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Knowledge of and Accordance with the Academy Evidence-Based Nutrition Practice Guideline for Disorders of Lipid Metabolism

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Knowledge of and Accordance with the Academy Evidence-Based Nutrition Practice Guideline for Disorders of Lipid Metabolism

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Abstract

The purpose of this study was to determine knowledge of and accordance with practices recommended by the Academy of Nutrition and Dietetics Guideline for Disorders of Lipid Metabolism. Knowledge and food frequency questionnaires were completed by dyslipidemic patients from an outpatient cardiology clinic (n = 51). Participants were primarily white (74.5%), obese (64.7%), female (64.7%) adults 62.0 ± 9.3 years of age. Mean Disorders of Lipid Metabolism guideline knowledge score was 53.l ± 13.4% correct. Mean accordance was 35.4 ± 13.0% correct. There were no significant associations between knowledge and accordance (r_s = 0.175, P = .219). In addition to increasing knowledge, registered dietitians should focus on behavior modification to increase accordance.

Keywords: accordance, dietary, guideline, knowledge, lipid

Disorders of lipid metabolism (elevated total cholesterol, low-density lipoprotein cholesterol, or triglyceride levels and low high-density lipoprotein cholesterol levels) have a significant impact on risk for cardiovascular disease (CVD). Several guidelines describing dietary intervention to reduce CVD risk currently exist.[1–3] In 2011, the Academy of Nutrition and Dietetics (Academy) released the Disorders of Lipid Metabolism (DLM) Update Evidence-Based Nutrition Practice Guideline. This evidence-based nutrition practice guideline is developed by nutrition experts and designed to be used by registered dietitians (RDs) to provide medical nutrition therapy to patients at risk for or previously diagnosed with CVD.[3] It includes recommendations for screening and referral, nutrition assessment, nutrition intervention, and nutrition monitoring and evaluation period needed here. The current research focused on the recommendations for nutrition intervention, which address intake of marine omega-3 fatty acids, plant omega-3 fatty acids, dietary lipids, fiber, antioxidant-rich foods, alcohol, omega-3 supplements, plant sterol and stanol supplements, B vitamin supplements, coenzyme Q10, and physical activity (detailed recommendations are listed in Table 1).

Although comprehensive research was reviewed to establish the Academy's DLM guideline, the current patient knowledge of and accordance with the recommendations for nutrition intervention have not been studied. The purpose of this research was to determine how much patients know about and are accordant with the dietary practices recommended by the Academy for patients with DLM, and if there is an association between knowledge and accordance. The results of this research may allow health care professionals to better tailor nutrition education for patients with DLM by focusing on the most pertinent guideline recommendations with which patients are least knowledgeable or accordant.

Methods

This was a descriptive study that utilized self-administered questionnaires to measure knowledge of and accordance with the Academy's Evidence-Based Practice Guideline for Disorders of Lipid Metabolism (DLM) in individuals attending an outpatient cardiology clinic at a large urban medical center in Chicago, Illinois. Inclusion criteria were men and women aged 18 to 75 years who were able to read and write English and who had been diagnosed with dyslipidemia, hyperlipidemia, or metabolic syndrome (with or without heart disease). Participants were excluded if they had heart failure, an implantable cardioverter defibrillator, impaired cognition as assessed by a validated 3-question cognition tool, or were unwilling to participate in the survey process.

A knowledge questionnaire based on the DLM guideline was created for use in this study and included a total of 27 questions (yes/no and multiple-choice responses). Of these questions, 24 addressed recommendations included in the DLM guideline concerning marine omega-3 fatty acids, plant omega-3 fatty acids, dietary lipids, fiber, antioxidant-rich foods, plant sterols/stanols, alcohol, omega-3 supplements, B vitamin supplements, coenzyme Q10 supplements, lifestyle changes for metabolic syndrome and elevated triglycerides, and physical activity. All questions included "I don't know" as an answer choice to deter guessing. An additional 3 questions addressed sources used to obtain information

regarding dietary recommendations for heart health and beliefs regarding heart healthy diet accordance.

Table 1. Comparison of Participant Knowledge of and Accordance with Dietary and Lifestyle Recommendations Made by the Academy[a] Evidence-Based Guideline for Disorders of Lipid Metabolism[b]

		Knowledgeable		Accordant	
	Recommendations	n	%	n	%
Marine-derived food sources of omega-3 fatty acids	Patients w/out CHD: 2 fish servings/wk (4 oz each)	40	78.4	4[c]	7.8
	Patients w/ CHD: ≥ 2 fish servings/wk (4 oz each)	29	56.9		
Plant-derived food sources of omega-3 fatty acids	Men: l.6g/d	3	5.9	3	16.7
	Women: 1.1 g/d	5	9.8	14	42.4
Omega-3 supplements (EPA and/or DHA)	Patients w/out CHD: no recommendation	5	9.8	NA[d]	NA
	Patients w/ CHD (no angina or ICD): 850 mg/d	16	31.4		
Antioxidant-rich foods (fruits, vegetables, nuts, and whole grains)	Incorporate into cardioprotective dietary pattern	50	98.0	NA	NA
Nuts	5 oz/wk	47	92.2	17	33.3
Total fat	25%–35% of calories	19	37.3	25	49.0
Saturated and *trans* fats	< 7% of calories	36	70.6	5	9.8
Cholesterol	< 200mg/d	21	41.2	33	64.7
Carbohydrate, protein, and unsaturated fat	Choose to replace saturated fat in the diet	40	78.4	NA	NA
Plant stanol and sterol ester-enriched foods	2–3 g/d	16	31.4	1	2.0
Alcohol	Men: Maximum of 2 drinks/d	33	64.7	14	77.8
	Women: Maximum of 1 drink/d	35	68.6	29	87.9
Physical activity	Resistance exercise: Minimum 2 d/wk	42	82.4	6	11.8
	Moderate intensity: 30 min most days	46	90.2	21	41.2
Coenzyme Q10	Not recommended	5	9.8	37	72.5
Metabolic syndrome	Incorporate physical activity and a heart healthy diet	48	94.l	NA	NA
High triglyceride levels	Incorporate physical activity and a heart healthy diet	46	90.2	NA	NA
B-Vitamin supplements (folic acid, vitamin B_6, vitamin B_{12})	Not recommended	10	19.6	41	80.4
Total fiber	25–35 g/d	30	58.8	11	21.6
Soluble fiber	7–13 g/d	16	31.4	10	19.6

Abbreviations: CHD, coronary heart disease; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; ICD, implantable cardioverter-defibrillator.

a. The Academy of Nutrition and Dietetics.
b. The table is organized on the basis of order of the Academy guideline.
c. Sample number and percentage (4 and 7.8%, respectively) represent all participants independent of CHD status, as CHD status was not assessed, and the guideline is quantitatively the same for those both with and without CHD.
d. NA, not applicable; accordance results were not able to be determined, as the sample was not stratified by CHD status or accordance was not able to be determined because of nature of the Disorders of Lipid Metabolism guideline question.

The knowledge questionnaire was evaluated for content validity (n = 16) and test-retest reliability (n = 19). The Cronbach alpha and the Kuder Richardson Coefficient of reliability (K-R 20) were 0.80 and 0.79, respectively, indicating good internal consistency. Using the Pearson correlation analysis for test-retest reliability, there was a statistically significant positive linear relationship observed between scores from the first and second times lay pilot participants completed the questionnaire *(r* = 0.770; *P* < .01).

The 2005 Block Food Frequency Questionnaire ([FFQ] © 2005, NutritionQuest/Block Dietary Data Systems, Berkeley, California) was used to determine accordance. The 110-item questionnaire estimates usual intake from diet and supplements. The 2005 Block FFQ is an updated version of a previously validated FFQ.[4,5] As the Block FFQ does not estimate intake of plant sterols and stanols, intake of coenzyme Ql0 supplements, or physical activity, supplemental questions mirroring the FFQ format were developed by the researcher.

This study was approved by the medical center's institutional review board, and data collection occurred between July and December 2012. Participants were recruited when they arrived for previously scheduled appointments with their cardiologist. Eligible participants, as assessed by the electronic medical record, were approached and provided with an introduction letter. Those who agreed to participate verbally received a short cognition assessment and gave consent before being given paper questionnaires to complete. Following completion of the questionnaires, participants were compensated with a pedometer and an educational brochure developed for this study that was based on the DLM guideline. Participants only met with the RD once to complete the questionnaires; however, participants were also provided with detailed dietary intake information based on the FFQ results, as well as individualized nutrition recommendations based on these results. These results were e-mailed to participants, with an opportunity to set up a phone call to review their estimated dietary intake and receive additional nutrition education based on these results.

Statistical analysis

Predictive Analytics Software (PASW; Version 18.0; Chicago, Illinois) was used for data analysis. Descriptive statistics were run for all variables. Knowledge questionnaires were scored by the researcher, and Block[4] FFQs were sent to NutritionQuest for analysis. Each knowledge question was scored as correct or incorrect, and the researcher further scored components of the Block FFQ results as accordant or not accordant with each DLM guide-

line recommendation. Total knowledge and accordance scores were calculated by summing the number of knowledge questions each subject answered correctly (out of 27 questions) and the number of dietary and lifestyle recommendations with which each subject was accordant (out of 16 questions), respectively. Participants with a knowledge score of 70% or more were considered overall knowledgeable, and participants with an accordance score of 70% or more were considered overall accordant. Knowledge and accordance were also examined using scores of 50% as cutoffs to further describe knowledge level of the participants.

The percentage of the sample that answered correctly was calculated for each knowledge question, as was the percent accordant for each guideline recommendation. Chi-square analyses were used to determine whether there was an association between knowledge of each guideline (correct/ incorrect) and individual recommendation accordance (yes/no). The Spearman correlation was used to determine whether there was an association between overall knowledge and accordance scores. Statistical significance was set at $P < .05$. As knowledge scores were normally distributed, an independent t test was used to determine the difference in mean knowledge score by gender. One-way analysis of variance was used to determine the difference in mean knowledge score by categorical demographic variables (race, age, education level, and body mass index [BMI] category). As accordance scores were not normally distributed, a Mann-Whitney U test was used to determine the difference in mean accordance score by gender. Kruskal-Wallis tests were used to determine the difference in median accordance score by categorical demographic variables (race, age, education level, and BMI category).

Findings

Of the 291 electronic medical records screened, 156 did not meet the inclusion criteria. The remaining 135 participants were approached for participation, with 52 giving consent. Of the 83 participants who did not give consent, 43 declined participation and 40 missed physician appointments or were unable to be reached. Of the 52 participants who completed the study, one was excluded for implausible caloric intake (354 kcal/d), which was defined as less than 500 kcal/d or more than 5000 kcal/d for women and less than 700 kcal/d or more than 7000 kcal/d for men, resulting in a final count of 51 participants. Participant demographics are described in Table 2. Mean age was 62.0 ± 9.3 years. The majority of participants were female (64. 7%), white (74.5%), and obese (64.7%).

A total of 64.7% of participants stated that they follow a heart healthy diet. The majority of participants (51.0%) reported using no national organizations to learn about a heart healthy diet. Other participants reported having utilized information from the American Heart Association (AHA) (33.3%); the Academy (2.0%); both the AHA and Academy (9.8%); and the AHA, Academy, and National Heart, Lung, and Blood Institute (3.9%).

A minority of participants (39.2%) reported previously seeing an RD to learn about a "heart healthy" diet, and 76.5% reported having received heart healthy diet information from a physician. Of those who previously saw an RD, 75% reported that they followed a

heart healthy diet compared with 56.7% who had not previously seen an RD. Other reported sources of heart healthy dietary information included other health care professionals (31.4%), media (62.7%), and family or friends (47.1%).

Table 2. Demographic Characteristics and Knowledge and Accordance Scores of Outpatient Cardiology Participants[a]

Variables	n(%)	Knowledge Score (out of 24), Mean ± SD	Knowledge Score (out of 24), Median (25th, 75th)	Accordance Score (out of 15), Mean ± SD	Accordance Score (out of 15), Median (25th, 75th)
Age, y					
< 55	9 (17.6)	12.3 ± 3.1	12.0 (10.0, 15.0)	5.0 ± 2.0	4.0 (4.0, 5.5)
55–65	22(43.1)	13.2 ± 3.7	13.0 (11.0, 16.3)	5.6 ± 2.1	5.0 (4.0, 7.0)
> 65–75	20 (39.2)	12.4 ± 2.8	13.0 (11.0, 14.0)	5.2 ± 1.9	5.0 (4.0, 6.8)
Body mass index					
> Normal	6 (11.8)	14.0 ± 2.3	13.5 (12.0, 15.8)	4.2 ± 1.3	4.0 (3.0, 5.3)
> Overweight	12 (23.5)	13.1 ± 3.3	14.0 (10.5, 16.0)	6.1 ± 2.4	5.0 (4.3, 8.5)
> Obese	33 (64.7)	12.4 ± 3.3	13.0 (11.0, 14.0)	5.2 ± 1.8	5.0 (4.0, 6.5)
Gender					
Male	18 (35.2)	13.1 ± 3.5	13.0 (11.8, 16.0)	5.1 ± 1.7	5.0 (4.0, 6.3)
Female	33 (64.7)	12.6 ± 3.1	13.0 (11.0, 15.0)	5.5 ± 2.1	5.0 (4.0, 6.5)
Race					
White	38 (74.5)	13.1 ± 3.1	13.0 (11.0, 16.0)	5.2 ± 1.8	5.0 (4.0, 6.0)
African American	9 (17.6)	11.0 ± 4.0	11.0 (7.0, 15.0)	5.6 ± 2.4	4.0 (4.0, 7.5)
Other	4 (7.8)	13.3 ± 0.5	13.0 (13.0, 13.8)	5.5 ± 3.0	5.0 (3.0, 8.5)
Education, y					
≤ 12	16 (31.4)	10.9 ± 3.0$_z$	11.0 (8.5, 12.8)	4.7 ± 1.8	4.0 (3.3, 5.0)
13–16	15 (29.4)	12.5 ± 3.4$_{z,y}$	13.0 (11.0, 15.0)	5.5 ± 1.9	5.0 (4.0, 7.0)
≥ 17	19 (37.3)	14.3 ± 2.5$_y$	14.0 (13.0, 16.0)	5.7 ± 2.1	5.0 (4.0, 7.0)

a. Values with unlike subscript letters are significantly different at $P < .01$ by 1-way analysis of variance.

Knowledge

Mean overall knowledge score was 53.1 ± 13.4% (12.8 ± 3.2 correct out of 24 questions). Mean knowledge score was 56.9 ± 11.4% in those who had seen an RD and 50.1 ± 14.1% in those who had not seen an RD ($P = .08$). A total of 13.7% of participants had a knowledge score of 70% or more, and 68.6% had a knowledge score of 50% or more. There were not significant differences in mean knowledge score by gender ($P = .55$), race ($P = .37$), age ($P = .66$), or BMI category ($P = .52$). A significant difference was found in mean knowledge score by education level ($P = .007$), with a Scheffe post hoc test showing that participants with 12 or less years of education had a significantly lower mean knowledge score than participants with 17 or more years of education (Table 2).

Knowledge questions that the majority of participants answered correctly included fish intake for people without heart disease (two 4-oz servings a week; 78.4% answered correctly), the percentage of kilocalories in a diet that should come from saturated and *trans* fats (< 7% of kilocalories; 70.6% answered correctly), and total fiber intake (25–35 g/d; 58.8%

answered correctly; Table 1). Knowledge questions that the majority of participants incorrectly identified included those regarding soluble fiber intake (7–13 g/d; 31.4% answered correctly), percent kilocalories from fat (25%–35% of kilocalories; 37.3% answered correctly), and dietary cholesterol intake (< 200 mg/d; 41.2% answered correctly).

Dietary intake

Dietary intake of this sample is shown in Table 3. Mean kilocalories intake was reported as 1489 ± 762 kcal/d. Percentage of kilocalories from saturated and *trans* fats combined was 11.5 ± 3.0%, similar to the intake of kilocalories from saturated fat (11%) for women aged 20 years and older in the National Health and Nutrition Examination Survey (NHANES). Total dietary fiber intake was 17.5 ± 11.0 g/d in this sample, compared with 15.5 g/d in the same NHANES population.[6]

Table 3. Dietary Intake of Outpatient Cardiology Participants[a]

Variable	Mean ± SD	Median (25th, 75th)
Kilocalories	1488.7 ± 761.9	1338.9 (1020.8, 1829.9)
Fat, % kcal	35.7 ± 6.6	34.4 (29.8, 39.6)
Saturated and trans fats, % kcal	11.5 ± 3.0	11.2 (9.6, 13.1)
Cholesterol, mg	192.9 ± 101.6	175.4 (126.5, 235.1)
Total fiber, g	17.5 ± 11.0	14.5 (9.1, 21.8)
Soluble fiber, g	5.3 ± 3.1	4.6 (3.0, 6.6)
Alcohol, drinks/d	0.8 ± 1.6	0.2 (0.0, 0.7)
Nuts and seeds, oz/wk	4.7 ± 5.4	2.7 (1.0, 6.8)
High omega-3 fish, oz/wk	2.6 ± 4.1	1.2 (0.2, 2.7)
Alpha-linolenic acid, g	1.1 ± 0.7	1.0 (0.7, 1.4)
Supplemental omega-3, mg	225.5 ± 247.2	0.0 (0.0, 500.0)

a. Means and medians could not be calculated for certain dietary and lifestyle components (plant stanols and sterols, coenzyme Ql0, supplemental B vitamin intake, resistance exercise, moderate intensity physical activity) due to the question format.

Accordance

Median (Interquartile Range [IQR]) accordance score to the DLM guideline was 33.3% (26.7–40.0), equal to 5 (4–6) out of 15 recommendations (Table 1). Only 1 of 51 participants had an accordance score of 70% or more, and 6 of 51 had scores 50% or more. There were no significant differences in median accordance score by gender ($P = .65$), race ($P = .44$), age ($P = .63$), education level ($P = .12$), BMI category ($P = .06$), or between those who had and had not seen an RD ($P = .34$).

Pertinent recommendations with which the majority of participants were accordant included those regarding alcohol intake (84.3% accordant; 0.8 ± 1.6 drinks per day vs. recommended ≤ 1 drink per day for women and ≤ 2 drinks per day for men), use of supplemental B vitamins (80.4% accordant; use not recommended), and dietary cholesterol intake (64.7% accordant; 192.9 ± 101.6 mg/d vs. < 200 mg/d recommended) (Table 1). Pertinent recommendations with which the majority of participants were not accordant included those

regarding high omega-3 fish consumption (92.2% not accordant; 2.6 ± 4.1 oz/week vs. recommended 8 oz/week), percentage of kilocalories from saturated and *trans* fats (90.2% not accordant; 11.5 ± 3.0% of total kilocalories vs. recommended < 7% of total kilocalories), and soluble fiber (80.4% not accordant; 5.3 ± 3.1 g/d vs. recommended 7–13 g/d).

Knowledge versus accordance

There were no significant relationships between overall knowledge and accordance scores (r_s = 0.18, P = .22) or between knowledge of and accordance with individual recommendations. Despite this, the majority of participants correctly identified but were not accordant with recommendations regarding consumption of 25 to 30 g/d of dietary fiber (78.4% were knowledgeable but not accordant), consumption of 8 oz/wk high omega-3 fish for patients without heart disease (72.5% were knowledgeable but not accordant), and consumption of less than 7% of kilocalories from saturated and *trans* fats (62.7% were knowledgeable but not accordant). On the contrary, the majority of patients did not have knowledge of but were accordant with the recommendation regarding nonuse of supplemental B vitamins (66.7% were not knowledgeable but were accordant). Also seen were instances where the majority of participants did not know and were not accordant with recommendations (consumption of 7–13 g/d soluble fiber [56.9% were not knowledgeable and not accordant]). In addition, the majority of participants did know and were accordant with recommendations for alcohol: 1 or less drink per day for women (57.6% women were both knowledgeable and accordant) and 2 or less drinks per day for men (55.6% men were both knowledgeable and accordant).

Discussion

The purpose of this research was to understand how much patients know about and are accordant with dietary practices recommended by the Academy for those with DLM and if there is an association between knowledge of and accordance with these recommendations. A majority of the participants were not considered knowledgeable about the dietary components that constituted the DLM guideline, nor were they accordant to this guideline. In addition, no relationship existed between knowledge and accordance.

When knowledge was assessed by correctly answering 70% of questions on the knowledge questionnaire, few participants (13.7%) were knowledgeable. Even when a less stringent knowledge cutoff (≥ 50%) was used, one third of the participants had low knowledge. Education played a role in participant knowledge; it is possible that those with greater formal education may have greater exposure to dietary recommendations.

Subjects were largely not accordant, whether assessed by the 70% or more or 50% or more cutoff. In a study by Bhupathiraju et al.,[7] only 3% of the study population (older Puerto Rican adults) had an adherence score 50% or more for an adherence index based on the AHA 2006 diet and lifestyle recommendations.[7] Dietary cholesterol accordance was similar between the current sample and a sample of older women with hypercholesterolemia, with 65% and 69% being accordant with the recommendation to consume less than 200 mg/d cholesterol, respectively.[8] In a sample of women with self-reported hypercholes-

terolemia (n = 13 777), Hsia et al.[8] found that 79% of the sample did not adhere to the National Cholesterol Education Program recommendation to consume less than 7% of kilocalories from saturated fat. Average energy intake was approximately 1400 kcal as assessed by the FFQ. As a majority of the sample was obese, it is likely that participants underreported their energy intake. Underreporting could have meant that actual dietary cholesterol intake was more than 200 mg (reported intake of 192.9 ± 101.6 mg/d; mean ± SD), or actual fiber intake was closer to the goal of 25 to 35 g/d (reported intake of 17.5 ± 11.0 g).

No overall relationship between knowledge and accordance was seen in this sample, with varying relationships seen within each specific dietary component. While we were unable to tailor the individual recommendations to the specific conditions of the participants, based on the individual relationships between knowledge and accordance, it is still prudent to recommend increasing soluble fiber (for which subjects were neither knowledgeable nor accordant), nuts, and omega-3 (both for which subjects were knowledgeable but not accordant). These dietary components are key components of a heart healthy diet and are constants for all those concerned about their heart health.

As only 2% of the sample had previously used the Academy for nutrition information regarding a heart healthy diet, the information that they did know originated from other sources. Indeed, one third of the participants stated that they had used the AHA to learn about a heart healthy diet. The AHA guidelines are similar to those of the DLM guidelines, and it is possible that participant knowledge and accordance could have been influenced by these overlapping recommendations. Similar recommendations include those for fish intake, alcohol consumption, saturated and *trans* fat, fiber, B vitamins, and plant sterol intake.[2]

While we enrolled patients who had a diagnosis of dyslipidemia, hyperlipidemia, or metabolic syndrome with or without heart disease, we did not screen for diabetes, and therefore we do not know how many participants had this condition. The American Diabetes Association recently released nutrition therapy recommendations for the management of adults with diabetes.[9] These recommendations are similar to those of the DLM guidelines, including omega-3 fatty acids, saturated fat, plant sterols, and alcohol. However, these recommendations are less specific than those of the DLM and differ in certain components; in addition, these recommendations were recently released and slightly differ from that of the 2008 guidelines. The 2008 position statement from the American Diabetes Association recommends 14 g/1000 kcal of fiber, less than 7% of kilocalories from saturated fat, less than 200 mg of dietary cholesterol, and 2 or more servings of fish per week.[10] Antioxidants supplementation is not recommended, and plant sterols can be a part of the recommended medical nutrition therapy. The 2008 guidelines also recommend antioxidant-rich foods such as fruits, vegetables, and nuts. As these recommendations largely align with the DLM guidelines, they may have contributed to the response of those with diabetes.

An additional factor that may have influenced knowledge or accordance was exposure to other sources of information related to a heart healthy diet. While a minority of the participants had previously seen an RD (39.2%), a majority received heart healthy diet information from a physician. However, the provision of adequate information and ability to

facilitate behavior change may not be feasible during a physician visit, with physicians citing barriers including insufficient time, knowledge, compensation, and resources.[11] In addition, media was a substantial source of information about a heart healthy diet, increasing the potential for exposure to both accurate and inaccurate information. It is possible that participant responses were influenced by the media, but unlike the influence of dietary guidelines and health care professionals, it is unclear if this influence positively or negatively impacted knowledge or accordance.

The specific questions used to determine knowledge and accordance could have influenced participant responses. Subjects tended to provide correct responses for those questions that were behavioral (e.g., exercise) or food-based questions rather than those that were nutrient-related (e.g., milligrams plant-derived omega-3, grams of soluble fiber). This indicates that individuals may be better able to conceptualize nutrition recommendations based on whole foods rather than individual nutrients, providing support for an RD to take a food-based approach to education. In addition, subjects believed that supplements should be consumed more than the guideline recommendations; this was true for both coenzyme Q10 and B-vitamin supplements, as 90.2% and 80.4% of participants thought that coenzyme Ql0 and B-vitamins were routinely recommended for those at risk or with heart disease.

Strengths and Limitations

Validity and reliability testing of the knowledge questionnaire were strengths of this study, as well as using the Academy's evidence-based guideline for DLM as the standard for evaluation of participant knowledge and accordance. Use of a standardized FFQ provided an assessment of dietary intake over time. While not a key component to the primary outcomes, providing personalized dietary intake information based on evaluation of long-term dietary intake as assessed by an FFQ used as an incentive was a strength.

The primary limitation of this study is the small sample size. It is possible that the study was underpowered, and differences between knowledge and accordance variables may have been seen with a larger number of participants. In addition, differences by gender or presence of heart disease for certain gender- or condition-specific questions were not able to be tested. We were also not able to compare knowledge or accordance scores to markers of CVD risk or CVD end points because of the small sample size. We did not address the use of lipid-lowering drugs, which may also influence dietary accordance.

Several of the questions asked about quantifying recommended nutrient intake (e.g., percent saturated fat) rather than asking about whole foods. It is likely that the lack of knowledge for these questions was in part based on the specificity of the question. Last, we are aware that the Academy's DLM guideline was developed for RD use, and therefore the participants were likely not familiar with the specific guidelines. However, it is important to determine whether patients have an understanding of dietary measures to benefit heart health, whether they be the Academy's guidelines or those of another organization.

Conclusions

This research provides information for RDs regarding common patient beliefs of what constitutes a heart healthy diet as well as with which DLM guideline recommendations patients may be least accordant. Participants in this sample displayed moderate knowledge (53% knowledgeable) of but low accordance (33% accordant) with heart healthy diet recommendations. There is a need for more dietary education and behavior change therapy among patients with DLM, which could be provided by RDs. Registered dietitians should utilize behavior change strategies, in addition to traditional dietary education, to improve both knowledge and accordance. Regarding specific foods and nutrients, it may be important for RDs to focus on soluble fiber, for which most patients were neither knowledgeable of nor accordant with the recommendation. It may also be beneficial to assist patients with strategies for incorporating nuts and high omega-3 fish into their diets, as most participants were knowledgeable of but not accordant with these recommendations.

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