The Dietary Fiber and Fat Intake, Dietary Fat Avoidance Patterns, and Diet-Disease Knowledge of College Women

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Abstract

Female college students (n=91) completed a survey assessing fat and fiber intake, fat avoidance behaviors, and diet-disease knowledge. Mean fiber intake was lower and mean fat intake higher than considered healthful. Most were well informed about diet-disease relationships and reported they avoid high fat foods. Most were not informed about their fat intake, with most underestimating actual fat intake. The majority indicated they would change their diet if they learned it was high fat.

Introduction

Over the last three decades, the link between a high fat diet and some prevalent and serious chronic conditions has received increasing attention. In the mid-1970s, government and health organizations, such as the U.S. Senate (1977), U.S. Departments of Agriculture and Health and Human Services (1980, 1985, 1990, 1995), and National Research Council (1989), began issuing recommendations for reducing the risk of chronic disease. During this same time period, consumers have become more aware of and interested in the linkages between diet and health (Blumenthal, 1989; National Cancer Institute, 1998). However, this awareness and interest has not translated into dietary patterns that reflect current dietary recommendations for Americans (Kant, Block, Schatzkin, Ziegler, & Nestle, 1991; Kant & Schatzkin, 1994). Specifically, American diets still exceed the recommended Healthy People 2010 objective of fat intakes equaling 30 percent or less of calories (Enns, Goldman, & Cook, 1997; McDowell, Briefel, Alaimo, Bischof, Caughman, Carroll, Loria, & Johnson, 1994; Murphy, Rose, Hudes, & Viter, 1992; U.S. Department of Agriculture, 1993). In addition, American diets fail to reach the recommended fiber intake (i.e., 25 to 35 grams/day).

Dietary patterns and preferences begin to form with a newborn infant's first meal, and perhaps even earlier during fetal life (Mennella & Beauchamp, 1994). Although many environmental factors will contribute to the development of a child's dietary patterns, it is widely acknowledged that the family remains the central force in establishing these patterns (American Dietetic Association, 1999). Recent changes in American family structure and women's work patterns have modified the responsibilities of many family members. For example, fathers are devoting more time to child rearing responsibilities and young children have increased responsibility for preparing their own breakfasts or snacks (Lamb, Pleck, Charnov, & Levine, 1987; Pleck, Lamb, & Levine, 1986). Despite the plethora of changes occurring in family life, 80 to 85 percent of all women still bear the primary responsibility for food purchasing and preparation (International Food Information Council, 1999). This female-dominated responsibility for food shopping begins early; in the U.S., over half of the 12- to 19-year-old-girls shop for some or all of their family's groceries every week (Kraak & Pelletier, 1998). Females, thus, are families' food gatekeepers. By extension, that means, women (i.e., mothers and potential future mothers) are a central force in establishing the dietary patterns of children and, thus, may be the key to the development of eating patterns that will help future generations reduce their risk of chronic diet-related disease.

Because women have such a large share of the responsibility for filling their families' grocery bags and stomachs, they are important candidates for nutrition education interventions. An increasing number of women are attending college and postponing child bearing until after the college years (Anonymous, 2000; Ventura, 1989), thus an ideal time to reach women may be while they are receiving post-secondary education. To design campus-based nutrition interventions that are responsive to their current and future needs, this audience's nutrition knowledge and dietary behaviors need to be elucidated. Thus, the purpose of this study was to examine specific dietary behaviors (i.e., fat and fiber intake) of female college students, their knowledge of dietary fat intake and chronic disease linkages, and their willingness to make dietary improvements.

Methods

Undergraduate women enrolled in human ecology classes at a northeastern university were recruited to participate in this study. A total of 91 volunteered to complete the study instrument. The age of the study sample ranged from 17 to 30 years, with the mean age$\pm$Standard Deviation (SD) being 21.6$\pm$2.93. The

vast majority (80%) of the surveyed students were white.

A six part self-report, survey instrument was used in this study. The first part of the instrument collected demographic data (e.g., age, ethnicity/race).

Parts two and three of the instrument examined actual fat and fiber intake as well as perceived fat intake. Part two was a food frequency questionnaire [i.e., the Eating Choices Food Questionnaire - Model 2 (ECFQ)(Kristal, Shattuck, Henry, & Fowler, 1990)]. The ECFQ instructed participants to indicate how frequently they consumed each of 52 food items (e.g., yogurt, hot dogs, breakfast cereals, red meat, dried fruit). Algorithms were used to score each participant's responses to the ECFQ and quantify her daily fiber intake in terms of grams and daily fat consumption as a percentage of total caloric intake. The validity of the ECFQ was established in a previous research study where it was compared to two criterion measures of usual dietary intake: a food frequency questionnaire and the mean of two four-day diet records (Kristal, et al., 1990). The complete discussion of the ECFQ questionnaire is available in the literature (Kristal, et al., 1990). In part three, each participant was asked a single question designed to determine her perception of her daily fat intake in terms of percent of caloric intake (i.e., *What percent of your calorie intake comes from fat?*).

The fourth portion of the instrument, based on the Stages of Change Algorithm for Dietary Fat Reduction (SCADFR)(Greene, Rossi, Reed, Willey, & Prochaska, 1994), included a series of six questions designed to determine the dietary fat avoidance behaviors the participant used. Sample questions from the fourth portion of the instrument included *Do you often eat bread, rolls, or muffins without butter or margarine?* and *Do you rarely or never eat red meat?* This instrument also determined the temporal differences in the onset of dietary fat avoidance behaviors by asking the participant to indicate whether she was currently avoiding, planning to avoid, or not planning to avoid dietary fat. See Greene, et al (1994) for a thorough discussion of the development and validation of the SCADFR.

The fifth section of the instrument, a 14-item Fat Intake-Disease Knowledge Test (FI-DKT) developed and validated by Finckenor (1997), measured each participant's knowledge of the relationship of high fat diets to health conditions or diseases. That is, in the fifth section of the instrument, participants were asked to indicate whether a high fat diet could cause each of 14 health conditions or diseases such as kidney stones and certain cancers. One point was awarded for each correct response; thus, the FI-DKT scores could range from 0 to 14.

The last part of the instrument assessed each participant's willingness to make dietary changes if she learned her diet was high in fat. Specifically, participants were asked, *If you found out that the amount of fat you are eating right now is too high, would you seriously consider reducing your fat intake?*

Mean fiber and fat intake were computed using the ECFQ algorithms (Kristal, et al., 1990). Data were analyzed using StatView (2000). Frequencies were computed to determine the most frequent sources of dietary fiber and fat in the participants' diets as well as the most commonly used dietary fat avoidance behaviors. Analysis of variance (ANOVA) and post hoc testing (Scheffe F) were conducted to determine if reported temporal differences in the onset of fat avoidance behaviors affected actual fat intake. ANOVA also was used to compare FI-DKT scores of individuals with temporal differences in the onset of fat avoidance behaviors.

Results

Fiber Intake

Mean daily fiber intake computed using the ECFQ was 10.91±3.3 SD grams (range 6.2 to 18.9 grams). The high fiber foods participants reported eating five or more times per week were: green salad (66% participants), two or more vegetables daily (59% participants), two or more fruits daily (59% participants), breakfast cereals (48% participants), whole wheat, rye, pumpernickel, or other dark breads (36% participants), and citrus fruits (27% participants). The most commonly consumed fruits and vegetables were bananas, melons, raisins, peas/green beans, broccoli/cauliflower, and squash. Most participants (87%) reported eating vegetables at dinner nearly every day of the week, but only 34 percent indicated they ate vegetables for lunch almost daily. The vast majority of the study sample (79%) also indicated that at least once per week their main meal was grain or bean-based and contained no meat, eggs, or cheese. While the dietary patterns these individuals report indicate that they do choose fiber-containing foods, they need to increase their intake because their fiber intake still falls substantially below recommended fiber intake for adults of 25 to 35 grams daily. The interest in eating fiber-rich foods noted among college age women coupled with the health promoting qualities of fiber indicates that this audience may benefit from educational interventions that help them learn ways to incorporate more fiber-rich foods in their meals and snacks. These data may also indicate that campus-based food service operations should increase their offerings of fiber-rich foods, perhaps by offering more vegetable choices at lunch or featuring more grain or bean-based entrees.

Fat Intake

Actual. Mean fat intake, as determined by the ECFQ, was 34.0%±7.0% SD (range 21 to 48%) of calorie intake. The participants' overall mean fat intake mirrors the 34 percent reported by the American public (McDowell, et al., 1994; National Research Council, 1989) and exceeds current dietary recommendations.

Only 26 (29%) participants consumed a diet containing the recommended level of 30 percent or less calories from fat—everyone else exceeded the recommended level. When these 26 individuals are factored out, the mean fat intake climbed to 37.4%±4.8% SD.

An examination of the sources of dietary fat revealed that approximately one-third of all participants ate these high fat foods five or more times weekly: cheese, regular salad dressing/mayonnaise, margarine, and butter. Nearly two-thirds (63%) reported eating red meat at least three times per week. Other high fat foods eaten at least weekly by more than one-third of the participants were: pies, cakes, or cookies (58% participants), fast food (56% participants), fried restaurant foods (53% participants), foods fried at home or in the dormitory (44% participants), pastries like donuts, sweets rolls, and croissants (44% participants), potato or corn chips (44% participants), hamburger (42% participants), ice cream (38% participants), and lunch meat (34% participants). The health risks associated with a diet higher in fat than is recommended indicates that this population, like most Americans, needs opportunities to learn how (and why) to trim fat intake as well as opportunities to purchase snacks and meals that are lower in fat.

Perceived. A total of 89 participants completed the question on the survey designed to determine their perception of their daily fat intake in terms of percent of caloric intake. Over two-thirds of these individuals (n=65) perceived that they consumed a diet deriving 30 percent or less of its calories from fat. Yet, a comparison of their perceived or estimated fat intake with actual intake indicated that more than two-thirds of these individuals (n=45) incorrectly estimated that the fat content of their diets was 30 percent or less of calories—that is, they believed they were eating less fat than they really were. In contrast, only 25 percent of the 24 participants who estimated that their diets contained more than 30 percent of calories from fat were incorrect. These data seem to indicate that college-age women tend to have misperceptions about the fat content of their diets. Of particular concern is the underestimation of fat intake by those whose diets contain more than the recommended proportion of fat, for if these women believe they are already eating a low fat diet, they may be less likely to attend to health promotion messages focusing on lowering dietary fat intake.

Fat Avoidance Behaviors

Table 1 reports the temporal differences in the onset of fat avoidance behaviors among study participants. That is, 60 percent of the study participants (n=55) reported that they were currently avoiding high fat foods. A quarter (n=23, 25%) reported that they planned to trim their fat intake in the near future. Approximately 1 in 7 students (n=13, 14%) reported that they had no plans to reduce their fat intake. Those who reported they were currently avoiding high fat foods had a significantly lower actual fat intake than those planning to and those not planning to avoid high fat foods. In addition, those planning to avoid high fat foods consumed a significantly lower proportion of calories as fat than those with no plans to avoid high fat foods did.

The specific fat avoidance behaviors surveyed included: not eating chicken or removing the skin from chicken; rarely or never eating red meat; not eating regular fat cheese; using low calorie/non-fat or no salad dressing; rarely eating high fat snacks (e.g., chips, pastries); and using no butter or margarine on bread. These behaviors were selected because of the substantial impact they have been found to have on lowering dietary fat intake (Kristal, et al., 1990). Table 2 summarizes the impact of participants' fat avoidance behaviors on their fat intake. Individuals who engaged in the surveyed fat avoidance behaviors were much more likely to consume a diet deriving 30 percent or less of its calories from fat. For example, 39 percent of the individuals who reported removing the skin from chicken had a fat intake of less than or equal to 30 percent of calories. In contrast, only 4 percent of the individuals who ate chicken with its skin met the recommendation for fat intake. This same trend was noted for all other fat avoidance behaviors. These findings seem to indicate that getting college-age women to engage in just six fat avoidance behaviors (i.e., remove chicken skin, limit red meat intake, eat low fat cheese, use low calorie/non-fat or no salad dressing, minimize high fat snack ingestion, and avoid butter or margarine) could lead to a substantial reduction in fat intake.

FI-DKT Scores

FI-DKT scores ranged from 3 to 14. The overall mean score was 11.0±2.0 SD, indicating a high degree of knowledge about dietary fat and disease relationships. Table 1 reveals that individuals who reported that they were currently avoiding high fat foods had a significantly higher FI-DKT score than those planning to and those not planning to avoid high fat foods. Although these data suggest that a relationship exists between knowledge of diet-disease relationships and avoidance of high fat foods, it was not possible to determine whether knowledge gains occurred before or after fat avoidance behaviors began. However, the inverse relationship that exists between actual fat intake and FI-DKT score (see Table 1) may indicate that the knowledge gains may be a precursor to fat avoidance behaviors. This is because those who were currently avoiding high fat foods had a significantly lower actual fat intake than those planning and those not planning to avoid high fat foods, and, to lower fat intake, they need to know how to do so. While they were learning how to lower fat intake it is possible that these individuals also learned

how a reduced fat intake could benefit their health status. However, this finding is in contrast to previously reported studies which found that nutrition and health knowledge often is not associated with diet and health behavior (Levy, Fein, & Stephenson, 1993; Prochaska, DiClemente, & Norcross, 1992).

Table 1: Mean Actual Daily Fat Intake as a Percent of Total Calorie Intake and Fat Intake-Disease Knowledge Test (FI-DKT) Score by Onset of Fat Avoidance Behaviors

Onset of Fat Avoidance Behaviors	Mean Actual Daily Fat Intake as a Percent of Total Calorie Intake	Mean FI-DKT Score
Currently Avoiding High Fat Foods (n=55)	$30.4 \pm 5.9^{ab\#}$	11.7 ± 1.5^{de}
Plan to Avoid High Fat Foods Soon (n=23)	37.1 ± 5.6^{ac}	10.6 ± 2.4^{d}
Do Not Intend to Avoid High Fat Foods (n=13)	41.66 ± 3.8^{bc}	9.6 ± 2.5^{e}

\# Items having the same superscripts were found to be significantly different using ANOVA. Significance levels and Scheffe F-test values: $^{a}p<0.0001$, F=11.54; $^{b}p<0.0001$, F=21.35; $^{c}p<0.10$, F=2.81; $^{d}p<0.10$, F=2.55; and $^{e}p<0.05$, F=6.18.

Willingness to Make Dietary Changes

When asked whether they would change their diet if they learned it was high in fat, nearly all participants (n=85, 93%) reported they would change their diets in the near future. The six individuals who reported that they would not change their diets if they found out they were high in fat were well informed about diet disease relationships (11.8±1.0SD FI-DKT score). The FI-DKT score data seem to indicate that knowledge of diet-disease relationships does not motivate everyone to change (Levy, et al., 1993; Prochaska, et al., 1992). More troubling, all of these six individuals needed to lower their fat intakes. That is, they had a mean actual fat intake of 40.2±5.6 (range 33 to 48) caloric intake and most (n=4) erroneously estimated their fat intake to be 30 percent or less of their calorie intake. It is not possible to determine from the data collected in this study why some individuals reported they would not change a potentially hazardous dietary practice.

Discussion

This study's findings reveal that college women tend to eat less fiber and more fat than is recommended. In general, they seem to be uninformed about the fat content of their diets in that over half underestimated their dietary fat intake. Study participants who reported that they were avoiding high fat foods had a significantly lower actual fat intake as well as significantly higher FI-DKT scores than those planning to and those not planning to avoid high fat foods. It is encouraging to note that the overwhelming majority reported that they would change their diet if they learned it was high fat.

The findings of this study seem to indicate that nutrition education programs targeted to college-age women should: provide opportunities for these women to accurately assess their fat intake; promote the value of increased fiber and reduced fat intake; provide practical, useful techniques for increasing fiber and reducing fat intake; and focus on straightforward, relatively easy to remember and implement dietary adjustments that can substantially reduce fat intake, such as removing chicken skin; choosing low fat cheese; choosing low calorie, nonfat, or no salad dressing; and limiting red meat, high fat snack, and butter or margarine intake. Campus food service can support these efforts by offering a greater array of fiber-rich and reduced fat food choices than is typically available (Hellmich, 2000).

Future research should investigate the usefulness of a nutrition education program based on this study's findings on participants' diet, fat avoidance behaviors, and knowledge of diet-disease relationships. In addition, it may be worthwhile to identify individuals who report they would not change their diets even if they found out they were high in fat and investigate the factors contributing to their reluctance to change. These factors may provide new insights and point to other dietary change strategies that promote and facilitate dietary change in individuals reluctant to change.

When examining the results of this study, it is important to keep in mind, however, that this study was limited to a relatively small sample size in a single geographic location. Additionally, the sample was comprised of volunteers, thus social desirability bias cannot be ruled out. Nonetheless, the findings do provide some direction for the development of a campus-based program designed to improve a woman's own nutrition knowledge and dietary intake now as well as enable her to facilitate the development of recommended dietary patterns in any future offspring.

Table 2: Specific Fat Avoidance Behaviors and Percent of Participants Consuming ≤30% Calories from Fat

Food Consumption	Percent of Participants Consuming ≤30% Calories from Fat
Chicken	
Does not eat (n=5)	40%
Eats without skin (n=62)	39%
Eat with skin (n=24)	4%
Red Meat	
Rarely or never eats (n=58)	43%
Eats (n=33)	6%
Cheese	
Rarely eats (n=35)	49%
Eats mostly low fat cheese (n=10)	40%
Eats mostly regular fat cheese (n=46)	13%
Salads	
Uses low calorie/non-fat or no salad dressing (n=52)	50%
Uses regular fat salad dressing (n=28)	4%
Rarely or never eats salad (n=11)	0%
High Fat Snacks	
Rarely Eats (n=51)	45%
Eats (n=40)	10%
Butter or Margarine	
Does not use on bread, rolls, or muffins (n=64)	39%
Uses on bread, rolls, or muffins (n=27)	7%

References

American Dietetic Association. Position of the American Dietetic Association: Dietary guidance for healthy children aged 2 to 11 years. (1999). *Journal of the American Dietetic Association, 99,* 93-101.

Anonymous. (2000). Essential demographics of today's college students. *Journal of Family and Consumer Sciences, 90,* (4), 13-14.

Blumenthal, D. (1989). The health-diet link: Charting a rising awareness. *FDA Consumer, 23,* 22-27.

Enns, C.W., Goldman, J.D., and Cook, A. (1997). Trends in food and nutrient intakes by adults: NCFS 1977-78, CSFII 1989-91, and SCFII 1994-95. *Family Economics and Nutrition Review, 10,* 2-15.

Finckenor, M. (1997). *Applying the transtheoretical model in nutrition education.* Master's Thesis. Montclair State University, Upper Montclair, NJ.

Greene, G.W., Rossi, S.R., Reed, G.R., Willey, C., and Prochaska, J.O. (1994). Stages of change for reducing dietary fat to 30% or less. *Journal of the American Dietetic Association, 94,* 1105-1110.

Hellmich, N. (2000). Freshman 15, plus. Students are packing on the pounds as never before. *USA Today,* August 23, D1-2.

International Food Information Council. (1999). *It's all about you. Our research with consumers.* Washington, D.C.: International Food Information Council. Available at: http://ificinfo.health.org/iaay/research.htm. Accessed on: July 29, 1999.

Kant, A.K., Block, G., Schatzkin, A., Ziegler, R., and Nestle, M. (1991). Dietary diversity in the US population. NHANES II, 1976-80. *Journal of the American Dietetic Association, 91,* 1526-31.

Kant, A.K. and Schatzkin, A. (1994). Consumption of energy-dense, nutrient-poor foods in the US population: Effect on nutrient profiles. *Journal of the American College of Nutrition, 13,* 285-291.

Kraak, V. and Pelletier, D.L. (1998). The influence of commercialism on the food purchasing behavior of children and teenage youth. *Family Economics and Nutrition Review, 11,* (3), 15-24.

Kristal, A.R., Shattuck, A.L., Henry, H.J., and Fowler, A.S. (1990). Rapid assessment of dietary intake of fat, fiber, and saturated fat: Validity of an instrument suitable for community intervention research and nutritional surveillance. *American Journal of Health Promotion, 4,* 288-295.

Lamb, M.E., Pleck, J.H., Charnov, E.L., and Levine, J.A. (1987). A biosocial perspective on paternal behavior and involvement. In Lancaster, J.B., Altmann, J., Rossi, A.S., and Sherrod, L.R. (Eds.) *Parenting across the lifespan: Biosocial dimensions.* New York: Aldine de Gruyter; 111-142.

Levy, A.S., Fein, S.B., and Stephenson, M. (1993). Nutrition knowledge levels about dietary fats and cholesterol: 1983-1988. *Journal of Nutrition Education, 25,* 60-66.

McDowell, M.A., Briefel, R.R., Alaimo, K., Bischof, A.M., Caughman, C.R., Carroll, M.D., Loria, C.M., Johnson, C.L. (1994). *Energy and macronutrient intakes of persons ages 2 months and over in the United States: Third national health and nutrition examination survey, phase 1, 1988-91.* Washington, DC: National Center for Health Statistics, Center for Disease Control and Prevention: US Department of Health and Human Services. Advanced data, Number 255.

Mennella, J.A. and Beauchamp, G.K. (1994). Early Flavor Experiences: When do they start? *Nutrition Today, 29,* (4):25-31.

Murphy, S.R., Rose, D., Hudes, M., and Viter, F.E. (1992). Demographic and economic factors associated with dietary quality for adults in the 1987-

88 nationwide food consumption survey. *Journal of the American Dietetic Association, 92,* 1342-1357.

National Cancer Institute. (1998). Improving public understanding: Guidelines for communicating emerging science on nutrition, food safety, and health. *Journal of the National Cancer Institute, 90,* 194-199.

National Research Council. (1989). *Diet and health: Implications for reducing chronic disease risk.* (Report of the Committee on Diet and Health, Food and Nutrition Board, Commission of Life Science, National Research Council). Washington, DC: National Academy Press.

Pleck, J.H., Lamb, M.E., and Levine, J.A. (1986). Epilog: Facilitating future change in men's family roles. *Marriage and Family Review, 9,* (3/4), 11-16.

Prochaska, J.O., DiClemente, C.C., and Norcross, J.C. (1992). In search of how people change. *American Psychology, 47,* 1102-1114.

StatView. (2000). Cary, NC: SAS Institute, Inc.

US Department of Agriculture. (1993). *Nationwide food consumption survey: Food and nutrient intakes by individuals in the United States, 1 day, 1988-89.* Washington, DC: US Department of Agriculture.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1995). *Nutrition and your health: Dietary guidelines for Americans, 4th Edition.* Home and Garden Bulletin No. 232. Washington, D.C: Government Printing Office.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1990). *Nutrition and your health: Dietary guidelines for Americans, 3rd Edition.* Home and Garden Bulletin No. 232. Washington, D.C: Government Printing Office.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1985). *Nutrition and your health: Dietary guidelines for Americans, 2nd Edition.* Home and Garden Bulletin No. 232. Washington, D.C: Government Printing Office.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (1980). *Nutrition and your health: Dietary guidelines for Americans.* Home and Garden Bulletin No. 232. Washington, D.C: Government Printing Office.

U.S. Senate. (1977). *Dietary goals for the United States, 2nd Edition. Report of the select committee on nutrition and human needs.* Washington, D.C.: U.S. Government Printing Office.

Ventura, S.J. (1989). *Trends and variations in first births to older women, 1970-86. Vital and Health Statistics, Series 21: Data from the National Vital Statistics System, No. 47.* DHHS (PHS) 89-1925. Hyattsville, Maryland: U.S. National Center for Health Statistics [NCHS], 1-27.