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Changing Adolescents' Food-Related Behavior Via Nutrition Education

Adrienne Adams White
University of Tennessee, Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Adrienne Adams White entitled "Changing Adolescents' Food-Related Behavior Via Nutrition Education." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

Jean D. Skinner, Major Professor

We have read this dissertation and recommend its acceptance:

Betty Ruth Carruth, Betsy Haughton, David Barnaby

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

CHANGING ADOLESCENTS' FOOD-RELATED BEHAVIOR VIA NUTRITION EDUCATION

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Adrienne Adams White

August 1988

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have a special place in my heart. They have been my constant "encouragers," ready with listening ears, helping hands, and reassuring voices. Thank you one and all.

ABSTRACT

A nutrition education behavior change strategy for secondary health classes was developed, implemented, and evaluated with 159 adolescents in 6 schools. The experimental design was pretest/posttest, treatment/control group with two treatment groups--one receiving only the behavior change strategy (BC) and one receiving the strategy plus a traditional knowledge-oriented component (BC+). Fundamental concepts of the behavior change strategy included personalization, goal setting, self-management, self-implementation, structured feedback, and structured self-evaluation. Based on a personal nutrient analysis, each adolescent in a treatment group selected improvement of one nutrient as a goal. Effectiveness of the strategy was tested by changes made in nutrient intake related to goal set. Pre- /post-assessments included three-day food records and written questionnaires of food practices and nutrition attitudes and knowledge. A rating instrument was administered to adolescents in treatment groups to assess their perceptions of activities facilitating change. Setting a goal for specific nutrient improvement had the strongest effect on change. No difference between treatment groups was found. Adolescents who set a goal related to calcium, vitamin A, and vitamin C increased intake and those with a sodium-related goal

decreased sodium. No positive changes in nutrient intake occurred for the control group. Gender was related to positive change for calcium, vitamin A, folacin, and vitamin C, with males making significant improvements. Nutrition attitudes and knowledge generally were not related to change. Food practice scores, as assessed by the written questionnaire, increased for the BC+ group only. Knowledge scores increased in both treatment groups but not in the control group. No differences in attitudes were seen, either within or among groups.

Activities perceived as most helpful in facilitating change included keeping food records, assessing personal nutrient intake, implementing a plan for nutrient improvement, and participating in follow-up classes.

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CHAPTER I

INTRODUCTION

Justification

Adolescents are an important target population for nutrition education. Educators call periods of change "teachable moments". Adolescence is described aptly as a period of change.

Physiologically, adolescence is a time of dramatic change. Fifty percent of ideal adult body weight is gained; 20-25% of linear height is achieved. Skeletal mass and vital organs, such as the heart, liver, kidney, thyroid, adrenal glands, gonads, and uterus double in size (1).

Changes also occur in psychosocial aspects of adolescence. The word "adolescence" is a Latin derivative meaning "to grow toward maturity" (2), suggesting movement from past dependence to future independence. This process results in a shift in orientation from home and parents to peers and the adult world (3). A critical developmental task of adolescence is establishing a self-identity (4). An adolescent achieves self-identity through the process of determining meaning in life, establishing rules and values

to guide behavior, and developing a sense of self-worth (2).

Adolescents are nutritionally at risk because of rapid growth and development that increase nutrient requirements above childhood levels (5). While they should be emphasizing food choices of high nutritive value, studies reveal poor dietary habits among adolescents, including skipped meals, snacks high in salt, sugar, and fat, and low intakes of some vitamins and minerals (6-10).

Nutrition intervention during adolescence provides opportunity for both present and future health benefits. Valadian et al. (11) found that food behaviors established as adolescents will be maintained as adults. Establishing prudent food habits during adolescence is important considering the relationships that exist between dietary practices and risk factors related to development of chronic degenerative diseases later in life.

Schools have been identified as appropriate sites for nutrition education (12). Presenting nutrition information (knowledge) was the focus of most school-based nutrition education programs. The assumption was that informed individuals will make wise food choices (13).

In the 1970s, cognitive learning remained the major focus; however, Skinner (14) identified studies that assessed attitudes and behavior, as well as knowledge. In

these studies (15, 16), significant increases in knowledge were reported, but attitude and behavior were not likely to be changed following nutrition education. Strong indication has been that knowledge does not ensure action.

Such results have been of great concern to nutrition educators. The ultimate goal of nutrition education is to affect behaviors (12). The aim of nutrition education is, as eloquently stated by Lewis (17): "to develop nutritionally literate decision-makers who are motivated, knowledgeable, and skilled to make continuing, intentional, informed food decisions in the face of changing food supplies in a variety of cultural, economic, and social environments."

A new direction in recent studies is to focus on identifying adolescents' needs and interests with an emphasis on increased understanding of adolescents' perspectives relative to food and nutrition, documentation of eating habits of specific adolescents targeted for nutrition education, and awareness of knowledge necessary for behavior change (18, 19). An underlying theme emerging from studies about adolescents is the need for skills in dietary planning (18, 19).

Conscientious efforts to teach adolescents factual, meaningful nutrition information and to develop their skills in applying information to daily food choice

behavior are worthwhile and necessary. To accomplish the ultimate goal of nutrition education and to intervene successfully during adolescence, the orientation of school-based nutrition education programs must change from a focus on knowledge attainment to a focus on behavior. Further support that the present study was in line with research needs in nutrition education is given by findings from the "Leading Edge" Nutrition Education Research Conference sponsored by the National Dairy Council in 1986 (20). Three areas of research were identified as priorities for nutrition education from the "Leading Edge" conference: 1) determinants of dietary behavior of various target groups; 2) changing dietary behaviors of priority target groups; and 3) linkages or collaboration between researchers and practitioners.

Recent research in Tennessee (7, 8, 21) fell under the first area of research. Adolescents have been the target group, and findings from these studies were incorporated into the planning of the present study.

The present study, changing food-related behavior among adolescents as a result of nutrition education, fell under the second area of research. The proposed outcome of this research area was to identify effective strategies for changing dietary behaviors of priority target groups. This was an integral part of the present study.

Overview of Study

The objective of the study was to design, implement, and evaluate a nutrition education program for adolescents focused on behavior change. All processes were conducted by the researcher.

The study included developing and implementing two nutrition education units to be taught in high school health classes and designing and administering instruments to measure changes in food intake, general food practices, and nutrition attitudes and knowledge. Both nutrition education units were designed with the identical behavior change strategy. One unit included a cognitive component, as defined by Bloom (22), and was designated the Behavior Change Plus group (BC+); the other group was designated the Behavior Change (BC) group. Goals and objectives presented in the instructional plan, Tennessee Educates for Nutrition Now, grades 10-12 (TENN) (23) were used in development of the instructional content. Both units, in all classes, were taught by the researcher. The BC+ unit involved twelve days in the classroom; the BC unit involved eight days in the classroom.

A third group served as a control (C) and participated in pre-/post-assessment at the same time as those in the treatment groups, but they received no nutrition education during the time of the research study. The primary purpose

of the control group was to monitor environmental conditions that might contribute to change in food intake, general food practices, and nutrition attitudes and knowledge while the experimental component was being conducted.

To determine the effectiveness of BC+ and BC nutrition education units, pre- and post-assessments were administered for food intake, general food practices, and nutrition attitudes and knowledge of the adolescents. The time span between pre- and post-assessments was four to five weeks.

Hypotheses

Hypotheses I-V refer to the two treatment groups; hypotheses VI-IX refer to the three groups--BC+, BC, and control.

Hypothesis I: There is no difference in change in nutrient intake between two treatment groups, one receiving a behavior change strategy and the other the identical behavior change strategy plus a cognitive component.

Hypothesis II: There is no difference in nutrient intake from pre-assessment to post-assessment when adolescents set

goals for nutrient improvement based on pre-assessment mean nutrient intake.

Hypothesis III: There is no effect of pre-assessment attitude scores on change in nutrient intake.

Hypothesis IV: There is no effect of pre-assessment knowledge scores on change in nutrient intake.

Hypothesis V: There is no effect of post-assessment knowledge scores on change in nutrient intake.

Hypothesis VI: There is no difference in change in nutrient intake among three groups--one receiving a behavior change strategy, one receiving a cognitive component in addition to the behavior change strategy, and one group serving as a control receiving no nutrition education.

Hypothesis VII: There is no difference in change in food practices as measured by a written questionnaire among or within the three groups--BC, BC+, and control.

Hypothesis VIII: There is no difference in change in knowledge as measured by a written questionnaire among or within the three groups--BC, BC+, and control.

Hypothesis IX: There is no difference in change in attitudes as measured by a written questionnaire among or within the three groups--BC, BC+, and control.

Findings which were of interest but were not tested for statistical significance were those related to adolescents' perceptions of which activities composing the nutrition education units were most helpful in making changes in nutrient intake. This information was assessed with a written questionnaire.

CHAPTER II

LITERATURE REVIEW

Several areas were considered important for review prior to developing a strategy for behavior change with adolescents. These included: 1) approaches that have been used to understand behavior (and, thus, how to change behavior); 2) theoretical bases for behavior change strategies; 3) studies from various settings that have reported positive behavior change; 4) a survey of the adolescent period, including reported assessments of nutrition knowledge, attitudes, dietary practices; 5) development of TENN (23), the state comprehensive sequential curricula in nutrition education; and 6) existing evaluation instruments, including dietary intake and nutrition attitude and knowledge instruments.

Approaches in Understanding Behavior

The traditional approach toward understanding behavior is called intrapsychic because psychological forces within the individual (needs, impulses, drives, motives) are supposed to explain behavior (24). The behavioral approach

places emphasis on direct observation of the behavior including the environmental, situational, and social determinants of that behavior. This approach also focuses on cognitive processes, which are specified as measurable events; thus their connection to overt behavior can be evaluated by observation (24).

"The behavioral approach considers the majority of behaviors to be learned or changed through learning procedures. Focus is on behaviors that have been learned or need to be learned" (24, p. 14). Training behaviors rather than altering aspects within a person (i.e., underlying motives) is the technique used by the behaviorist.

Assessment of behaviors is made by direct observation of the behaviors to be changed and the environmental events preceding and following the behavior. Using a behavioral approach, treatment, or the intervention, is carried out in the setting in which the behavior requiring change is evident (24).

In order to develop or change behavior, three types of learning are considered important (24): classical conditioning, operant conditioning, and observational learning. Classical conditioning refers to controlling behavior by the preceding stimuli, since stimuli can be made to elicit reflex responses. Operant conditioning

refers to controlling behavior by its consequences. Thus, positively reinforced behaviors will increase in frequency, and ignored or punished behaviors will decrease in frequency (25). Observational learning or modeling refers to learning by observing another's behavior. Observers seem to imitate models more when the model is similar, more prestigious, higher in status and expertise, and when several models perform the same behavior (24).

Theoretical Base for Behavior Change Strategy

Activated Health Education (AHE) Model

The Activated Health Education (AHE) model developed by Dennison (26) is a behavior-based instructional model developed for use in health education intervention programs. This model is a culmination of Dennison's retrospective study of interventions that had a behavioral impact. Through an evaluation process, Dennison defined three premises important for successful behavior-based intervention: 1) ACTIVE INVOLVEMENT of participants in the instructional process; 2) AWARENESS of positive and negative influences on health; and 3) RESPONSIBILITY for personal health.

During intervention, AHE is operationalized with three phases that include specific procedures during each phase. The first phase is the experiential, which includes

measuring and recording target health behavior. The second phase is awareness, which includes presenting information and individual evaluation of susceptibility to disease. The third phase is responsibility, which includes identifying actual and ideal behavior and establishing a self-management program to improve or maintain health.

A unique feature of the model is the experiential phase precedes and is independent from the other phases. The objective of the phase is to increase participants' interest due to relevant personal data.

AHE includes formative evaluation; this provides immediate feedback. During the experiential phase, evaluation determines needs, interests, and expectations of participants. Objective tests may be used to evaluate the awareness phase. Evaluation of the responsibility phase may be by completion of self-management reports.

Because AHE was developed by combining "the best" from a review of intervention studies, Dennison has incorporated concepts from several theories, models, and ideologies, including health belief model (27), cognitive dissonance (28), social learning theory (29), behavioral self-management (30), and operant conditioning (24).

Self-Management Technique

When behavioral principles (described previously) are applied to one's self, the process is called self-management. Self-management techniques may involve identifying physical or emotional antecedents or physical or emotional consequences (31). Cognitive techniques may be a part of self-management procedures. Cognitive techniques are words or symbols including self-instructions, modeling, plans, and problem-solving (31).

The philosophy behind self-management is that the individual is responsible for managing his/her life. Although the environment exerts certain control over the individual, there are ways one can and does control that environment. For an individual to have control over oneself and the environment, self-study is necessary. This includes collecting and analyzing information to discover controlling mechanisms in one's life. An individual can learn how to change the environment, so it changes him/her the way desired (31). The major steps in self-management are defining a target for change and setting specific goals for that target behavior. An individual must assess where one is relative to those goals and develop specific strategies for reaching those goals. "The challenge of self-management is to identify the internal and external events that will facilitate one's goal-related behavior and

then arrange for those events to occur" (30, p. 25). The premise is that without systematically manipulating those events, the behavior one desires is not likely to occur.

Steps in the self-management process as defined by Yates (31, ch. 3) include: 1) self-monitoring; 2) self-analyzing; 3) choosing a self-intervention, including costs and benefits; 4) implementing; 5) integrating a self-management project into one's life; and 6) preventing relapse.

Goal Setting Concept

The concept of goal setting, as defined by Locke et al. (32), is that a beneficial effect on task performance is seen when goals are set because goals: 1) direct attention and action; 2) mobilize effort; 3) increase persistence; and 4) motivate toward relevant strategies for goal attainment.

Goal setting adds an important dimension to a behavior change strategy. It integrates conscious actions--intentions, desires, purposes--into the behavior change process. Goal setting is a cognitive concept explaining an individual's actions in terms of conscious goals, unlike a strict behaviorist approach that seeks to

understand human behavior in terms of what can be observed (33). Cognitive techniques (i.e., self-instructions, plans, problem-solving) applied to the self-management process are in keeping with the goal setting concept. Locke et al. (32) found that goal setting was most effective (i.e., higher performance) when individuals designed specific, hard goals, rather than "do your best" goals. Performance was also positively affected by feedback and an individual's participation in the goal setting process.

Problem-Solving Process

The problem-solving process (34) is a systematic procedure for finding solutions to problems. The steps include: 1) identifying the problem; 2) determining alernatives; 3) choosing among alternatives; 4) implementing the choice; 5) and evaluating the results. Performing these steps develops skills which can be applied in numerous settings. The TENN plan (23) suggests the problem-solving process as a means of solving food- and nutrition-related problems.

Studies from Various Settings Reporting Positive Behavior Change

The following studies were reviewed from a variety of areas including: 1) families in home environments; 2) students in classroom settings; 3) patients in hospital settings; and 4) areas of specialized counseling for obesity, diabetes, and dental disease. The objective was to identify unique features of the studies that contributed to the observed behavior changes.

As early as the 1970s, there was evidence that nutrition educators were looking for behavior change outcomes after providing nutrition education programs in a variety of settings. Gassie and Jones (35) reported sustained behavior change among homemakers participating in the Expanded Food and Nutrition Education Program in Louisiana. Four months after receiving instruction on the Basic Four Food Groups, these homemakers continued to report consuming the daily minimum number of recommended servings of each group. The unique component of the program that seemed to have a strong impact on its success was peer education; aides, living within the community, served as teachers of the classes.

Social learning theory has been applied in nutrition education settings to facilitate behavior change. Leonard et al. (36) developed a program for parents of preschool

children based on principles of social learning theory. A small group format was implemented. Families were led through a three-step procedure for achieving change that included assessing, planning (implementing), and evaluating in the areas of food selection, eating habits (how people eat and ways families reinforce habits), and activity habits. The program was evaluated by assessing parents' verbalizations and behaviors relevant to children's eating patterns. Parental responses did become more constructive as a result of the intervention. No assessment of children's dietary intake was made to test for behavior change due to the program.

Changing the eating behavior of school children has been approached in a variety of ways. Coates et al. (37) reported a study designed to change specific behaviors of tenth, eleventh, and twelfth graders enrolled in a mandatory health class. Principles of social learning theory were applied in a program focusing on decreasing students' consumption of salty snacks and increasing consumption of fruits. Eight classes within the treatment school varied as to whether they received classroom instruction and as to whether they had parent involvement. A schoolwide media program was designed to encourage peer support. Classroom instruction focused on goal setting, problem-solving for barriers to change, resisting peer

pressure, reading product labels, and learning the principles behind salt intake and cardiovascular physiology. Two follow-up assessments were made--the first, one month after the end of the program and the second, following summer vacation the following school year. Significant reduction in salty snacks occurred in the treatment school versus control school. Within the treatment school, significant reduction in salty snacks was reported for those receiving classroom instruction versus no classroom instruction at the first follow-up. Students receiving no instruction had returned to baseline values by the first follow-up. By the second follow-up, even those receiving classroom instruction had returned to baseline values. Parent involvement was positively correlated to change made in students' diets at post-treatment and the first follow-up, but at second follow-up, students whose parents were involved ate fewer fruits than students with no parent involvement.

Contento et al. (19) reported on a method to personalize nutrition information. They developed a method to help groups of adolescents generate descriptions of their dietary intake. By identifying dietary problems particular to the group, adolescents could select food and nutrition content tailored for their own needs. Contento et al. used a 24-hour recall for dietary data collection.

They used a score card containing 33 categories designed to pinpoint specific foods that might be problems in teens' diets. Students used the cards along with the 24-hour recalls to tally the number of servings of the 33 food-item categories. The researchers tallied totals to give a group "profile." The "profile" was presented as a bar graph showing number of servings per student of the 33 food categories. The 33 categories were reorganized into six macronutrient groups: high protein foods, complex carbohydrates I and II, high sugar foods, fats, and others. The students were able to determine which macronutrients were over- or underconsumed and to make specific, appropriate decisions for the nutrition education unit.

Howison et al. (38) designed a behavior-focused nutrition education program for fifth graders that was implemented by classroom teachers. Students used the Four Food Groups to analyze their own food choices. They developed specific written plans for modifying food choices to better meet serving recommendations. Two other dimensions of the program included a focus on personal responsibility in making food choices and simulated real life situations which could affect food choices. Students reported increasing consumption of the selected food group by at least one serving following instruction. Six to eight weeks later, students reported increases of 1 1/2 to

2 servings, and all reported means were above the recommended daily minimum number of servings.

McGandy (39) reported changes in eating behaviors related to lowered fat intake among adolescent boys attending boarding school. Working with the school cafeteria, he made low fat modification for meats, cooking and table fats, dairy products, eggs, and baked goods. Changes in the adolescents' diets were a result of imposed substitutions, not direct personal choices; however, this method has relevance for such places as school lunch programs and vending machines.

Podell et al. (40) reported on a nutrition education program for tenth grade biology students that focused on reducing cardiovascular risk factors. A questionnaire, designed to elicit knowledge about cardiovascular nutrition, attitudes, and dietary habits, was administered at the beginning and seven months after completion of the cardiovascular education lesson plans. Students kept two-day food records and self-calculated fat consumption. Serum cholesterol and triglycerides were measured prior to intervention and one year after intervention. An important finding was that students with greater risk because of either personal or family history of elevated cholesterol levels made more changes related to attitudes and reported attempts at lowering fat intake. Baseline data revealed

students did not know how to follow a cholesterol-lowering diet, but knowledge significantly increased following intervention. Serum cholesterol levels increased significantly in both control and experimental groups, while difference in change in cholesterol values between the two groups was not significant. The authors' explanation was that either reported attitudes and diet did not reflect actual practice or that diet change was not enough to counter maturational increases in serum cholesterol.

Stunkard (41) reported on the use of behavior modification techniques in the treatment of obesity. In a review of studies, Stunkard found that weight loss was modest and variable, and maintenance was no better than traditional treatments. However, features of behavior modification were effective, such as contingency contracting for decreasing treatment drop-outs. He suggested combining behavior methodologies with other types of treatments for greater effectiveness in treatment of obesity.

Kaplan et al. (42) were interested in equipping adolescents with diabetes with various skills in an attempt to increase dietary compliance. Their study, based on social learning theory, included one group receiving training in social skills and resisting peer pressure

through role modeling and guided practice. The other group received a traditional information-based program. Using glycosylated hemoglobin as a measure of compliance, they found the skills group had significantly lower values, indicating better metabolic control than the control group.

Gotto et al. (43) documented the importance of on-going dietary counseling versus yearly dietary counseling with two groups of patients with type IV hyperlipoproteinemia. The group whose diets were personalized, considering such things as lifestyle, work schedule, and food preferences, had a decreased concentration of plasma triglycerides compared to a similar group receiving no personalized counseling. Dietary modification in use of sugar and sweet desserts was greater for those having dietary counseling.

Glanz (44) emphasized the need for dietary counseling by focusing on dietitians as facilitators of behavior change. She suggested that interviewing skills and careful probing are important in eliciting information to help patients overcome problems of noncompliance. Glanz recommended repeated measures of compliance to maximize dietitians' effectiveness and on-going evaluation of change efforts.

Wikner (45) used a behavioral approach in a study with twelve-year-olds who were at high risk for dental caries.

Using a counseling technique that involved showing participants the bacteria count of their own saliva, Wikner encouraged reduced sugar consumption and use of a fluoride rinse. He documented decrease in bacteria count in those children receiving counseling. Thus, by showing children their personal susceptibility to tooth decay in addition to appropriate counseling, Wilker was able to change behaviors. Bacteria counts were taken three and seven weeks after counseling. One year after counseling, caries increment was smaller for the group having counseling versus the control. Peer influence was indicated in the success of the program because the group compared and discussed successes and failures of individuals.

Goldberg et al. (46) investigated reducing atherosclerotic risk factors of elementary school children through a three year intervention study, which consisted of an education component, physiological measurements, and alteration in foods served in the school cafeteria. Results revealed no difference in risk factors between treatment and control groups. Researchers suggested that the education component might be improved by including skills training. The population had a low initial risk, which prompted the authors' comment that applying dietary principles appropriate for treatment of hypertension and

hypercholesterolemia to an entire population may have limited effect.

Although Goldberg et al. (46) did not report positive results relative to behavior change, their comments are noteworthy. One important comment is the recommendation to include skills training as part of the educational component. The other comment relates to the question they raise as to the appropriateness of teaching certain behavior modifications to the total population. This emphasizes the need for personalization and meeting the needs of individuals in developing strategies that are aimed at behavior change.

From the above studies several features stand out as desirable components of a behavior change strategy. Several of the features were included in more than one study. These features, some specific and others more general, include: 1) educating with peers; 2) on-going counseling; 3) personalizing; 4) on-going evaluation; 5) contracting, a technique used in behavior modification by Stunkard (41) who suggested combining the best of several types of treatments; 6) training in skills; 7) assessing personal susceptibility to disease; 8) developing specific plans for change; and 9) imposing substitutions. Imposed substitutions might include the use of low-salt products or low-fat dairy products by the school cafeteria.

A Survey of the Adolescent Period

Adolescence is the period between puberty, which is marked by the appearance of secondary sex characteristics and the completion of physical growth (47). It is commonly termed "the teen years", 13-19 years of age.

Growth and Development

Physiological Processes

The main event of puberty for the male is the period of greatest height velocity (48). The average age of peak height velocities and maximal increments in muscle bulk for males in the United States is 13.5 years old. For the female, the onset of puberty begins with the first appearance of the breast bud followed by peak height velocity and menarche. The average age of menarche for females in the United States is 12.7 years.

During adolescence, 20-25% linear growth is achieved, and 50% of the ideal adult body weight is gained. Skeletal mass and vital organs, such as the heart, liver, kidneys, thyroid, adrenal glands, gonads, and uterus double in size (1). This process of growth and maturation is intricately controlled by a series of rate changes and/or interactions of hormonal secretion (48). The secretion of gonadotropin-releasing hormone (GnRH) from the axons of the cells of the hypothalamic arcuate nucleus initiates puberty.

GnRH stimulates the pituitary to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH) which activates the steroid hormone-secreting cells of the gonads (48). Somatotropin or growth hormone secreted by the pituitary is necessary for growth and contributes to maturation of the central nervous system. The thyroid hormones, triiodothyronine and thyroxine also have an effect on body growth and skeletal and central nervous system maturation. Increases in many metabolic actions result from thyroid hormonal secretion, including nitrogen retention, protein synthesis, and glucose absorption and utilization. The steroid hormones, androgen and estrogen, secreted by the adrenal cortex, are responsible for sexual development and function. Androgens increase nitrogen and mineral retention, as well as protein synthesis, thus contributing to total body growth along with the development of organs and tissues related to sexual maturation. Estrogen is specific for development and maintenance of secondary sex characteristics (49).

Lean and non-lean body mass double during puberty (1). Males develop a greater quantity and quality of lean body mass. Muscular strength increases, and alteration in cardiovascular function occurs to supply large muscles with oxygen (48). Female maturation results in twice as much non-lean mass, or body fat, compared to males. Frisch (50)

stated the proportion of body fat is crucial because 17% of body composition as fat is believed to be needed for beginning of menses and 22% to begin and maintain regular ovulatory periods. However, this has not been confirmed.

For the adolescent, the most important issue is the variation among individuals in the progression of these physiological processes. Tanner (48) referred to the rate of adolescent development as the tempo of growth using a musical analogy to illustrate the timing in a child's growth. The timing may be allegro (fast), moderato, or lento (slowly).

Psychological Processes

Adolescence is a time not only of dramatic physical development, but also psychosocial development. The word adolescence is a Latin derivative meaning "to grow toward maturity" (2), suggesting movement from past dependence to future independence. This process results in a shift in orientation from home and parents to peers and the adult world. The adolescent becomes increasingly more aware of self with the resulting need for identity (3). Erikson (4) identified self-identity as a critical developmental task during the adolescent period. The adolescent begins to define and structure a self-identity through the process of determining the meaning of life, establishing rules and

values to guide behavior, and developing a sense of self worth (2). The adolescent, confronted with a multitude of choices, becomes a decision maker, making decisions that affect his/her present and future life, physically, psychologically, and socially.

Food-related Behavior

The food-related decisions adolescents make are of concern to the nutrition educator. In looking at food-related behavior, it is important to know the nutritional recommendations for adolescents. It should be noted that there are few actual studies using adolescents to determine nutrient requirements (51). The Recommended Dietary Allowances (RDA) (5) for most nutrients are based on studies conducted with younger children or adults.

Recommended Dietary Allowances of Adolescents

The nutrient recommendations developed by the Food and Nutrition Board of the National Research Center (5) increase above childhood levels for all nutrients except vitamin D and vitamin B_{12}. Thiamin, niacin, and riboflavin increase for adolescent males and decrease for females compared to childhood levels; vitamin D and vitamin B_{12} remain the same as childhood levels. The RDAs are set according to chronological age, but because of individual

variance in physical growth and sexual maturation, biological age may be a more desirable guide for individual application. If adolescents do not respond to increased nutrient needs with appropriate food choices, they can be at risk nutritionally.

Dietary Intake versus Recommended Allowances

What has research revealed about adolescents' diets relative to recommended nutrient intake? National and regional surveys of food intake of adolescents have identified calcium, iron, and vitamin A as nutrients deficient in teenagers' diets (7, 9, 10, 52-55). Other nutrients reported low on a less consistent basis have been vitamin C (10, 53, 54), riboflavin (52, 54), and thiamin (7). Surveys spanning the United States have reported similar dietary findings for over 20 years.

Various influences affecting nutrient intake have been documented. Skinner et al. (7) reported differences in reported food intake and calculated nutritive value depending on whether adolescents or their mothers prepared meals. Adolescents who prepared their own breakfasts had foods lower in energy, protein, fat, and niacin than those who ate mother-prepared breakfasts. Adolescent-prepared breakfasts were higher in calcium, riboflavin, and thiamin per 1000 calories, a measure of nutrient density. Evening

meals prepared by adolescents were lower in nutrient density for iron and thiamin.

Using data from the Nationwide Food Consumption Survey, Morgan et al. (56) evaluated breakfast consumption patterns of the United States child and adolescent population. They were interested in overconsumption of fat, cholesterol, and sodium and underconsumption of some vitamins and minerals: vitamin A, pyridoxine, iron, calcium, magnesium, copper, and zinc. They evaluated these dietary component levels for children and adolescents who frequently skipped breakfast versus those who ate a breakfast that contained ready-to-eat cereals and those who ate a breakfast that did not contain ready-to-eat cereals. Dietary data were collected with three-day food records. Adolescents skipped breakfasts more often than children. Male adolescents skipped 13.3% of all possible breakfasts. Female adolescents skipped 18.4% of all breakfasts. Skipping breakfast, especially for female adolescents, was a strong factor contributing to dietary inadequacies. Consumers of ready-to-eat cereals had higher average daily intakes of the identified vitamins and minerals. Cholesterol intake was higher when breakfasts did not contain ready-to-eat cereal. No consistent relationship was found between breakfast consumption and total daily intakes of fat and sodium.

Duyff et al. (57) found Puerto Rican-American teenage girls' diets richer in sources of ascorbic acid and poorer in sources of vitamin A than typical teen diets in the United States. Low vitamin A intake was due to very low consumption of vegetables.

Moussie et al. (58) reported that the nutritional status of low income adolescents in Florida was positively affected by the nutrition education their mothers received. These researchers investigated the impact of socioeconomic characteristics on food expenditure patterns and adolescents' nutritional status. They were interested in the influence of several economic and noneconomic factors: household income, participation in the Food Stamp Program, family size, educational level of homemaker, employment status of homemaker, urban versus rural residence, ethnicity, and participation in a nutrition education program. They were specifically interested in looking at the influence of the Expanded Food and Nutrition Education Program (EFNEP).

They found that household income, family size, and participation in the Food Stamp Program had a significant effect on food expenditure but did not have an effect on the overall nutritional status of the adolescents. They did find that when homemakers received nutrition education, an impact was seen on adolescents' nutritional status as

measured by certain biochemical parameters. Higher levels of red blood cell folacin, serum folacin, iron, and protein were found for these adolescents. They also found a significant negative relationship between nutrition education and food expenditures, meaning that households participating in a nutrition education program spent their food dollar more efficiently, both qualitatively and quantitatively. This translates into better food choices available at home for these low income adolescents.

It is particularly significant that an effective nutrition education program can be implemented outside the formal school setting because it has been documented that increased education of the parents, specifically the mother (54, 59-61) positively affects adolescents' diets.

Diets versus Four Food Groups

Researchers have evaluated adolescents' diets relative to the basic food groups. Greger et al. (62) reported only 3-4% of females in early adolescence consumed a diet meeting recommended quantities for each food group. The only food group eaten in adequate quantity consistently was the bread and cereal group. Similar results with seventh through twelfth grade students were reported by Edwards et al. (63), who noted low intake of vegetables of the green and yellow varieties and those rich in vitamin C.

Burdine et al. (64) reported findings from a Texas survey of seventh and eighth grade students of mixed ethnic origin, including whites, blacks, and Mexican Americans. Their findings support those of Huenemann et al. (65) in identifying blacks as consuming significally more sweets than the other groups. Blacks in the Burdine et al. study also consumed more salty foods, fresh vegetables, hot and cold cereals, and peanut butter. Males selected more healthful foods than females, choosing milk, hot and cold cereals, and peanut butter more often than did females.

Burdine et al. (64) found teens had more regular meal patterns when their fathers had higher status occupations. For these teens, fruit consumption at home was higher than at school, while teens whose fathers had lower status jobs consumed more fruits at school because of participation in school feeding programs. Milk was named as the most frequent snack both at school and home.

These findings support data compiled by Stults et al. (66) from 7-day food records of a cross-sectional sample of 1,135 United States students from 5 to 18 years of age. Milk was reported as the most popular beverage at meals and snacks across all ages. Milk consumption averaged 15.6 ounces per day with little day to day variation. Eighty percent of all those surveyed consumed at least 8 ounces of milk per day, and while 80% also consumed carbonated sweet

drinks, the quantity consumed was less than that of milk. Fruit and vegetable juices were consumed half as much as milk, averaging 7.5 ounces per day. It should be noted that the popularity of milk does not ensure that recommended amounts will be ingested. Milk meets with great competition from less nutrient-dense beverages. Also, milk is not always seen as socially acceptable, as peer influence affects adolescents' choice of beverage (67).

Woodard (59) reported a study of influences on food intake in Australia. Males ate more food than females; food categories where gender had a strong influence were milk, potatoes, bread, cereals, and red meat. For males and females, intake of bread and non-milk dairy products rose with age. Intake of citrus fruits and berries increased as social status of the family rose. Females of well educated mothers (post secondary training) had lower intakes of potatoes and higher intakes of green vegetables and white meat. Males of well educated mothers had higher intakes of citrus fruits and berries.

Influences on Food-related Behavior

In studying adolescents' food-related behavior, researchers have found similar consumption patterns: meal skipping (7, 9, 53, 65); frequent intake of "fast foods"

(68, 69); and high incidence of snacking, many times in place of structured meals (70-73). Factors influencing these particular types of consumption patterns have been investigated.

Adolescents' Employment

Skinner et al. (8) studied the effect of adolescents' employment on meal pattern and diet quality among teens 16 to 18 years old in Tennessee. They found working teens more likely to eat the evening meal away from home. This meal was more likely to be a sandwich type and less likely to include a vegetable other than potatoes compared to meals eaten by non-working teens. This is consistent with the fact that 38% of the working adolescents were employed by food service establishments, most serving "fast food" combinations of sandwiches and french fried potatoes. Eleven percent of working teens skipped the evening meal compared to 3% of non-working teens. The ascorbic acid intake of the evening meal, while meeting the RDA for both groups, was lower for working versus non-working adolescents. When diets were compared per 1000 kcalories, which is a more sensitive indicator of diet quality, lower riboflavin intake for working adolescents was identified.

Mothers' Employment

It has been suggested that adolescents' food-related behavior may differ relative to whether their mothers are employed. Ortiz et al. (74) found that employed mothers spent less time preparing food than unemployed mothers. They also found that if women were employed full time, their families ate more meals away from home. Part-time employment did not increase meals away from home above that seen in unemployed women. In a more recent study, Skinner et al. (21) found no difference between adolescents with employed mothers versus adolescents with unemployed mothers relative to whether the evening meal was eaten at home or away from home, the types of food consumed, the regularity of the evening meal, and in the freedom of choice in food selection the adolescent perceived him/herself as having. When investigating snacking patterns, they found adolescents with unemployed mothers had snacks higher in nutrient density for iron and thiamin than did adolescents of employed mothers. There was a trend toward lower intakes of ascorbic acid for a 24-hour period among adolescents with unemployed mothers compared with teens with employed mothers.

Region

McCoy et al. (75) were involved in a regional nutrition project studying the eating behavior of 1224 adolescent females in eight southern states. They looked at snack habits related to age (12-16-year-olds), race (black and white), and per capita income (low, middle, and high). They found snacks occurred throughout the day from pre-breakfast to post-evening meal. A high percentage of subjects had afternoon (91% of subjects) and evening (80% of subjects) snacks. More blacks than whites snacked pre-breakfast, but the reverse was true for snacks between breakfast and lunch. The proportion of females who snacked differed according to income. Percentages of females eating morning snacks increased with decreased income; percentages of females eating afternoon snacks increased with increased income. Snacks contributed to daily nutrient intake, in particular providing 52% of the RDA for riboflavin, 43% of RDA for ascorbic acid, and 39% for thiamin. Nutrient composition of snacks was low in folacin, vitamin D, zinc, and iron. White females consumed snacks more nutrient dense in carbohydrate, vitamin D, folacin, calcium, magnesium, and zinc than black females. Black females consumed snacks more nutrient dense in fat than white females.

Regional influences on Appalachian adolescents' eating

patterns were reported by Skinner et al. (7). They noted the popularity of biscuit breakfasts and the use of vegetable protein in the form of dried legumes for the evening meal.

Freedom of Choice

Skinner et al. (7) noted the choice adolescents have in food selection. Over one-third of the teens prepared their own evening meal or ate in a restaurant on the day of the survey. Compared to rural youth, urban youth reported a higher incidence of restaurant meals.

Snack Patterns

Adolescents eat more of their foods as snacks than adults do (70). Seventy-eight percent of the teens surveyed in the Ten State Nutrition Survey reported eating snacks, with 23% of their caloric intake coming from this source (72). Sixty-five percent of teens surveyed in the Nationwide Food Consumption Survey (9) had at least one snack during the course of a day. An average of 20% of total daily caloric intake was provided by snacks. McGandy et al. (39) reported snacks contributed only 14% to total caloric intake for 13-18-year-old males in Massachusetts. However, the researchers expressed concern because snack foods contributed 38% of total daily fat intake.

Thomas and Call (72) and Musgrave et al. (76) concluded that snacks could not be labeled as low nutrient dense foods because they supplied a good balance of nutrients, especially protein, riboflavin, and ascorbic acid. However, Thomas and Call pointed out that snacks were not making significant contributions to those nutrients identified as low in adolescents' diets, namely calcium and iron. Ezell et al. (6), reporting on Tennessee adolescents, confirmed this fact, and in addition, noted low vitamin A intake among snack choices. They noted similarity between meal and snack patterns in nutrient contribution, indicating diversity was not accomplished through snack consumption. Snacks contributed about a third of adolescents' daily caloric intake. The influence of availability was evidenced by the higher consumption of lower nutrient dense foods, which were higher in sugar and salt, during school hours than after school hours. Snacks eaten at school were obtained mainly from vending machines and school stores and included candies, carbonated beverages, and salty snacks.

Media Influence/Television

Burdine et al. (64) identified the influence of media, specifically television, on adolescents' eating behaviors. They reported television watching was a key predictor of

sweet and salty food consumption at home and school.

Researchers have been concerned with the effects that television advertising has on teens and, also, about the modeling that may occur as teens identify with television personalities. Many teens watch a significant amount of television, which may be additive to the effect of having watched television frequently during childhood. Postman (77) reported that an American child from the ages of 5 to 18 years has spent 30% more time watching television than in school.

Way (78) examined food-related behavior on prime-time television and reported that food actually consumed by television personalities was not as nutritious as food that was prepared, served, or talked about to others. Television characters ate out twice as often as they ate at home. Foods served away from home were observed to be less nutritious than foods served at home. The question arises as to what long term effects eating patterns of specific characters, relative to consumption of sweets, snacks, and alcohol, might have on adolescents who identify with television personalities.

Singer (79, p. 668) stated her belief that "the most powerful conveyer of health habits may...be the day and nighttime soap operas and prime time shows." She expressed concern that television seems to legitimize the use of

alcohol but minimizes the consequences (79). Television most frequently presents alcohol being consumed by leading male characters in the home context. Its consumption is made to look not only glamorous but as standard behavior in society. The adolescent, at the stage of self-identification, role determination, and physical maturation, is extremely vulnerable to such a potent influence.

Alcohol consumption is a food-related decision many adolescents are choosing to make. According to Singer (79), of the adolescents between the ages of 12 and 17, 80% have had an alcoholic drink, 50% drink once a month, and 3% are daily drinkers. The Surgeon General's Report (80) listed alcohol abuse as one of the major health problems of teens. Even if adolescents' alcohol consumption is not abusive, this choice is competing with other nutrient-dense beverages, such as milk or juice, and as suggested, may lay the foundation for unhealthy dietary practices in later life.

Influence of society's focus on the body

Focusing on the tremendous changes occurring during the adolescent period from a biological, psychological, and social standpoint, it is easy to see how eating decisions become entwined in this maze of development. How an

adolescent sees him/herself is reflected by one's body image, and this in turn influences food-related behaviors. Adolescents quickly sense the control they can have over their own food choices. They are particularly susceptible to food and diet fads as they attempt to create a body of slimness, muscular strength, or athletic prowess.

Researchers have reported the majority of diets among adolescent girls were initiated because of discontent with body appearance (81, 82). Girls report dieting who would not be considered obese or in need of reducing (82).

An obsession with slimness has resulted in the increased incidence of eating disorders. Two eating disorders, the names of which are becoming commonplace in American society, are anorexia nervosa and bulimia nervosa. Anorexia nervosa is self-induced starvation. Bulimia nervosa involves a cycle of food binges followed by purging with a diuretic, laxative, or vomiting. It seems to be more common than anorexia nervosa, affecting 5% of adolescents and young adults. In both disorders, the individuals desire to exert control over their lives, and they attempt to do this through bizarre food behaviors. Males can be affected by these disorders but much less commonly than females (83).

Anorexia nervosa, which often occurs at the onset of puberty, is marked by an emaciated figure and amenorrhea

because the proportion of body fat necessary to maintain menses has been altered. The phychosocial aspects of this disorder involve a desire for perfectionism, including the motivation to excel at being thin (84).

Bulimia nervosa occurs at any body weight and, although it is characterized by frequent weight changes, may be difficult to diagnose because of relatively few clinical symptoms. Post and Crowther (85) have identified factors which differentiate between bulimic and non-bulimic adolescents. People with bulimia nervosa have disturbed eating attitudes, negative perceptions of physical appearance, depression, and use alcohol more frequently than their non-bulimic counterparts. Post and Crowther believe that teens who are dissatisfied and unhappy will be more susceptible to unrealistic expectations when pressured to be thin.

Anorexia nervosa and bulimia nervosa are multi-dimensional problems and must be treated by a multi-disciplinary team in order to deal effectively with the biological, psychological, and social implications.

Nutrition Knowledge, Attitude, and Dietary Studies of Adolescents

Douglas and Douglas (86) investigated nutrition knowledge and food practices of high school athletes.

Food practices were analyzed by recording how often foods in each of Four Food Groups were consumed. The knowledge portion included nutrition concepts considered important for the general public. Female athletes had higher nutrition knowledge scores than male athletes. However, male athletes had higher food practice scores than female athletes. Athletes who participated in a greater number of sport seasons had relatively higher scores on both knowledge and practice assessments than athletes participating in a fewer number of sport seasons.

Singleton and Rhoads (87) assessed the nutrition knowledge of students in grades three through twelve using a proportionally stratified sample of Louisiana students. The nutrition knowledge instrument included 15 statements developed from major nutrition concepts taught in state schools. The mean score was 10.3; two-thirds of the sample scored 10 or above (range 0-15). Mean scores increased with increase in grade level from elementary to middle school to high school. The authors suggested active participation by students could stimulate them to internalize knowledge and produce desirable dietary changes.

Searles et al. (88) examined the relationship between body image satisfaction and nutrition knowledge as related to weight control among adolescent females. They

hypothesized knowledge of weight control concepts would increase with decreased satisfaction with body image. The hypothesis was not supported. They did find adolescents' nutrition knowledge test scores tended to increase with mother's education and socioeconomic level. Adolescent females lacked knowledge of safe weight loss. Sixty-percent of females were more satisfied than dissatisfied with their bodies.

Skinner and Woodburn (89) assessed nutrition knowledge of 1193 high school students in health and home economics classes in Oregon. The instrument included 28 multiple choice items developed around the following items: food sources of energy and nutrients, definitions of nutrients, special nutrient needs of teenagers, evaluation of meals and snacks, and common misconceptions about food and nutrition. Topics were developed by reviewing related high school textbooks and interviewing representative teachers; other considerations included surveys of nutritional status and dietary intake. Mean score on the nutrition knowledge test was 39.4%. The authors suggested teens probably know the Four Food Groups and a "best" food source of many nutrients. They recommended students need to learn about nutrient composition of foods, how to identify which nutrients are likely to be low in their diets, and which foods are good sources of those nutrients.

Podell et al. (90) surveyed New Jersey adolescents enrolled in tenth grade biology classes to determine baseline data related to lipid levels and cardiovascular knowledge and attitudes. Assessment occurred prior to initiation of a cardiovascular nutrition education program. Students answered correctly approximately 50% of the questions on nutrition and heart disease. They were able to identify margarine, skim milk (however, most drank whole milk), and tuna fish as low cholesterol choices. Identification of other low cholesterol items was no better than might be anticipated by guessing. The suggestion was made that media may have been responsible for this knowledge pattern. Students reported eating acceptable low cholesterol diets only related to eggs and margarine. Seventy-one percent of students felt their style of eating was satisfactory. The majority of students responded they did not know how they felt about a low cholesterol diet.

Salvetti and Skinner (91) assessed the relationships between nutrition attitudes, knowledge, and dietary practices of high school students in East Tennessee. The attitude portion consisted of 26 items (possible score 130) developed by Carruth and Anderson (92), Sims (93), and Grotkowski and Sims (94). The knowledge portion was a 28-item (possible score 28) test developed by Skinner and Woodburn (89). Dietary data were collected with 24-hour

food records. Two dietary scores were calculated, one based on RDA (possible score 18) and one based on nutrient density (possible score 16). Mean score on the attitude portion was 85.1, indicating generally favorable nutrition attitudes. Mean score on the knowledge portion was 10.4, indicating low level of nutrition knowledge. Mean dietary scores were 14.5 on the 18 point scale and 13.6 on the 16 point scale (based on nutrient density). No relationship was found between knowledge and either dietary score. A significant correlation was found between attitude scores and dietary scores based on nutrient density.

Story and Resnick (18) investigated adolescents' opinions and views on nutrition-related topics as part of the Minnesota Youth Poll, an ongoing research project. A focus group format was used. Peers acted as discussion leaders and recorders. A prepared series of open-ended questions was used that dealt with participants' perceptions of adolescents' diets, barriers to change, attitudes towards food and eating, food preferences, fast foods, school lunch, and family meals.

A majority of students felt teens do not eat the right kinds of foods. Suggestions made for improvement included balancing their diet and taking more time to plan and eat meals. Although adolescents appeared to know what to eat, they identified barriers preventing improved diets, which

included lack of time, inconvenience of proper eating, and lack of a sense of urgency.

Adolescents identified a list of "junk foods" and endorsed eating such foods in moderation. However, taste and convenience of these foods made them an important part of their diets. Fast foods and sweets were identified as foods of preference, while fresh or cooked vegetables, spinach, liver, and, in general, foods that take time to prepare tended not to be eaten. The majority of adolescents felt eating meals regularly with the family was important.

Story and Resnick (18, p. 191) stated that "there is a need for intervention programs for youth that focus on behavior change rather than acquisition of knowledge." They suggested that adolescents need "to learn the skills necessary to make dietary changes and the opportunity to practice newly learned skills" (18, p. 191).

Development of Comprehensive Sequential Curricula In Nutrition Education

In the final report of the 1969 White House Conference on Food, Nutrition, and Health, the recommendation was made that a comprehensive and sequential program in nutrition education was needed as a part of the curricula of all schools in the United States (95). Establishment of the

federal Nutrition Education and Training (NET) program in 1977 was the culmination of this recommendation. After the establishment of the Tennessee NET program, an interdisciplinary team developed and evaluated a framework for nutrition education. The team included specialists in nutrition and food sciences, human development, curriculum and instruction, home economics education, and health education. From this framework, assessment instruments (96) and instructional plans were developed. Instructional plans, Tennessee Educates for Nutrition Now, were developed for preschool (97), grades K-6 (98), 7-9 (99) and 10-12 (23).

As a result of NET funding other states have developed similar guidelines and instructional material for nutrition education. The Nutrition and Food Science Department at the University of Kentucky developed the Nutrition Education and Training Manual for teachers and school foodservice personnel (100). The focus of the manual was to "provide accurate information to teach nutrition concepts that would enable individuals to make informed decisions" (100, p. ii), train foodservice personnel, and link nutrition education between the classroom and school cafeteria.

Many other sequential plans have been developed including: 1) Food...Your Choice by the National Dairy

Council (101); 2) Nutrition Education Today by the Fresno Unified School District in California (102) ; and 3) Nutrition in a Changing World by The Pennsylvannia State University (103).

Such plans have become invaluable resouces in school settings and have contributed to the success of nutrition education programs. In the meta-analysis conducted by Johnson and Johnson (104), they found that the National Dairy Council curriculum increased participants' knowledge, attitudes, and behavior. They stated that FOOD...Your Choice was effective in improving consumption of nutritious foods (104).

Evaluation Instruments

Dietary assessment

Assessing dietary intake can be done using several types of methodology: food record, weighed intake, food recall, diet history, and food frequency. There are both advantages and disadvantages to each type of assessment. The method of choice depends on the objectives of the study and characteristics of the population studied.

Since the 1930s, when interest in analyzing diets began, recording food intake has been a method of choice. Subjects keep an exact record of food intake over a specified period of time, either in weighed amounts or

household measures. Both "how many and which days" to include for reliability and validity have been studied. Representative dietary assessment periods must include weekend as well as weekdays (105, 106). Researchers in the 1980s have studied variability in food records for varying lengths of time: three days (107), 28 days (108), one year, consisting of four one-week records for each of four seasons (109), and two years, consisting of two randomly selected days per month over a two-year period (110, 111). Greater precision is obtained when food records are kept for longer periods of time; however, interest of subjects in keeping records must be maintained. Researchers have suggested modifying the widely used three-day record (112, 113) to include four days (108, 112).

Food records of weighed food intake are very precise (114) and in the United States are a technique primarily used for metabolic studies because of the high degree of accuracy and precision needed (115). This method is very labor intensive and usually requires supervision; therefore, sample sizes are usually small. Stockley et al. (116) reported on a Food Recording Electronic Device that has been developed for quantitative collection of dietary data. Information normally recorded by the subjects or researcher on weights, types of foods, and time of consumption are transferred immediately to a computer for

calculation of the nutrient compostion of the diets.

Dietary recall methods require the participant to remember and accurately estimate quantities of food intakes. Data are less accurate as the length of time of recall increases (117). The 24-hour recall has been a widely used method (52). It is relatively quick and easy. The data are not representative of an individual's usual diet but are appropriate for gathering group data (118).

Evans and Gines (119) reported a study with elderly patients using three techniques for collecting 24-hour dietary data. They compared accuracy in reporting using 1) unaided recall; 2) printed questionnnaire with lists of specific food names; and 3) flip chart of actual-size color pictures of foods plus food models and measures. There was no difference in mean scores for the three methods. However, when the 30 subjects above 76 years of age were analyzed alone, accuracy scores were higher with the questionnaire. No differences in scores were seen for sex, educational level, obesity, place of residence, or food preparer.

The diet history was designed to identify usual dietary intake (120). Extensive interviews are conducted to elicit information on usual food patterns and recent food intake (121). With emphasis on epidemiological studies in the 1960s came a modification of the diet history--the food

frequency questionnaire. The food frequency questionnaire was introduced by Stefanik and Trulson (122). It consists of a list of foods and set of frequency response options to indicate how often each food has been consumed during a specified period of time. The composition of the list depends on whether interest is in overall food habits or in hypotheses related to certain foods or nutrients. Data from food frequencies can be presented as number of times food is consumed per time period and as nutrient intake scores by mutiplying frequency times nutrient content of specified amounts of food (123).

Attitude Assessment

Nutritionists began to study attitudes in the mid-1960s. The study of attitudes involves describing the interaction between the individual and the world in which one lives (124). The nutritionist is interested in attitudes toward food and eating in interaction with the environment. Defining what one means when assessing attitudes is important because beliefs, opinions, motivations, and intentions have also been used synonymously with the concept of attitudes (125).

Instruments that have been used to measure attitudes include Thurstone's method of equal-appearing intervals (126), Likert's method of summated ratings (127), Guttman's

scalogram (128), and Osgood's semantic differential (129).

In constructing and evaluating an attitude measurement instrument, these principles of measurement should be followed: 1) unidimensionality, i.e. measuring common dimensions; 2) linearity, and equal (or equal appearing) intervals; 3) validity; and 4) reproducibility (130).

The relationship between attitude, knowledge, and food behavior is of interest to the nutritionist. One expression of the relationship is that knowledge precedes attitudes which precede behavior. A reverse order has also been seen that attitudes precede knowledge which precedes behavior (131). Schwartz (16) suggested several models for the attitude, knowledge, and behavior relationship.

Fishbein and Ajzen (132) state that intention is the best predictor of behavior. Intention is determined by an individual attitude toward an act and the preceived social pressure to perform the behavior (subjective norm). In the model, attitude is determined by the sum of one's salient beliefs about the consequences of performing the behavior multiplied by one's evaluation of the consequences. The subjective norm is determined by the sum of one's normative beliefs (beliefs about what relevant others think about his/her performing the particular behavior) multiplied by one's motivation to comply to others (133).

Knowledge Assessment

To assess nutrition knowledge a test should be developed and administered that will reveal what a person knows about nutrition. The learning outcomes measured by a test should reflect the objectives of the instruction or a core of basic concepts believed to be critical to the understanding of nutrition (134).

In the 1970s researchers stated they found no suitable questionnaire to measure nutrition knowledge (12, 14). However, in the last decade assessment of nutrition knowledge has become standardized.

The conceptual framework developed by the Interagency Committee on Nutrition Education that was recommended at the White House Conference on Food, Nutrition, and Health in 1969 (95) and the set of educational objectives developed by Sherman et al. in 1978 (135) are two resources that have been used to provide standardization in measurement of nutrition knowledge. Gronlund's book, Constructing Achievement Tests, has also been used for desirable procedures to follow in test planning, question writing, and validity and reliability analyses (136).

A classic resource has been the Taxonomy of Educational Objectives, published by Benjamin Bloom (22). It is a comprehensive system that applies to knowledge in general and classifies objectives within three domains:

1) cognitive, which deals with intellectual outcomes;
2) affective, which deals with interests and attitudes; and
3) psychomotor, which deals with motor skills (22).

The focus of knowledge assessment is the cognitive domain. Bloom's cognitive domain consists of a series of six learning outcomes arranged in order of increasing complexity--knowledge, comprehension, application, analysis, synthesis, and evaluation. Each stage of learning outcome includes those categories that precede it; therefore, the course of learning resembles a stair-step, upward growth process. This classification is very useful in planning because it focuses on the mental processes that should be considered when identifying learning outcomes. It also provides standard vocabulary for describing and classifying learning outcomes and serves as a guide for stating learning outcomes in specific performances (136).

Researchers are acknowledging use of the above resources in test development (14, 88, 137). Tests developed that were based on standardized procedures include: 1) CANKAP (96), a multidimentional measure of nutrition beliefs developed for testing kindergarten through twelfth grade children and based on the framework for nutrition education for the State of Tennessee; 2) the NKT (138), a general nutrition knowledge test that can be used to discriminate between those possessing basic

nutrition knowledge and those who do not; and 3) the NATS (139), nutrition achievement tests for elementary grades, developed by the National Dairy Council.

Tests with reliability and validity determined may be used or adapted for use by researchers. If a test or portion of a test must be constructed, careful planning is essential. The following procedures should be used: 1) determine purpose of test; 2) identify and define intended learning outcomes; 3) prepare test specifications; and 4) construct relevant test items (136).

Determining the purpose of the test relates to determining the purpose of the proposed study so that the test fits the objectives of the study. Identifying and defining learning outcomes relates to topics previously discussed.

Writing test items should be guided by a set of test specifications, which describes achievements to be measured and provides guidelines for obtaining a representative sample of test functions (136). The procedure to follow when preparing a table of specifications is to select learning outcomes to be tested, outline subject matter, and make a two-way chart that describes the sample of items to be included on the test (136).

Primary emphasis in constructing relevant test items is to write an item that accurately measures the acquired or

lack of acquired knowledge. The specific learning outcome relates to the performance to be measured. Thus, the test item should provide a task that makes measurement of that specific performance possible. Only those who have achieved the outcome should get the item right. All others should miss the question. It is necessary, therefore, to eliminate barriers that might inhibit a knowledgeable person from responding correctly and all clues that might help the uninformed choose the correct answer, such as ambiguity and unclear directions (136).

Knowledge outcomes are typically measured by objective test items because of adaptability, provision for adequate sampling of respondents' performance, and ease of scoring. Objective tests may be mutiple choice, true and false, matching, and short answer; the later are appropriate when there is only one right answer. Multiple choice items tend to yield the highest quality (136).

Tests prepared for a research study must be reviewed by a team of professionals and revised as needed. Pretesting to check timing and readability is an important consideration because test questions should be written with clarity and appropriateness for the intended target population (140).

After administering and scoring the test, it is desirable to evaluate the effectiveness of the items. This

is done by a technique called item analysis in which the responses to each item are studied (136). The analysis produces information about how well each item in the test functioned and thus, is designed to discriminate between subjects. The information provided concerns the item's difficulty, discriminating power, and effectiveness of each alternative (136).

After the above procedure has been followed on a test population and appropriate adjustments in the questionnaire have been made, the test is ready to be administered to the sample population. Results from tests indicate individual performance compared to others. Statistical analyses of various types are computed on the accumulated data.

When interpreting test results it is important to be sure what one believes has been measured has actually been measured. It is therefore necessary to test for validity. There are three basic types of validity, each concerned with a particular question in reference to the interpretation of the test results. Content validity is concerned with how well the test content samples the larger domain of situations it represents (136). Content validity will be high when the preceding procedures are followed, including identifying subject matter topics and learning outcomes, preparing a set of specifications, and constructing a test that fits the set of specifications.

When determining criterion-related validity, the question asked relates to how well the test performance predicts future performance or estimates present standing on some other measure (136). This type of validity is not seen often in research literature but is used, for instance in predicting a course grade from an aptitude test score. Construct validity is concerned with how well the test performance can be explained in terms of psychological attributes and might be evidenced by determining the difference in test scores between known groups and changes in performance with training (136).

Another important aspect in determining the quality of a test is to estimate the reliability. Reliability is concerned with the consistency of responses from one item to the next on the same test or with the consistency of scores over time or consistency on different forms of the test (136).

In summary, the subject areas detailed in the literature review provided a basis for developing the methodology. Knowledge of both successes and failures in research settings was used to design the behavior change strategy. Knowledge of methods of data collection and of existing evaluation instruments was used to design instruments for the present study.

CHAPTER III

METHODOLOGY

Experimental Design

The design of the study included three groups; two treatment and one control. Both treatment groups received a nutrition education unit that focused on the behavior change strategy. One treatment group received the behavior change strategy plus an additional cognitive component and was designated the Behavior Change Plus group (BC+); the other group was designated simply the Behavior Change (BC) group. The BC+ unit involved twelve days in the classroom; the BC unit involved eight days in the classroom. Assessments of dietary intake, food practices, nutrition attitudes and knowledge were made before and after nutrition education intervention in the BC+ and BC groups. The control group (C) received the pre- /post-assessment but no nutrition education during the interim. The control group was used to account for anything occurring in the environment that might have an effect on a change in food intake. The time between pre- and post-assessments was

four to five weeks. All processes of the study were conducted by the researcher.

The study was conducted in school systems in the Knoxville area during the 1987-88 school year. The study was conducted during two time spans during the fall semester. During the early part of the first semester, three high schools were involved in the study. Each school formed one group, either one of the treatments (BC+ or BC) or the control (C). Two health classes participated from each school that was part of the treatment groups. Two English classes participated from the school designated control. During the last part of the first semester, three different high schools were involved, again with two health classes from each treatment school. Two American History classes participated from the control school.

Sample Selection

Male and female adolescents enrolled in high school health classes in the Knoxville, Tennessee area were the target population. Health is a state-required course offered at the ninth or tenth grade level. Students may take the class any time during their program; however, the majority are expected to be 14 to 16 years of age. In the study a representative sample of high school students was anticipated by selecting a required, rather than an

elective course. Required classes were also selected for the control group.

Area schools were classified by socioeconomic status. Those schools designated as rural, low/middle income or urban/suburban, middle/upper income were considered in sample selection. Using a random numbers table, three schools were chosen from the rural, low/middle income classification. Schools chosen were randomly placed into groups, either treatment or control. Three alternate schools were chosen and assigned treatment type in the aforementioned manner. Likewise, three schools were chosen from the urban/suburban, middle/upper income classification and assigned treatment type as previously indicated. Three alternate schools were chosen.

In the second phase, a letter was sent to each high school principal explaining the study. A follow-up phone call was made to answer any questions and to secure approval for the project. In two school systems, the researcher was referred to the local Board of Education for approval of the project before the principals were willing to commit to the study. Two alternate schools were used because one of the schools in the original drawing had started a nutrition unit and the other school was involved in a state assessment and did not want additional outside influences.

Each principal of a treatment school was asked to identify a health teacher who would be interested in participating in the study. Each principal in the control schools was asked to identify such a teacher with a stipulation that the teacher taught a required subject not generally taken at the same grade level as health. The objective was to eliminate the chance of students having a nutrition unit during the course of the study. This resulted in the selection of ninth grade English and eleventh grade American History classes as the controls. Each teacher was called to determine willingness to participate and to assure the study schedule was compatible with the teacher's plans. Teacher participation was voluntary, but all teachers contacted agreed to participate in the study. They were asked to select two of their classes for participation, resulting in a total of twelve classes in the study. In one school two teachers were involved because scheduling required back-to-back classes. Based on projected class sizes of 18-25, the total sample was expected to include 200-300 adolescents with approximately 70-100 in each of three groups.

Overview of Behavior Change Strategy

The major components of the behavior change strategy are shown in Table 1. Components of the strategy are

Table 1. Major Components and Theoretical Framework of Behavior Change Strategy.

Components of Behavior Change Strategy	Activated Health Education AHE Model[1]	Self Management Techniques[2]	Problem Solving Plan[3]	Concept of Goal Setting[4]
Keep 3-day food records (including factors surrounding eating, i.e., time of day)	Baseline Evaluation Experiential Phase	Self-monitoring		
Assess nutrient intake using nutrient analysis; list problem nutrients	Awareness Phase	Self-analysis	Define the problem	
Set a goal for nutrient improvement for one problem nutrient				Set a specific standard of proficiency (direct attention and actions)
Assess lifestyle characteristics that may affect intake of nutrient goal	Awareness Phase	Self-analysis	Define problem into model with basic elements of problem	Determine how to reach goal (mobilizing effort)
Generate list of possible solutions for nutrient goal based on cost/benefit analysis of alternate decisions; identify those of greatest benefit	Responsibility Phase	Self-intervention	Choose solutions that maximize benefits and minimize costs	Set subgoals
Develop calendar including goal, 2-3 solutions to achieve goal	Responsibility Phase	Self-intervention		
Implement selected solutions for 3 day period (week-end) keeping calendar to tally times/day solutions occur	Responsibility Phase	Self-intervention	Try out solution on trial basis	

Table 1 (continued)

Components of Behavior Change Strategy	Activated Health Education AHE Model[1]	Self Management Techniques[2]	Problem Solving Plan[3]	Concept of Goal Setting[4]
Evaluate successes and failures and revise solution plans accordingly	Responsibility Phase	Relapse prevention	Compare actual costs & benefits to what was expected	Feedback (motivating individual to develop relevant strategies over time)
Continue implementing solutions (same/revised) for 3 more days (weekdays)	Responsibility Phase	Self-intervention	If solutions worked, implement on larger scale or rework	
Monitor relapse situations, with focus on reasons to continue plan	Responsibility Phase	Relapse prevention		
Evaluate successes and failures and revise solution plans accordingly	Responsibility Phase	Self-intervention		Feedback
Continue implementing solutions for 3 more days keeping food record of all foods eaten	Responsibility Phase			
Evaluate food records focusing on nutrient goal	Outcome Evaluation			Feedback (Prolonged effort over time)
Make implementation a natural part of life		Integrating self management project into your life		

[1](26).

[2](31).

[3](34).

[4](33).

listed in sequence as they occurred in the classroom setting. A unique feature of this behavior change strategy is goal setting for nutrient improvement by each adolescent, individually, based on his/her personal nutrient analysis. Each person made a written committment to achieve a specific nutrient goal, based on a personal assessment of his/her individual needs and interests. The framework for this strategy was drawn from a model, a technique, a process, and a concept. The application of these ideas to the behavior change strategy is shown in Table 1. The strategy was structured to include a series of implementation days followed by evaluation/feedback sessions. Neither was the researcher present in the classroom nor was nutrition taught during implementation days to allow adolescents to take personal responsibility for achieving goals.

Theoretical Framework of Behavior Change Strategy

The theoretical framework for this study was developed by incorporating several fundamental concepts from a series of sources as shown in Table 1. These fundamental concepts include personalization, goal setting, self-management, self-implementation, structured feedback, and structured self-evaluation.

Personalization was achieved by implementation of the

three phases of the Activated Health Education model (26)--experiential, awareness, and responsibility. The experiential phase, which included measuring and recording target health behaviors, consisted of each student keeping food records and receiving a computerized nutrient analysis printout. The awareness stage included activities designed to help adolescents assess positive and negative influences on food intake. BC+ group had a more developed awareness stage which included such things as filmstrips, videos, worksheets, demonstrations, and lectures to: 1) focus on the RDAs for all individuals; 2) learn about the relationship of nutrient recommendations to adolescent growth and development; 3) evaluate personal susceptibility to lifestyle diseases; and 4) investigate lifestyle factors affecting nutrient intake. The responsibility stage included developing the self-management program for improving target behaviors, identifying barriers to establishing behaviors, and participating in feedback sessions.

The goal setting concept (33) was applied to the behavior change strategy because of the belief that behavior change, as measured by positive change in nutrient intake, would occur when adolescents select a specific nutrient for improvement and work toward accomplishment of that specific goal. Knowledge of performance, or feedback,

was an important part of the goal setting concept incorporated into the behavior change strategy. Feedback was seen as important to give adolescents direction and to increase motivation, effort, and persistence.

The concept of self-management (31) was implemented because it involves steps concerned with changing a specific behavior. This technique provided an environment for teaching skills for changing food-related behaviors and the structure for self-intervention and self-evaluation.

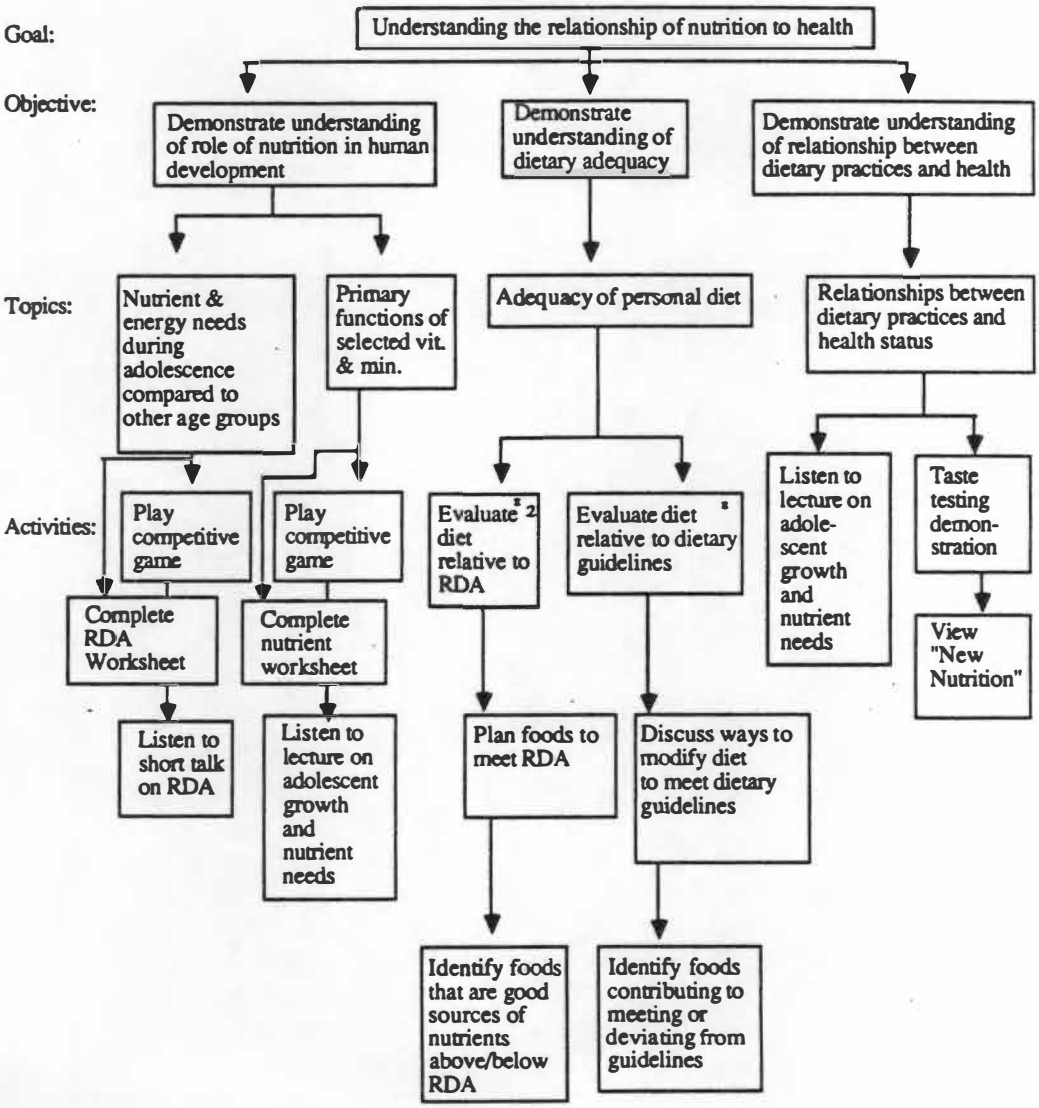
The problem solving process (34) as described in TENN (23) was incorporated because it added a systematic approach to the process of achieving nutrient improvement. Application of this process involved identifying a problem nutrient and planning self-intervention and self-evaluation.

Development of the Behavior Change Strategy for the Classroom

The four goals of the TENN plan, grades 10-12, (141) are presented in Tables 2-5. Goal IV (Table 5) formed the basis for designing the behavior change strategy. Goal IV focuses on one's personal role and adequacy in solving food and nutrition-related problems and was developed around the problem-solving process (34).

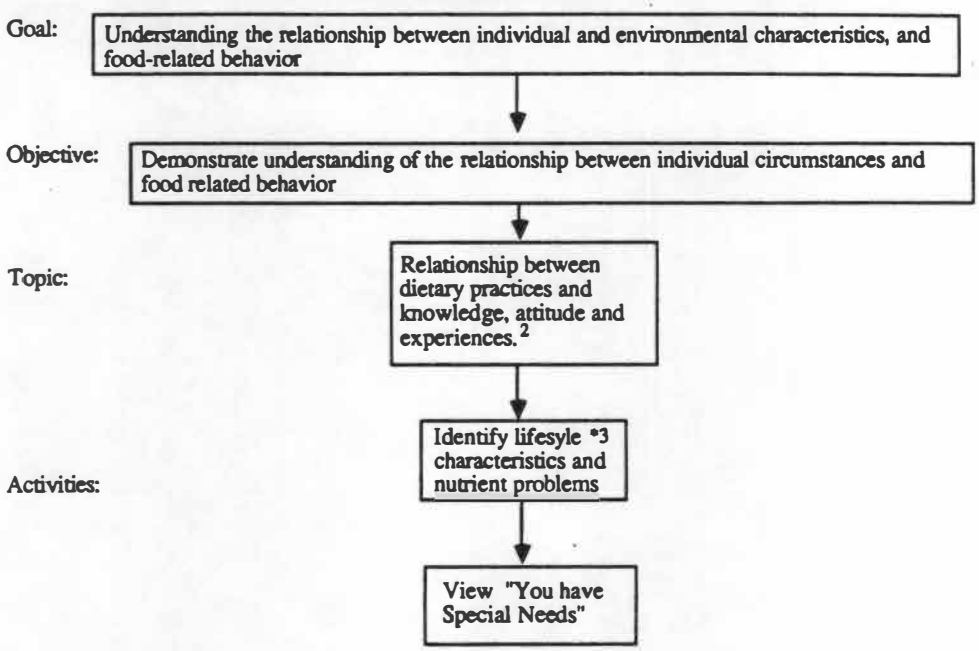
A problem-solving approach was considered a desirable

TABLE 2. Activities Planned to Fulfill TENN Plan[1] Goals and Objectives: Goal I.



Note: [1] Modified from TENN Plan Grades 10-12 (23).
[2] *Means activity was part of Behavior Change, as well as, Behavior Change Plus unit.

TABLE 3. Activities Planned to Fulfill TENN Plan[1] Goals and Objectives: Goal II.

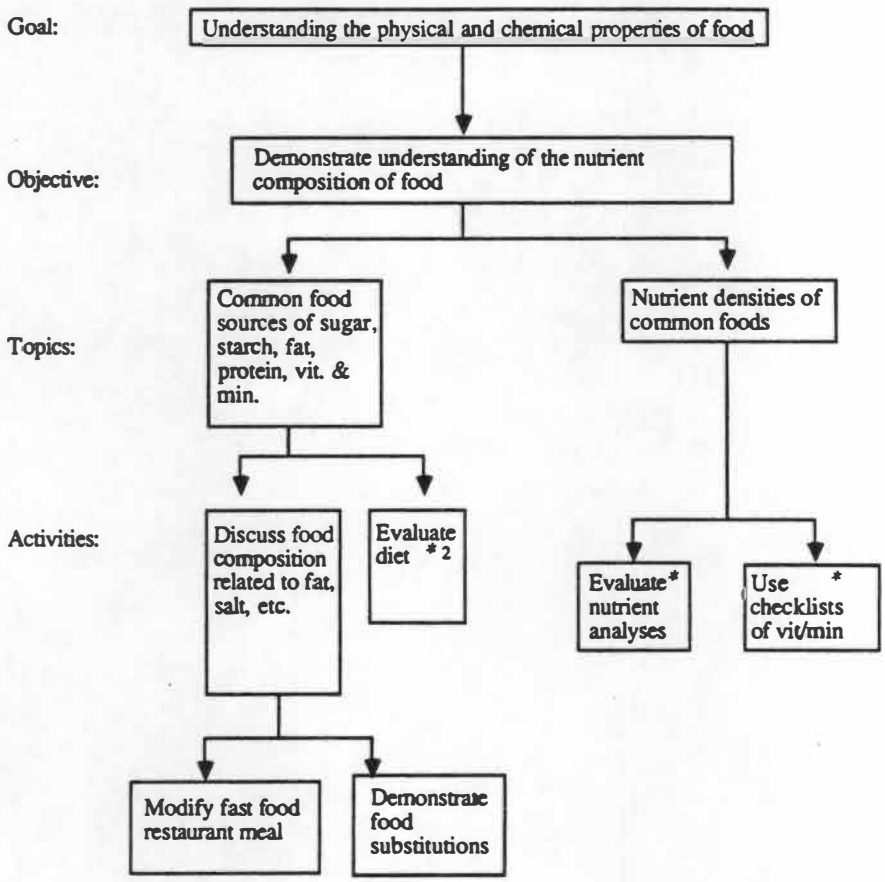


Note: [1] Modified from TENN Plan, Grades 10 - 12 (23).

[2] Topic is from TENN Plan, Grades 7 - 9. (99).

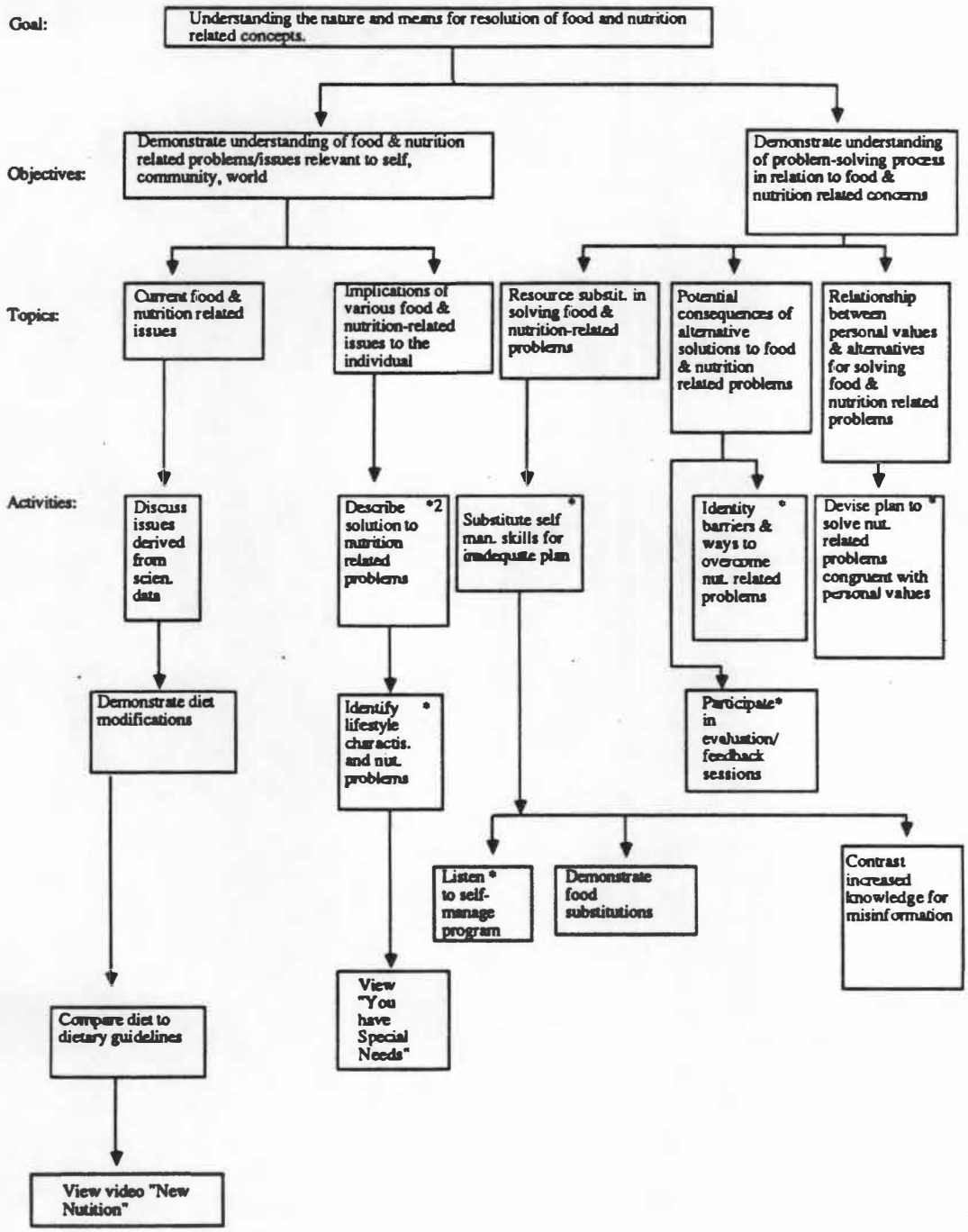
[3] *Means activity was part of Behavior Change, as well as, Behavior Change Plus unit.

TABLE 4. Activities Planned to Fulfill TENN Plan[1] Goals and Objectives: Goal III.



NOTE: [1] Modified from TENN Plan, Grades 10 - 12 (23)
[2] * Means activity was part of Behavior Change, as well as, Behavior Change Plus unit.

TABLE 5. Activities Planned to Fulfill TENN Plan [1] Goals and Objectives: Goal IV.



Note: [1] Modified from TENN Plan, Grades 10-12 (23).
[2] *Means activity was part of Behavior Change, as well as, Behavior Change Plus unit.

way to teach skills in dietary planning. The importance of skills training has been emphasized by Story and Resnick (18). These researchers identified two aspects of skills training as necessary: 1) the ability to verbalize appropriate total daily food choices; and 2) the opportunity to participate in a "how to" process. Self-management techniques were chosen as a structured step-by-step plan of action to teach dietary skills for behavior change.

Personalization of the strategy was operationalized by giving each student a computer printout of his/her own nutrient analysis from the first set of three-day food records. A dietary assessment microcomputer software package, Nutritionist III (142) was used to generate the computer printouts, which were used as teaching tools. Each adolescent received mean values of fourteen dietary components given in actual amounts and as percentages of the RDAs, when applicable. Mean values were presented in graph and tabular form. The printout also included a list of all foods eaten with the amount of each of the fourteen dietary components in each food listed separately. For example, if an adolescent had eaten cheese, bread, and lettuce, the amount of calcium in cheese, bread, and lettuce was listed separately. This format enabled

adolescents to identify foods in their diet that were good or poor sources of each dietary component.

To implement the concept of goal setting, adolescents set goals to improve intakes of a specific nutrient based on their personal nutrient analysis printout. Instruction became very specialized at that time because each adolescent focused only on one nutrient. From the perspective of their own nutrient goal, adolescents were taught dietary assessment and how to incorporate nutrient-rich foods into their diets.

Assessing one's lifestyle as it related to the intake of the selected nutrient was personalized also. By using information recorded on the food record forms adolescents identified their personal lifestyle characteristics (i.e., sleeping late and missing breakfast). Solutions to changing food-related behavior were made in relation to personal lifestyle.

Instructional materials were developed and adapted from materials by Yates (31) to incorporate the self-management technique (Appendix A). The worksheet entitled Matrix Madness was used to assess lifestyle characteristics. The worksheet entitled Summary Questions was used to summarize findings.

Adolescents used brainstorming to identify all possible solutions to their nutrient problems. Through a

cost/benefit analysis, using the worksheet entitled Decision Making Sheet, they chose two or three solutions to implement on a trial basis. To accomplish this, adolescents identified the benefits and costs of implementing each potential solution. They rated the benefits and costs, using a scale from 1-10, to signify the importance of each cost or benefit. For example, if an adolescent selected "to drink milk at lunch" as a solution for improving calcium intake, the benefit might be "easy to get" and the cost might be "have to stop drinking coke." The adolescent gave a numerical rating to describe the importance to him/her of the benefit, "easy to get", and to describe the importance to him/her of the cost, "have to stop drinking coke." If "easy to get" were a very important consideration to the adolescent, a rating of 9 might be given; if "have to stop drinking coke" was mildly important, a rating of 5 might be given. By subtracting the numerical rating given the cost from the numerical rating given the benefit, the net benefit of the solution "to drink milk at lunch" was identified, which in this example would be +4. After all potential solutions were rated, the two or three solutions with the highest positive net benefit were selected for implementation.

The Goal, Solutions, and Achievements Calendar (GSA Calendar) was developed as an aid to implementation and as

a source of instant feedback. Tally marks were placed on the calendar every time one of the solutions was performed.

Solutions were implemented for two sets of three-day periods, one including the two week-end days and the other weekdays. After each set of three-day periods, adolescents evaluated their successes and failures and received feedback from the researcher. To evaluate successes and failures, the worksheet entitled Evaluation Form (Appendix A) was used. The column labeled "Successes" identified solutions that worked. The column labeled "Failures" identified solutions that did not work. "Problems" identified trouble in accomplishing solutions, i.e., running out of milk on the second day of implementation. The column labeled "Solutions" identified solutions the adolescents developed for the failures/problems which had occurred and laid the foundation for developing solutions for the next three-day stage of implementation. Adolescents revised the GSA Calendar with new solutions as needed/desired. During the evaluation/feedback sessions, adolescents used checklists of nutrient sources, described in the next section, to record and compare nutrient intake to the RDA for the selected nutrient.

During the third three-day implementation period, a complete record of all foods eaten was kept. Three-day food records, identical to those kept during the three-day

pre-asssessment period, were used. This was the post-assessment for the research study, as well as a means for adolescents to assess progress in accomplishing goals. Final classroom evaluation included a reassessment of lifestyle factors affecting nutrient intake. This was accomplished with a Matrix Madness worksheet that was compared to the first Matrix Madness worksheet, which had been filled out using the pre-assessment food record. Nutrient checklists were completed and compared to previous checklists to assess improvement. In the process of working through the self-management process, the concepts of self-evaluation and feedback were implemented.

Development of Nutrient Checklists

Checklists of target nutrients were used by adolescents to identify good food sources of each specified nutrient. This format was chosen to allow adolescents quick and easy assessment of their progress, as well as to double as a tool for identifying nutrient sources. The nutrient checklists served as feedback and reinforcement instruments.

Checklists were developed for five target nutrients--iron, calcium, vitamin A, vitamin C, and folacin. These nutrients were selected because past research studies identified iron, calcium, and vitamin A as nutrients

consistently low in adolescents' diets (7, 9, 52). Vitamin C was considered important because of its role in iron absorption (5). Folacin was included because of its need during rapid growth, as during the adolescent period.

The basis for developing the checklists was the share system. The share system, a way of expressing food values, was first described by Mary Swartz Rose in 1927 (143). Later in 1959, Taylor wrote Food Values in Shares and Weights (143). The share system expresses nutrient intake in portions, or shares, based on the daily caloric intake of the "reference" man, as recommended by the Food and Nutrition Board of the National Research Council. When Food Values in Shares and Weights was written, the Food and Nutrition Board of 1958 recommended a daily allowance of 3200 calories for the "reference" man, identified as a 25-year old, 70 kilogram male. For the current study, shares were calculated based on the current caloric recommendations of 2700 calories for the 70 kilogram male and adapted for adolescents.

The reasoning behind the share system is that if a man needs 2700 calories daily, 100 calories will furnish 1/27 of the day's requirement, and the diet will be composed of 27 portions, or shares. Each share should contain 1/27 of all other essential nutrients, and the reference man will need 27 shares of each essential nutrient daily. To

determine the value of one share of each of the essential nutrients for which a recommended dietary allowance has been established, the RDA for each nutrient is divided by 27.

The checklist design was adapted from the iron checklist developed by Hertzler and McAnge (144) whose work also was based on the share system (143). To determine the number of shares of each target nutrient needed daily, the RDA for each nutrient for male and female 15-18 years old was divided by the value of 1 share for the "reference male". Table 6 presents this information.

Nutritive Value of Foods (145) was used to compile a list of food sources of the nutrients. Foods selected were compared with those listed as good sources of the specified nutrients in Nutrition in Health and Disease (146).

The iron, calcium, vitamin A, vitamin C, and folacin checklists contain 12, 10, 15, 15, and 13 foods, respectively (Appendix B). The number of shares/servings of food was calculated by dividing the nutrient amount contributed by one serving of food by the value of one share. Nutrient composition of several foods was an average of varieties of the same food. For example, greens included spinach, kale, mustard greens, and turnip greens. Cheese included cheddar, mozzarella, pasteurized process American, and swiss.

Table 6. Number of Shares Needed Daily to Meet the RDA for Selected Nutrients for Males and Females 15-18 Years Old.

RDA for:	Value of 1 Share		No. of Shares Needed Daily
15-18 yr. female			
18 mg iron	0.4 mg	=	45
1200 mg calcium	30.0 mg	=	40
800 RE vitamin A	37.0 RE	=	22
60 mg vitamin C	2.2 mg	=	27
400 ug folacin	14.8 ug	=	27
15-18 yr. male			
18 mg iron	0.4 mg	=	45
1200 mg calcium	30.0 mg	=	40
1000 RE vitamin A	37.0 RE	=	27
60 mg vitamin C	2.2 mg	=	27
400 ug folacin	14.8 ug	=	27

To aid adolescents' conceptualizations of the share system, share values were converted to a percentage scale base. The word "share" was referred to as "point", so that meeting the dietary recommendation would be equivalent to 100% and falling short of that mark would be readily conceptualized as meeting some fraction of 100, for example, 75% of the nutrient allowances.

The checklists were tested for accuracy by using each to calculate nutrient points of 10 diets compared to a computerized nutrient analysis of foods consumed.

Development of Nutrition Education Units

The goals and objectives developed in TENN (141) were used to structure two nutrition education units. The BC unit was composed of only the behavior change strategy, and the only nutrition information given to this group was specific to that needed to work through the behavior change process. The cognitive component added to the BC+ unit involved information about all nutrients and was presented to all students. Sources and functions of all target nutrients were presented to all students using various teaching techniques. Rationals for making good nutrient choices were associated with good health, lifestyle, disease prevention, and adolescent nutritional needs during growth and development. The flow charts presented in

Tables 2-5 show unit development: goals, objectives, topics, and activities. The instructional formats are shown in Appendix C.

Sequence of Research Study

Table 7 shows the sequence of the research study organized by group--BC, BC+, and control. The first column labeled "Day" indicates on what day of the study specified activities occurred. The second column "Topic" lists the title of the lesson or activity for the day. The researcher was in the classroom twelve days for the BC+ treatment group and eight days for the BC treatment group. These study days do not count ten minutes of class time used on an additional day to collect pre-assessment food records. The four day difference provided time to incorporate the cognitive component into the BC+ nutrition education unit. This variation seems reasonable because the length of a nutrition unit has not been shown to correlate with student learning, as measured by change in knowledge or dietary scores (14, 147). The "Measurements" column identifies instruments used for evaluation. Food record forms also were used for instructional purposes.

Table 7. Sequence of Research Study

11	Behavior Change (BC)		Behavior Change Plus (BC+)		Control	
DAY	Topic	Measurement	Topic	Measurement	Topic	Measurement
1	How to complete food record forms Assessment of PAK *	Food record form PAK Instrument	How to complete food record forms Assessment of PAK	Food record form PAK Instrument	How to complete food record forms Assessment of PAK	Food record form PAK Instrument
3-5	Keep food records		Keep food records		Keep food records	
6	Collect food records		Collect food records		Collect food records	
12	Intro / Expectations Compare diet to RDA/Dietary Guidelines					
13	Food-related problems associated with lifestyle		Intro/Expectations Compare diet to RDA			
14	Solutions to nutrient problems		** Improving my diet			
15	Develop GSA calendar		**Compare diet to dietary guidelines			
16	Implement plan over week-end					
19	Evaluate/Feedback/Revise		**Adolescent Growth and Nutrient Needs			
20	Implement plan during week days		**Nutrient problems related to lifestyle characteristics			
21			Food-related problems associated with lifestyle			
22			Solutions to nutrient problems			
23	Evaluate/Feedback/Revise; K test Begin 3 day food records	K portion of PAK Food records	Develop GSA calendar Implement plan over weekend			
26			Evaluate/Feedback/Revise			
27	Pick up 3 day food records Give back K test Success / failure / problem / solution Assessment of AP; Rating Instrument	AP portion of PAK Rating Instrument	Implement plan during week days			
30			Evaluate/feedback/revise, K test Begin 3 day food records	K portion of PAK; food records		
34			Pick up 3 day food records Give back K test Success / failure / problem / solution Assessment of AP; Rating Instrument	AP portion of PAK Rating Instrument		
36					Assessment PAK Food record forms	PAK Instrument Food record forms
41					Collect Food records	

*PAK Instrument is Practices, Attitude, and Knowledge Instrument.

** Indicates topic was part of cognitive component.

Development of Evaluation Instruments

Operationalization of Variables

To measure food-related behavior, three-day food record forms (Appendix D) were used. These were designed to provide a quantitative record of average daily food intake; nutrient analyses of these data provided average intakes of fourteen dietary components. In addition, food-related behavior was measured with a written questionnaire to assess general food practices [Practices Instrument (PI), Appendix E].

To measure attitudes and knowledge of adolescents, the Attitude Instrument (AI) and Knowledge Instrument (KI) were designed. These instruments were combined with the Practices Instrument to form the Practices, Attitude, and Knowledge Instrument (PAK) (Appendix E).

To measure adolescents' perceptions of activities that facilitated their own behavior change, the Rating Instrument (RI) was developed (Appendix F).

Food Record Forms

The three groups (BC, BC+, and control) completed three-day food record forms (Appendix D). One food record form, used by the control group, was designed to record food intake only. The other food record form was designed to help adolescents in the treatment groups (BC and BC+)

record not only food intake, but also monitor circumstances that surrounded food intake. Monitoring included the time of intake, feelings before and after eating, with whom they ate, place, what they were doing while eating, and who prepared the food, as well as providing descriptive information about type of food. For all adolescents selected demographic information was requested on the food record form (height, weight, age, and gender).

The recording period included one week-end day for representativeness of usual food intake. The researcher used measuring cups and spoons and glasses of different sizes to demonstrate techniques for estimating portion sizes and to increase students' accuracy in reporting their food intake.

Practices Instrument

To measure food-related behavior in general, the PI was constructed of twelve statements (Appendix E). Responses were elicited, using a five point scale from "always true" to "never true". The Dietary Guidelines (148) were used as a guide in developing statements. Other resources used were Health Style--A Self Test (149) and Teen Wellness Check (150).

Attitude Instrument

To measure adolescents' attitudes toward nutrition, AI was modified from other published scales (Appendix E) (92, 93). AI was designed with 17 statements selected from the flexibility-rigidity scale (8 statements) developed by Carruth and Anderson (92) and the "nutrition is important" scale (9 statements) developed by Sims (93). Ten statements were originally in the attitude factor "nutrition is important" developed by Sims, but one statement was eliminated for this study because it was not applicable to adolescents. Recorded reliabilities of the 10 item scale ranged from .76 to .84 (94).

Knowledge Instrument

KI (Appendix E) was designed with 25 multiple choice questions. Using a table of specifications based on the nutrition education units developed for this study, test questions were compiled from tests developed by Skinner and Woodburn (89), Woolcott et al. (137), and Brush et al. (151). In addition 5 new questions were developed and evaluated, according to the learning outcomes comprising Bloom's cognitive domain (22). All questions were structured to meet criteria ranging from knowledge to application.

Rating Instrument

Adolescents were asked to indicate how helpful each of the activities listed on RI was in contributing to behavioral change. They responded on a five-point scale ranging from "very helpful" to "very unhelpful". Two forms of RI were designed. One form for the BC group listed nine activities comprising only the behavior change strategy. The other form for the BC+ group included evaluation of the same nine activities plus five additional activities reflective of the cognitive component.

Two open-ended questions were included for BC and BC+ as an opportunity for the respondents to describe additional activities in the education unit perceived as helpful in changing behavior. Any activities/modifications they could suggest for future classes were requested.

Pilot Project

Prior to initiating the research study, a pilot project was done. One school was selected for this purpose from a pool of schools remaining after the study sample was drawn. Contacts with the principal and a designated teacher were made in the manner stated previously. The teacher selected two classes to participate in the pilot study, which was conducted during the first month of the 1987-88 school year. One class (39 students) was designated the BC+ group

and the other class (34 students) was the BC group. Each nutrition education unit was conducted in its entirety. All instruments and instructional materials were tested. Written and verbal comments from students and classroom teacher were elicited for feedback/evaluation purposes.

The pilot study indicated the alloted time for each unit was adequate and the amounts of instruction and planned activities were reasonable. Several instruments and instructional materials were revised. The PAK Instrument was too long because some students were unable to finish all questions. Because five questions on KI were not addressed during the unit, these questions were deleted from the final instrument, resulting in 25 questions.

Some students were confused by the initial ranking scale format of RI so a rating format was selected. One of the instructional materials, "Strengths and Weaknesses of Food Intake", (same for BC and BC+) proved to be very confusing and time-consuming. This handout was revised with explicit directions, including examples. Minor changes were made on other handouts.

Two weeks after completion of the pilot study, the research study began.

Data Collection

Nutrition education intervention and collection of evaluation data occurred from October through December 1987. All teaching and data collection were conducted by the researcher. Table 7 shows the sequence of the research study, indicating the timing of assessment instruments.

Data collection involved two stages. The first stage preceded nutrition intervention and included administration of PAK and collection of three-day food records from the three groups--BC, BC+, and control. The second stage occurred at the end of nutrition intervention and included administration of PAK and collection of three-day food records for all three groups. In addition, both treatment groups completed RI.

Statistical Analysis of Data

Coding and Checking

Prior to statistical analysis, pre- /post-assessment food record forms and questionnaires were coded, checked, and verified for accuracy. The mean of three-day intakes from the computerized nutrient analyses were transferred to coding forms. Items on PI and AI were scored from 1 to 5, 5 being the most desirable response. Because most desirable responses were scored as 5, 11 of the 17 attitude

statements were reverse coded. Responses from KI were transferred to coding forms for computer scoring.

Descriptive Statistics

Using pre- /post-assessment food records, means of the three-day food records for fourteen dietary components were calculated for each adolescent. Dietary components selected for consideration included: energy, protein, fat, carbohydrate, calcium, iron, vitamin A, vitamin C, vitamin B_{12}, folacin, cholesterol, dietary fiber, sodium, and caffeine. Nutritionist III (142), a microcomputer software package, was used for this purpose. Certain foods, for example calcium-fortified orange juice and low salt crackers, were added to the data base for more accurate reflection of the total food intake.

Frequency distributions and means, when appropriate, were tabulated for demographic data from the pre-assessment, using the Statistical Analysis System (SAS) (152) FREQ and MEANS procedures. General descriptive statistics were generated for questionnaire data using the same SAS (152) procedures. The number of correct responses on the pre-assessment KI was summed, as was the number of correct responses on the post-assessment KI. This procedure provided nutrition knowledge scores for the pre- and post-assessment instrument. Scores were generated and

mean values calculated for pre- and post-assessment PI and AI. Mean scores were generated also for individual items on the PI and AI.

Responses on the pre-assessment AI were factor analyzed with SAS (152) FACTOR procedure, with Varimax rotation. This procedure provides iterated principal factor analysis with orthogonal rotation. Four meaningful attitude factors were retained to explain the greatest percent of variability among adolescents. Each factor had three or more primary loadings greater than .40 and an eigenvalue greater than one. A fifth factor, which explained 15% of the variability and had two primary loadings greater than .40 and an eigenvalue greater than one, was dropped because it did not add any additional meaningful information. The factors, presented in Table 8, were labeled descriptively. A high score on Factor 1, labeled "No Simple Solution", indicates a perception that there is more to good nutrition than satisfying a single condition, such as drinking milk or maintaining desirable weight. A low score on this factor indicates the adolescent perceives there is no need to worry about nutrition if one satisfies a certain condition. Factor 2 is a measure of how flexible or rigid the adolescent may be in making changes in food intake. Adolescents with a high score on Factor 2 would be considered more flexible and, therefore, "Willing to Try

Table 8. Results of Factor Analysis of Attitude Responses of 168[1] Adolescents.

Factor	Descriptor	Percent of Variance	Factor Loading	n[2]	Primary Attitude Statement[3]
1	No Simple Solution	23.74	0.75	14	If I drink milk, I still need to worry about nutrition.
			0.61	16	Even if I maintain a desirable weight, I still need to worry about nutrition.
			0.58	15	Even if I am satisfied with foods I eat, I still see a reason to change.
			0.48	13	Even if I eat a lot of food, nutrition is important to me.
			0.48	7	Learning basic ideas in nutrition will probably alter my personal eating habits.
			0.45	11	I feel the foods I eat will affect my future health.
2	Willing to Try New Foods	21.46	0.84	5	I would be willing to try an unfamiliar food at least once.
			0.74	12	Trying new foods appeals to me.
			0.73	3	I usually will try a food even if its appearance is similar to something I dislike.
3	Interested and Will Use Nutrition Knowledge	20.71	0.67	6	I have time to think about nutrition.

Table 8 (Continued)

Factor	Descriptor	Percent of Variance	Factor Loading	n[2]	Primary Attitude Statement[3]
			0.64	2	Knowing something is "good for me" influences what I choose to eat.
			0.60	17	In actual practice my nutrition knowledge influences what I select to eat.
			0.53	7	Learning basic ideas in nutrition will probably alter my personal eating habits.
4	Concerned about Nutrition	18.21	0.75	10	I am concerned about eating nutritious foods throughout the day.
			0.67	1	Nutrition is important to me and one should not be careless about it.
			0.46	9	I feel the person who gets most satisfaction out of food tries foods that are unfamiliar.

[1]Includes all adolescents for whom attitude data were obtained.

[2]Question number in original instrument; see Appendix E.

[3]Original statements were reverse coded when appropriate; statements presented here reflect this coding.

New Foods." Factor 3 relates to the adolescent's interest in and willingness to use nutrition knowledge: high scores indicate an adolescent is interested and willing to use nutrition knowledge. Factor 4 relates to the adolescent's concern about nutrition; high scores indicate high concern for nutrition.

Pre-assessment AI was scored using the scoring coefficients for each factor for the 17 items, using SAS (152) Score procedure. These same scoring coefficients were used to score the AI post-assessment. With responses forced into the four factors, Pearson's correlation coefficients of the four factors on the pre-assessment with the four factors on the post-assessment are shown in Table 9. A difference score between pre-assessment and post-assessment was calculated.

For items on RI, a group mean score was generated to indicate adolescents' perceptions of how helpful the behavior change strategy had been. Mean scores for individual items also were generated. SAS (152) PROC MEANS was used for these procedures.

Pre- /and post-assessment data from the control group were used to generate reliabilities using the test/retest method. Pearson's product moment correlations were generated for PI, AI, and KI, using SAS (152) procedure PROC CORR.

Table 9. Correlation of Pre-Assessment Attitude Factors with Post-Assessment Attitude Factors.

Pre-Assessment	Post-Assessment			
	Attitude 1[1]	Attitude 2	Attitude 3	Attitude 4
Attitude 1	.55[2]	.03	.10	.15
Attitude 2	.06	.61	.10	.07
Attitude 3	.00	.04	.65	.15
Attitude 4	.25	.07	.09	.34

[1]Attitudes: 1. No Simple Solution; 2. Willing to Try New Foods; 3. Interested, Will Use Nutrition Knowledge; 4. Concerned about Nutrition.

[2]Pearson's r.

Statistical Models

All of the models were tested using SAS (152) GLM procedure. Least-squares means, using the option LSMEANS, were computed for all dependent variables by each independent variable. Least-squares means, or least-squares estimates of marginal means, are appropriate when the experimental design is unbalanced. The statistic is an estimator of class means that would have been expected if the design had been balanced (152). A significance level of .05 was the criterion used for all analyses.

Hypotheses I-V (pages 6, 7) were tested with the following model: a mathematical model incorporating both continuous and classification variables as independent variables. The six dependent variables were the difference scores generated for nutrients (calcium, iron, vitamin A, vitamin C, folacin, and sodium) from pre-assessment to post-assessment. These nutrients were those selected by adolescents as goals for nutrient improvement. Three other dietary components (fat, fiber, and complex carbohydrates), which also were selected as goals for nutrient improvement, were not included in this analysis because only a small number of adolescents chose these goals; thus cell sizes were too small for statistical analysis.

Independent variables tested for effect on behavior

change included: 1) treatment group, with two levels BC and BC+; 2) school nested in treatment, which included four schools, two in each treatment; 3) gender of adolescent; 4) goal set by adolescent, including one of six goals; 5) four attitude factor scores; 6) pretest knowledge score; and 7) posttest knowledge score.

The following hypotheses relate to all three groups--BC, BC+ and control.

Hypothesis VI (page 7) was tested with an analysis of variance model. The dependent variables were 14 difference scores computed from pre- and post-assessment mean nutrient intakes of the 14 nutritional components printed on the nutrient analysis printout. The independent variables were treatment, school nested in treatment, and gender.

Hypotheses VII and VIII (pages 7) were tested with an analysis of variance model. The dependent variable was either the difference score generated from pre- /post-assessment KI or PI. The independent variables were treatment, with three levels BC, BC+, and control, and school nested in treatment, which included six schools, two in each group.

Hypothesis IX (page 8) was tested with an analysis of variance model. The dependent variables were four

attitude difference scores; independent variables were treatment, school nested in treatment, and gender.

Approval of Human Subjects Committee

In accordance with university regulations regarding research with human subjects, all procedures and test instruments were reviewed by the University of Tennessee Committee for the Protection of Human Subjects. The project was conducted with its knowledge and approval. Approval of the larger project, AES-TN 750, has been granted by the University of Tennessee Committee for Protection of Human Subjects. Participation in the research study was voluntary for both adolescents and teachers. Parental approval for adolescents was obtained because they were under eighteen years of age. No fees/gratuities were paid for participation in the study.

CHAPTER VI

RESULTS

Descriptive Characteristics of Sample

Table 10 shows the number of adolescents who participated in the study, characterized by gender, treatment, and status of data collected. Data collected are designated complete, which identifies all adolescents for which all pre- /post-assessments were available; incomplete, which identifies adolescents for whom at least one of the assessment instruments was missing; and no permission, which identifies adolescents who chose (or parents chose) not to be included in the study and for whom the only data assessed were scores on pre- /post-assessment knowledge instrument.

The total number of adolescents enrolled in the twelve classes in the six schools combined was 298: 92 in BC, 87 in BC+, and 119 in control. Complete data were received by 55%, 67%, and 42% of the students in the BC, BC+, and control groups, respectively. Several reasons are given for incomplete data: 1) adolescents joined class after the pre-assessment (n=3); 2) adolescents did not complete

Table 10. Total Number of Adolescents Characterized by Group, Gender, and Status of Data Obtained.

Group	Males	Females	Total
Behavior Change:			
Complete Data	25	26	51
Incomplete Data	16	7	23
No Permission	13	5	18
Behavior Change Plus:			
Complete Data	28	30	58
Incomplete Data	7	6	13
No Permission	13	3	16
Control:			
Complete Data	18	32	50
Incomplete Data	8	15	23
No Permission	22	24	46

pre-assessment food records (n=11); 3) adolescents did not follow through with post-assessment food records (n=37); 4) adolescents were unable to perform all tasks because of reading level (classified as learning disabled) (n=2); or 5) adolescents' food records were lost in the mail (n=6). Eighty of the 298 (27%) did not give permission to be included in the study [learning disabled adolescents in treatment schools (n=11); other adolescents in treatment schools (n=23); adolescents in control group (n=46)]. Adolescents in the control group without permission to participate in the study did not complete any food records. For those with complete data, distribution of males and females was similar (Table 10), except in the control group in which there were more females than males. Combining all three groups--BC, BC+, and control--percentages of adolescents at each grade level were as follows: 37%, ninth grade; 32%, tenth grade; 28%, eleventh grade; and 3%, twelfth grade. Mean ages of adolescents in each treatment were as follows: BC, 15.1; BC+, 14.9; control, 15.3 years of age. Other characteristics of the sample are reported in Appendix G.

Pretest Mean Nutrient Intake

Table 11 presents the pre-assessment three-day mean nutrient intake by the three groups--BC, BC+, and control--

Table 11. Pre-Assessment Mean Nutrient Intake By Group--Behavior Change, Behavior Change Plus, and Control.

Dietary Component		Behavior Change n=51 (26/25)[1]	Behavior Change Plus n=58 (28/30)	Control n=50 (18/32)
Energy (kcal)	Male	2186 ± 681[2]	2224 ± 664	2682 ± 897
	Female	1710 ± 563	1735 ± 727	1832 ± 559
Carbohydrate (g)		256 ± 95	250 ± 94	273 ± 102
Protein (g)		69 ± 25	72 ± 31	76 ± 33
Fat (g)		74 ± 26	78 ± 32	85 ± 37
Iron (mg)		14 ± 8	12 ± 6	12 ± 5
Calcium (mg)		870 ± 436	801 ± 456	894 ± 394
Vit A (IU)	Male	3210 ± 2290	4335 ± 4059	4108 ± 3769
	Female	3059 ± 3062	2365 ± 1713	3816 ± 6415
Vit C (mg)		65 ± 43	62 ± 51	106 ± 62
Vit B_{12} (ug)		3.72 ± 2.92	3.54 ± 2.39	3.88 ± 2.20
Folacin (ug)		235 ± 190	183 ± 124	224 ± 103
Sodium (mg)		2992 ± 1177	2975 ± 1471	3077 ± 1343
Dietary Fiber (mg)		8.45 ± 4.42	7.81 ± 3.78	8.98 ± 3.53
Cholesterol (mg)		185 ± 119	250 ± 178	239 ± 152
Caffeine (mg)		57 ± 36	77 ± 43	62 ± 43

[1]Number males/females in group.

[2]MEAN ± SD.

for the fourteen dietary components. Because the primary interest of this study was to investigate change in intake of specific nutrients defined by individual adolescents as goals for nutrient improvement, Table 12 presents the pre-assessment mean nutrient intake for adolescents by goal. Number of adolescents who set a goal for each nutrient is shown by treatment, as well as by both treatments combined. The control group is not shown in Table 12 because goals were not set in this group; goal setting was unique to the behavior change strategy.

Positive Changes by Goal

The numbers of adolescents who made positive changes by goal are shown in Appendix H. Overall 67% of the adolescents made positive changes in dietary component intake. Changes in percentages of the RDAs from pre-assessment to post-assessment for nutrients selected as goals are shown in Appendix I.

Results of Hypotheses Testing

The R^2 values--the amount of variability in change in nutrient intake which can be accounted for by the model--are given in Table 13. The R^2 values for the 6 models ranged from 0.54 for folacin to 0.37 for vitamin C.

Table 12. Pre-Assessment Mean Nutrient Intake by Goals, Separated and Combined by Group.

Nutrient Goal		n	Behavior Change	n	Behavior Change Plus	n	Combined
Iron (mg)		13	12.1 ± 4.6[1]	8	11.3 ± 4.1	21	11.8 ± 4.3
Calcium (mg)		13	577 ± 278	19	595 ± 253	32	588 ± 260
Vit A (IU)	Male	3	1981 ± 1629	5	3187 ± 1001	8	2735 ± 1311
	Female	5	1938 ± 826	3	1173 ± 315	8	1651 ± 758
Vit C (mg)		4	28 ± 15	7	41 ± 28	11	36 ± 24
Folacin (ug)		4	157 ± 49	6	143 ± 92	10	148 ± 74
Sodium (mg)		7	4582 ± 836	6	4070 ± 1829	13	4346 ± 1346

[1] MEAN ± SD.

Table 13. Test of Hypothesis of Model Predictor Variables on Nutrient Intake for Two Treatment Groups--Behavior Change and Behavior Change Plus.[1]

Predictor Variable	Iron	Calcium	Vitamin A	Vitamin C	Folacin	Sodium
Treatment Effect	3.06[2] .0851[3]	.00 .9790	.81 .3725	.00 .9668	3.96 .0510	.94 .3355
School (Treatment)	.87 .4242	.92 .4019	.36 .7014	.07 .9344	.77 .4683	.00 .9992
Gender Effect	2.59 .1124	9.64*[4] .0029	7.33* .0087	1.97 .1652	8.29* .0054	.94 .3354
Treatment By Gender	1.66 .2026	.32 .5732	.33 .5677	1.58 .2138	1.00 .3200	.19 .6674
Goal Effect	3.33* .0099	7.29* .0001	6.14* .0001	3.47* .0079	3.59* .0064	4.23* .0022
Treatment by Goal	.97 .4450	.81 .5469	1.03 .4062	1.05 .3954	.84 .5296	.60 .7033
Goal By Gender	.73 .6047	1.25 .2970	3.53* .0071	.68 .6403	.45 .8145	1.94 .0999
Attitude 1[5]	.06 .8027	4.49* .0381	.15 .6962	.02 .9010	.45 .5052	2.28 .1357
Attitude 2	.09 .7716	.31 .5798	1.74 .1920	.94 .3356	.37 .5443	.27 .6039
Attitude 3	.19 .6649	1.96 .1668	2.62 .1106	2.08 .1539	2.50 .1187	.83 .3648

Table 13 (Continued)

Predictor Variable	Iron	Calcium	Vitamin A	Vitamin C	Folacin	Sodium
Attitude 4	.49 .4843	1.29 .2604	.50 .4188	6.16* .0157	9.35* .0033	.05 .8226
Pre-Assessment Knowledge	.26 .6100	.49 .4856	.76 .3864	.02 .8933	2.99 .0886	.18 .6687
Post-Assessment Knowledge	1.97 .1655	.39 .5346	.04 .8416	1.26 .2663	4.12* .0467	1.27 .2634
R^2	.44	.51	.42	.37	.54	.39

[1] n = 103 in both groups.

[2] F value.

[3] p value.

[4] * = Significant F values; $p \leq 0.05$.

[5] Attitudes: 1. No Simple Solution; 2. Willing to Try New Foods; 3. Interested, Will Use Nutrition Knowledge; 4. Concerned about Nutrition.

Hypothesis I: There is no difference in change in nutrient intake between two treatment groups, one receiving a behavior change strategy and the other receiving the identical behavior change strategy plus a cognitive component.

This hypothesis is supported. No effect of treatment was seen (Table 13).

Hypothesis II: There is no difference in nutrient intake from pre-assessment to post-assessment when adolescents set a goal for nutrient improvement based on pre-assessment mean nutrient intake.

Hypothesis II is rejected. A strong effect of goal setting was seen (Table 13) as evidenced by the significant effects for each nutrient. Those adolescents who set goals related to calcium, vitamin A, and vitamin C made positive increases. Those adolescents selecting a sodium goal decreased sodium intake as appropriate for this goal. Table 14 shows the LSMEAN nutrient intake differences by goal. Changes in iron and folacin were not significant. Table 15 shows that in accomplishing a decrease in sodium, these adolescents also decreased all other targeted nutrients, except vitamin C. Thus, the effect of goal on folacin and iron (Table 13) can be accounted for by those setting a goal for sodium. Table 16 shows LSMEAN nutrient

Table 14. LSMEAN Nutrient Intake Differences by Goal.

Nutrient Goal	n[1]	Difference
Iron (mg)	21	1.8 ± 1.5[2]
Calcium (mg)	32	384 ± 81*[3]
Vit A (IU) M	8	5383 ± 1478*
F	8	2242 ± 1292
Vit C (mg)	11	86 ± 24*
Folacin (ug)	10	68 ± 53
Sodium (mg)	13	-1378 ± 532*

[1] Behavior change and behavior change plus ~~groups~~ combined.

[2] LSMEAN ± SEM.

[3] * = Change from pre- to post-assessment significant; $p \leq 0.05$.

Table 15. LSMEAN Nutrient Intake Differences for Adolescents[1] with Sodium as a Nutrient Goal.

Nutrient	Differences
Iron (mg)	-9.84 ± 2.8[2*3]
Calcium (mg)	-469 ± 183*
Vit A (IU)	-5168 ± 1395*
Vit C (mg)	-33 ± 28
Folacin (ug)	-225 ± 63*
Sodium (mg)	-1378 ± 532*

[1] n = 13.

[2] LSMEAN ± SEM.

[3] * = Change from pre- to post-assessment significant; $p \leq 0.05$.

Table 16. LSMEAN Nutrient Intake Differences by Goal and Treatment Group.

Nutrient Goal	Behavior Change	Behavior Change Plus
Iron (mg)	0.9 ± 1.9[1]	2.8 ± 2.4
Calcium (mg)	421 ± 120*[2]	346 ± 112*
Vit A (IU)	4260 ± 1600*	3365 ± 1220*
Vit C (mg)	91 ± 32*	82 ± 36*
Folacin (ug)	-34 ± 89	170 ± 73*
Sodium (mg)	-1437 ± 545*	-1320 ± 793

[1] LSMEAN ± SEM.

[2] * = Change from pre- to post-assessment significant within group; $p \leq 0.05$.

intake differences by goal and treatment group. Positive changes in four of the six nutrients in both BC and BC+ groups were made when a goal for specific nutrient improvement was made.

Hypothesis III: There is no effect of pre-assessment test attitude scores on change in nutrient intake.

Hypothesis III is supported generally. As indicated in Table 13, a minimal effect of two of the four attitude factors were related to change in nutrient intake. Attitude factor 1, "No Simple Solution" was related to change in calcium. Attitude factor 4, "Concerned about Nutrition" was related to change in vitamin C and folacin. Significant relationships existed in only 3 of the 24 combinations tested.

Hypothesis IV: There is no effect of pre-assessment knowledge scores on change in nutrient intake.

Hypothesis IV is supported. As seen in Table 13, pre-assessment knowledge scores were not related to change in any nutrient measured.

Hypothesis V: There is no effect of post-assessment knowledge scores on change in nutrient intake.

Hypothesis V is supported for five out of six models.

As seen in Table 13, post-assessment knowledge scores were seen only to affect the change in one nutrient intake, folacin.

The following section will address the independent control variables (school and gender) and effects of interactions among variables presented in Table 13.

Table 13 presents the independent control variables (school and gender) analyzed for effect on nutrient intake for BC and BC+ groups. After goal effect, gender effect made the second most consistent contribution to the change in nutrient intake. As shown in Table 17, gender of adolescent was related to changes in nutrient intake. Males increased intake of calcium, vitamin A, vitamin C, and folacin. Females decreased iron intake from pre-assessment to post-assessment. A goal by gender interaction (Table 13) was observed in the change seen in vitamin A intake. No effect on change in nutrient intake was seen for school or for any other interaction between variables tested.

Hypothesis VI:There is no difference in change in nutrient intake among three groups, one receiving a behavior change strategy, one receiving a cognitive component in addition

Table 17. LSMEANS Nutrient Intake Differences by Gender.

Nutrient	Males n=53	Females n=56
Iron (mg)	-0.2 ± 1.2[1]	-3.1 ± 1.3*[2]
Calcium (mg)	222 ± 77*	-157 ± 88
Vit A (IU)	1244 ± 584*	-1272 ± 669
Vit C (mg)	35 ± 12*	9 ± 14
Folacin (ug)	63 ± 26*	-58 ± 30
Sodium (mg)	-106 ± 223	-451 ± 255

[1] LSMEAN ± SEM.

[2] * = Change from pre- to post-assessment significant; $p \leq 0.05$.

to the behavior change strategy, and one group serving as a control receiving no nutrition education.

Hypothesis VI is rejected. Table 18 presents the test of model predictor variables on dietary component intake for the three groups--BC, BC+, and control. Group had the strongest effect on change. The effect of group on nutrient intake is seen for the following nutrients/dietary components: energy, protein, calcium, vitamin C, folacin, sodium, and fiber. Table 19 shows LSMEAN nutrient intake differences for the three groups. The effect of group can be explained by the decreases in nutrient intake by the control group for the following: energy, carbohydrate, protein, fat, iron, and sodium. For the control group, the differences in change in nutrient intake for energy, protein, fat, calcium, vitamin C, sodium, and fiber were greater than for either treatment group. For folacin, changes in intake for control and BC+ were different, but there was no difference in the change between the control and BC.

The effect of group can be explained also by the positive changes in vitamin C and caffeine that occurred within both BC and BC+; vitamin C increased and caffeine decreased in these groups (Table 19). Positive changes in calcium and folacin, as well as in vitamin C and caffeine, occurred within the BC+ group (Table 19).

Table 18. Test[1] of Hypothesis of Model Predictor Variables on Dietary Component Intake for Three Groups--Behavior Change, Behavior Change Plus, and Control.

Dietary Component	Predictor Variables		
	Group[2]	School (treatment)	Gender
Energy (kcal)	3.17*[3]	.13	.00
	.0450[4]	.9447	.9909
Carbohydrate (g)	2.03	.39	.05
	.1346	.7592	.8268
Protein (g)	3.66*	.44	.01
	.0281	.7246	.9137
Fat (g)	2.95	.14	.10
	.0555	.9384	.7466
Iron (mg)	2.04	2.87*	.08
	.1335	.0384	.7732
Calcium (mg)	5.35*	.90	3.49
	.0057	.4407	.0638
Vit A (IU)	1.43	.74	3.13
	.2432	.5294	.0787
Vit C (mg)	4.58*	1.01	.00
	.0117	.3888	.9753
Vit B_{12} (ug)	1.71	.90	1.61
	.1841	.4427	.2069
Folacin (ug)	3.16*	.92	.73
	.0454	.4319	.3928
Sodium (mg)	3.70*	.40	.00
	.0270	.7559	.9694
Fiber (mg)	3.41*	1.11	1.05
	.0357	.3486	.3074
Cholesterol (mg)	1.26	1.45	1.34
	.2855	.2306	.2487
Caffeine (mg)	1.40	4.14*	.06
	.2497	.0075	.8047

[1] Statistical test--Analysis of Variance.

[2] Total number in three groups = 159.

[3] F value; * = $p \leq 0.05$.

[4] p value.

Table 19. LSMEAN Nutrient Intake Differences for Three Groups--Behavior Change, Behavior Change Plus, and Control.

Dietary Component	Behavior Change n=51	Behavior Change Plus n=58	Control n=50
Energy (kcal)	-64 ± 96[1a][2]	-61 ± 90[a]	-352 ± 95[b*][3]
Carbohydrate (g)	-20 ± 13	-17 ± 13	-51 ± 13*
Protein (g)	2 ± 4[a]	3 ± 4[a]	-10 ± 4[b*]
Fat (g)	1 ± 4[a]	-0 ± 4[a]	-12 ± 4[b*]
Iron (mg)	-1.1 ± .8	.5 ± .8	-1.8 ± .8*
Calcium (mg)	107 ± 68[a]	176 ± 64[a*]	-116 ± 67[b]
Vit A (IU)	1226 ± 795	844 ± 749	-557 ± 787
Vit C (mg)	24 ± 10[a*]	24 ± 9[a*]	-12 ± 10[b]
Vit B_{12} (ug)	-.22 ± .62	1.12 ± .59	-.25 ± .62
Folacin (ug)	3 ± 22[ab]	46 ± 21[a*]	-29 ± 22[b]
Sodium (mg)	2 ± 185[a]	-73 ± 174[a]	-640 ± 183[b*]
Fiber (g)	.87 ± .70[a]	1.28 ± .66[a]	-1.07 ± .69[b]
Cholesterol (mg)	27 ± 24	14 ± 23	-25 ± 24
Caffeine (mg)	-12 ± 6*	-19 ± 6*	-6 ± 6

[1] LSMEAN ± SEM.

[2] Different letters in row = significant differences among groups; $p \leq 0.05$.

[3] * = Change from pre- to post-assessment significant within group; $p \leq 0.05$.

An effect of school on change in two of the fourteen dietary components--iron and caffeine--was seen (Table 18).

Hypothesis VII: There is no difference in food practices as measured by a written questionnaire among or within the three groups--BC, BC+, and control.

Hypothesis VII is rejected. An effect of group was seen in change in food practices. The BC+ group made positive changes from pre- to post-assessment. The degree of change differed from the control group but not the BC group; degree of change for BC and control was similar. Mean post-assessment scores of the three groups were similar. Mean scores on the pre/post administration of the PI (test/retest reliability=.84) for the three groups are presented in Table 20. Differences in these scores presented as least-squares means are also given.

Pre-assessment and post-assessment mean scores for all groups fell in the range of "sometimes true" as an overall picture of good food habits as depicted by this questionnaire. Pre- /post-assessment mean scores on PI for each statement by group are given in Appendix J. The food practice statement with the highest ratings "almost always true" among all groups related to the practice of eating lunch. Two food practice items were consistently given a low rating "almost never true" by all groups having low

Table 20. Mean Practice Scores[1] and Differences from Pre-Assessment to Post-Assessment and Among Groups.

Group	n	Pre-Assessment Score MEAN ± SD	Post-Assessment Score MEAN ± SD	Difference[2] LSMEAN ± SEM
Behavior Change	51	3.29 ± 0.57	3.40 ± 0.55	0.07 ± 0.06[ab3]
Behavior Change Plus	58	3.08 ± 0.64	3.29 ± 0.59	0.21 ± 0.05[a*4]
Control	50	3.28 ± 0.51	3.29 ± 0.56	0.02 ± 0.05[b]

[1]Response scores ranged from 1 = never true to 5 = always true.

[2]Statistical test--Analysis of Variance.

[3]Different letters in column represent significant differences among groups; $p \leq 0.05$.

[4]* = Change from pre- to post-assessment significant within group; $p \leq 0.05$.

sugar snacks and weekly eating more fish and chicken than red meat.

Hypothesis VIII: There is no difference in change in knowledge as measured by a written questionnaire among or within the three groups--BC, BC+, and control.

Hypothesis VIII is rejected. Results from the knowledge questionnaire (test/retest reliability=.49) (Table 21) reveals an effect of group on knowledge. All three groups differed from one another as to the change in knowledge that occurred. Change in knowledge as reflected by differences in least-squares means from pre-assessment to post-assessment occurred in both BC and BC+ groups. No change in knowledge from pre-assessment to post-assessment occurred in the control group.

Hypothesis IX: There is no difference in change in attitudes as measured by a written questionnaire, among or within the three groups--BC, BC+, and control.

Hypothesis IX is generally supported. An effect of school on Attitude factor 2, "Willing to Try New Foods" was observed (Table 22). LSMEAN attitude factor differences presented in Table 23 reveal the only change in attitudes occurred in the control group for Attitude 2, "Willing to Try New Foods."

Table 21. Mean Knowledge Scores[1] and Differences from Pre-Assessment to Post-Assessment and Among Groups.

Group	n	Pre-Assessment Score MEAN ± SD	Post-Assessment Score MEAN ± SD	Difference[2] LSMEAN ± SEM
Behavior Change	51	8.47 ± 2.37	10.74 ± 2.54	2.46 ± 0.44[a 3,*4]
Behavior Change Plus	58	8.62 ± 2.18	13.66 ± 3.28	5.34 ± 0.41[b*]
Control	50	9.76 ± 2.23	9.74 ± 2.51	0.06 ± 0.42[c]

[1]Possible score = 25

[2]Statistical test--Analysis of Variance.

[3]Different letters in column represent significant differences between groups; $p \leq 0.05$.

[4]* = Change from pre- to post-assessment significant within group; $p \leq 0.05$.

Table 22. Test[1] of Hypothesis of Model Predictor Variables on Difference in Attitude Factors from Pre-Assessment to Post-Assessment for Three Groups--Behavior Change, Behavior Change Plus, and Control.

Predictor Variable	Attitude 1[2]	Attitude 2	Attitude 3	Attitude 4
Treatment	.90[3]	1.44	1.78	1.69
	.4807[4]	.2123	.1193	.1409
School	1.70	2.65*	1.46	1.25
	.1238	.0179	.1940	.2861
Gender	.05	.59	.63	.17
	.8246	.4442	.4294	.6829
Treatment by Gender	.24	1.51	1.38	.17
	.9464	.1883	.2339	.9723

[1]Statistical test--Analysis of Variance.

[2]Attitudes: 1. No Simple Solution; 2. Willing to Try New Foods; 3. Interested, Will Use Nutrition Knowledge; 4. Concerned about Nutrition.

[3]F value; * = $p \leq 0.05$.

[4]p value.

Table 23. LSMEAN Attitude Factor Differences for Three Groups--Behavior Change, Behavior Change Plus, and Control.

	Differences[1] LSMEAN ± SEM			
Group	Attitude 1[2]	Attitude 2	Attitude 3	Attitude 4
Behavior Change	-.06 ± .16	.03 ± .14	.18 ± .15	.29 ± .19
Behavior Change Plus	.14 ± .15	-.17 ± .13	.09 ± .14	.21 ± .18
Control	-.12 ± .15	.32 ± .13* [3]	.13 ± .14	-.35 ± .18

[1] Statistical test--Analysis of Variance.

[2] Attitudes: 1. No Simple Solution; 2. Willing to Try New Foods; 3. Interested, Will Use Nutrition Knowledge; 4. Concerned about Nutrition.

[3] * = Change from pre- to post-assessment significant within group; $p \leq 0.05$.

Results from numeric summing of items on attitude instrument (test/retest reliability=.74) follow. Pre-assessment and post-assessment mean scores for all groups fell in the range of "uncertain" (range=strongly agree to strongly disagree) for an overall picture of adolescents' attitudes toward nutrition as depicted by this questionnaire. Pre-assessment and post-assessment mean scores on AI for each statement by group are given in Appendix K. Most positive attitudes across groups related to the attitudes that nutrition is important, concern about foods eaten even if taking vitamins, and concern for nutrition even if drinking milk. The most negative attitudes across groups related to choosing a food because it is "good for you" or tasting foods similar to a disliked food.

Results of the Rating Instruments

Results from the rating instruments for the two treatment groups--BC and BC+--are presented in Table 24. The overall mean scores 3.75 (BC) and 3.62 (BC+), when 5=very helpful, indicates adolescents perceived the strategy as generally helpful in making changes in nutrient intake. Components of the behavior change strategy perceived most helpful by both groups included keeping food records, applying the computer analysis to personal

Table 24. Rating Instrument: Mean Scores by Facilitating Activity for Two Treatment Groups--Behavior Change and Behavior Change Plus.

	Facilitating Activity[2]	Mean Score[1] Behavior Change	Mean Score[1] Behavior Change Plus
1.	Keeping food records of your own food intake	4.10	3.75
2.	Using own nutrient analysis to understand and evaluate your personal food intake	4.10	3.88
*3.	Learning to select kinds and quantities of foods to meet the RDA, as you did on the worksheet Improving My Diet	----	3.89
*4.	Video showing health consequences of different eating styles and ways of eating to decrease risk of lifestyle diseases, such as cancer and heart disease	----	3.70
*5.	Teacher demonstration and taste-testing of selected health-promoting foods	----	4.00
*6.	Learning about the relationship between teen growth and nutrient needs	----	3.75
*7.	Filmstrip showing how lifestyles such as family eating patterns, busy schedules, and emotional factors can influence eating habits	----	3.55
8.	Using the Matrix Madness worksheet and looking at categories that affect eating behavior, such as time of day, feelings, place, and who prepared food	3.33	3.21

Table 24 (continued)

Facilitating Activity[2]	Mean Score[1] Behavior Change	Behavior Change Plus
9. Using Decision Making Sheet to make decisions to change food-related behavior based on benefits and costs of different solutions	3.78	3.52
10. Actually implementing the solutions you selected for making changes in food-related behavior	3.88	3.72
11. Using GSA Calendar to implement solutions	3.59	3.55
12. Using the Desire to Relapse/Desire to Continue worksheet to monitor the solutions you selected	3.13	3.13
13. Using the Evaluation Form to evaluate your successes and failures	3.66	3.57
14. Being in a class structured with follow-up sessions (class days separated from each other)	3.94	3.45

[1]Response scores ranged from 1 = very unhelpful to 5 = very helpful.

[2]* indicates facilitating activity not part of Behavior Change treatment group.

nutrient intake, implementing solutions and participating in follow-up classes. Activities included in the cognitive component received high ratings by the BC+ group, indicating these activities were perceived as helpful in making changes. Activities included the taste-testing demonstration and learning to select kinds and quantities of food to meet the RDA. The taste-tasting demonstration was part of the lesson, developed exclusively for the BC+ unit, entitled "Compare diet to dietary guidelines" (Appendix C). Included in the lesson were a video, focusing on the relationship between lifestyle diseases and food choices, class discussion, and taste-tasting of ways to modify the diet in fat, sugar, salt, and fiber.

CHAPTER V

DISCUSSION

Positive behavior change, as measured by increased intake of specific nutrients, did occur for the majority of adolescents who participated in the behavior change strategy. This is unlike most school-based nutrition education programs in the past that have documented little or no change in behavior (15, 40).

This study showed that when adolescents set a goal to improve the intake of a specific nutrient, change in food-related behavior does occur. Goal setting proved to be an important concept to the success of the strategy. Goal setting to enhance performance has been used in other disciplines (32) but has been used very little in the area of nutrition. Coates (37) mentioned using goal setting in a strategy designed to help adolescents decrease use of salty snacks. However, he did not acknowledge an effect of goal setting as was evident in the present study.

Because it has been reported that performance is higher when specific, hard to reach goals are set (32, 33), for future programs this researcher recommends using the RDA in the goal statement. Thus, instead of the goal being "to

improve calcium intake," the goal would be "to meet the RDA of 1200 mg each day." Such a goal might be met by developing a series of subgoals. This idea is in keeping with the basic intent of the behavior change strategy which is for adolescents to apply the strategy to problem nutrients, one by one and to achieve success (increased intake) before choosing another problem nutrient.

Gender was shown to be related to change. Males increased nutrient intake across the target nutrients more consistently than females. This researcher emphasized food substitutions, not additions in many cases. However, the concept of improving one's diet, except in the case of sodium and fat content, may be interpreted as eating more food. This concept would seem to have more appeal to males, who desire to be big, tall, and muscular, than to females. Females' concept of growth and development has a lot to do with body shape, which is not associated with eating more food.

Gender differences in food intake have been reported previously. Woodward (59) found that males ate more food than females, including more milk, potatoes, bread, cereal, and red meat. Burdine et al. (64) reported similar findings. Males in their study selected more healthful foods, including peanut butter, milk, and cereals.

No effect on change in nutrient intake was seen by

either nutrition knowledge or attitudes. Douglas and Douglas (86) found no relationship between nutrition knowledge and food practices when investigating male and female high school athletes. Salvetti and Skinner (91) found no relationship between nutrition knowledge and dietary scores, however they did found a correlation between attitudes and dietary scores. Whatever the relationships may be for this group, and it may well be a fluid connection, the present study clearly shows that for change to occur, the major focus must be on behavior change.

The model developed in this study to test the effect of selected variables on change explained a high percentage of the variability that occurred in nutrient intake. R^2 values for two of the nutrients--folacin and calcium--exceeded 0.50.

Results from the present study are similar to those reported by Howison et al. (38). They implemented a strategy at the fifth grade level that included having students keep food records, identify the "most neglected" food group, and develop specific, written plans to better meet serving recommendations. Although the researchers did not identify the goal setting process as such, the concept was quite similar to the present study. A focus on increasing servings from the Four Food Groups is

appropriate for a behavior-based intervention program at the elementary school level. However, the more sophisticated approach of a nutrient-based focus is desirable at the high school level in order to override students' desensitization to the Four Food Groups, the basis for nutrition units during the elementary school years (98).

A drawback of a nutrient-based program is the need for availability of computers, software, and technical knowledge of computers. Also, classroom teachers must have knowledge of how to collect, analyze, and interpret dietary data.

In regard to testing this model, determining the importance to the strategy of each of the fundamental concepts (personalization, goal setting, self-management, implementation, structured feedback, and structured self-evaluation) was beyond the scope of this study. However, consistent mean scores between each item on the Rating Instrument suggest that concepts are approximately equal in importance to the success of the strategy. In other words, the strategy appears to be a package deal. There is no evidence that the strategy would be strengthened by removal of any concept or that success can be attributed primarily to one or two components.

Streamlining the self-management process to eliminate

some of the paperwork would be desirable because adolescents completed many written exercises. However, it is important, as one is learning this process, to go carefully through each stage. Translating thoughts into concrete, written statements or solutions is valuable.

The data for the two treatment groups--BC and BC+--were analyzed differently from past projects in which nutrient gains were studied. Only those nutrients selected as goal nutrients were analyzed for pre- /post-assessment differences. When total group is analyzed for change on various nutrients, the effect of individuals making changes for specific nutrients, which may cause alterations in other nutrients, may not be seen. For example, adolescents may increase vitamin C and in the process reduce iron intake; others may increase iron and decrease vitamin C. The end result when looking at change in total group, instead of by individual goals, is to see no change.

Several interrelationships between nutrients were seen. Adolescents with calcium as a nutrient goal increased vitamin A, and somewhat surprisingly, vitamin C, as well as calcium. Vitamin A goal setters increased dietary sodium, indicating they were choosing dairy products to increase vitamin A. Setting a goal to decrease sodium intake appeared to have a negative effect on the intake of other nutrients. No firm conclusions can be drawn because only

13 adolescents set this goal. However, these 13 adolescents who at pre-assessment test had nutrient levels that met or exceeded the RDA, decreased food sources of calcium, iron, vitamin A, and folacin in the process of successfully reducing sodium. The indication is that adolescents who choose this goal should be monitored very closely. If salt were the main flavoring in the diet and adolescents were restricting salt too quickly, the "tastelessness" of food could cause reduced intake or a substitution of other foods with high taste satisfaction (i.e., sweets), which could maintain calorie intake, while decreasing nutrient intake.

When the control group was included in the analysis, an effect of treatment on change in nutrient intake was seen. The decrease in nutrient intake by the control group may be explained by the adolescents becoming sensitive to food intake in the process of writing down intake. Another possible explanation is inconsistency in record keeping. However, a check of food records revealed nothing particularly suspicious, such as obvious omissions.

As stated previously, the purpose of the control group was to monitor the environment for influences on food intake so that changes in nutrient intake in the treatment groups could be attributed to something other than the behavior change strategy. Based on findings from the

control group, no positive influence on adolescent food intake within the environment occurred during the course of the study.

In addressing the results of the the PAK Instrument, several comments are appropriate. Knowledge gains (or lack of gain in control group) were as expected because the BC+ group, which received the cognitive component made the greatest gain in knowledge, followed by the BC group.

An interesting finding was the increase in food practices, as measured by PI, for the BC+ group, but not for the BC group (or control). The cognitive component included several activities structured around the Dietary Guidelines, including a video and taste-testing of foods to meet the recommendations of the Dietary Guidelines. As stated previously, PI was designed around the Dietary Guidelines. Perhaps, these cognitive-based activities had an influence on behavior change in the BC+ group.

The finding of no change in attitudes for any group was not surprising since there was no direct emphasis on attitudes in this study. While attitudes may have been affected, the time span was short and subtle changes, if they occurred, were not detected.

The reliabilities of the instruments were good, except for the knowledge instrument (.49). Scores for the control group (for which test/retest reliabilities were generated)

ranged from 4-16 on the pretest and 6-16 on the posttest (possible score = 25). There was essentially no change in range of scores from pretest to posttest. The range of scores is not as wide as would be desirable. The term applied to this condition is "restriction of range." When this occurs, it can account for lack of high reliability. Minimal knowledge (low mean scores) also contributes to low test reliability (136).

CHAPTER VI

LIMITATIONS

One of the limitations inherent in this study is that it relied on self-reported data. No attempt was made to confirm the legitimacy of the adolescents' food records by such methods as observation of eating occasions. However, food records were examined, and only one food record was deleted from the study because the truthfulness of reporting was suspect.

Another limitation of some concern is that many students in this study were willing to do only minimal work at home. Classroom teachers confirmed this. This finding may vary in other setting; however, the lack of complete student participation should be addressed. While it is unrealistic to assume all adolescents will be willing to change food-related behavior or have the interest and motivation to follow through with the behavior change strategy, making the environment as conducive as possible to participation is the teacher's obligation. One method that may facilitate this is using a food recall method instead of food records for pre- /post-assessment evaluations. If food recalls were done in class over a

period of three days, teachers would not have to rely on students returning food records. Food recalls could be done on three consecutive days or over a period of several weeks, which could increase representativeness of food recalls.

CHAPTER VII

SUMMARY

Adolescents in a secondary classroom setting were the target population for a nutrition education intervention strategy designed to promote behavior change. The study design included three groups: 1) one group (n=51; mean age=15.1) received a behavior change strategy developed specifically for adolescents (BC); 2) one group (n=58; mean age=14.9) received the identical strategy plus a cognitive component (BC+); and 3) one group (n=50; mean age=15.3) served as the control and received no nutrition education during the intervention phase (C). Evaluation instruments included pre- /post-assessment three-day food records and a pre- /post-assessment written questionnaire including general food practices, attitudes, and knowledge.

A random sample was drawn from schools within a 30 mile radius of Knoxville, Tennessee. Schools were separated by socioeconomic status prior to sample selection. Six schools, two classes in each school, participated in the study. For representiveness, required classes were chosen--health for the treatment groups and non-health for control group.

Basis concepts of the behavior change strategy included: 1) personalization, which was accomplished by adolescents looking at their own food intake; 2) goal setting, which involved adolescents setting a goal for nutrient improvement based on a nutrient analysis computer printout; 3) self-management, which involved learning skills for dietary change; 4) self-implementation, which involved adolescents carrying out a plan of action for nutrient improvement; 5) structured feedback, which involved teacher involvement and instructional materials designed to give knowledge of progress; and 6) structured self-evaluation, which involved a systematic approach for revision of plans based on successes and failures of prior plans. Feedback and follow-up sessions were separated in time from the rest of the unit to allow adolescents to implement plans on their own.

The cognitive component, added to the behavior change strategy, included the use of a variety of teaching techniques and instructional activities. These included the use of a filmstrip, video, lecture, and game. In addition, taste-tasting, worksheets, and discussions were incorporated to present topics related to the RDA, lifestyle diseases, relationship of nutrient needs to adolescent growth/development, and lifestyle factors affecting nutrient intake.

To test for changes in nutrient intake for the two treatment groups, analysis by nutrient goal (selected by adolescent) was conducted. Analysis of differences in nutrient intake for the two treatment groups revealed increases in calcium, vitamin A, and vitamin C. Sodium intake decreased, as appropriate for that goal. Setting a goal for a specific nutrient had the strongest effect on difference in change in nutrient intake. Gender had the next most consistent effect on change. Males increased nutrient intake more than females. No effect of treatment--Behavior Change or Behavior Change Plus--was seen.

Food practice scores, as assessed by the written questionnaire, increased from pre-assessment to post-assessment for the BC+ group only. Changes in food practice scores for BC and BC+, and BC and C did not differ; changes in BC+ were greater than C. Knowledge increased pre- to post-assessment for both the BC and BC+ groups. All three groups differed in change in knowledge. BC+ had greater gains than BC; BC had greater gains than C, which had no change in knowledge. No change difference in attitudes was seen, either among or within groups.

Adolescents in the treatment groups rated the facilitating activities composing the behavior change strategy. Activities perceived most helpful in

contributing to change included: 1) keeping food records; 2) assessing personal nutrient intake using the nutrient analysis print out; 3) implementing a plan of action; and 4) participating in the follow-up classes.

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APPENDIXES

APPENDIX A

SELF-MANAGEMENT INSTRUCTIONAL MATERIALS

40 Points

Name_____
School_____
Date_____
Period_____

MATRIX MADNESS

I. Use your Food Record Form to select 3 food sources of the nutrient you are improving in your diet.
II. Fill in the headings for each matrix, as sleepy, hungry, starved, and tired for "Feelings Before Eating".
III. Mark the appropriate square indicating when you ate each food.

EXAMPLE:

Nutrient Selected Vitamin A

Good Food Sources 1) carrot
2) cantaloupe
3) tomato

Food Sources	Feelings Before Eating								Total
	sleepy	hungry	nervous	tired					
carrot		II		I					3
cantaloupe	I	I							2
tomato		II							2
Total	1	5	0	1					7

Nutrient Selected _____
Good Food Sources 1) _____
2) _____
3) _____

Food Sources	Time							Total
	6-8:55	9-10:55	11-1:55	2-4:55	5-7:55	8->		
Total								

Food Sources	Feelings Before Eating							Total
Total								

Food Sources	Who ate with You							Total
Total								

Food Sources	Feelings After Eating							Total
Total								

Food Sources	Place							Total
Total								

Food Sources	What were You Doing							Total
Total								

Food Sources	Who Prepared							Total
Total								

50 points

Name _____

SUMMARY QUESTIONS

Time

When are you eating foods high in the nutrient you selected?

When you consider "Time", how could you improve your food intake?

Feelings Before Eating

What are your feelings before you are eating foods high in the nutrient you selected?

When you consider "Feelings Before Eating", how could you improve you food intake?

Who Ate With You

Who are the people who ate with you when eating foods high in the selected nutrient?

When you consider "Who Ate With You", how could you improve your food intake?

Feelings After Eating

What are your feelings after eating foods high in the nutrient you selected?

When you consider "Feelings After Eating", how could you improve your food intake?

Place

Where are the places you are eating foods high in the nutrient you selected?

When you consider "Place", how could you improve your food intake?

What Were You Doing

What were you doing when eating foods high in the nutrient you selected?

When you consider "What You Were Doing", how could you improve your food intake?

Who Prepared

Who prepared the foods you ate which were high in the nutrient you selected?

When you consider "Who Prepared" the food, how could you improve your food intake?

40 points

Name_____
Nutrient Selected_____
Period_____

DECISION MAKING SHEET

Potential Solutions	Benefit +	Rating 1-10	Cost -	Rating 1-10	Net Benefit

50 Points

GSA CALENDER

Name_____
School_____
Date_____
Period_____

Goal(s):

Solutions				

20 points

Name _____
Nutrient Selected _____
Period _____

EVALUATION FORM

Successes	Failures/problems	Solutions

25 Points

Name_____
School_____
Date_____
Period_____

Monitor Desire to relapse /Desire to Continue

What Preceded Desire	Desire	What Followed Desire

Desire	Benefit	Rating 1-10	Cost	Rating 1-10	Net Benefits
	+		-		

APPENDIX B

NUTRIENT CHECKLISTS

Iron Checklist

Food	Amount You Ate		Typical Serving Size	=	No. Of Servings	X	Iron Points Per Serving	=	Total Iron Points
Beef, Pork	_____		3 oz.	=	_____	X	13	=	_____
Liver	_____		3 oz	=	_____	X	42	=	_____
Chicken, Tuna	_____		3 oz.	=	_____	X	7	=	_____
Egg	_____		1	=	_____	X	4	=	_____
Dry beans	_____		1 cup	=	_____	X	27	=	_____
Greens	_____		1 cup	=	_____	X	24	=	_____
Broccoli	_____		1/2 cup	=	_____	X	7	=	_____
Dried fruit	_____		1/4 cup	=	_____	X	7	=	_____
Watermelon	_____		4x8" wedge	=	_____	X	11	=	_____
Bread	_____		1 slice	=	_____	X	4	=	_____
Pasta	_____		1/2 cup	=	_____	X	4	=	_____
Cookies	_____		2	=	_____	X	4	=	_____
Cereal	_____		1 cup	=	_____	X	24	=	_____
Nuts	_____		1/2 cup	=	_____	X	9	=	_____
Pizza	_____		4 3/4" slice		_____	X	6	=	_____
							For foods not listed add		35

							Grand Total		_____

How do you rate?

Score:	
100	Great! You are getting 100% of the RDA for iron.
66-99	Careful! Check your daily food choices.
Below 66	Oops! Major trouble. Concentrate on choosing iron-rich foods.

Calcium Checklist

Food	Amount You Ate		Typical Serving Size	No. =Of Servings	X	Calcium Points Per Servings	=Total Calcium Points
Cottage Cheese	_____	½	1/2 cup	=_____	X	5	= _____
Cheese	_____	½	1 oz.	=_____	X	18	= _____
Yogurt	_____	½	8 oz.	=_____	X	25	= _____
Milk	_____	½	1 cup	=_____	X	25	= _____
Ice Cream	_____	½	1 cup	=_____	X	15	= _____
Salmon, canned/bones	_____	½	3 oz.	=_____	X	15	= _____
Pizza	_____	¼	4 3/4" slice	____	X	8	= _____
Macaroni/ Cheese							
Canned	_____	½	1 cup	=_____	X	7	= _____
Homemade	_____	¼	1 cup	=_____	X	12	= _____
Baked Beans	_____	½	1 cup	=_____	X	8	= _____
Greens	_____	½	1 cup	=_____	X	15	= _____
Fortified foods							
Total cereal, 1/2 c. milk	_____	¼	1 cup	=_____	X	22	= _____
Orange juice with added calcium	_____	½	3/4 cup	=_____	X	17	= _____

For foods not listed add 25

Grand Total _____

How do you rate?

Score:	
100	Great! You are getting 100% of the RDA for calcium.
66-99	Careful! Check Your daily food choices.
below 66	Oops! Major trouble. Concentrate on choosing calcium rich foods.

Vitamin A Checklist

Food	Amount You Ate	÷	Typical Serving Size	= No. Of Servings	X	Vitamin A Points Per Serving		=Total Vitamin A Points
						Boys	Girls	
Cheese	_____	÷	1 oz.	=_____	X	7	9	= _____
Milk	_____	÷	1 cup	=_____	X	15	18	= _____
Ice Cream	_____	÷	1 cup	=_____	X	15	18	= _____
Egg	_____	÷	1	=_____	X	7	9	= _____
Margarine, butter	_____	÷	1 T.	=_____	X	15	18	= _____
Liver	_____	÷	3 oz.	=_____	X	1400	1700	= _____
Apricots, dried	_____	÷	1/2 cup	=_____	X	37	45	= _____
Watermelon	_____	÷	4x8"	=_____	X	26	32	= _____
Canteloupe	_____	÷	1/4	=_____	X	44	54	= _____
Dry cereal	_____	÷	1 cup	=_____	X	44	54	= _____
Broccoli	_____	÷	1/2 cup	=_____	X	44	54	= _____
Carrots	_____	÷	1	=_____	X	203	250	= _____
Greens	_____	÷	1 cup	=_____	X	126	154	= _____
Spinach fresh	_____	÷	1 cup	=_____	X	44	54	= _____
Sweet potato	_____	÷	1	=_____	X	107	132	= _____
Pizza	_____	÷	4 3/4" slice	___	X	4	5	= _____
				For foods not listed add				20

				Grand Total				_____

How do You rate?

Score:	
100	Great! You are getting 100% of the RDA for vitamin A.
66-99	Careful! Check Your daily food choices.
Below 66	Oops! Major trouble. Concentrate on choosing vitamin A rich foods.

Vitamin C Checklist

Food	Amount You Ate		Typical Serving Size	= No. Of Servings	X	Vitamin C Points Per Servings	= Total Vitamin C Points
Asparagus	_____		1/2 cup	=_____	X	33	= _____
Broccoli	_____		1/2 cup	=_____	X	104	= _____
Brussels Sprouts	_____		1/2 cup	=_____	X	112	= _____
Cabbage	_____		1/2 cup	=_____	X	34	= _____
Cantaloupe	_____		1/8 melon	=_____	X	76	= _____
Cauliflower	_____		1/2 cup	=_____	X	65	= _____
Grapefruit	_____		1/2-1/2 cup	=_____	X	74	= _____
Greens	_____		1/2 cup	=_____	X	62	= _____
Green Pepper	_____		1/4 pod	=_____	X	34	= _____
Okra	_____		10 pods	=_____	X	35	= _____
Orange	_____		1-1/2 cup	=_____	X	104	= _____
Potatoes	_____		1/2 cup 1 baked	=_____	X	52	= _____
Strawberries	_____		1/2 cup	=_____	X	74	= _____
Tomato	_____		1	=_____	X	47	= _____
Watermelon	_____		4" x 8"	=_____	X	50	= _____

For foods not listed add 20

Grand Total _____

How do you rate?

Score:	
100	Great! You are getting 100% of the RDA for vitamin C.
66-99	Careful! Check Your daily food choices.
below 66	Oops! Major trouble. Concentrate on choosing vitamin C rich foods.

Folacin Checklist

Food	Amount You Ate		Typical Serving Size	= No. Of Servings	X	Folacin Points Per Servings	= Total Folacin Points
Asparagus	____		1/2 cup	=____	X	18	= ____
Beans,dry	____		1 cup	=____	X	22	= ____
Black eyed peas	____		1 cup	=____	X	20	= ____
Broccoli/Brussels Sprouts	____		1/2 cup	=____	X	12	= ____
Cereal,dry fortified	____		1 cup	=____	X	27	= ____
Corn	____		1 ear/1/2 cup	=____	X	17	= ____
Green Peas	____		1/2 cup	=____	X	14	= ____
Greens	____		1 cup	=____	X	28	= ____
Lima Beans	____		1/2 cup	=____	X	13	= ____
Liver	____		3 oz.	=____	X	30	= ____
Orange juice	____		1/2 cup	=____	X	13	= ____
Pineapple juice	____		1/2 cup	=____	X	7	= ____
Sunflower seeds	____		1/4 cup	=____	X	21	= ____

For foods not listed add ___20___

Grand Total _____

How do you rate?

Score:	
100	Great! You are getting 100% of the RDA for folacin.
66-99	Careful! Check Your daily food choices.
below 66	Oops! Major trouble. Concentrate on choosing folacin rich foods.

APPENDIX C

INSTRUCTIONAL FORMATS

INSTRUMENTAL FORMATS

FOR

BEHAVIOR CHANGE PLUS

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 10

Day: Sept. 4 Time:

Lesson Plan Title:
Pretest
How to complete food record form
Assessment of PAK

Name: BC+

I. Long range unit goals:
   Goal I: Understanding the relationship of nutrition to health.
   Goal II: Understand the relationship between individual and environmental characteristics, and food related behavior.
   Goal III: Understand the physical and chemical properties of food.
   Goal IV: Understand the nature and means for resolution of food and nutrition related concerns.

II. Instructional objectives:
   Students will:
   know how to use food record form to list foods, description & amount, for 3 day period (Friday, Saturday, Monday)
   know how to use food record form to monitor situations surrounding each eating occasion
   demonstrate nutrition knowledge, attitude, and food practices

III. Set: Interest in teenage nutrition education

IV. Instruction:
   1. Introduction
   2. Give pretest
   3. Explain food record form
      emphasize accuracy, completeness
      use Instructions for Record of Food eaten
   4. Explain letters of consent
   5. Entertain questions/discussion

VI. Closure:
   Assign food record form
   Give date to be returned

Handouts: Food record forms, Instructions for Record of Food Eaten, PAK Instrument

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 10

Day: Oct 27 Time:

Lesson Plan Title:
Intro/Expectations
Compare diet to RDA

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
compare mean nutrient intake with RDA
identify positive and negative aspects of diet by plotting nutrient values against RDA

III. Set:
Cartoon clips to stimulate interest in food choices

IV. Instruction:
1. Introduction--Format of unit/grading system/expectations
2. Lecture: RDA-A standard for evaluating food behavior (TENN p.36; Dairy Council, p.16)
3. Explain printouts of nutrient analysis
4. Explain handouts: (listed below)

V. Closure:
Call for questions

IV. Handouts:
Nutrient Analyses
Strengths and weaknesses
RDA chart
Food composition table
RDA Worksheet

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Improving my diet

Grade: 10

Day: Oct 28 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
select foods to meet RDA for 1 nutrient by using food composition table
practice incorporating selected foods into own day's food intake by rewriting one day's intake (from food record) to include new selections

III. Set:
Discuss homework assignment: What did we do yesterday; direction for today (S&W-similarities, differences)

IV. Instruction:
1. List on board nutrients above & below RDA
note similarities among individuals in class
2. Handouts:
RDA worksheet to orient to use of RDA handout
Improving my diet
Explain activities

V. Closure:
Summarize major points

Handouts:
RDA Worksheet
Improving my diet
Food Sources
of Nutrients and Dietary Components

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Compare diet to dietary guidelines

Grade: 10
Day: Oct 29 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
evaluate their dietary intake relative to standards set forth as guidelines for health promotion
evaluate their risk for lifestyle diseases by watching "New Nutrition" and assessing own dietary intake

III. Set:
Draw connection between yesterday's standard for diet adequancy and today's lesson

IV. Instruction:
1. Go over Dietary Guidelines
2. Use worksheet % Calories... to evaluate diet
3. Introduce video "New Nutrition"/another way to evaluate diet
4. Video "New Nutrition" 20 min.
5. Teacher demonstration of ways to modify diet:
fat (milk, meat, pastries)
salt (snacks, processed foods
fiber (fruits/veg/cereals)
sugar/complex CHO
4. Use Chart of % calories from protein, fat, CHO to evaluate diet

V. Closure:
Homework: Pick a fast food restaurant-write a menu and modify

Handouts:
% calories from protein, fat, CHO
Dietary Guidelines for Americans

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Adolescent Growth & Nutrient Needs

Grade: 10
Day: Nov. 2 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
discuss major nutrients previously identified as low/high in adolescents' diets & as being implicated in "lifestyle" diseases
(Ca; Vit A; Fe; fat, fiber, sugar)
identify reasons these nutrients are needed in the body
access adolescents' needs vs. needs at other time in lifecycle

III. Set:
Correlate evaluation work on food intake (RDA & Dietary guidelines) to today's discussion

V. Instruction:
1. Take up fast food modification; short discussion
2. Lecture: Adolescent growth and nutrient needs (lifestyle diseases; stress immediate consequences of low nutrient & calorie intake for expanding body-growth
3. Handout: nutrient functions--Dairy Council 2c,9c
Nutrient Worksheet
Students: personalize functions particular to adolescence
personalize needs for adolescents related to other age groups

V. Closure:
Emphasize major points

Handouts: Nutrients for Your Health
Nutrient Worksheet

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 10
Day: Nov 3 Time:

Lesson Plan Title:
Nutrient problems related to lifestyle characteristics
Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
identify lifestyle characteristics relating to nutritional problems by viewing filmstrip "Nutrition for Teenagers Only" 14 min: "You have special needs"
identify personal lifestyle characteristics relating to desirable nutrient intake & problem nutrient intake by evaluating food records

I. Set:
Transition from knowing what foods (nutrients) to include and how to plan in diet to environmental influences that inhibit success

IV. Instruction:
1. Introduce & view filmstrip-14min.
2. Lifestyle Questions/committment to improve some aspect of food behavior
3. Quiz-tomorrow: Learn 2 functions and 2 sources of nutrient selected.
4. Demonstrate how to use Matrix Madness worksheets
a. Students assess own lifestyle characteristics (use handout: Matrix Madness and food records)

Closure:
Homework: Complete lifestyle assessment (matrices) as needed

Handouts:
Lifestyle Questions (pink)
Matrix Madness; food records

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Food-related problems
associated with lifestyle

Grade: 10
Day: Nov 4 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
identify personal lifestyle characteristics relating to desirable nutrient intake & problem nutrient intake by compiling information gained from analyzing food records
discuss specific "lifestyle" problems and ways to meet nutrient requirements

I. Set: Family Circus cartoon on lifestyle change

IV. Instruction:
1. Nutrient quiz
2. Students use matrices to draw conclusions from 7 categories listed on food record to help identity behavioral reasons for nutrient problems
3. Play Nutrient Bonanza game as time allows

Closure:
Homework: Complete individual assessments as needed

Handouts: Summary Questions (green)

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Selecting solutions to
nutrient intake problems

Grade: 10
Day: Nov 5 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
identify solutions to nutrient problems through use of a cost-benefit analysis as a continuation of the self-management program

I. Set:
How to implement summary work from yesterday to decision sheet

IV. Instruction:
1. Demonstrate use of decision making sheet
a. Students construct decision making sheets
2. Play Nutrient Bonanza game

Closure:
Keep game points for both groups

Handout: Decision Making Sheet

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Develop GSA Calendar

Grade: 10

Day: Nov 6 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
formulate calendar of goals, solutions, and achievements

III. Set: Day's plans

IV. Instruction:
1. Demonstrate how to use checklists
2. Demonstrate how to complete GSA Calendar
a. Students work on calendar
3. Distribute labels for addressing

V. Closure:
Homework: Keep GSA Calendar over weekend
Special assignment: Write success or failure story involving your effort

Handouts:
GSA Calendar
Checklists: Ca, Fe, vit. A, fat
Na, fiber, folacin, vit C
complex CHO

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Evaluate/feedback/revise

Grade: 10

Day: Nov 9 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
evaluate and reorganize GSA Calendar when appropriate

III. Set: Encourage discussion of week-end successes and failures.

IV. Instruction:
1. Individual evaluation using evaluation form
2. Individual work time: revise self-management plans or develop new goal, whichever is applicable
3. Check calender-reward (smile face)
4. Explain "Desire to Relapse/Desire to Continue" form and give to students
5. Start food record forms on Friday
6. Test Friday-study notes/handouts
7. Give teacher food records to give to class Thursday

V. Closure:
Plans for next class period-4 days away
Test on Friday-nutrition knowledge

Handouts:
Evaluation Form
Desire to Relapse/Desire to Continue
GSA Calendars
**Food Record Forms

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Evaluate/feedback/revise
Knowledge Test

Grade: 10
Day: Nov 13 Time:

Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
take Knowledge Test
evaluate and reorganize GSA Calendar

III. Set: Encourage discussion of week-day successes and failures.

IV. Instruction:
1. Take up "Desire To Relapse/Desire to Continue" forms
2. Give Knowledge Test
3. Individual worktime : revise goals and solutions
use GSA Calendar
4. Share successes, failures, and PLANS

V. Closure: Recap
Call for questions

Handouts: Evaluation Form
Knowledge Test
Desire to Relapse/Desire to Continue
Three day food records

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 10
Day: Nov 17 Time:

Lesson Plan Title:
Success/failure/problem/solution
Assessment of AP
Rating Instrument
Name: BC+

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
take AP portion of PAK
complete Rating Instrument
evaluate food records

III. Set: Encourage class discussion of successes and failures.

IV. Instruction:
1. Give AP portion of PAK
2. Give Rating Instrument
3. Students self evaluate food records comparing first and second set of food records using Matrix Madness and checklists
4. Take up food records
5. Hand back Knowledge Test

V. Closure:
Stimulate interest in continuing
Mailout in 5 mo.

Handouts:
AP portion
Rating Instrument
Matrix Madness
Checklists

INSTRUMENTAL FORMATS

FOR

BEHAVIOR CHANGE

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 10

Day: Sept. 4 Time:

Lesson Plan Title:
Pretest
How to complete food record form
Assessment of PAK

Name: BC

I. Long range unit goals:
- Goal I: Understanding the relationship of nutrition to health.
- Goal II: Understand the relationship between individual and environmental characteristics, and food related behavior.
- Goal III: Understand the physical and chemical properties of food.
- Goal IV: Understand the nature and means for resolution of food and nutrition related concerns.

II. Instructional objectives:
Students will:
- know how to use food record form to list foods, description & amount, for 3 day period (Friday, Saturday, Monday)
- know how to use food record form to monitor situations surrounding each eating occasion
- demonstrate nutrition knowledge, attitude, and food practices

III. Set: Interest in teenage nutrition education

IV. Instruction:
1. Introduction
2. Give pretest
3. Explain food record form
   emphasize accuracy, completeness
   use Instructions for Record of Food eaten
4. Explain letters of consent
5. Entertain questions/discussion

VI. Closure:
Assign food record form
Give date to be returned

Handouts: Food record forms, Instructions for Record of Food Eaten, PAK Instrument

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 9

Day: Oct 26 Time:

Lesson Plan Title:
Intro/Expectations
Compare diet to RDA/Dietary guidelines

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
compare mean nutrient intake with RDA
identify foods to improve food-related behavior

III. Set:
Cartoon clips to stimulate interest in food choices

IV. Instruction:
1. Introduction--Format of unit/grading system/expectations
2. Explain printouts of nutrient analysis
3. RDA for individual
4. Explain handouts:
Evaluating My Diet
% Calories...
5. Selection of nutrient willing to improve--notebook paper

V. Closure:
Call for questions

IV. Handouts:
Nutrient Analyses
Evaluating My Diet
Food Sources
% Calories...
RDA for individual

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade 9

Day: Oct. 27 Time:

Lesson Plan Title:
Food-related problems
associated with lifestyle
characteristics

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
identity personal lifestyle characteristics relating to
desirable food intake and problem food
intake by evaluating food records

III. Set:
Family Circus cartoon on lifestyle change

IV. Instruction:
1. Yesterday looked at food intake--today at lifestyle
1. Explain how to use Matrix Madness
a. Students assess own lifestyle characteristics
(use handout: Matrix Madness and Food Records)
2. Demonstrate how to draw conclusions from Matrix Madness
Summary Questions
use Food Sources handout

V. Closure:
Homework assignment:
Complete worksheets as needed

IV. Handouts:
Matrix Madness, Summary Questions

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Selecting solutions to
nutrient intake problems

Grade: 9
Day: Oct 28 Time:

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
identify solutions to food intake problems through use of a cost-benefit analysis as a continuation of the self-management program
practice problem-solving food

III. Set:
How to implement summary work from yesterday to decision sheet

IV. Instruction:
1. Demonstrate use of decision making sheet
a. Students construct decision making sheets
2. Let students generate list of problem situations and possible solutions

V. Closure:
Homework: Complete decision-making sheet

Handout: Decision Making Sheet

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Develop GSA Calendar

Grade: 9

Day: Oct. 29 Time:

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
formulate calendar of goals, solutions, and achievements

III. Set: Day's plans

IV. Instruction:
1. Demonstrate how to complete GSA Calendar
a.Students work on calendar

V. Closure:
Homework: Keep GSA Calendar over weekend
Special assignment: Write success or failure story involving your effort

Handouts:
GSA Calendar

INSTRUCTIONAL FORMAT

Subject: Nutrition

Lesson Plan Title:
Evaluate/feedback/revise

Grade: 9
Day: Nov 2 Time:

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
relate successes and failures of plan to improve food intake
evaluate and reorganize GSA Calendar where appropriate

III. Set: Encourage discussion of week-end successes and failures

IV. Instruction:
1. Individual work time: revise self-management plans or develop new goal, whichever is applicable
a. evaluate and reorganizeGSA Calendar
2. Check calender-reward (smile face)
3. Explain "Desire to Relapse/Desire to Continue" form and give to students

V. Closure:
Plans for next class period-4 days away
Test on Friday-nutrition knowledge

Handouts:
Evaluation Form
Desire to Relapse/Desire to Continue

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade: 9
Day: Nov 6 Time:

Lesson Plan Title:
Test on Nutrition Knowledge
Evaluuate/feedback/revise

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
take Knowledge Test
evaluate and reorganize GSA Calendar

III. Set: Encourage discussion of week-day successes and failures

IV. Instruction:
1. Take up "Desire To Relapse/Desire to Continue" forms
2. Give Knowledge Test
3. Individual worktime: revise goals and solutions
evaluate implementation of solutions

V. Closure:
Give out 3 day food records
Keep Friday, Saturday, Monday

Handouts: Evaluation Form
Knowledge Test
Desire to Relapse/Desire to Continue
Three day food records

INSTRUCTIONAL FORMAT

Subject: Nutrition

Grade 9

Day: Nov 10 Time:

Lesson Plan Title:
Success/failure/problem/solution
Assessment of AP
Rating Instrument

Name: BC

I. Long range unit goals:
see Day 1

II. Instructional objectives:
Students will:
take AP portion of PAK
complete Rating Instrument
evaluate food records

III. Set: Encourage class discussion of successes and failures.

IV. Instruction:
1. Give AP portion of PAK
2. Give Rating Instrument
3. Students self evaluate food records comparing first and second set of food records
4. Take up food records

V. Closure:
Stimulate interest to continue
Mailout in 4 mo.

Handouts:
AP portion
Rating Instrument

APPENDIX D

SAMPLE FOOD RECORD FORMS

FOOD RECORD FORM - **Saturday**

Name _____

Gender: (circle) Male Female
Age: ____years

Height _____ inches
Weight _____ pounds

School _____

Date _____

	Food Description	Amount	Leave Blank	1 Time	2 Feelings Before Eating	3 Who ate With You	4 Feelings After Eating	5 Place	6 What were You Doing	7 Who Prepared
1st time Food was eaten										
2nd time Food was eaten										
3rd time Food was eaten										
4th time Food was eaten										
5th time Food was eaten										

Name _____

Food Record Form - **Saturday**

Gender: (circle) Male Female
Age: ____years

Height _____ inches
Weight _____ pounds

	Food Description	Amount	Do Not Write in this Column
1st time Food was eaten			
2nd time Food was eaten			
3rd time Food was eaten			
4th time Food was eaten			
5th time Food was eaten			

APPENDIX E

PRACTICES, ATTITUDE, AND KNOWLEDGE INSTRUMENT (PAK)

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

College of
Human Ecology

Nutrition and
Food Science

Dear Parent:

Your son or daughter has been selected to participate in a study about teenage nutrition. The purpose of the study is to find better ways of teaching nutrition to teenagers. The results of the study will be used to improve nutrition education programs for teenagers. Participation in the study involves completing records of food intake and questionnaires related to nutrition. Because we want the study to represent all teenagers, we hope you allow your son or daughter to participate, but the choice is yours. Mrs. Adrienne White, a former teacher and now a doctoral candidate at The University of Tennessee, Knoxville, will be teaching a nutrition unit as part of your teenager's health class this semester; however your teenager may participate in the nutrition unit without being included in the study.

The information that your son or daughter gives will be confidential; his/her name and the name of his/her school will not be connected in any way with his/her responses. If you are willing to have your son or daughter participate in the study, please complete the form below and return it to school. All the information for the study will be collected using paper and pencils. Most of the assessments will be made during the first semester as part of the nutrition unit. One form will be mailed to your son/daughter in May to be completed at that time.

If you have questions at any time, you may call us at 974-6244 or 974-0824.

Thank you for your help,

Jean D. Skinner, Ph.D., R.D.
Associate Professor

Adrienne A. White
Graduate Research Assistant

I, the undersigned, agree to allow my son/daughter to participate in the project, "Changing Dietary Behavior Via Nutrition Education", conducted by personnel of the Agricultural Experiment Station of The University of Tennessee, Knoxville.

I voluntarily give my permission for my son/daughter to participate and understand that I may withdraw that permission at any time.

I understand that participation in the project involves no known risks and although there are no direct benefits, data from the study will be used to improve the quality of nutrition education for teenagers.

I further understand that I may ask questions about the study and that my son/daughter may also ask questions prior to participation.

It also is understood that my son/daughter may decide not to participate if he/she so chooses.

Student's Name_____

Parent's Signature_____

Date_____

1215 West Cumberland Avenue, Room 229 / Knoxville, Tennessee, 37996-1900 / (615) 974-5445, 974-3491

Food Practices Instrument

Are your food habits promoting a healthy lifestyle? Place a check in the column that best describes your response to each of the following

	Always True	Almost Always True	Sometimes True	Almost Never True	Never True
1. On a typical day, I eat breakfast.					
2. On a typical day, my snacks are LOW in sugar, so I don't snack on foods such as pastries, candy, cakes, cookies, and soft drinks.					
3. On a typical day, I eat something from each of these 4 food groups: 1)fruit vegetables 2)breads/cereals 3)milk 4) meats/fish/poultry.					
4. On a typical day, I eat lunch.					
5. On a typical day, I eat at least 6-3 foods containing fiber, such as whole-grains breads/cereals and fruits and vegetables.					
6. On a typical day, I eat moderate quantities of food, which helps maintain desirable weight.					
7. In a typical day, I drink at least 3 glasses of milk and/or select 3 servings of other dairy products.					
8. I limit salt intake in ways such as minimal use of table salt, avoiding salty snacks, and choosing low or no salt varieties of foods (low salt crackers/chips).					
9. I limit fat intake by having few fried foods (meats, vegetables, french fries), using small quantities of margarine, butter, cream or shortening, and not eating fat around meat.					
10. In a typical WEEK, I eat more fish including tuna and/or poultry (chicken, turkey) than red meat (hamburger, steak, pork).					
11. From week to week, I eat different kinds of meat, fruits, vegetables, breads/cereal milk products; therefore, I eat a variety of foods.					
12. When I drink milk or have it combined with other foods, for example, with cereal or in pancakes, I use low fat or skim milk.					

Attitude Instrument

For the following statements, please indicate the extant of your agreement or disagreement by checking the appropriate column.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. Nutrition is important to me and one should not be careless about it.					
2. Knowing something is "good for me" has little or no influence on what I chose to eat.					
3. I usually will not taste a food if its appearance is similar to something I dislike.					
4. If my diet were poor, I would probably take vitamin pills rather than vary the foods I choose.					
5.* I would be willing to try an unfamiliar food at least once.					
6. I don't have time to think much about nutrition.					
7. Learning the basic ideas in nutrition will probably NOT alter my personal eating habits very much.					
8. Even if I take vitamins, I feel that I should be concerned about the foods I eat.					
9. I feel that a person who gets the most satisfaction out of eating is the one who sticks to the foods that are familiar.					
10. I am concerned about eating nutritious foods throughout the day.					
11. I feel the foods I eat now will affect my future health.					
12. Trying new foods appeals to me.					
13. Nutrition is not so important to me as long as I eat a lot of food.					
14. I feel that if I drink milk, I don't have to worry about nutrition.					
15. If I am satisfied with the foods I eat, I see no reason to change.					
16. I feel that as long as I maintain a desirable weight, I don't have to worry about nutrition.					
17. In actual practice my nutrition knowledge has little influence on what I select to eat.					

Knowledge Instrument

Select the one best response to each question. If you don't know, use your best guess. Circle your answer.

1. For most people in the world, the major source of energy (calories) comes from which of the following nutrients?

   a. Carbohydrates
   b. Fats
   c. Proteins
   d. Vitamins

2. Which of the following nutrients are often low in the diets of teenagers according to recent surveys in the U.S.?

   a. Calcium, iron, and vitamin A
   b. Protein, iron, and fiber
   c. Protein, folacin, and fat
   d. Vitamins A, B_{12}, and C

3. One of the uses of fat in the diet is a carrier for which of the following?

   a. Niacin
   b. Protein
   c. Vitamin A
   d. Vitamin C

4. Which of the following foods has the greatest amount of iron?

   a. 1 cup yogurt
   b. 1/2 fresh grapefruit
   c. 1 carrot
   d. 3 oz. cooked hamburger

5. Which of the following is the best source of vitamin A?

   a. Cauliflower
   b. Corn
   c. Green beans
   d. Sweet potatoes

6. Which of the following is the best source of vitamin C?

   a. Apples
   b. Bananas
   c. Peaches
   d. Strawberries

7. Which of the following foods provides the calcium equivalent to that in 8 oz. milk?

   a. 1/2 cup ice cream
   b. 1/2 cup carrots
   c. 1 cup strawberry yogurt
   d. 1 pork chop

8. Calcium needs for teenagers are the same as those for the following:

   a. Adult men
   b. Children, 6-12 years old
   c. Infants, 0-12 months old
   d. Pregnant women

9. Teenage boys have nutrient needs greater than teenage girls for the following nutrient:

   a. Calcium
   b. Iron
   c. Vitamin A
   d. Vitamin C

10. Which of the following provides the most vitamin A?

   a. Green and yellow vegetables
   b. Meat, fish, and poultry
   c. Potatoes, turnips, and dried beans
   d. Whole grain breads and cereals

11. Which of the following is the best source of folacin?

   a. Egg
   b. Fish
   c. Macaroni and cheese
   d. Spinach

12. Fast foods tend to be high in:

   a. Calcium, folacin and iron
   b. Calories, fat, and salt
   c. Calcium, cholesterol, and fiber
   d. Vitamins A, C, and B_{12}

13. A lifestyle disease related to nutrition is:

   a. Heart disease
   b. Influenza
   c. Pneumonia
   d. Scarlet fever

14. An example of a cruciferous vegetable is:

    a. Asparagus
    b. Broccoli
    c. Corn
    d. Lettuce

15. Which of the following is the best source of vitamin C?

    a. Cabbage
    b. Carrot
    c. Green peas
    d. Lima beans

16. Which of the following is the best source of iron?

    a. Banana
    b. Cereal
    c. Milk
    d. Tomato

17. Foods high in sodium (salt) include:

    a. American cheese, bacon, steak sauce
    b. Apples, grapes, tangerines
    c. Cucumbers, lettuce, tomatoes
    d. Noodles, puffed wheat, rice

18. During teen growth and development, a teenager will achieve the following percentage of the weight they will have as an adult.

    a. 10% weight
    b. 30% weight
    c. 50% weight
    d. 70% weight

19. The best source of calcium among the following foods is:

    a. Canned salmon
    b. Peanut butter
    c. Squash
    d. Watermelon

20. Of the following groups of foods, the one highest in cholesterol is:

    a. Apple pie, lemon sherbet, coffee
    b. Broccoli, chicken, rice
    c. Green salad, whole wheat bread, margarine
    d. Shrimp, whole milk, liver

21. Generally speaking, fats classified as saturated tend to be:

    a. Found only in foods which have not been processed
    b. Found primarily in vegetable oils
    c. Found primarily in animal foods
    d. Saturated with cholesterol and found in most foods

22. The recommended dietary allowances (RDA's) are:

    a. Amount of salt recommended for daily use
    b. Amount of fiber recommended for daily intake
    c. Nutrient standards for almost all healthy Americans
    d. Same as basic four foods groups

23. Iron is more easily absorbed by the body when a meal also includes a good source of which nutrient:

    a. Calcium
    b. Folacin
    c. Vitamin A
    d. Vitamin C

24. Foods high in fiber include the following:

    a. Dairy products
    b. Fats
    c. Meats
    d. Vegetables

25. Vitamin A has an important role in:

    a. Developing and maintaining mucous membranes
    b. Forming and maintaining collagen
    c. Forming organic framework of bones
    d. Metabolizing carbohydrates, protein, and fat

Demographic Information

1. What is your age? _____ years

2. Gender (circle) male female

3. What is your race?

____ White	____ Asian
____ Black	____ Hispanic
____ American Indian	____ Other, please specify _____

4. What is your current grade in school?

____ 7th grade	____ 10th grade
____ 8th grade	____ 11th grade
____ 9th grade	____ 12th grade

5. How many older brothers do you have? _____

younger brothers? _____

6. How many older sisters do you have? _____

younger sisters? _____

7. Are you the oldest, middle or youngest child in your family?

____ only child

____ oldest

____ in the middle

____ youngest

8. How many children live in your household? _____

9. Who lives with you? (check all those that apply)

____ brothers & sisters	____ stepmother
____ mother	____ stepfather
____ father	____ grandparents

____ others, please specify _____

10. Is your father or male legal guardian employed?

_____ Yes _____ No

If yes, what is his current occupation? _____

11. How many years of schooling has he completed?

_____ less than grade school

_____ completed grade school

_____ some high school

_____ completed high school

_____ technical or vocational school

_____ some college

_____ completed college

_____ graduate school

12. Is your mother or female legal guardian employed?

_____ Yes _____ No

If yes, what is her occupation? _____

13. How many years of schooling has she completed?

_____ less than grade school

_____ completed grade school

_____ some high school

_____ completed high school

_____ technical or vocational school

_____ some college

_____ completed college

_____ graduate school

14. Do you work? _____ Yes _____ No

If so, how many hours per week? _____

APPENDIX F

RATING INSTRUMENTS

Rating Instrument

Behavior Change

Place a check in the box that corresponds to the statement that best describes how helpful or unhelpful each of the following activities was in helping you improve your food-related behavior.

	very helpful	helpful	uncertain	unhelpful	very unhelpful
1. Keeping food records of your own food intake					
2. Using own nutrient analysis to understand and evaluate your personal food intake					
3. Using the Matrix Madness worksheet and looking at categories that affect eating behavior, such as time of day, feelings, place, and who prepared food					
4. Using Decision Making Sheet to make decisions to change food-related behavior based on benefits and cost of different solutions					
5. Actually implementing the solutions you selected for making changes in food-related behavior					
6. Using GSA Calendar to implement solutions					
7. Using the Desire to Relapse/Desire to Continue worksheet to monitor the solutions you selected					
8. Using the Evaluation Form to evaluate your successes & failures					
9. Being in a class structured with follow-up sessions (class days separated from each other)					

List anything else about the nutrition unit that helped you to improve your food-related behavior? How helpful were these activities compared to the activities listed? very helpful or helpful

What other activities would have helped you to improve your food-related behavior?

Rating Instrument

Behavior Change Plus

Place a check in the box that corresponds to the statement that best describes how helpful or unhelpful each of the following activities was in helping you improve your food-related behavior.

	very helpful	helpful	uncertain	unhelpful	very unhelpful
1. Keeping food records of your own food intake					
2. Using own nutrient analysis to understand and evaluate your personal food intake					
3. Learning to select kinds and quantities of foods to meet the RDA, as you did on the worksheet Improving My Diet					
4. Video showing health consequences of different eating styles and ways of eating to decrease risk of lifestyles diseases, such as cancer and heart disease					
5. Teacher demonstration and taste-testing of selected health-promoting foods					
6. Learning about the relationship between teen growth and nutrient needs					
7. Filmstrip showing how lifestyles such as family eating patterns, busy schedules, and emotional factors can influence eating habits					
8. Using the Matrix Madness worksheet and looking at categories that affect eating behavior, such as time of day, feelings, place, and who prepared food					
9. Using Decision Making Sheet to make decisions to change food-related behavior based on benefits and cost of different solutions					
10. Actually implementing the solutions you selected for making changes in food-related behavior					
11. Using GSA Calendar to implement solutions					
12. Using the Desire to Relapse/Desire to Continue worksheet to monitor the solutions you selected					
13. Using the Evaluation Form to evaluate your successes & failures					
14. Being in a class structured with follow-up sessions (class days separated from each other)					

List anything else about the nutrition unit that helped you to improve your food-related behavior? How helpful were these activities compared to the activities listed? very helpful or helpful

What other activities would have helped you to improve your food-related behavior?

APPENDIX G

DESCRIPTIVE CHARACTERISTICS OF ADOLESCENTS

Table 25. Familial Characteristics of Adolescents.

Group	n	% with		Total Children in Family	% Living with		% Race		
		Working Fathers	Working Mothers		Step Father	Step Mother	White	Black	Hisp
Behavior Change:									
Complete Data	48	95.7	72.9	2.40 ± 1.20[1]	14.3	0.0	94	4	2
Incomplete Data	23	100.0	76.9	1.96 ± 0.88	4.3	8.7	87	13	-
Behavior Change Plus:									
Complete Data	55	94.4	65.4	2.09 ± 0.92	8.9	7.1	95	3	2
Incomplete Data	13	95.2	65.2	1.92 ± 0.95	7.7	0.0	92	-	8
Control:									
Complete Data	49	89.8	71.4	2.18 ± 1.00	12.0	8.0	100	-	-
Incomplete Data	23	95.5	60.9	2.30 ± 0.97	4.3	8.7	-	-	-

[1] MEAN ± SD.

Table 26. Percent of Working Adolescents by Treatment and Data Completion.

Group	n	% Working Adolescents	Hours/Wk
Behavior Change:			
Complete Data	48	9	2.8
Incomplete Data	23	39	8.1
Behavior Change Plus:			
Complete Data	56	14	4.2
Incomplete Data	13	4	6.3
Control:			
Complete Data	50	11	4.5
Incomplete Data	23	5	3.3

Table 27. Percent of Parents with Various Education Levels.

Group	n	< Grade School	Grade School	Some HS	Completed HS	Tech/Voc School	Some College	Completed College	Graduate School
Behavior Change:									
Complete data	47								
Father		-	2.2	4.3	19.6	13.0	8.7	32.6	19.6
Mother		2.1	2.1	4.3	29.8	2.1	21.3	25.5	12.8
Incomplete data	23								
Father		4.5	9.1	18.2	27.3	4.5	9.1	13.6	13.6
Mother		-	-	13.0	30.4	13.0	21.7	13.0	8.7
Behavior Change Plus:									
Complete data	55								
Father		1.9	9.3	22.2	31.5	14.8	7.4	11.1	1.9
Mother		-	5.5	20.0	36.8	7.3	16.4	10.9	3.6
Incomplete data	13								
Father		-	7.7	30.8	23.1	7.7	7.7	7.7	15.4
Mother		-	-	30.8	30.8	7.7	7.7	15.4	7.7
Control:									
Complete data	48								
Father		-	4.3	6.4	25.5	4.3	14.9	25.5	19.1
Mother		2.1	2.1	6.3	37.5	2.1	4.2	35.4	10.4
Incomplete data	23								
Father		-	-	13.6	27.3	4.5	-	45.5	9.1
Mother		-	-	4.3	21.7	8.7	26.1	34.8	4.3

APPENDIX H

NUMBER OF ADOLESCENTS WITH POSITIVE CHANGE IN NUTRIENT INTAKE BY GOAL

Table 28. Number of Adolescents with Positive Change in Nutrient Intake by Goal.

Nutrient Goal	Total Number[1]	Number with Change
Iron	21	10
Calcium	32	24
Vit A	16	13
Vit C	11	7
Folacin	10	7
Sodium	13	9
Other[2]	6	3

[1] n = 109.

[2] Includes fat, complex carbohydrates, and fiber.

APPENDIX I

CHANGE IN PERCENT RDA FOR NUTRIENT GOALS
FROM PRE-ASSESSMENT TO POST-ASSESSMENT

Table 29. Change in Percent RDA for Nutrient Goals from Pre-Assessment to Post-Assessment.

Nutrient Goal	n	% RDA	
		Pre	Post
Iron	21	67	72
Calcium	32	49	81
Vit A	16	48	109
Vit C	11	60	165
Folacin	10	37	63

APPENDIX J

MEAN SCORES BY STATEMENT OF PRACTICES INSTRUMENT

Table 30. Food Practices Instrument: Pre-/Post-Assessment Mean Score by Statement for Three Groups--Behavior Change, Behavior Change Plus, and Control.

	Statement		Mean Score[1] Behavior Change n=57	Behavior Change Plus n=58	Control n=50
1.	On a typical day I eat breakfast.	Pre	3.44	3.39	3.84
		Post	3.76	3.61	3.72
2.	On a typical day, my snacks are LOW in sugar, so I don't snack on foods such as pastries, candy, cakes, cookies, and soft drinks.	Pre	2.77	2.68	2.58
		Post	2.92	2.80	3.72
3.	On a typical day, I eat something from each of these four food groups: 1) fruits and vegetables; 2) breads/ cereal; 3) milk; 4) meats/fish/ poultry.	Pre	3.68	3.48	3.64
		Post	3.74	3.42	3.58
4.	On a typical day, I eat lunch.	Pre	4.30	3.93	4.35
		Post	4.18	4.00	4.34
5.	On a typical day, I eat at least 6-8 foods containing fiber, such as whole grains breads/cereals and fruits and vegetables.	Pre	3.08	3.23	2.84
		Post	3.15	3.71	2.88
6.	On a typical day, I eat moderate quantities of food, which helps maintain desirable weight.	Pre	3.60	3.29	3.61
		Post	3.55	3.26	3.35
7.	In a typical day, I drink at least 3 glasses of milk and/or select 3 servings of other dairy products.	Pre	3.32	3.16	3.44
		Post	3.49	3.43	3.53

Table 30 (continued)

Statement		Mean Score[1] Behavior Change n=57	Behavior Change Plus n=58	Control n=50
8. I limit salt intake in ways such as minimal use of table salt, avoiding salty snacks, and choosing low or no salt varieties of foods (low salt crackers or chips).	Pre	3.40	2.75	2.84
	Post	3.39	3.15	3.04
9. I limit fat intake by having few fried foods (meats, vegetables, french fries), using small quantities of margarine, butter, cream or shortening, and not eating fat around meat.	Pre	2.98	2.73	2.64
	Post	3.08	2.78	2.80
10. In a typical WEEK, I eat more fish including tuna and/or poultry (chicken, turkey) than red meat (hamburger, steak, pork).	Pre	2.60	2.30	2.46
	Post	2.78	2.70	2.60
11. From week to week, I eat different kinds of meat, fruits, vegetables, breads/cereal, milk products; therefore I eat a variety of foods.	Pre	3.88	3.68	3.88
	Post	3.78	3.56	3.62
12. When I drink milk or have it combined with other foods, for example, with cereal or in pancakes, I use low fat or skim milk.	Pre	2.73	2.84	3.26
	Post	3.03	3.17	3.40

[1]Response scores ranged from 1 = never true to 5 = always true.

APPENDIX K

MEAN SCORES BY STATEMENT OF ATTITUDE INSTRUMENT

Table 31. Attitude Instrument: Pre-/Post-Assessment Mean Score by Statement for Three Groups--Behavior Change, Behavior Change Plus, and Control.

	Statement[2]		Mean Score[1] Behavior Change n=51	Behavior Change Plus n=58	Control n=50
1.	Nutrition is important to me and one should not be careless about it.	Pre	3.96	4.10	4.04
		Post	4.12	4.06	4.06
*2.	Knowing something is "good for me" has little or no influence on what I choose to eat.	Pre	2.92	2.82	2.98
		Post	3.26	3.11	2.78
*3.	I usually will not taste a food if its appearance is similar to something I dislike.	Pre	2.92	2.34	2.84
		Post	2.94	2.74	3.08
*4.	If my diet were poor, I would probably take vitamin pills rather than vary the foods I choose.	Pre	3.61	3.76	3.62
		Post	3.74	3.58	3.52
5.	I would be willing to try an unfamiliar food at least once.	Pre	3.88	3.95	3.80
		Post	3.92	3.71	3.96
*6.	I don't have time to think about nutrition.	Pre	3.20	2.96	2.96
		Post	3.16	2.96	2.73
*7.	Learning the basic ideas in nutrition will probaby NOT alter my personal eating habits very much.	Pre	2.92	2.93	3.22
		Post	3.33	3.31	3.02
8.	Even if I take vitamins, I feel that I should be concerned about the foods I eat.	Pre	3.90	4.02	3.86
		Post	4.00	4.07	3.80
*9.	I feel that a person who gets the most satisfaction out of eating is the one who sticks to the foods that are familiar.	Pre	2.96	2.70	3.08
		Post	2.92	2.57	3.00

Table 31 (continued)

	Statement[2]		Mean Score[1] Behavior Change n=51	Behavior Change Plus n=58	Control n=50
10.	I am concerned about eating nutritious foods throughout the day.	Pre	3.06	3.11	2.74
		Post	3.31	3.43	3.08
11.	I feel the foods I eat now will affect my future health.	Pre	3.73	4.02	3.70
		Post	3.86	3.92	3.88
12.	Trying new foods appeals to me.	Pre	3.31	3.62	3.62
		Post	3.46	3.41	3.56
*13.	Nutrition is not so important to me as long as I eat a lot of food.	Pre	3.62	3.73	4.02
		Post	3.66	3.81	3.76
*14.	I feel that if I drink milk, I don't have to worry about nutrition.	Pre	4.12	4.05	4.02
		Post	4.12	4.08	3.96
*15.	If I am satisfied with the foods I eat, I see no reason to change.	Pre	3.14	2.88	3.26
		Post	3.12	3.04	3.10
*16.	I feel that as long as I maintain a desirable weight, I don't have to worry about nutrition.	Pre	3.41	3.42	3.54
		Post	3.71	3.46	3.41
*17.	In actual practice, my nutrition knowledge has little influence on what I select to eat.	Pre	2.90	2.64	2.78
		Post	3.31	3.11	2.82

[1]Responses were scored from 1 = most negative attitude to 5 = most positive attitude.

[2]* indicates response was coded to give a higher score for disagreeing with the statement.

VITA

Adrienne Adams White was born in Berea, Kentucky on May 15, 1946, the daughter of William and Katheryn Adams. She attended primary and secondary schools in Erlanger and Richmond, Kentucky and graduated from Model High School in Richmond, Kentucky in 1964. She received a Bachelor of Science degree in Home Economics Education from the University of Tennessee, Martin in 1968. Adrienne taught Home Economics at Georgian Hills Junior High and Manassas High School in Memphis, Tennessee from 1968-1972. In 1982, she reentered college at the University of Tennessee, Chattanooga. The following year, she and her two children, Adam Coles and Whitney Allison, moved to Knoxville where she began graduate work in the Department of Nutrition and Food Sciences at the University of Tennessee, Knoxville. While there she worked as an administrative assistant within the College of Human Ecology and as a graduate research assistant within the Department of Nutrition and Food Sciences. Requirements for the Doctor of Philosophy degree, with a major in Human Ecology were completed in August 1988.

Adrienne White is a member of the American Dietetic Association, American Home Economics Association, Institute of Food Technologists, Society of Nutrition Education, Omicron Nu, and Phi Kappa Phi.