

Dietary Fiber: Is Information the Key?

James Blaylock, David Smallwood, and Jayachandran N. Variyam
(202) 219-0900 (202) 219-1265 (202) 501-7420

Better diets can help unlock the door to good health. Researchers estimate that poor diets and sedentary lifestyles account for over 300,000 deaths a year. According to health authorities, fully 35 percent of all cancer deaths are attributable to poor diet. Furthermore, USDA surveys reveal that Americans overwhelmingly believe that what you eat can make a big difference in your chances of contracting a disease.

With such evidence pointing to a growing public awareness of the links between diet and health, increased knowledge about the nutrient content of foods, and improved attitudes about healthier eating, why do some people continue to make poor food choices even when armed with better nutrition information? Who are these people? Are some forms of nutrition information more persuasive than others for encouraging people to eat healthier?

Understanding how nutrition and health information vary across population groups and how they relate to nutrient intake levels is critical for designing and evaluating nutrition education programs and monitoring the progress of the Nation in moving toward dietary recommenda-

tions. This article focuses on dietary fiber intake.

Many Factors Influence Dietary Fiber Intake

The *Surgeon General's Report on Nutrition and Health* advises Americans to increase consumption of all complex carbohydrates, including dietary fiber. Consumption of dietary fiber has been linked to reduced incidence of heart disease, some cancers, and symptoms of chronic constipation, diverticular disease, and hemorrhoids.

However, despite intensive nutrition education efforts and media exposure, dietary fiber intake remains below the levels recommended by the National Cancer Institute of 20-30 grams per day for a 2,000-calorie diet. Americans report consuming an average of 10-13 grams of dietary fiber per day in an average reported diet of 1,609 calories. Of course, these are only averages. Males, older Whites, and more educated people were more likely to consume more fiber than the average but still less than the recommended amount. People consuming less than the average were more likely to be Black, live in larger households, smoke, and live in the North Central region.

To help determine whether there is any connection between a person's nutrition knowledge and/or diet-disease awareness levels and

actual dietary fiber intake, USDA's 1989-90 Diet and Health Knowledge Survey (DHKS) and its associated Continuing Survey of Food Intake by Individuals (CSFII) were used. Fiber intake was measured in terms of density (grams of fiber per 1,000 calories; see box for more details about the survey data). The data provided information on socioeconomic and demographic characteristics, nutrition knowledge, and diet-disease awareness among the population.

Factors helping to explain variations in dietary fiber density as well as variations in nutrition knowledge levels, awareness, and attitudes can be delineated into three broad categories: household, individual, and dietary characteristics. Household characteristics include income, food-assistance program participation, household size, and location of residence. Gender, race, education, and age are individual characteristics. Dietary or health-related characteristics include smoking and vegetarianism.

Awareness of the link between dietary fiber and health had the largest effect on fiber density among the three types of information studied. That is, the more an individual knew of the fiber-health link, the more fiber one consumed in the diet, per 1,000 calories. This suggests that nutrition education programs aimed

The authors are economists with the Food and Consumer Economics Division, Economic Research Service, USDA.

About the Data

This research is based on analysis of the 1989 and 1990 USDA Continuing Survey of Food Intake of Individuals (CSFII) and its companion Diet and Health Knowledge Survey (DHKS) conducted by the USDA's Human Nutrition Information Service, which is now part of USDA's Agricultural Research Service. The CSFII gathers information on the dietary intake of individuals over a 3-day period. The first day's data were collected in a personal in-home interview using a 1-day dietary recall. The second and third days' data are from a dietary record kept by all respondents. Personal and household characteristics such as income, age, weight, height, race, and education were also collected.

The 1989 and 1990 DHKS were conducted as a detailed 30-minute telephone followup survey to the CSFII.

Individuals identified in the CSFII as the main meal planner/preparer for the household were contacted about 6 weeks after the CSFII and asked a series of questions about their diet and health knowledge, awareness, and attitudes.

The DHKS was designed so that information from it could be directly linked to information on food consumption from the CSFII. These surveys are the first nationally representative data to provide a combined and detailed look at the intake of foods eaten as well as the individual's knowledge, attitudes, and awareness of diet and nutrition and its relationship to health and behavior.

This analysis is restricted to include only the main meal planner/preparer who reported 3 days of complete intake data. After merging DHKS data for 1989 and 1990 and eliminating

cases with missing values, our final sample consisted of 2,466 respondents.

In the analysis, dietary fiber intake is measured using the concept of nutrient density or grams of fiber per 1,000 calories. The nutrient density concept adjusts for differences in consumption and for under-reporting of consumption, which is common in these types of surveys.

Of the 2,466 respondents, 80 percent were women. The average age was 48 years, and the average per capita income was about \$10,200 per year. The average household size was about 2.6 people. Approximately 85 percent were White, 12 percent Black, and 7 percent identified themselves as Hispanic. The majority of those interviewed had obtained a high school education, and 27 percent smoked.

at increasing awareness of fiber-health-disease linkages will likely have the highest payoff in terms of raising dietary fiber consumption. This is in contrast to providing more information on the fiber content of specific foods or simply telling people to eat more fiber.

How We Measure Knowledge, Attitudes, and Awareness

The DHKS data provide measures of a person's knowledge of the fiber content of foods, attitude toward consuming fiber-rich foods, and awareness of health problems linked to insufficient fiber intake. Referred to collectively as "fiber information," these are three different types of nutrition knowledge or attitudes that potentially influence fiber intake.

Six questions, each asking which of two food items has the higher fiber content, help determine a person's knowledge of the fiber content

of foods (table 1). The pairs are meat/fruit, cornflakes/oatmeal, white bread/whole wheat bread, orange juice/apple, pretzels/popcorn, and lettuce/kidney beans. Most people identified the high-fiber choice correctly. Given a choice of two foods, 80 percent of the meal planners were able to identify which was higher in fiber in about five out of six cases (exceeding the Federal Government goal that by 1990, 70 percent of the population would be able to identify foods that are good sources of fiber).

Attitude toward consuming fiber-rich food is determined using three survey questions: a general one about eating foods with adequate fiber, and two specific questions about consuming five servings a day of fruits and vegetables and six servings a day of breads, cereals, and grains (table 2). The survey revealed that more people believed that eating at least six servings of breads, cereals, and other grain products was important or very important (37 percent) than those who believed it

was slightly or not at all important (22 percent). Responses to the importance of eating at least five servings of fruits and vegetables revealed a similar pattern: 45 percent considered it important or very important, and 24 percent considered it slightly or not at all important. A large majority, 64 percent, said it is important for them to eat foods with adequate fiber; only 8 percent said it is not important.

Disease awareness is measured by a question asking people if they have heard about health problems related to how much fiber a person eats (table 3). Half said yes and half said no.

Statistical methods were used to combine the six questions on the fiber content of foods into a single indicator of fiber content knowledge. Likewise, the three questions measuring attitude toward consuming fiber-rich foods were combined into a single measure. There was only one measure of diet-disease awareness. Advanced statistical models were used to isolate the in-

fluence of each household, individual, and dietary/health characteristic variable (such as income, race, and vegetarianism) from another on the fiber information measures. Similar models isolated the impacts of fiber knowledge, attitudes toward consuming fiber-rich foods, awareness of diet-disease relationships, and socioeconomic factors on dietary fiber density.

Fiber Information: Who Has It, Who Doesn't

The person most likely to be armed with considerable fiber information is not surprising: she is highly educated, has a relatively high household income, and tends to be older. Household income influences all three fiber information measures—fiber knowledge, attitude toward eating fiber-rich foods, and awareness of diet-disease linkages—but in different ways. Those with per person household income over \$10,000 are more knowledgeable about the dietary fiber content of foods and are more aware of fiber-related diseases. For example, out of the six fiber questions, the highest income meal planners answered an average of 5.0 questions correctly, compared with 3.9 for the lowest income group (table 1).

As income increases so does the likelihood that a person believes it is important or very important to eat foods with adequate fiber. Curiously, income does not appear to uniformly influence attitudes toward eating five servings per day of fruits and vegetables or six servings of grain products. For example, about 44 percent of the lower income people felt it was important or very important to eat six servings per day of grain products, while 36 percent of the wealthiest individuals were so inclined. This may reflect a misconception by the wealthier that fiber-rich foods, such as many grain products or beans, are inferior goods.

Gender appears to be associated with knowledge about sources of fiber. Women answered an average

of 4.9 out of six questions correctly, while men averaged 4.5 correct answers. Women were also more likely

Table 1
Most People Can Identify Which Foods Have More Fiber

Survey respondents asked to choose which food contains the most fiber	Respondents answered—	
	Incorrectly	Correctly
	<i>Percent</i>	
Meat versus fruit	20.4	79.6
Cornflakes versus oatmeal	18.3	81.7
White versus whole wheat bread	6.7	93.3
Orange juice versus apple	23.9	76.1
Pretzels versus popcorn	23.6	76.4
Lettuce versus kidney beans	41.3	58.7
Respondent profile	Average number of correct answers (out of six questions)	
	<i>Number</i>	
All	4.8	
Age:		
Under 30 years	4.8	
30-49 years	4.9	
50-69 years	5.0	
70 years and over	4.6	
Sex:		
Male	4.5	
Female	4.9	
Race:		
White	4.9	
Black	4.3	
Other	4.3	
Ethnicity:		
Hispanic	4.3	
Non-Hispanic	4.9	
Yearly per capita income:		
\$3,800 or less	3.9	
\$3,801-\$5,400	4.4	
\$5,401-\$10,200	4.3	
Over \$10,200	5.0	
Education:		
Less than high school	4.3	
Completed high school	4.9	
More than high school	5.1	

Table 2
Attitudes About Fiber Get Better With Age But Not Education

Survey respondents asked to rate 3 attitudes on fiber consumption	Attitude about importance of fiber					
	Not at all important 1	2	3	4	5	Very important 6
	<i>Percent</i>					
Eat foods with adequate fiber	3.9	3.8	11.8	16.7	20.9	42.9
Eat at least five servings per day of fruits and vegetables	15.7	8.4	13.1	17.6	14.6	30.7
Eat at least six servings per day of breads, cereals, and other grain products	10.0	12.3	18.3	21.9	13.7	23.7

Respondent profile	Eat food with adequate fiber	Eat at least five servings per day of fruits and vegetables	Eat at least six servings per day of breads, cereals, and other grain products
	<i>Percent</i>		
All	64	46	36
Age:			
Under 30 years	52	37	28
30-49 years	61	44	35
50-69 years	75	52	47
70 years and over	70	54	35
Sex:			
Male	55	31	30
Female	66	50	38
Race:			
White	65	46	37
Black	55	48	36
Other	62	45	30
Ethnicity:			
Hispanic	61	52	32
Non-Hispanic	64	45	37
Yearly per capita income:			
\$3,800 or less	51	44	44
\$3,801-\$5,400	58	48	34
\$5,401-\$10,200	64	45	36
Over \$10,200	65	46	36
Education:			
Less than high school	64	44	36
Completed high school	65	47	39
More than high school	63	45	35

to believe it is important to eat fiber-rich foods and more aware of fiber-health relationships (tables 2 and 3).

Knowledge of fiber sources is directly related to formal education. Meal planners with at least some college background answered about 5.1 questions correctly, while those with less than a high school educa-

tion correctly identified 4.3. However, there appears to be little relationship between education and attitudes about fiber intake. Regardless of education, about 63-65 percent of the respondents felt it was important or very important to eat foods with adequate fiber, and 44-47 percent felt it was important or very

important to eat five daily servings of fruits and vegetables.

On the other hand, there was a strong relationship between education and fiber-disease awareness. About 67 percent of those with higher levels of education had heard about health problems related to fiber intake versus 39 percent of those with less than a high school education.

People's fiber information also varies with ethnicity and race. Blacks are more likely than Whites to have lower levels of fiber information. The same holds true for Hispanics versus non-Hispanics. Both Blacks and Hispanics averaged 4.3 correct responses to the six fiber knowledge questions, while Whites and non-Hispanics averaged 4.9 correct responses. Attitudes toward eating five fruits and vegetables daily or six servings of grain products were about the same for Blacks and Whites. Slightly more non-Hispanics than Hispanics felt it was important or very important to eat food with adequate fiber, but more Hispanics than non-Hispanics felt it was important or very important to eat five daily servings of fruits and vegetables. More non-Hispanics than Hispanics, 57 versus 37 percent, had heard about health problems associated with insufficient fiber intake. These findings probably relate to cultural differences in diets and food preparation and to more limited access to print and electronic media sources for information because of language barriers.

Older people tend to be more aware of the day-to-day importance of eating fiber-rich foods and of eating at least five servings of fruits and vegetables a day. For example, 70 percent of respondents over age 70 said it was important or very important to eat food with adequate fiber, compared with 52 percent of people under age 30.

Table 3
Fiber-Disease Awareness Rises Dramatically With Income and Education

Survey respondents asked to relate diet-disease awareness	Aware of fiber-disease link	
	No	Yes
Heard about health problems related to fiber	44.4	55.6
Respondent profile	Percent indicating a yes response	
	Percent	
All	55.6	
Age:		
Under 30 years	46	
30-49 years	60	
50-69 years	58	
70 years and over	48	
Sex:		
Male	53	
Female	56	
Race:		
White	58	
Black	43	
Other	46	
Ethnicity:		
Hispanic	37	
Non-Hispanic	57	
Yearly per capita income:		
\$3,800 or less	37	
\$3,801-\$5,400	45	
\$5,401-\$10,200	40	
Over \$10,200	59	
Education:		
Less than high school	39	
Completed high school	51	
More than high school	67	

Better Information Results in Higher Fiber Density

Diet-disease awareness has the largest impact on dietary fiber consumption among the fiber information variables. This is not surprising given that avoiding health problems has the most immediate and concrete benefit to the consumer. This suggests that nutrition education programs aimed at increasing the general awareness of fiber-health-disease links will likely have the highest payoffs in terms of raising dietary fiber densities. The results also suggest that a person's attitude toward eating fiber-rich foods has a greater influence on fiber consumption than does specific fiber-content information.

These conclusions on the effects of fiber information on consumption applied to all population groups in the study, although the relative importance of these impacts varied across groups. These differences become clear when we consider the direct and indirect channels through which various consumer characteristics affect dietary fiber density. For example, age has an indirect effect on fiber density because it influences the fiber information variables which in turn affect intake. Age also has a direct effect on fiber density because older people may have different preferences and nutrient needs that influence the types of food that they consume. Table 4 shows how fiber intake varies across various economic/demographic groups. In our statistical analysis and in the following discussion, the influence of a characteristic on fiber intake is isolated from the influence of other factors. For example, the impact of a person's income is separated from the impact of a person's race or sex.

The impact of income on dietary fiber density is mixed. Overall, there is a small negative impact. That is, a 10-percent rise in income reduced

fiber density (grams of fiber consumed per 1,000 calories) by about 0.03 gram. While a higher income improves fiber information levels, which in turn increase dietary fiber density, this impact is offset by income-induced taste and preference shifts to foods that are lower in fiber. For example, higher income people tend to substitute other foods, such as steaks, for grain products. Because of this mixed impact, income

alone is not the key to improved fiber consumption.

Dietary fiber density was about 0.5 gram lower for people participating in either USDA's Food Stamp Program or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Most of the lower consumption is associated with the lower fiber-health awareness among food-assistance recipients in the study. This suggests

Table 4
Dietary Fiber Density Increases with Income

Respondent profile	Daily fiber density
	<i>Grams per 1,000 calories</i>
All	7.9
Age:	
Under 30 years	6.5
30-49 years	7.3
50-69 years	9.0
70 years and over	9.7
Sex:	
Male	7.3
Female	8.0
Race:	
White	8.1
Black	6.4
Other	7.9
Ethnicity:	
Hispanic	7.9
Non-Hispanic	8.0
Yearly per capita income:	
\$3,800 or less	7.2
\$3,801-\$5,400	7.8
\$5,401-\$10,200	7.9
Over \$10,200	8.0
Education:	
Less than high school	7.8
Completed high school	7.8
More than high school	8.0
Vegetarian	9.9
Non-vegetarian	7.8
Nonsmoker	8.2
Smoker	6.9

opportunities for nutrition education efforts in these programs to add emphasis on increasing diet-disease awareness and fiber knowledge.

Women had a 5-percent (0.3 gram) higher dietary fiber density than males, attributed to higher fiber awareness and attitudes.

One's level of education influences the fiber density of one's diet, perhaps because it influences an individual's knowledge of fiber-rich foods, diet-disease awareness, and attitudes toward consuming certain foods. Almost the entire effect on fiber density of a high school education occurs through a higher level of concern toward consuming fiber-rich foods. The high-school educated tend to be no more aware of fiber-health links than are those with less education. Therefore, the contribution of disease awareness to dietary fiber density is small for those with a high school education or less. However, the contribution of diet-disease awareness rises considerably for the college-educated and even more substantially for those with a post-graduate education. This suggests that people with higher education are better able to access and to process generally available information on fiber and that there may be a high public payoff to targeting fiber awareness campaigns to those with less education.

Smokers consume significantly lower amounts of dietary fiber than do nonsmokers—11 percent lower (0.9 gram). Sixty-three percent (0.7 gram) of this lower consumption is a direct effect, which implies that smokers and nonsmokers have different diets even after adjusting for fiber information levels. Such dietary behavior on the part of smokers may be related to evidence that smokers underestimate health risks relative to nonsmokers.

Vegetarians are a very distinct group when it comes to fiber consumption. They consume about 23 percent (1.7 grams per 1,000 calories) more dietary fiber than do non-vegetarians. Vegetarians consume an average of 14 grams of dietary fiber per day, still falling far short of the 20-30 grams recommendation. Higher intake is associated with vegetarians' better awareness and attitudes and the fact their diet is rich in high-fiber foods.

Implications for Nutrition Education

Nutrition information about dietary fiber translates into diets higher in fiber. The jury, however, is still out for many other nutrients such as fat, saturated fat, sodium, and cholesterol. ERS research on these other nutrients is just beginning.

According to the data presented here, the most potentially effective message to change fiber intakes is that there are well-documented links between some diseases and low dietary fiber intake. People who are more aware of these linkages tend to consume more dietary fiber than do those less informed. A positive attitude toward eating fiber-rich foods also helps increase consumption of fiber. Knowledge of the fiber content of foods is of less importance than awareness and attitudes.

Nutrition education efforts regarding dietary fiber might have improved success by emphasizing dietary fiber's role in lowering the risk of developing certain types of cancer as well as fiber's other health virtues. Nutrition education strategies emphasizing general messages such as "5 A Day for Better Health," encouraging people to eat more fruits and vegetables, likely have a greater impact in modifying dietary patterns than do strategies emphasizing specialized knowledge about the nutrient content of foods.

Like any campaign to change people's consumption, be it of soft drinks or fiber, the likelihood of success increases dramatically if the proper message is conveyed to the proper audience. In the case of fiber, the message might be more effective if geared toward individuals and groups that tend to have low levels of fiber knowledge, low diet/disease awareness, or attitudes toward eating fiber-rich foods that could stand some improvement.

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