurement, n = 9). Demographic information was obtained from a random sample (n = 41) of nonparticipants (men who met the protocol criteria but did not volunteer to participate.) The project was approved by the University's Institutional Review Board for the protection of human subjects.

2.2. Data collection

During weeks 1 and 6 (pre- and post-assessment) all participants came to the Nutritional Assessment Laboratory at the university for data collection. At the initial visit, participants signed a consent form, completed a demographic questionnaire, and were randomly as-

Table 1. Nutrition intervention protocol for a nutrition counseling program in healthy young men

Week	Session	Topic
1	Pre-assessment	24-hour recall
		Instruction for keeping 2-day food record
		Food frequency
		Demographic questionnaire
2	1	Discuss computer analysis of 24-hour recall
		Introduce Food Guide Pyramid[a]
		Individual dietary goal setting
		Discuss results of serum cholesterol measurement with NC + SC group
3	2	Discuss computer analysis of 2-day food record
		Obtain 24-hour recall
		Discuss risk factors contributing to coronary heart disease
4	3	Discuss analysis of week 3 24-hour recall
		Obtain 24-hour recall
		Review progress toward dietary goals and/or set new goals
		Discuss low-fat meat choices[b]
5	4	Discuss analysis of week 4 24-hour recall
		Review progress toward dietary goals
		Discuss artery section model depicting four levels of blockage
6	Post-assessment	24-hour recall
		2-day food record
		Food frequency

a. The United States Department of Agriculture (USDA) and Food Marketing Institute's "The Food Guide Pyramid…Beyond the Basic 4."

b. Beef Industry Council and Beef Board's "As Easy as 1,2,3" and the National Pork Producer's "Counseling Kit."

signed to a treatment group. A trained interviewer obtained a 24-hour dietary recall from each participant using three dimensional food models (Nasco, Fort Atkison, WI), life-size food pictures (National Dairy Council, Rosemont, IL), and pre-measured household and fast food utensils/dinnerware to assist in the estimation of food portions. Participants were taught to use a food record form, and they were assigned two non-consecutive days to record their food intake so that one of the three food records (including 24-hour recall) was a weekend day. A post-assessment 24-hour recall and 2-day food record were obtained at week 6. Each participant also completed a food frequency at weeks 1 and 6.

Subjects assigned to the NC + SC and the SC groups were instructed to have a fasting blood sample drawn by the University Health Center, at weeks 1 and 6. Blood samples were analyzed for serum cholesterol using the cholesterol esterase/cholesterol oxidase procedure described by Allain et al. [9]. The NC + SC participants were informed of the results of the week 1 serum cholesterol measurements at the first counseling session (Table 1), and the SC participants were informed of the their serum cholesterol results by telephone.

During weeks 2 to 5, nutrition counseling was provided once a week for participants in the NC + SC and NC groups. Table 1 lists topics covered during each of the four individualized weekly sessions. One nutritionist provided all of the counseling and each session was 20 to 30 minutes in length. Participants who received nutrition counseling (n = 24) were

contacted by telephone within 2 months after completion of the study and asked to respond to a 10-item questionnaire that assessed their response to the nutrition counseling.

2.3. Data analysis

Nutrient intakes were analyzed using the Food Processor II computer software program (version 6.0, ESHA Research, Salem, OR) and each participant's mean energy and fat intake and percent kcal from fat were determined for the pre- and post-assessment. For specific foods consumed that were not in the Food Processor program, a similar food was substituted. The 24-hour recall and 2-day food records were analyzed separately for each participant. Mean percent calories from fat were not different for the two types of instruments. Therefore, the 3 days of food intake were combined and one mean daily intake value was determined for each individual. Results of the food frequency were not different for the two groups that received nutrition counseling. Therefore, data from these two groups were combined for the food frequency analysis. The Statistical Analysis System (version 7, 5th ed., 1994, SAS Institute, Cary, NC) was used for all data analysis. Chi-square was used to compare demographic characteristics of participants and nonparticipants. Analysis of variance and least squares means were used to compare change in percent calories from fat and the frequency of consumption of high- and low-fat foods from pre- to post-assessment. In this analysis, each of the three intervention groups was compared with the control group. Frequencies were used to characterize responses on the participant questionnaire assessing response to nutrition counseling.

3. Results

Letters were sent to 233 men and 75 (32%) volunteered to participate. Forty-five of the volunteers met the screening criteria. The participants were Caucasian (100%), the majority were employed part-time (73%), and two-thirds of them were college juniors and seniors living off campus. Twenty percent of the men reported a family history of CHD. Mean age (± SD) of the participants was 21.5 ± 1.4 years. Comparison of the demographic characteristics of participants and nonparticipants indicated these were similar except that more of the nonparticipants (95%) were juniors and seniors ($P < 0.01$).

3.1. Fat intake and food frequency

At the pre-assessment, the range in percent calories from fat among the men was from 30% kcal to 49% kcal. Mean percent calories from fat in each group at the pre-assessment were NC + SC = 36.7% kcal, NC = 35.2% kcal, SC = 37.1% kcal, and C = 37.1% kcal. Table 2 shows the change in percent calories from fat from pre- to post-assessment in each group. In the NC + SC group there was a significant reduction in fat ($P < 0.02$), the NC group tended toward a reduction in fat intake ($P < 0.06$), and the SC and C groups did not experience a significant change in percent calories from fat. Analysis of the food frequency questionnaire indicated that participants who received nutrition counseling (NC + SC and NC groups) increased their servings of fresh fruit, "light" salad dressing, and

Table 2. Change in percent calories from fat among young men from pre- to post-assessment (mean ± standard deviation[a])

Group	Change in % kcal from fat	P-value[b]
Nutrition counseling[c] + serum cholesterol[d] (n = 13)	−3.2 ± 1.4	0.02
Nutrition counseling (n = 11)	−2.7 ± 1.5	0.06
Serum cholesterol (n = 12)	−0.9 ± 1.4	0.56
Control[e] (n = 9)	+0.2 ± 1.5	1.00

a. Mean age (±SD) = 21.5 ± 1.4 years.
b. Probability of difference between intervention group and control group.
c. Participants received four individualized nutrition counseling sessions.
d. Participants had pre- and post-measurements of serum cholesterol.
e. No nutrition counseling or serum cholesterol measurements.

<30% fat ground beef after the counseling ($P < 0.05$) and they tended to consume fewer potato chips ($P < 0.10$). There were no differences in the food frequency from pre- to post-assessment in the SC and C groups.

3.2. Participant assessment of nutrition counseling

All of the men who received nutrition counseling reported gaining some nutrition knowledge by their participation in this study and 92% said that the nutrition counseling convinced them that lowering their dietary fat intake would reduce their risk of CHD. Ninety-six percent of the participants stated they had made dietary changes as a result of the study. When asked to identify one or more changes they were continuing to follow at the time of the post-evaluation, responses included "eating less fast food, eating more fruits and vegetables, trimming fat from meat, eating less junk food such as potato chips, choosing fresh foods over processed foods, and eating less total food."

When asked what part of nutrition counseling was most helpful, replies ranged from "everything" to "nothing specific." The two items mentioned most often as being helpful were 1) keeping diet records and 2) the computer diet analysis. These were mentioned by forty percent of respondents. Ninety-two percent of the participants stated that the discussion of CHD risk factors (counseling session 2) and the artery model (counseling session 4) were helpful. Eighty-four percent of the participants stated that the Food Guide Pyramid (counseling session 1) and the discussion of low-fat meat choices (counseling session 3) were helpful. Approximately one-third of the participants (31%) stated they did not find "goal setting" helpful in reducing dietary fat intake.

4. Discussion

The results of this study indicate that the effectiveness of four weekly nutrition counseling sessions in healthy male university students is slightly increased when it is com-

bined with pre- and post-measurements of serum cholesterol. Measurement of serum cholesterol alone has little influence on dietary fat intake.

Several researchers have reported reductions in fat intake in hypercholesterolemic men [10, 11]. Following a 12-month worksite nutrition education program that included individual counseling, Baer [10] reported fat intake was reduced by 7% of kcal from fat (from 38% of kcal to 31% of kcal from fat). In the Baer study the population sample was older (mean age 44 years), had elevated serum cholesterol levels (>200 mg/dl), and the intervention was longer than in the study reported here. Men who are older and have elevated serum cholesterol levels may be more motivated to change their dietary behavior than younger men with normal serum levels may, but risk reduction and disease prevention programs rely on behavior changing before disease is evident.

Individualized nutrition counseling brings about the greatest behavioral change when participants are provided with information that identifies sources of dietary fat and are given examples of substitutes that are lower in fat [12]. In our study, a computer nutrient analysis of the participant's food intake was used at each counseling session to help participants identify sources of fat in their diet. Participants indicated this was the most helpful part of the nutrition counseling they received. Examples of specific suggestions for lowering the percent of calories from fat included: a) reducing the amount of oil used in cooking and salad dressings, b) selecting and preparing lean cuts of meat, and c) increasing consumption of fresh fruits and sources of complex carbohydrates. Smith-Schneider et al. [13] reported that men achieved the targeted level of 30% of kcal from fat by simply replacing high-fat meats with lean meat. In our study men who received nutrition counseling reduced their intake of high-fat ground beef and increased their use of fresh fruit and low-fat salad dressing.

Targeted behavior change combined with review of the individual's current intake (i.e., 24-hour recall) can help guide the client in identifying where specific changes can fit into their eating pattern. Goal setting is a recommended nutrition counseling strategy [14]. However a small subgroup (31%) of the young men in our study responded negatively to goal setting. Therefore the goal setting strategy may need to be used judiciously for young men who do not have identifiable risk factors such as high serum cholesterol. In contrast, our participants indicated that using some type of "scare tactic" may be better than goal setting as a way of motivating young men to change their eating habits. Ninety-two percent of the men said seeing the model of the "clogged artery" in counseling session 4 was helpful. Fear arousing appeals have been one way of persuading people to change their attitudes and behaviors. In early communication literature, Dabbs and Leventhal compared the effectiveness of low-fear and high-fear messages in motivating subjects to obtain tetanus shots [15]. Those exposed to high-fear messages were more likely to want shots and actually take action to get shots than individuals receiving low-fear messages. According to Bowen et al. [16] interventions designed to change individuals' dietary fat intake should consider emotional, cognitive, and behavioral factors.

In summary, a series of four nutrition counseling sessions with healthy male college students resulted in nearly a three percent decline in the percent of kcal from fat in their diet. Young males responded positively to keeping diet records, seeing computer printouts of their nutrient intakes, and being shown visual models of "clogged" arteries.

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