Self-regulation training enhances dietary self-efficacy and dietary fiber consumption

ROSEANNE SCHNOLL, PhD, RD; BARRY J. ZIMMERMAN, PhD

ABSTRACT

Objective To evaluate the effectiveness of incorporating two self-regulation strategies (goal setting and self-monitoring) into a nutrition education class to enhance dietary fiber self-efficacy and foster a positive change in dietary fiber consumption.

Design College students in an introductory nutrition class (n = 113) were randomly assigned to one of four treatment conditions: goal setting, self-monitoring, goal setting and self-monitoring, and no goal setting and no self-monitoring. Twenty-six college students from an introductory health class served as the control group.

Statistical analyses The main and interaction effects of goal setting and self-monitoring on postintervention variables were analyzed using analysis of covariance with baseline intake levels as the covariate. Analysis of variance was used to examine differences in the mean changes between the groups. Path analysis was conducted to analyze the causal linkage among the pretest and intervening variables to predict postintervention knowledge, self-efficacy, and fiber consumption.

Results Goal setting had a significant main effect on [illegible] or dietary fiber consumption. There was no significant interaction between goal setting and self-monitoring. Changes in dietary fiber scores differed between the groups. Increases in dietary fiber for the goal setting and self-monitoring group were significantly higher than the goal-setting, self-monitoring, no goal setting and no self-monitoring, and control groups. In addition, the goal setting only group had significantly greater increases in fiber intake than the self-monitoring, no goal setting and no self-monitoring, and control groups. Changes in self-efficacy scores were significantly different between the groups. The goal setting and goal setting and self-monitoring groups had significantly higher self-efficacy scores than the control group. Path analysis revealed that both goal setting and self-monitoring affected dietary fiber consumption through knowledge and dietary fiber self-efficacy, goal setting had a strong direct effect on fiber consumption, and postintervention knowledge affected fiber consumption only through self-efficacy.

Applications/conclusions Our findings suggest that [illegible]

SELF-REGULATION

Social cognitive theory provides a model for understanding dietary behavior change (26). According to the theory, self-regulation is an individual's ability to set specific and attainable goals, employ effective strategies for attaining the goal, and self-monitor to evaluate his or her success in attaining the goal. Self-regulation, includes three subprocessses: self-observation, self-judgment, and self-reaction (26,27).

Another important concept in social cognitive theory is that an individual's behavior is mediated through self-efficacy expectations (28). The motivation to perform a specific behavior is driven by the individual's confidence that he or she can perform the actions necessary to produce the specific behavior. Therefore, an individual's belief in his or her ability to perform a behavior required to achieve a goal is a prerequisite for actual performance of self-regulatory strategies (29-34).

Unless self-efficacy is enhanced, subjects will fail to self-regulate. Therefore, setting attainable goals, self-monitoring, and self-reward are used to increase self-efficacy and improve motivation to initiate and maintain dietary change (31,35-37).

FIBER CONSUMPTION

Increased fiber consumption has been linked to the prevention of various degenerative diseases including cancer, cardiovascular disease, and diseases of the bowel (38-41). Other benefits of increasing fiber intake are reduced blood pressure, improved glycemic control in persons with diabetes, and increased satiety leading to improved weight loss and weight maintenance (40,42). Health care professionals strongly advocate increasing the consumption of dietary fiber. Studies indicate a need to increase dietary fiber intake from 7g to 13 g per day to 25 to 35 g per day (42-45). A nutrition class may be students' only exposure to nutrition education, so encouraging dietary change, in addition to increasing general nutrition knowledge, is an important goal.

The task of self-regulatory dietary fiber intake in a healthy population is a challenging one. In fat reduction studies, subjects have increased motivation to monitor their intake since weight loss or blood cholesterol reduction are highly valued outcomes. However, increasing dietary fiber consumption does not provide immediate visible benefits in the healthy population. Therefore, strategy training and self-efficacy enhancement must be the factors that motivate subjects to change their behaviors. Subjects who perceive the greatest self-efficacy in monitoring fiber goals are most likely to show the greatest behavior change and maintenance of change (30,34,46).

Our study evaluated the effectiveness of incorporating self-regulation strategies (goal setting and self-monitoring) into a nutrition education curriculum to promote and enhance dietary self-efficacy and foster a change in dietary fiber consumption. Research has not specifically investigated the effect of goal setting and self-monitoring on dietary behavior change or its effect on self-efficacy to influence behavior change.

METHODS

Procedure

Undergraduate students in an introductory nutrition education class participated in a study of dietary behavior change. Students in an introductory health class served as the control group. Students received the education component normally given in the respective class. A knowledge pretest was administered to all students on the second day of class.

In the second week of class, all students were trained in recording intake and given the assignment of keeping a 3-day food diary, which is a common assignment for both courses. Participants averaged total energy, fiber, and fat intake for their 3-day diet diaries using a pocket food data book (47) that includes over 30,000 foods. The diet diaries were submitted by week 4 of the course and examined by the author (RS) for transcription and computation errors. After submitting the food diaries, students completed a dietary fiber self-efficacy questionnaire.

Students in the nutrition course were then randomly assigned to 1 of 4 experimental groups: short-term goal setting only, self-monitoring only, short-term goal setting and self-monitoring, and no goal setting and no self-monitoring and trained in the intervention on the 7th week of class, after a lecture on dietary fiber (48).

The 4-week intervention took place between week 8 and week 12 of this 14-week course. Members of each group submitted appropriate forms at each class meeting (twice a week).

At week 13, students completed a 3-day food diary and fiber self-efficacy and knowledge questionnaires. The control group did not receive the nutrition education (knowledge) component or any interventions, but completed the pre- and postintervention diet diaries, knowledge, and self-efficacy questionnaires. Students were asked not to communicate with individuals in the other treatment groups about the project until after the study.

At the end of the study, students were debriefed. To account for possible contamination, a questionnaire was developed to examine students' practices during the intervention.

Instrument Development

The following instruments were developed for the study:

Dietary fiber self-efficacy questionnaire Dietary fiber self-efficacy is defined as confidence that one can perform the actions necessary to increase dietary fiber consumption. Self-efficacy can be assessed by asking an individual to indicate whether or not he or she thinks he or she can perform a specific behavior at the present time and to indicate his or her confidence of success on a probability scale (28). A self-efficacy scale for dietary fiber intake was developed for this study. The scale contained items that examined students' confidence in following a diet ample in dietary fiber. The scale ranged from 0 to 100 points with 10 unit intervals; 0% for definitely cannot do it to 100% for definitely can do it. The following instructions were given to the participants: "Please rate your confidence that you can do the following...(eg, 'read labels for fiber content; choose high fiber snacks such as whole grain pretzels, popcorn, fruits, and vegetables')." And, "Indicate your degree of confidence by circling the appropriate numbers." Test-retest reliability (2-week interval) was r=0.80, P<.05, and internal consistency was α=0.96.

Dietary fiber knowledge questionnaire A 25-item multiple choice instrument was developed to assess students' knowledge of fiber (ie, sources and clinical application of dietary fiber such as "The average intake of dietary fiber for Americans is approximately ____"). Test-retest reliability (2-week interval) was r=0.63, P<.05, and internal consistency was α=0.71. Content validity was assessed through a panel of nutrition experts.

Goal setting group Goal setting entails setting short-term goals. Students in the goal-setting group were assigned the

Table
Means±standard deviations for pre- and poststudy fiber consumption, pre- and poststudy self-efficacy scores, pre- and poststudy knowledge scores, and standard error of means for mean differences

Group	Dietary fiber (g)[a]			Dietary self-efficacy[b]			Knowledge scores[c]		
	Prestudy	Poststudy	Difference	Prestudy	Poststudy	Difference	Prestudy	Poststudy	Difference
	← mean±SD →		← mean±SEM →	← mean±SD →		← mean±SEM →	← mean±SD →		← mean±SEM →
(Group 1) Goal setting (n=29)	11.8±9.0	19.7±9.8*	+7.9±1.3	60.8±21.7	72.8±16.3*	+12.0±3.2	13.3±3.5	16.6±3.5*	+3.3±0.7
(Group 2) Self-monitoring (n=29)	10.0±5.2	11.5±4.0	+1.5±1.0	57.3±15.6	63.6±15.1	+6.3±1.9	12.3±2.6	16.2±3.4*	+3.9±0.6
(Group 3) Goal setting and self-monitoring (n=29)	13.0±8.2	24.3±10.2*	+11.4±1.5	63.0±18.7	71.9±17.8*	+8.9±2.3	12.6±3.4	17.0±2.6*	+4.4±0.7
(Group 4) No goal setting and no self-monitoring (n=26)	9.9±4.8	11.5±5.8	+1.6±0.9	54.6±15.2	62.9±21.0	+8.3±2.8	11.9±3.7	15.1±4.7*	+3.2±1.0
(Group 5) Control (n=26)	11.7±8.1	11.2±7.5	−0.5±0.6	59.7±16.0	58.6±16.7	−1.1±3.6	11.7±2.9	12.7±3.8	+1.0±0.8

[a]Differences in post-study fiber intake for group 3 compared to groups 1, 2, 4, and 5; and differences in post fiber intake for group 1 compared to groups 2, 4, 5; using Newman-Keuls post hoc comparisons.
[b]Differences in post-study self-efficacy scores for groups 1 and 3 compared to group 5 using Newman-Keuls post hoc comparisons. Self-efficacy scores ranged from 21.0 to 100. The lower the score, the lower the self-efficacy.
[c]Differences in post-study knowledge scores for groups 1-4 compared to group 5 using Newman-Keuls post hoc comparisons. Scores ranged from 3 to 25, with the lowest possible score being 0 and the highest 25.
*$P<.05$.

task of setting goals for increasing their dietary fiber intake. After recording the short-term goal of increasing their daily fiber intake by 5 g for the first week, they proceeded to increase their fiber intake by 5 g per week until reaching their long-term goal of 25 g to 35 g of dietary fiber per day. Students recorded the written goals daily and submitted them twice a week at each class meeting.

Self-monitoring group Self-monitoring entails recording daily intake. The self-monitoring group recorded fiber intake daily on fiber monitoring forms that were submitted twice a week.

Goal setting and self-monitoring group Students in the goal setting and self-monitoring group set written goals for increasing their daily fiber intake by 5 g for the first week then increasing fiber intake by 5 g per week until they reached the goal of 25 g to 35 g per day. They completed the fiber monitoring forms on a daily basis and submitted them along with the written goals twice a week.

No goal setting and no self-monitoring group These students did not receive any training for increasing dietary fiber consumption. To give the appearance that they were in a viable treatment group, they were asked to monitor their daily activity levels and to submit the self-monitoring forms at each class meeting.

Control group Students from the same population with similar demographic profiles in a basic health class were selected for the control group.

The Brooklyn College Committee on the Rights and Welfare of Human Subjects and the CUNY Graduate School and University Center Committee on the Protection of Human Subjects approved the study. No student declined to participate despite the opportunity to do so. No incentives were offered.

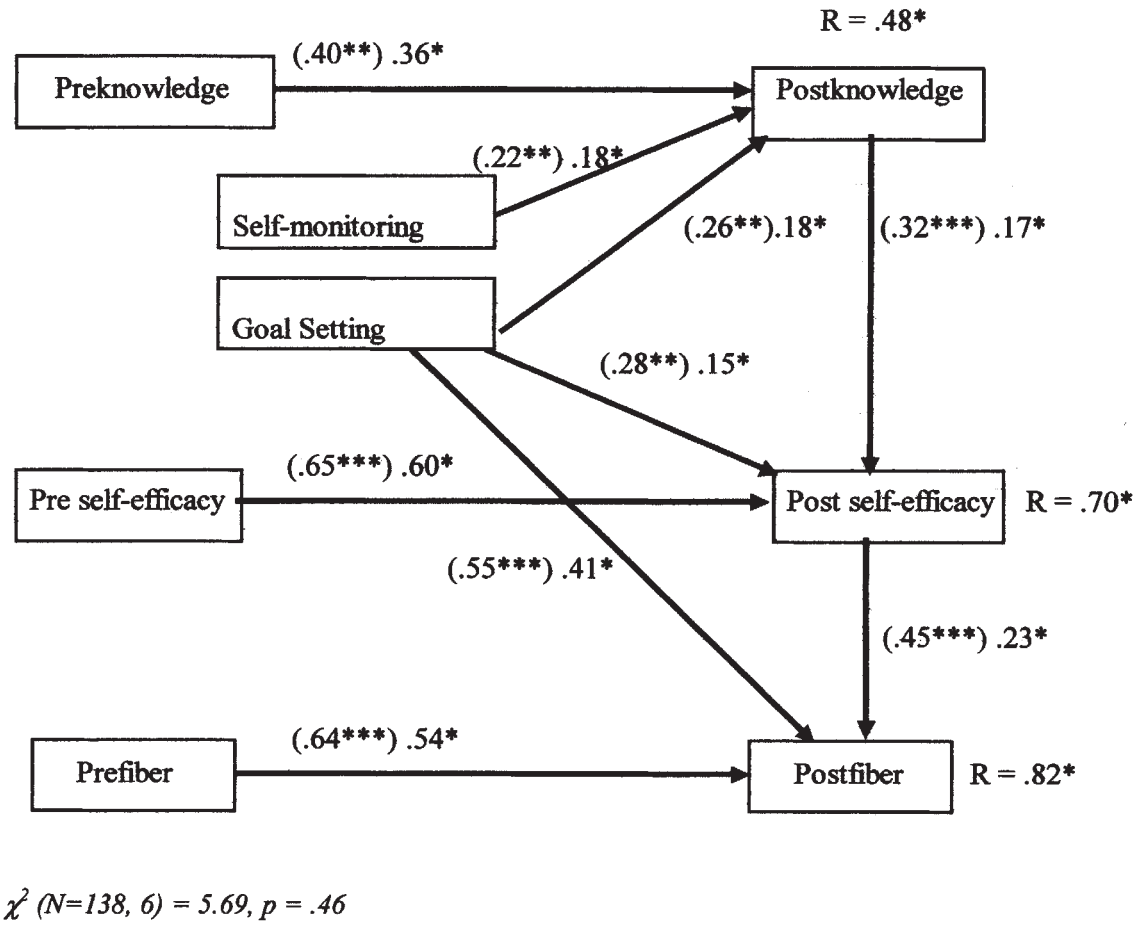
Data Analysis

Descriptive statistics included the means and standard deviations of pre- and postintervention dietary fiber intake from the diet analysis, and dietary fiber self-efficacy and fiber knowledge scores. ANOVA was used to examine differences in the mean changes between groups. Main and interaction effects of goal setting and self-monitoring on postintervention variables were analyzed using ANCOVA with baseline intake levels as the covariate. Path analysis was conducted to analyze the causal links among the pretest and intervening variables to predict postintervention knowledge, self-efficacy, and fiber consumption.

RESULTS

Sample

One hundred thirty-nine students (72% female) participated in the study. One hundred thirteen students (83 female, 30 male) enrolled in an introductory nutrition class were randomly assigned to 1 of the 4 experimental conditions. Each of the 4 groups included approximately 7 to 9 males and 20 to 23 females. Twenty-six other students (17 female, 9 male) from a health class served as the control group. The mean age for both males and females was 23±6.3 years. Fifty-nine percent of the students were white, 19% were African-American, 11% were Hispanic, and 11% were Asian.



*Results of path analysis to determine the effects of goal setting and self-monitoring (mediated through knowledge and self-efficacy) on postintervention dietary fiber intake of college students (N=139). The model had 8 variables: goal setting, self-monitoring, pre- and postintervention knowledge, pre- and postintervention self-efficacy, and pre- and postintervention dietary fiber consumption. χ^2 tests were preformed to test the reduced model's soundness and demonstrated a good fit of the data. *P<.05. **P<.01. ***P<.001.*

The means and standard deviations for pre- and postintervention dietary fiber intake, pre- and postintervention self-efficacy, and pre- and postintervention knowledge scores for the entire sample appear in the Table.

Dietary Fiber Intake

Subjects who set goals (the goal-setting group and the goal setting and self-monitoring group) had a mean fiber intake of 22 g compared to 11.5 g for subjects who did not set goals. Therefore, subjects who set goals consumed 91% more fiber than subjects who did not set goals.

ANOVA results for changes in dietary fiber intake showed significant differences between groups (F [4, 134]=16.54; P<.0001). Newman-Keuls post hoc comparisons revealed that increases in dietary fiber for the goal setting and self-monitoring group were significantly higher than those of the goal-setting, self-monitoring, no goal setting and no self-monitoring, and control groups. In addition, the goal setting only group had significantly greater increases in fiber intake than the self-monitoring, no goal setting and no self-monitoring, and control groups.

Goal setting had a significant main effect on postintervention dietary fiber consumption (F[1,108]=54.78; P<.001). Self-monitoring had no significant effect on postintervention fiber intake, and there was no significant interaction between goal setting and self-monitoring.

Dietary Fiber Self-efficacy

Subjects who set goals had a mean fiber self-efficacy score of 71.8 compared to 62.7 for the subjects who did not set goals. Therefore, subjects who set goals (the goal-setting group and the goal setting and self-monitoring group) scored 15% higher on the dietary fiber self-efficacy scale than subjects who did not set goals.

ANOVA results for changes in self-efficacy scores showed significant differences between the groups (F(4,134)=3.46; P=.01). Newman-Keuls post hoc comparisons revealed that the goal-setting group and goal setting and self-monitoring group were significantly different from the control group. Although the goal-setting group and the goal setting and self-monitoring group numerically surpassed the self-monitoring

and the no goal setting and no self-monitoring group, these differences did not reach statistical significance.

Goal setting had a significant main effect on changes in dietary fiber self-efficacy scores ($F(1,108)=54.78; P<.05$]. Self-monitoring had no significant main effect on changes in dietary fiber self-efficacy, and there was no significant interaction between goal setting and self-monitoring.

Nutrition Knowledge

ANOVA outcomes for postintervention knowledge scores showed significant differences between groups (F[4, 134]=5.97; P=.0002). Newman-Keuls post hoc comparisons revealed that subjects in all 4 groups that received the nutrition education gained more knowledge than subjects in the control group.

Path Analysis

Path analysis was used to determine whether the effects of goal setting and self-monitoring on postintervention dietary fiber intake were mediated through the intervening variables knowledge and self-efficacy. This procedure was also used to control for the effects of the covariates, preintervention dietary fiber consumption, preintervention dietary fiber self-efficacy, and preintervention knowledge scores. The results of the path analysis are presented in the Figure.

There was a high correlation between goal setting and postintervention dietary fiber consumption. Postintervention dietary fiber self-efficacy scores were also highly correlated with postintervention dietary fiber consumption. Self-monitoring and postintervention knowledge scores were significantly correlated to poststudy fiber consumption, however, these correlations proved not to be significant once the effects of the other variables were statistically controlled.

Sixty-seven percent of the variance in poststudy fiber consumption was explained by pre-intervention fiber consumption, goal setting, and post-intervention dietary fiber self-efficacy. When the strong effects of preintervention fiber consumption were statistically controlled, goal setting and self-monitoring were found to effect post-intervention fiber consumption through knowledge and dietary fiber self-efficacy. In addition, goal setting had a significant direct effect on postintervention fiber consumption.

Forty-nine percent of the variance in postintervention dietary fiber self-efficacy was explained by preintervention dietary fiber self-efficacy, goal setting, and postintervention knowledge. When the strong effects of preintervention dietary fiber self-efficacy were statistically controlled, the direct contribution of goal setting on postintervention dietary fiber self-efficacy was moderate. The contribution of postintervention knowledge on postintervention dietary fiber self-efficacy also proved to be moderate.

Finally, 23% of the variance in postintervention knowledge scores was explained by goal setting, self-monitoring, and preintervention knowledge scores. When the strong effects of preintervention knowledge was statistically controlled, the direct contribution of goal setting and self-monitoring to postintervention knowledge was moderate.

DISCUSSION

The purpose of the study was to investigate the mediating role of nutrition education and dietary fiber self-efficacy on dietary fiber intake, and examine the effects of goal setting and self-monitoring on dietary fiber self-efficacy and dietary fiber intake. Both goal setting and self-monitoring proved to exert a significant indirect effect on postintervention fiber consumption mediated through postintervention knowledge and dietary fiber self-efficacy. In addition, goal setting had a direct effect on postintervention fiber self-efficacy and fiber consumption. In general, goal setting was more strongly associated with postintervention fiber consumption than was self-monitoring. Self-monitoring only contributed to the variance in postintervention knowledge. Students who only recorded their daily fiber intake without setting goals did not directly alter their behavior or their self-efficacy perceptions. However, the activity of self-recording may have made them more aware of the issue of dietary fiber, which helped them to retain knowledge and indirectly affected their behavior through self-efficacy perceptions. Students who set goals were also able to access dietary fiber knowledge acquired in class and effectively transform that knowledge through self-efficacy to improve fiber intake.

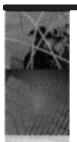
Why didn't the self-monitoring condition alone influence dietary fiber behavior change? Zimmerman (49) suggests that self-regulation consists of 3 subprocesses that must be present for change to occur. These subprocesses are self-observation, self-judgment, and self-reaction. All involve adoption of a specific goal and ongoing strategy adjustment for goal achievement. The data indicate that self-monitoring alone is not a powerful component for behavior change. It must be combined with goal setting to produce the desired effect.

An important objective of our study was to separate goal setting and self-monitoring from one another to see the relative contributions of each variable. The finding that self-monitoring alone did not directly contribute to behavior change supports the belief that persons who self-monitor must have a standard by which they can compare their performance to successfully achieve their goals (27). It is equally interesting that goal setting exerted a strong direct effect even when separated from self-monitoring. Despite the attempt to separate goal setting from self-monitoring, it was obvious that those who set goals did monitor their intake in some way, particularly mentally. The data indicate that the act of keeping written records further enhances self-regulation.

This study highlights the importance of self-efficacy as a mediator in the relationship between knowledge and behavior change. The effect of postintervention knowledge on fiber consumption occurred entirely though mediation of self-efficacy.

Our findings are consistent with the literature on self-regulation (18,31-33,50-51). A critical component of self-regulation is for persons to set attainable and short-term goals and monitor their behavior in order to achieve their goals (24,29,52). This suggests that before embarking on any behavior change activity a person must have a goal in mind. Self-monitoring alone does not have as strong an effect.

From these results it is clear that dietary change does not occur from knowledge alone. Setting specific goals and keeping written monitoring records are essential for achieving change (15,24,29,52). These strategies increase perceived self-efficacy and improve dietary behavior. There is clearly a need for more research on incorporating cognitive, behavioral, and motivational measures to provide a more complete picture of the determinants of dietary behavior change.



APPLICATIONS

- Dietary change requires active self-regulation of food intake, and a combination of goal-setting and self-monitoring has been shown to be an effective self-regulation strategy. Dietitians and nutrition professionals can use this finding to develop effective strategies for behavior change.
- Dietary self-management can be implemented with just 2 skill training classes: recording and evaluating initial dietary intake, and setting dietary goals and self-monitoring intake. These can easily be incorporated into nutrition education or counseling programs to enhance dietary behavior change.

References

1. National Research Council. *Diet and Health: Implications for Reducing Chronic Disease Risk. Report of the Committee on Diet and Health, Food and Nutrition Board.* Washington, DC: National Academy Press; 1989.
2. Frazao E. The high costs of poor eating patterns in the United States. In: Frazao E, ed. *America's Eating Habits: Changes and Consequences.* Washington, DC: US Dept of Agriculture, Economic Research Service; 1999. Publication No. AIB-750.
3. Keim KS, Stewart B, Voichick J. Vegetable and fruit intake and perceptions of selected young adults. *J Nutr Educ.* 1997;29:80-85.
4. Byrd-Bredbenner C, O'Connell LH, Shannon B, Eddy JM. A nutrition curriculum for health education: its effect on students' knowledge, attitude, and behavior. *J Sch Health.* 1984;54:385-338.
5. Johnson DW, Johnson RT. Nutrition education: a model for effectiveness, a synthesis of research. *J Nutr Educ.* 1985;17:1-35.
6. Martinez-Pons M, Schnoll R, Bonner S. The path-analytical evaluation of instruction concerning health risks in the diet. Paper presented at The Meeting of the New England Education Research Organization; April 25, 1991; Portsmouth, NH:.
7. Perron M, Endres J. Knowledge, attitudes, and dietary practices of female atheletes. *J Am Diet Assoc.* 1985;85:573-576.
8. Shannon B, Chen AN. A three-year school-based nutrition education study. *J Nutr Educ.*1988;20:114-124.
9. Baranowski T, Domel S, Gould R, Baranowski J, Leonard S, Treiber F, Mullis R. Increasing fruit and vegetable consumption among fourth- and fifth-grade students: results from focus groups using reciprocal determinism. *J Nutr Educ.* 1993;25:114-120.
10. Coates TJ, Barofsky I, Saylor KE, Simons-Morton B, Huster W, Sereghy E, Straugh S, Jacobs H, Kidd L. Modifying the snack food consumption of inner city high school students: the Great Sensations Study. *Prev Med.* 1985;14:234-247.
11. Howison D, Niedermyer F, Shortridge R. Field testing a fifth-grade nutrition education program designed to change food selection behavior. *J Nutr Educ.* 1988;20:82-86.
12. Skinner JD. Changes in students' dietary behavior during a college nutrition course. *J Nutr Educ.* 1991;23:72-75.
13. White AA, Skinner JD. Can goal setting as a component of nutrition education effect behavior change among adolescents? *J Nutr Educ.* 1988;20:327-335.
14. Brinberg, D, Axelson, ML. Increasing the consumption of dietary fiber: a decision theory analysis. *Health Educ Res.* 1990;5:409-420.
15. Harnack L, Block G, Lane S. Influence of selected environmental and personal factors on dietary behavior for chronic disease prevention: a review of the literature. *J Nutr Educ.* 1997; 29: 306-312.
16. Hardeman W, Griffin S, Johnston M, Kinmonth AL, Warcham NJ. Interventions to prevent weight gain: a systematic review of psychological models and behaviour change methods. *Int J Obes.* 2000;24:131-143.
17. Glasgow RE, Toobert DJ, Hampson, SE. Effects of a brief office-based intervention to facilitate diabetes dietary self-management. *Diabetes Care.* 1996;19:835-842.
18. Corwin SJ, Sargent RG, Rheaume CE, Saunders RP. Dietary behaviors among fourth graders: s social cognitive theory study approach. *Am J Health Behav.* 1999;23:182-197.
19. Kayman S, Bruvold W, Stern JS. Maintenance and relapse after weight loss in women: behavioral aspects. *Am J Clin Nutr.* 1990;52:800-807.
20. Reynolds KD, Franklin FA, Brinkley D, Raczynski JM, Harrington KF, Kirk KA, Person S. Increasing the fruit and vegetable consumption of fourth-graders: results from the High 5 project. *Prev Med.* 2000;30:309-319.
21. Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M, Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. *J Nutr Educ.* 1999;31:14-20.
22. Chang Ma F, Contento IR. Development and formative evaluation of a nutrition education curriculum aimed at reducing fat intake in Taiwan elementary students. *J Nutr Educ.* 1997;29:237-243.
23. Albright CL, Bruce B, Howard-Pitney B, Winkleby MA, Fortmann SP. Development of a curriculum to lower dietary fat intake in a multiethnic population with low literacy skills. *J Nutr Educ.* 1997;29:215-223.
24. Robinson TN. Behavioral treatment of childhood and adolescent obesity. *Int J Obes.* 1999;28(suppl):S52-S57.
25. Contento I, Blach GI, Bronner YL, Lytle LA, Maloney SK, White SL, Olson CM, Swadener SS. The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: A review of research. *J Nutr Educ.* 1995;27(special issue):277-422.
26. Bandura A. *Social Foundations of Thought and Action.* Englewood Cliffs, NJ: Prentice Hall; 1986.
27. Schunk DH. Learning theories: An educational perspective. NY: Macmillan; 1991.
28. Bandura A. Self-efficacy: toward a unifying theory of behavior change. *Psychol Rev.* 1977;84:191-215.
29. Baldwin TT, Galciglia GA. Application of cognitive behavioral theories to dietary change in clients. *Health Educ Behav.* 1997;24:357-368.
30. Shannon J, Kirkley B, Ammerman A, Keyserling T, Kelsey K, DeVellis R, Simpson RJ. Self-efficacy as a predictor of dietary change in a low-socioeconomic-status Southern adult population. *Health Educ Behav.* 1997;24:357-368.
31. Clark NM, Dodge JA. Exploring self-efficacy as a predictor of disease management. *Health Educ Behav.* 1999;26:72-89.
32. Hevey D, Smith M, McGee HM. Self-efficacy and health behavior: a review. *Irish J Psych.* 1998;19:248-273.
33. AbuSabha R, Achterberg C. Review of self-efficacy and locus of control for nutrition and health-related behavior. *J Am Diet Assoc.* 1997;97:1122-1132.
34. Povey R, Conner M. Application of the theory of planned behavior to two dietary behaviors: roles of perceived control and self-efficacy. *Br J Health Psych.* 2000;5:121-139.
35. Shannon B, Bagby R, Wang MQ, Trenkner L. Self-efficacy: a contributor to the explanation of eating behavior. *Health Educ Res.* 1990;5:395-407.
36. McCann BS, Retzlaff BM, Dowdy AA, Valden CE, Knopp RH. Promoting adherence to low-fat, low-cholesterol diets: review and recommendations. *J Am Diet Assoc.* 1990;90:1408-1414.
37. Conn VS. Older women: social cognitive theory correlates of health behavior. *Women Health.* 1997;26:71-85.
38. Brinberg D, Axelson ML. Increasing the consumption of dietary fiber: a decision theory analysis. *Health Educ Res.* 1990;5:409-420.
39. Truswell AS. Food carbohydrates and plasma lipids—an update. *Am J Clin Nutr.* 1994;59(suppl):710S-718S.
40. Anderson JW, Smith BM, Gustafson NJ. Health benefits and practical aspects of high-fiber diets. *Am J Clin Nutr.* 1994;59(suppl):1242S-1247S.
41. Heaton KW. Dietary fiber. In: Temple NJ, Burkitt DP, eds. *Western Diseases: Their Dietary Prevention and Reversibility.* Totowa, NJ: Humana Press;1994:187-208.
42. Position of The American Dietetic Association: health implications of dietary fiber. *J Am Diet Assoc.* 1993;93:1446-1447.
43. Lanza E, Butrum RR. A critical review of food fiber analysis and data. *J Am Diet Assoc.* 1987;46:732-743.
44. Tilgner SA, Schiller MR. Dietary intakes of female college athletes: the need for nutrition education. *J Am Diet Assoc.* 1989;89:967-969.
45. Nicklas TA, Farris RP, Myers L, Berenson GS. Dietary fiber intake of children and young adults: the Bogalusa Heart Study. I.1995;95:209-214.
46. Smith A, Owen N. Associations of social status and health related beliefs with dietary fat and fiber densities. I. 1992;21:735-745.
47. Ulene A. *The Nutribase Guide to Fat and Fiber in your Foods.* Garden City Park, NY: Avery; 1995.
48. Sizer F, Whitney E. *Nutrition: Concepts and Controversies.* 8th ed. Stamford, Conn: Wadsworth; 1994.
49. Zimmerman BJ. A social cognitive view of self-regulated academic learning. *J Educ Psychol.* 1989;81:329-339.
50. Havas S, Treiman K, Langenberg P, Ballesteros M, Anliker J, Damron D, Feldman R. Factors associated with fruit and vegetable consumption among women participating in WIC. *J Am Diet Assoc.* 1998;98:1141-1148
51. Meland E, Gunnar Maeland J, Laerum E. The importance of self-efficacy in cardiovascular risk factor change. *Scan J Public Health.* 1999;1:11-17.
52. Boutelle KN, Kirschenbaum DS. Further support for consistent self-monitoring as a vital component of successful weight control. *Obes Res.* 1998;6:219-224.