CHANGES IN OBESITY-RELATED FOOD BEHAVIOR:

A NUTRITION EDUCATION INTERVENTION TO CHANGE ATTITUDES AND OTHER FACTORS ASSOCIATED WITH FOOD-RELATED INTENTIONS IN ADOLESCENTS:

AN APPLICATION OF THE THEORY OF PLANNED BEHAVIOR

A Dissertation

by

DIANE ELIZABETH CARSON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2010

Major Subject: Nutrition

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Approved by:

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ABSTRACT

Changes in Obesity-Related Food Behavior: A Nutrition Education Intervention to Change Attitudes and Other Factors Associated with Food-Related Intentions in Adolescents:

An Application of the Theory of Planned Behavior. (May 2010)

Diane Elizabeth Carson, B.S., California State University, Sacramento; M.S., California State University, Long Beach

Chair of Advisory Committee: Dr. Wm. Alex McIntosh

This research examines the effect of a nutrition education intervention to change attitudes and other factors associated with eating breakfast and consuming low-fat dairy and whole-grains. Adolescents (n = 106) 11 to 15 years old were recruited from after-school programs in Los Angeles County, California. Participants in the treatment group (n = 57) met once weekly for 60 minutes during seven weeks. The curriculum focused on changing attitudes, subjective norms, and perceived behavioral control toward eating breakfast along with including low-fat dairy and whole grains. The first three lessons focused on basic nutrition concepts. The later lessons focused on identifying barriers and overcoming barriers, goal-setting, and identifying methods to stay motivated. Questionnaires were administered at baseline and post-intervention. Data were analyzed using SAS statistical analysis program (v. 9.2).

Eighty-eight percent of participants were Hispanic, 55% were girls, and mean age was 12 years. One-hundred six adolescents completed the questionnaire at baseline and 75 completed it at post-intervention. Cronbach alpha statistic for subjective norms and attitudes toward eating breakfast, consuming low-fat dairy and whole-grains were 0.67 and higher for each dependent variable. Intention was significantly predicted by attitudes, subjective norms, and perceived behavioral control; however, as these models do not differentiate change, additional models were run with interactions between group (treatment versus control) and the change variables. Significant changes in perceived behavioral control were observed among participants in the treatment group regarding drinking skim milk, 1% milk, and 2% milk respectively ($p < .05$; $p < .001$; $p < .001$) and attitude ($p < .05$). No change was observed in breakfast eating or consumption of whole-grains.

DEDICATION

This dissertation, including all of the blood, sweat, and tears that went into it, could not have happened without Doug Hatton. Doug – from the beginning, you have been the rock of stability in my life. Without your love that kept me grounded and focused, this would not be. For every single word I wrote and every single word you read, I am forever grateful. This is as much yours as it is mine.

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1. INTRODUCTION: THE IMPORTANCE OF RESEARCH

Overweight and obesity are a result of energy imbalance. Several factors play a role including change in dietary habits, larger portion sizes, increase in consumption of fast food, lack of physical activity at school and in the home, and availability of high-calorie nutrient-poor foods (1). Addressing adolescent overweight is critical because it is associated with an increased risk of obesity into adulthood (2) but also independently is related to morbidity and mortality in adulthood (3). Adolescence is the period between puberty and adulthood.

Between the NHANES surveys of 1976-1980 and 2003-2006, prevalence of obesity increased from 6.5% to 17% among 6-11 year olds and 5% to 17.6% among those aged 12- to 19-years (4). Limited attention has been given to behavioral factors which may increase the risk of obesity. These include skipping breakfast, choosing high-fat dairy products over their low-fat counterparts, and choosing refined grains over whole-grain products.

Skipping breakfast has increased over time and may be more common among certain ethnic or low-socioeconomic groups in the adolescent population. Considering that skipping breakfast is associated with obesity risk and perhaps the under-consumption of some essential nutrients, it is more important than ever that adolescents consume a healthy and nutritious breakfast every day (5-7).

This dissertation follows the style of the *American Journal of Clinical Nutrition.*

In an analysis of NHANES III and NHANES 1999-2002 data, adolescents who consumed the least amount of dairy had a higher BMI along with a higher percentage of body fat (8). Another study showed consumption of flavored milks was not associated with higher BMI among youth aged 6-11 years and 12- to 18-years while both female and male non-milk drinkers had higher BMIs (9). Studies examining consumption of ready-to-eat cereal and its relationship with BMI have seen similar results. One study looked at whole grain intake among adolescents and found, after adjustment for age, gender, race, and energy intake, BMI was lower in those consuming more than one and one-half servings per day compared to those who consumed less (10). Another study in Greece found that adolescents who chose breakfast cereal had lower average BMIs compared to children who chose other breakfast foods (11).

DEFINITION OF BREAKFAST

One problem faced by researchers is the lack of a standard definition of breakfast. Different definitions exist including those defined by the participant (e.g., "How often do you eat breakfast?") (12), defined by the participant within boundaries (e.g., frequency of eating breakfast before going to school) (13), or defined by the researchers (e.g., "any eating occurring between 5:00 and 10:00 AM on weekdays or between 4:00 and 11:00 AM on weekends" or intake of certain foods) (5, 14-15). The United States Department of Agriculture Child and Adult Care Food Program guidelines (16) defines breakfast as "a meal which meets the nutritional requirements set out in §220.8, and which is served to a child in the morning hours. The meal shall be served at or close to the beginning of the child's day at school."

VALUE OF THE BREAKFAST MEAL

It is estimated children receive as much as 30% of their total daily caloric intake from the breakfast meal (17-18). When averaged over a school week, the breakfast meal provided at schools as part of the School Breakfast Program (SBP) must provide one-fourth of the Recommended Dietary Allowances (RDA) for protein, calcium, iron, vitamins A and C, and provide adequate calories (16). Participation in the SBP has grown since its inception from about 500,000 children participating in 1970 to 8.2 million children participating in 2002-2003 (19).

Consuming breakfast is associated with adequate nutrient intake, healthier food choices, more regular eating patterns throughout the day, more favorable body weight status, and improved exercise patterns (5, 20-21). Eating a healthy breakfast is important in meeting the health and nutrition needs of adolescents. Adolescents who eat breakfast are more likely to meet the daily recommended intakes for vitamins A, B_6, and B_{12}, and calcium than those who skip breakfast (5, 18, 22-26). More importantly, research has shown adolescents who skip breakfast do not, on average, make up the nutrient deficits during the rest of the day (7).

Participation in the school-breakfast program has been shown to be associated with higher breakfast intakes of food energy, calcium, riboflavin, phosphorus, and magnesium (27). An experimental study showed making breakfast available in elementary schools increased the likelihood children would consume a nutritious breakfast (28). More recently, researchers found children participating in the SBP had significantly lower BMI especially among non-Hispanic, white children (29).

LOW-FAT DAIRY, BREAKFAST AND BODY MASS INDEX

The Dietary Guidelines for Americans (30) recommend adolescents consume three cups per day of fat-free or low-fat milk or equivalent milk products. Overall, only 30% of the United States population aged 2 and older obtain the recommended levels of calcium (31). Research shows compared to breakfast skippers, mean daily intakes of calcium were higher in adolescents who consume breakfast regularly (7, 32). Calcium intake among adolescents is significantly and positively associated with eating breakfast, socioeconomic status, social support for healthful eating, and the availability of milk at meals (33). The question remains however, does intake of low-fat dairy during the breakfast meal correlate with BMI? As early as 1984, data from the first NHANES showed calcium intake was correlated with BMI (34). In 2000 it was reported fat acid synthesis and thus adiposity was regulated at the cellular level by dietary calcium (35).

WHOLE-GRAINS, BREAKFAST AND BODY MASS INDEX

There is limited literature examining the benefit of including whole-grains in the breakfast meal in terms of meeting the daily recommended intakes of dietary fiber, vitamins and minerals in the adolescent population. Cross-sectional surveys with adolescents in the United States have found that inadequate dietary fiber intakes could be improved by increasing the consumption of whole-grains (30). In a study conducted by Affentio et al., (5), researchers reported that adolescents who eat breakfast had increased intakes of calcium and fiber. The Dietary Guidelines for Americans (30) recommend that children and adolescents should consume whole-grain products often and that at least half of the grains in the diet should be whole grains. Diets rich in whole-grains

provide a host of potential benefits to overall health including reducing the risk of heart disease, helping with weight maintenance and lowering the risk of other chronic diseases (30).

CONCEPTUAL FRAMEWORK

The present study examines the impact of an after-school based intervention designed to improve breakfast behavior and habits among adolescents. The purpose was to increase breakfast eating and the consumption of whole-grains and low-fat dairy in a predominantly, Hispanic adolescent population. The intervention is grounded in the Theory of Planned Behavior (TPB). Conceptual model is at **Figure B-1**.

There have been few interventions delivered to adolescents which used the TPB as a conceptual framework. One study tested the effectiveness of an intervention program to alter adolescents' healthy eating attitudes and behavior (36). Results showed the intervention was effective in improving attitudes toward healthy eating. Another study examined the effect of a condom promotion leaflet and 20-minute intervention on adolescents intention and attitude toward using a condom (37). Results showed after the intervention, attitude toward using a condom with new partners increased along with intention to use condoms. In an examination of the efficacy of an intervention designed to positively influence physical activity behavior among pediatric cancer survivors, researchers found that the intervention had a small yet meaningful impact after one year (38).

THEORY OF PLANNED BEHAVIOR (TPB)

The TPB is an expectancy-value model which states an individual's behavior is determined proximally by his/her intentions to perform a given behavior (39). A number of studies suggest the role of the TPB in understanding and predicting health behaviors (40). The TPB model has been applied to a number of nutrition related behavior research involving soft drink consumption among female adolescents (41), fruit and vegetable consumption among young adolescents (42), sugar restriction (43), and intention to adopt a low-fat diet in men 30- to 60- years old (44).

Central to the model is the individual's intention to perform a given behavior. Intentions are assumed to capture the motivational factors that influence a behavior and are indicative of how hard a person is willing to try and how much effort a person is willing to exert in order to perform the behavior (39). Intention is the immediate antecedent of behavior and is determined by the attitude toward the behavior, subjective norm, and perceived behavioral control (39).

Attitude is defined as the overall evaluation of behavior and refers to the degree to which a person has a favorable or unfavorable assessment of the behavior in question (behavioral beliefs) and how much value is placed on the behavioral outcome (evaluation) (45). For example, a person may like bran cereal (behavioral belief), but may not purchase bran cereal because the benefits of bran in his/her overall diet are not valued (evaluation) (39). Thus, if a person holds strong beliefs about the positive outcome of eating bran cereal, a more positive attitude toward the behavior will be held (45). Whether a person has a favorable or unfavorable assessment of the behavior in

question, she/he must have the required skills to perform the behavior. In this example, a person would have to possess the abilities to grocery shop and make breakfast (46). In addition, there should be no environmental constraints that make it difficult or impossible to perform the behavior (46). A positive environment is requisite in order to produce a given behavior. This means, in order for a person to eat bran cereal, bran cereal has to be available.

Subjective norm is defined as the perceived belief about whether most people approve or disapprove of the behavior and refers to the perceived social pressure to perform or not perform the behavior (39, 45). This concept is centered on how one "should" act in response to the views and opinions of others (normative belief) and the desire to do what others think (motivation to comply). Strong influences include family and friends; weaker influences include doctors, teachers, colleagues, or religious organizations (39).

Perceived behavioral control refers to the perceived ease or difficulty of performing the behavior, or stated another way, how much control a person has in performing the behavior (39). For example, a person may not be able to purchase bran cereal if it is not available in the store where he/she shops. Perceived behavioral control is assumed to reflect past experiences about the behavior (habits) and in some cases, second-hand information provided by others (control beliefs). The perceived ease or difficulty in performing the behavior is also considered (perceived power) (39, 45). The TPB model says perceived behavioral control, together with behavioral intention can be used directly to predict behavioral achievement (39).

The more positive a person's attitude toward a behavior and the greater the perceived behavioral control, the more likely a person is to perform the behavior (39). While motivation to carry out the behavior is present, non-motivational factors such as availability and opportunity must be present in order for the behavior to be performed (39). Perceived behavioral control can influence behavior directly. An increased sense of control strengthens a person's intention to perform a behavior and increases effort as well as determination (40).

An advantage of the TPB model is that it is a complete theory of behavior. Variables in the model are assumed to mediate the effects of the other variables including demographic influences such as ethnicity, gender, age, socioeconomic status, and personality (39-40). More importantly, the model is open to incorporating new variables that may explain a significant proportion of variance in intention or behavior beyond the variables specified in the theory (39).

OBJECTIVES

Most nutrition education efforts have examined the health benefits of eating breakfast to increase nutrition knowledge and awareness. Few studies have explored the value and effect of designing interventions to examine the influences of peers and family on predicting and explaining intention and behavior to eat breakfast. In the long-term this is important because intention is not only influenced by peers and family but is an indicator of how hard a person is willing to try and how much effort a person will exert toward performing a behavior. It is also important to gain an understanding of attitude toward eating breakfast because changing knowledge and behavior is not enough; the

ultimate goal is to effect lifelong knowledge and behavior. Educating and motivating adolescents about the long-term benefits of consuming breakfast and consuming a breakfast that is rich in whole-grain and low-fat dairy could have a significant impact on overall health and well-being among this age group.

The **first objective** of this study was to assess the needs and test the feasibility of delivering an after-school based intervention to low-income, ethnically diverse adolescent boys and girls 12- to 14- years old aimed at changing breakfast behavior and habits. To accomplish this objective, focus groups will be conducted with after-school personnel and students to identify perceptions, behaviors and beliefs that contribute to eating whole-grains and low-fat dairy as part of a healthy breakfast every day. The **second objective** was to test the effectiveness of the intervention based on the TPB as a conceptual framework. The effects of attitude, social and personal factors, personal characteristics, self-efficacy, parental influence, and individual determinants on intention to predict breakfast consumption frequency will be examined. To accomplish this, a seven-week curriculum will be delivered to participants. Questionnaires that address breakfast behavior and habits of adolescents and their parents will be evaluated. Change in BMI will not be assessed due to the short length of this intervention.

2. REVIEW OF LITERATURE

ADOLESCENT DIET QUALITY AND BEHAVIORS

Diet Quality of Adolescents in the United States

Adolescence is an important life-stage and nutrition behaviors play a key role in health and well-being. Adolescence is a time of great physical and cognitive development with growth rate accelerating. It is believed that habits developed in this life-stage track to adulthood so it is important to promote healthy eating behaviors. Many adolescents consume diets that are inconsistent with the Dietary Guidelines for Americans (47-50). Diets are low in fruits, vegetables, whole-grains and high in fat, saturated fat, and sugar (47-50).

People do not eat individual nutrients; rather foods are consumed as snacks and meals which make up a dietary pattern. People do not usually make their food choices in terms of nutrients; rather they only see food in front of them. Dietary patterns established in childhood tend to track into adolescence and adulthood. At the same time, dietary patterns vary among ethnic groups and socioeconomic status. Most research on dietary patterns has focused on adults. Research of adolescent dietary patterns vary, indicating as few as two (51) and as many as 17 dietary patterns (52) indicating a lack of consistency in defining dietary patterns. Dietary pattern analysis is popular for characterizing the entire diet in combination. This approach can capture complex behaviors along with interactive and antagonistic effects (53). Principal component factor analysis and cluster analysis have become more popular in epidemiology to summarize dietary data (54). Other analyses have considered socioeconomic factors

(55) or meal frequency such as skipping breakfast (51) while others have examined health outcomes and risk factors such as BMI, blood pressure or cholesterol (52, 56). Adolescents tend to consume less fruits, vegetables, dairy, and whole-grains, and more sugary drinks and foods, and foods higher in total fat, saturated fat, cholesterol, and sodium compared to the Dietary Guidelines for Americans (6, 25, 32, 52, 56). In a population-based, cross-sectional study that included middle and high school students from Minneapolis/St. Paul public schools, researchers found frequency of family meals was positively associated with higher socioeconomic status, race (Asian American), and mother's employment status (not employed). Frequency of family meals was positively associated with higher intakes of fruits, vegetables, grains, and calcium-rich foods and negatively associated with soft-drink consumption (55). Additionally, positive associations were seen between frequency of family meals and protein; calcium; iron; folate; fiber; vitamins A, C and E; and total energy. Another study found that Hispanic youth acculturated to the United States tend to consume diets higher in energy and sodium with a higher percent of energy from fat and saturated fat compared to all racial/ethnic youth groups in the United States (49). A study in Australia examined the risk of obesity and high blood pressure among Australian youth 12- to 18-years. After factor analysis, three dietary patterns emerged: (1) fruit, salad, cereals, and fish; (2) high fat and sugar; and (3) vegetables. Results showed the fruit, salad, cereals, and fish pattern was inversely associated with age and diastolic blood pressure; the high fat and sugar pattern was associated with males; and the vegetable pattern was associated with a rural region of residence.

Another important factor to consider when examining dietary quality in youth is the consumption of breakfast. As children progress through adolescence, breakfast skipping increases (6, 25). Breakfast consumption patterns among children and adolescents are of concern given the association of breakfast consumption with overall diet quality and nutritional adequacy (32), school performance (57), and the relationship with overweight and obesity (5, 15, 20, 25, 58). Data from the Nationwide Food Consumption Surveys for 1965-1966 and 1977-1978 (59) and the 1989, 1990, and 1991 Continuing Surveys of Food Intakes by Individuals (59) document a decline in breakfast consumption by youth in the United States. Also, these trends are seen among youth in Canada (60), England (61), Spain (62), Greece (63), Finland (13), Sweden (14), Australia (64), Iran (65), and Taiwan (66).

Development of Food Behaviors and Preferences

A host of factors including food preferences, genetics and environmental influences, family demographics, and parenting style contribute to overweight children in the United States (55, 67-72). Three major learning processes are thought to modify the food acceptance patterns of the child (73-75). The first, repeated exposure to unfamiliar foods can reduce neophobia, the tendency to reject unknown or unfamiliar foods. Second, social influences can change food acceptance. Children who observe parents and peers consuming a food are more likely to try the food. Finally, children learn to associate the physiological consequences of food intake with taste cues and this eventually may result in the development of cognitive structures and processes such as attitudes and beliefs about food and eating.

Recent studies show neophobia may be heritable (67-68). In one study with twins (8 to 11 years old), variation in neophobia because of heritable genetic differences was estimated at 78% with 22% of the variance explained by non-shared environmental factors (68). In another study with same-sex twins (4 to 5 years old), heritability was found to be modest for dessert foods, moderate for vegetables and fruits, and high for protein foods (67).

Research indicates that children and youth of low-socioeconomic status and minority populations are more likely to consume nutrient poor diets, exercise less, and be overweight or obese (76-77). Gangi and colleagues reported race-, gender-, and age-specific differences in dietary micronutrient intakes in US children 1 to 10 years old and found Black males and females had significantly lower dietary intakes for several micronutrients compared to their white counterparts (76). Delva and colleagues found minority, low-income male adults and male youth were consistently at or above the 85th percentile compared to their White counterparts at every socioeconomic status (77). Early food experiences among Hispanics were found to be different from their non-Hispanic counterparts in many ways in the Feeding Infants and Toddlers Study (78). In this study, Hispanic infants under 12 months of age were more likely to be breastfed along with consuming fresh fruits, fruit-flavored drinks, baby cookies, and foods like soup, rice, and beans as compared to non-Hispanic infants. Additionally, they were less likely to consume non-infant cereals and baby food vegetables.

Parent Feeding Styles and Expectations

Research suggests parental feeding practices play a role in later eating and weight outcomes of their children (79-80). Parents play a pivotal role in the development of their children's eating habits, especially through their child-feeding practices (70, 80). It is the parent who determines which foods are offered to his or her child, which foods the child is forbidden to eat, along with the emotional tone of the meal (81). Parenting style can have profound effects on the development of food preferences in children and it is clear that the degree of parental control should be considered (69, 82), especially since parental control of child eating has been associated with a greater risk of child overweight (72, 80, 82-83).

One study explored the role of modeling and control among 112 pairs of parents and their children (9 to 13 years old) when consuming snack foods (69). Snack intake was significantly correlated between parent and child. Children had higher intakes of both healthy and unhealthy snacks if their parents reported greater attempts to control their child's diets. These parents also had higher dissatisfaction with their own body images. When parents tried to control the food intake of children (e.g., offering one food as reward for eating another food), it often resulted in the opposite effect intended with preference for the distasteful food decreasing and preference for the reward food increasing (70, 84). Another study found adolescents' perception of how they were parented (e.g., nurture versus authoritarian style of nurturing) directly predicted body fat (82). Associations between authoritative parenting by the mother and heavier adolescent

body weight, sub-scapular skinfold, body mass index, and waist circumferences were significant.

A recent study examined the role of psychological variables (e.g., parental perceived responsibility for child's eating, parental perceptions of the child's weight, and parents' own eating patterns) in a French and American sample (85). Researchers found that among parents in France, monitoring was associated with parental perceived responsibility for child's eating, parental restrained eating, and parents' desire for their child to be thinner. Restriction of foods for reasons of body weight was more prevalent in France while use of foods for nonnutritive purposes was more prevalent in the United States. In the United States, more parents reported controlled or emotional eating. In a similar study, researchers examined the socio-cultural differences between the United States and France in levels of feeding practices and the relationships between parent and child BMI and parental feeding practices in both cultural contexts (86). They found parental feeding practices such as monitoring, modeling of healthy eating habits, and use of food as a reward was associated with child BMI in both France and the United States.

Influence of Peers on Food Choices

The role of peers in adolescent food choices is a relatively new concept. Studies have shown adults eat more and spend more time eating when they are in the presence of others rather than alone (87). It is important to note however, that in the presence of certain others, eating behavior may change. One study examined the effects of peer influence on lean and overweight pre-adolescent girls' snack intake (88). Participants included 23 lean (at or below the 85th BMI percentile) and 23 overweight or at risk for

becoming overweight (>85th BMI percentile) girls 8 to 10 years old. Each participant took part in a 45-minute experimental session that involved each child working on a sorting task in the presence of another participant while having access to snack foods. Half of the sample was composed of lean-lean or overweight-overweight dyads. The other half was composed of lean-overweight dyads. Results indicate the amount of snack consumed by the co-eater predicted their partners' snack food consumption. Overweight girls eating with an overweight peer consumed more kilocalories than overweight participants eating with a normal-weight peer. Lean participants eating with overweight peers ate similar amounts of snack food as those who ate with lean eating companions. A similar study examined how the social context (alone versus presence of peers) influences overweight and normal-weight children's food intake (89). Thirty-two children (6 to 10 years old) participated in the study. Seventeen were overweight. Results showed overweight children ate more when alone than with a group of peers and normal-weight children ate more when they were with peers than when they were alone. Another study tested the hypothesis that modeling influences eating in overweight and non-overweight preadolescent girls (90). In this study, researchers had participants perform a sorting task while watching a video. Snacks were provided and participants were informed they could eat as much as they wanted. The video model (10-year-old girl at the 75th percentile for BMI) performed the same task. The video model was shown performing her task and choosing either a small or large serving of cookies. Results indicated that overweight participants consumed significantly more cookies than

non-overweight participants suggesting peer-modeling influences overweight and non-overweight preadolescent girls' snack consumption.

Influence of Teachers on Food Choices

We could find no research on the influence of teachers on food choices of adolescents. Social Cognitive Theory says teacher modeling should be one of the most effective methods to encourage young children to accept foods during preschool lunch (91). Preschool teachers rated modeling as an effective method to encourage a child's food acceptance (92). When preschool teachers modeled with enthusiasm ("Mmm! I love mangos!"), preschool children maintained the new food acceptance across five meals (92).

In summary, Benton (70) reported that if parents want to encourage their children to eat a particular food, they should not try to control the diet because it would likely be ineffective. Hispanic youth tend to consume diets that are less than optimal for long-term health and not in line with the Dietary Guidelines for Americans (49). Because consumption of a healthy diet leads to long-term health and because dietary patterns tend to track into adulthood from childhood and adolescence, researchers should focus attention on developing interventions targeting this age and ethnic group.

BREAKFAST BEHAVIOR DURING ADOLESCENCE

Breakfast may be considered the most important meal of the day yet most people skip it and adolescents are no exception. Breakfast consumption patterns among children and adolescents are of concern to public health experts given the association of breakfast consumption with overall diet quality and nutritional adequacy (17, 23, 32,

93), school performance (7, 57) and the relationship with overweight and obesity (5, 15, 20, 25, 58). Data from the Nationwide Food Consumption Surveys for 1965-1966, 1977-1978 (18, 59) and the 1989, 1990, and 1991 Continuing Surveys of Food Intakes by Individuals (18, 59) document a decline in breakfast consumption by youth in the United States. Also, these trends are seen among youth in Canada (60), England (61), Spain (62), Greece (63), Finland (13), Sweden (14), Australia (64), Iran (65), and Taiwan (66).

Although breakfast consumption has favorable implications, frequency of breakfast consumption decreases from childhood through adolescence (6, 25). Several reasons why adolescents skip breakfast are apparent. They include more frequent snacking, lack of time, lack of hunger and/or dieting to maintain or lose weight (7, 26, 32). Research suggests children and adolescents who report skipping breakfast are found to consume a greater proportion of total energy from fat and snacks that contain fat during the day (94).

Female adolescents are more likely to skip breakfast than male adolescents of similar age (7, 18) and African-American and Hispanic adolescents are more likely to skip breakfast than are white adolescents (5-7). Research indicates that skipping breakfast increases with age, may be more common among certain ethnic groups or low socioeconomic groups (6-7), and may be associated with lifestyle factors that may be detrimental to health, such as cigarette smoking and not participating in regular physical activity (7, 14).

Low-Fat Dairy, Breakfast and Body Mass Index

The Dietary Guidelines for Americans (95) recommend adolescents consume three cups per day of fat-free or low-fat milk or equivalent milk products. Overall, only 30% of the United States population aged 2 and older obtain the recommended levels of calcium (31). Research shows mean daily intakes of calcium are higher in adolescents who consume breakfast regularly, compared to breakfast skippers (5, 7, 31-32). Calcium intake among adolescents is significantly and positively associated with eating breakfast, socioeconomic status, social support for healthful eating, body mass index and the availability of milk at meals (8-9, 33).

Whole-Grains, Breakfast and Body Mass Index

There is limited literature that examines the benefit of including whole-grains in the breakfast meal in terms of meeting the daily recommended intakes of dietary fiber, vitamins and minerals in the adolescent population. Nevertheless, cross-sectional surveys with adolescents in the United States have found that inadequate dietary fiber intakes could be improved by increasing the consumption of whole-grains (30). Affentio et al. (5) reported that adolescents who eat breakfast have increased intakes of calcium and fiber. The Dietary Guidelines for Americans (96) recommend that children and adolescents consume whole-grain products often and that at least half of the grains in the diet should be whole grains. Diets rich in whole-grains provide a host of potential benefits to overall health including reducing the risk of heart disease, helping with weight maintenance, and lowering the risk of other chronic diseases (96).

RESEARCH NEEDS

Research to date has been primarily cross-sectional when examining breakfast consumption patterns among youth. Breakfast history may impact overall health indicators. Eating breakfast on a consistent basis, over time, could be important for, as an example, weight management. Studies have been conducted that examine consumption of ready-to-eat cereals; however, limitations do exist. Specifically, we could find none that asked youth about specific cereals consumed. Although consumption of sugared cereals is better than no breakfast at all, emphasizing whole-grain breakfast cereals should be the message as consumption of whole-grains could lead to improved overall nutrient status along with a healthful body mass index among adolescents. Despite the availability of a growing body of literature examining dairy consumption and overall calcium intake and/or body mass index, they too have been primarily cross-sectional in nature. Numerous benefits are observed with daily consumption of low-fat dairy products. Future research should target low-income, minority youth as they have a higher incidence of overweight and obesity.

OBESITY

In the last 30 years, the prevalence of overweight and obesity in this country has seen marked increases in both children and adults. Overweight and obesity are labels for ranges of weight that are greater than what is typically considered to be healthy for a given height. Overweight and obesity are shown to increase the risk of developing certain diseases and other health problems (1). For children, BMI $\geq 85^{th}$ percentile and

≤ 95th percentile is defined as "at risk for overweight); and, if his/her BMI ≥ 95th percentile, he/she is considered overweight (97).

Data from the National Health and Nutrition Surveys (NHANES) reveals that for those aged 6 to11 years, prevalence increased from 6.5% (1976-1980 survey) to 17.0% (2003-2006 survey) (97), and for those aged 12-19 years, prevalence increased from 5% (1976-1980 survey) to 17.6% (2003-2006 survey) (97). New data show one in seven low-income, preschool-aged children is obese (98). Moreover, among non-Hispanic white adolescent boys, the prevalence of obesity increased from 11.6% to 17.3%; among non-Hispanic black boys, the prevalence of obesity increased from 10.7% to 18.5%; and among Mexican-American boys, the prevalence of obesity increased from 14.1% to 22.1% (97). Non-Hispanic black adolescent girls showed the highest increase in prevalence of obesity (14.5%) compared to non-Hispanic white (7.1%) and Mexican-American adolescent (10.7%) girls.

These sharply increasing rates have serious implications for the overall health of American children and adolescents. Overweight and obesity are linked with increased risk and development of chronic disease including hypertension, osteoarthritis, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, sleep apnea, respiratory problems and certain cancers (97-98). More importantly, children and adolescents are developing chronic disease as a result of their obesity (97-98). The Centers for Disease Control (CDC) reports 70% of obese 5- to 17-year olds had a least one risk factor for heart disease and 39% had at least two (98). The American Diabetes

Association reports 22% of individuals 20-years and younger have diabetes and two million adolescents (1 in 6 overweight adolescents) aged 12-19 have prediabetes (99).

HEALTH BEHAVIOR THEORIES IN NUTRITION EDUCATION

Understanding **why** people behave the way they do, understanding **how** what people do affects their health, and understanding **what** causes people to change their health related behavior are important and oftentimes perplexing questions facing public health professionals today. As the obesity epidemic continues to rise in the United States, making sense of the numerous causal factors – social, structural, psychological, and others that predict health behavior has moved to center stage. The use of theory when designing interventions to elicit behavior change is crucial (100).

Theory acts as a guide describing the nature and strength of relationships of mediators to the behavior change and is based upon evidence from nutrition research (100). Constructs are connected together in order to explain food choices and behavior. There are several models of individual health behavior. Some address increasing awareness and enhancing motivation (e.g., Health Belief Model and Theory of Planned Behavior), some facilitate the ability to take action (e.g., Social Cognitive Theory and the Transtheoretical Model), while others address environmental factors influencing people's health actions (100). Theories are better at predicting health behavior when the behavior is specifically stated therefore, the more effective interventions will have a specifically stated behavior (100). Also, establishing habit – the repeated practice of a behavior so it becomes *automatic* is essential in developing behavior change interventions (100).

With all behavior theories, there are strengths and weaknesses. The Health Belief Model (HBM) framework has been strong in explaining and predicting acceptance of health and medical care recommendations however, it is important to be aware that use of the HBM in multicultural settings requires adaptation of constructs to make them more relevant to the target culture (101). In the Theory of Planned Behavior (TPB), the focus is on cognitive factors that predict motivation. The TPB has had considerable success in explaining behavior but it is important to identify the behavioral, normative, and control beliefs relevant to the behavior and population in question. When a researcher understands the control beliefs regarding each factor, only then can they be measured (45). Weaknesses with this model exist – for example habit and emotion are not considered. The Transtheoretical Model (TTM) comes from an analysis of leading theories of psychotherapy and behavior changes and incorporates ten stages of change (102). An advantage of the TTM is that health-care practitioners are able to treat individuals as they are – in different phases of readiness to make changes in their health behaviors. An important guideline when designing interventions around the TTM is to consider relationships of the TTM variables with constructs from other established health behavior theories such as perceived risk and subjective norms. Learning if these constructs relate to the stages of change and if they can predict progress across stages is one example (102). The most successful studies of TTM have used tailor-made messages. It is also important to consider how diverse populations respond to tailor-made messages and if they need to be edited for specific audiences. Social Cognitive Theory (SCT) explains human behavior by examining personal factors and

environmental factors which influence each other at the same time. One of the biggest pitfalls with SCT is that many practitioners believe it is too complex of a model in its formulation due to the large number of constructs (103).

A model that has been used in understanding the nutrition choices that people make is the Theory of Planned Behavior (TPB) described by Ajzen in 1991 (39). The TPB is an expectancy-value model which states an individual's behavior is determined proximally by his/her intentions to perform a given behavior (6). Intentions are assumed to capture the motivational factors that influence a behavior and are indicative of how hard a person is willing to try and how much effort a person is willing to exert in order to perform the behavior (39). Intention is the immediate antecedent of behavior and is determined by the attitude toward the behavior, subjective norms, and perceived behavioral control (39).

Attitude is defined as the overall evaluation of behavior and refers to the degree to which a person has a favorable or unfavorable assessment of the behavior in question (behavioral beliefs) and how much value is placed on the behavioral outcome (evaluation) (45). For example, a person may like bran cereal (behavioral belief), but may not purchase bran cereal because the benefits of bran in his/her overall diet are not valued (evaluation) (39). Thus, if a person holds strong beliefs about the positive outcome of eating bran cereal, a more positive attitude toward the behavior will be held (45). Whether a person has a favorable or unfavorable assessment of the behavior in question, she/he must have the required skills to perform the behavior. In the example with bran cereal, a person would have to possess the abilities to grocery shop and make

breakfast (46). Finally, there should be no environmental constraints making it difficult or impossible to perform the behavior (46). A positive environment is requisite in order to produce a given behavior. This means, in order for a person to eat bran cereal, bran cereal has to be available.

Subjective norm is defined as the perceived belief about whether most people approve or disapprove of the behavior and refers to the perceived social pressure to perform or not perform the behavior (39). This concept is centered on how one "should" act in response to the views and opinions of others (normative belief) and the desire to do what others think (motivation to comply). The strongest influences include family and friends; weaker influences include doctors, colleagues, and/or religious organizations for example (39).

Perceived behavioral control refers to the perceived ease or difficulty of performing the behavior, or stated another way, how much control a person has in performing the behavior (39). For example, a person may not be able to purchase bran cereal if not is not available in the store where they shop. Perceived behavioral control is assumed to reflect past experiences about the behavior and in some cases, second-hand information provided by others (control beliefs). The perceived ease or difficulty in performing the behavior is also considered (perceived power) (6). The TPB model says perceived behavioral control, together with behavioral intention can be used directly to predict behavioral achievement (39).

The more positive a person's attitude toward a behavior and the greater the perceived behavioral control, the more likely a person is to perform the behavior (39).

While motivation to carry out the behavior is present, non-motivational factors such as availability and opportunity must be present in order for the behavior to be performed (39). Perceived behavioral control can influence behavior directly. An increased sense of control strengthens a person's intention to perform a behavior and increases effort as well as determination (39).

An advantage of the TPB model is that it is a complete theory of behavior. Variables in the model are assumed to mediate the effects of the other variables including demographic influences such as ethnicity, gender, age, socioeconomic status, and personality (39-40). More importantly, the model is open to incorporating new variables that may explain a significant proportion of variance in intention or behavior beyond the variables specified in the theory (39). There are weaknesses with the TPB. The inclusion of habit in the TPB is rare as is the inclusion of emotions. Most of the above theories fall into the general category of rational choice theories; rational choice suggests that a person 1) considers a behavior before performing it rather than relying on habit and 2) uses beliefs – themselves considered rational by most researchers using this model – in order to make a decision about behaving in a particular way. Habit has been found to a factor in hamburger doneness in adults; habits have been included in the study of children/adolescents but it should be.

Evidence on Food Choice and Dietary Behaviors – Intention and Behavior

The TPB model has been applied to a number of nutrition-related behavior research studies with adolescents in the past decade. Most have focused on the predictive ability of the theory and indicate a range of behaviors and targeted groups

(41-42, 104-110). In one study that examined the soft drink consumption among female adolescents, intention to drink soda predicted its consumption (106). Attitude, subjective norms, and perceived behavioral control were statistically significant in predicting intention and together explained 64% of the variance. In another study only 17% of the variance was explained in eating a healthy diet that included fruits, vegetables, and calories (105) among adolescents. A study with urban Native American youth that examined healthy eating behaviors found no association between intention and healthy eating behavior (108).

Researchers administered two identical, self-administered surveys six months apart to 7th graders in Minneapolis/St. Paul, Minnesota to determine how well the TPB could predict the frequency of consumption of fruits and vegetables and if gender or socioeconomic status moderated the effects (42). In this model, 7% of the variation in the frequency of fruit and vegetable consumption and 31% of the variation in intention to eat more fruits and vegetables were explained by the model. Gender, but not socioeconomic status seemed to have moderating effects on attitude and intention and on intention and behavior. Another study designed to assess the predictors of intention to eat fruits among 9th-grade students in North Carolina found perceived beliefs were important to teens (110). In this study, 55% of the variance was explained by attitude, subjective norms, and perceived behavioral control. Two studies examined the influences of the TPB constructs on understanding choice of milk among male adolescents in the US (41) and Swedish schoolchildren in grades 5, 7, and 9 (104). In the former, attitude, subjective norms, and perceived behavioral control were significant

predictors of intention to drink reduced-fat milk. The later study found consumption of milk was predicted by intention but also by the perceived behavioral control of the adolescent.

Evidence on Food Choice and Dietary Behaviors – Subjective Norms

A weakness of the TPB is the ability to predict intention or behavior from subjective norms (39). In an effort to improve this weakness, some researchers have made a distinction between normative (e.g., subjective, or injunctive) and informational (descriptive) social influences. Two studies have investigated the role of subjective norms in explaining attitude and intention in food choices (111-112). The first longitudinally predicted healthy eating intention and behavior among university students in Australia (18). Consistent with previous research, attitudes, subjective norms, and perceived behavioral control predicted intentions for healthy eating and two weeks later, intention predicted behavior. The other study used cross-sectional data collected from consumers in Vietnam and found attitude, descriptive norms, and perceived behavioral control explained intention to consume a fish product (112).

Predicting Maintenance

An underlying issue with the TPB is its inability to predict maintenance and specific suggestions for processes that people can use to make change. One study with adults explored the additive and interactive effects of habit strength within the framework of the TBP (113). Researchers collected cross-sectional data and found that habit strength was significantly correlated with fat intake. Additionally, they found intention was significantly correlated with low intake levels of dietary fat. Shankar and

colleagues (40) used the TPB to predict maintenance of a frequently repeated behavior – self-monitoring of blood glucose in patients with Type 1 diabetes over a 2-week period. In this model, 46% of the variance in behavioral intention and 57% of the variance in self-monitoring behavior was observed.

The TPB is not often used in nutrition education intervention studies with adolescents. In all of the above studies, researchers relied on self-report by the adolescents. In order for an individual to become motivated to take a nutrition related action, they need specific skills and knowledge. Food and nutrition are complex issues and require building behavioral skills along with self-efficacy. The studies above demonstrate the predictability of the constructs in the TPB framework. Differences observed in variability can be the result of questionnaire construction, administration of questionnaires (e.g., group versus individually or self-report), the number of questionnaires administered, age of youth to only name a few. Variability can also be explained by studies that looked at behavior in a general way (e.g., healthy eating) versus specific behaviors (e.g., consumption of fruits and vegetables).

3. PAPER 1: BREAKFAST

INTRODUCTION

Overweight and obesity are a result of energy imbalance. Several factors play a role in this imbalance, including dietary habits, larger portion sizes, consumption of fast food, lack of physical activity at school and in the home, and availability of high-calorie nutrient-poor foods (1). Addressing adolescent overweight is critical because it is associated with an increased risk of obesity into adulthood (2) but also independently is related to morbidity and mortality in adulthood (3). Adolescence is the period between puberty and adulthood.

Between the NHANES surveys of 1976-1980 and 2003-2006, prevalence of obesity increased from 6.5% to 17% among 6-11 year olds and 5% to 17.6% among those aged 12- to 19-years (4). Although attention focused on causes of increasing obesity rates, limited attention has been given to behavioral factors which may increase the risk of obesity. These include skipping breakfast, choosing high-fat dairy products over low-fat counterparts, and choosing refined grains over whole-grain products.

The practice of skipping breakfast has increased over time and may be more common among certain ethnic or low-socioeconomic groups in the adolescent population (6). Considering that skipping breakfast is associated with obesity risk and perhaps the under-consumption of some essential nutrients, it is more important than ever that adolescents consume a healthy and nutritious breakfast every day (5-7).

It is estimated children receive as much as 30% of their total daily caloric intake from the breakfast meal (17-18). When averaged over a school week, the breakfast meal

provided at schools as part of the School Breakfast Program (SBP) must provide one-fourth of the Recommended Dietary Allowances (RDA) for protein, calcium, iron, vitamins A and C, and provide adequate calories (16).

Consuming a breakfast meal is associated with better nutrient intake, healthier food choices, more regular eating patterns throughout the day, more favorable body weight status, and improved exercise patterns (5, 20-21). Regularly eating a breakfast meal is important in meeting the health and nutrition needs of adolescents. Adolescents who eat breakfast are more likely to meet the daily recommended intakes for vitamins A, B_6, and B_{12}, and calcium than those who skip breakfast (5, 18, 22-26). More importantly, research has shown adolescents who skip breakfast do not, on average, make up the nutrient deficits during the rest of the day (7).

The School Breakfast Program serves over 10 million children per day (114). Participation in the SBP has grown since its inception from about 500,000 children participating in 1970 to 8.2 million children participating in 2002-2003 (19). Participation in the school-breakfast program has been shown to be associated with higher breakfast intakes of food energy, calcium, riboflavin, phosphorus, and magnesium (27). An experimental study showed making breakfast available in elementary schools increased the likelihood children would consume a nutritious breakfast (28). More recently, researchers found children participating in the SBP had significantly lower BMI especially among non-Hispanic, white children (29).

Most nutrition education efforts have examined the health benefits of eating breakfast through an increase in nutrition knowledge and awareness. Few studies have

explored the value and effect of designing interventions to examine the influences of peers and family on predicting and explaining intention and behavior to eat breakfast. An individual's behavior is thought to be determined proximally by his/her intentions to perform a given behavior (39). Intentions are assumed to capture the motivational factors that influence a behavior and are indicative of how hard a person is willing to try and how much effort a person is willing to exert in order to perform the behavior (39). In the long-term this is important because intention is not only influenced by peers and family but is an indicator of how hard a person is willing to try and how much effort a person will exert toward performing a behavior. It is also important to gain an understanding of attitude toward eating breakfast because changing knowledge and behavior is not enough; the ultimate goal is to effect lifelong knowledge and behavior. Educating and motivating adolescents about the long-term benefits of consuming breakfast every day could have a significant impact on overall health and well-being among this age group.

CONCEPTUAL FRAMEWORK

The present study examines the impact of an after-school based intervention designed to improve breakfast behavior and habits among adolescents. The purpose is to increase breakfast eating in a predominantly low-income, Hispanic, adolescent population. The intervention was grounded in the Theory of Planned Behavior (TPB). The conceptual model guiding the intervention is presented in **Figure B-1**.

There have been few interventions delivered to adolescents which used the TPB as a conceptual framework. One tested the effectiveness of an intervention program to

alter adolescents' healthy eating attitudes and behavior (36). Results showed the intervention was effective in improving attitudes toward healthy eating. Another study examined the effect of a condom promotion leaflet and a 20-minute intervention on adolescents intention and attitude toward using a condom (37). Results showed after the intervention, attitude toward using a condom with new partners improved along with intention to use condoms. In an examination of the efficacy of an intervention designed to positively influence physical activity behavior among pediatric cancer survivors, researchers found that the intervention had a small yet meaningful impact after one year (38).

METHODS

The objective was to test the effectiveness of an after-school based intervention designed to improve breakfast behavior and habits among adolescents. Specifically, the purpose was to increase breakfast eating. The effects of attitude, social and personal factors, personal characteristics, self-efficacy, parental influence, and individual determinants on intention to predict change in breakfast consumption frequency was examined. To accomplish this, a seven-week curriculum was delivered to participants.

Focus group study

The purpose of the focus group study was to collect information and suggestions from representatives of members in the target community to aid in improving and fine-tuning the intervention program. Three focus group discussions were conducted. The first consisted of the administration and staff of the after-school program (n = 4; n = 2 respectively). The second two focus group discussions were conducted with adolescents

at two different schools (*n* = 10; *n* = 7 participants respectively). Focus group discussions took less than 60 minutes to complete. Six questions were asked (see Table A-1). Focus groups were not audio recorded because parents refused consent.

Intervention participants

Adolescents 11 to 15 years old (*n* = 106) and their parents were recruited from after-school programs located in Los Angeles County, California. Children were primarily Hispanic and from low socioeconomic families. Parental consent (passive) was obtained for all participants. Adolescents provided assent. The research study protocol was approved by the Texas A&M University Institutional Review Board of Human Subjects.

Intervention

Participants were assigned by after-school site to either the treatment group or control group. Within the treatment group (*n* = 57), participants were assigned to groups based on grade to facilitate discussion and to allow for easy group interaction (**Figure B-2**). Each group met for 60 minutes, once weekly, for seven weeks. Two weeks were set aside for completion of the survey (pre-intervention and post-intervention). The curriculum focused on identifying the influences of and changing behaviors of attitude, subjective norms, and perceived behavioral control. Nutrition education lessons are identified in Table A-2. The first three lessons focused on basic nutrition concepts to include the food guide pyramid and the importance of including whole-grains in the breakfast meal to overall health and well-being. The later lessons focused on identifying

barriers and overcoming barriers, goal-setting, and identifying methods to stay motivated.

During weeks two through seven, to increase self-efficacy (perceived behavioral control) adolescents were provided the opportunity to taste various whole-grain breakfast cereals and cereal bars, and low-fat milk and diary products, and different flavors of soy milk.

Survey Questions

Questionnaires were administered by trained staff to adolescents in the control and treatment groups and self-administered to both parents of each group (in two-parent households). Questionnaires were administered at baseline and post-intervention (seven weeks after the program had started). The principle investigator was present at all times during survey completion by adolescents to avoid inconsistencies of administration. All constructs of the Theory of Planned Behavior (TPB) were developed based on the guidelines described by Ajzen (115). In total, 76 questions addressed salient, behavioral, normative, and control beliefs relative to the dependant variable (breakfast) in the adolescent survey. Each belief was paired with a corresponding value statement of that belief. For example, the statement “I think eating breakfast every day is good for me” was paired with a corresponding value statement of this belief: “I think eating breakfast every day will help me to do better in school”.

Behavioral intention

Intention was measured by two questions on a 7-point, unipolar scale scored from +1 to +7. Higher scores indicated a stronger intention (e.g., I intend to eat breakfast every day… 'strongly disagree – strongly agree').

Attitude

Attitude toward eating breakfast (behavioral belief) was measured by twelve questions using a 7-point, unipolar scale indicating a more positive attitude (e.g., I think that eating breakfast is good for me… 'strongly disagree – strongly agree'). Attitude toward the value of eating breakfast was measured on a bipolar bad-good scale scored from -3 to +3 (e.g., I think that eating breakfast will provide important nutrients to my diet … 'strongly disagree – strongly agree').

Subjective norm

Subjective norm was measured by six questions using a 7-point unipolar disagree-agree scale scored +1 to +7 with higher scores indicating more pressure from others (normative belief). Motivation to do what each referent thinks (motivation to comply) was measured by using a 7-point unipolar disagree-agree scaled scored +1 to +7 (e.g., I think it is important to do what my parents want me to do ... 'strongly disagree – strongly agree').

Perceived behavioral control

Perceived behavioral control over performing the behavior was measured by two questions on a semantic differential scale (e.g., I believe it is "up to me" … "not up to me" to eat breakfast every day). The perceived ease or difficulty of performing the

behavior (perceived power) was measured using a bipolar difficult-easy scale scored -3 to +3 (e.g., I think it is ‘easy’ to eat breakfast every day).

Demographic characteristics

Adolescents self-reported race, ethnicity, and age at time of questionnaire completion.

Statistical analysis

Data were analyzed using the SAS statistical analysis program (v. 9.2). Standard descriptive statistics were obtained for all variables. The Cronbach alpha test was used to measure internal consistency, and thus the reliability, of the items that measure the constructs in the TPB. A given set of items is needed to produce an alpha of 0.70 or greater to be considered internally consistent (116). Regression analysis was used to determine the predictors of participants’ intention to eat breakfast. Predictors in these models included attitudes, subjective norms, perceived behavioral control, and control variables representing the adolescent’s gender and whether they were in the treatment or control groups. A *p*-value of .05 was considered to indicate a statistical significance. Where multiple measures of a given construct were present, a Cronbach’s alpha was generated to test for internal consistency, with an alpha of .70 or above considered acceptable.

Variable creation

The behavioral, normative, and control scores were determined by multiplying each belief statement by the corresponding value statement. Principal component analysis was run as a variable reduction procedure (See Appendix D). Factors produced

by these analyses were accepted if they met the minimum eigenvalue of 1.0 and if they explained at least 10% of the variance in the items; a variable was considered to load on a given factor if the loading was equal to or greater than .600. Finally, interaction variables were created between group (treatment vs. control) and attitude, group and subjective norms, group and perceived behavioral control, group and change in attitude, group and change in subjective norms, and group and change in perceived behavioral control.

Power

To determine power and effect size, the tables from Clark-Carter (117) were used. The tables for regression analysis are based on the number of variables. A regression model with six predictors that explains a modest amount of variance (around 15%) produces statistical power of .88 with a sample size of 100 (treatment plus control group). A regression model with eight independent variables or predictors that explains a modest amount of variance (around 15%) would achieve statistical power of .72 with a sample size of 80.

RESULTS

Baseline characteristics of our study population are shown in Table A-3. Eighty-eight percent of participants were Hispanic, 55% were girls and mean age was 12 years. One-hundred six adolescents completed the questionnaire pre-intervention and 75 completed the questionnaire post-intervention (70%). Results of this study were based only on the 75 cases with the complete data. Missing data were the result of participation attrition in the after-school program. Attrition in after-school programs

occurs frequently in this geographic area and is usually because parents cannot afford to have their child in after-school care during that particular month. Chi-square analyses revealed no significant (ns) differences ($p > 0.05$) between the treatment and intervention groups ($\chi^2 = 1, 106$) or gender ($\chi^2 = 1, 106$). Significance was seen in race with the majority of participants comprised of Hispanics ($\chi^2 = 3, 106$) <.0001 (see Table A-4).

Outcome measures: item analysis

Cronbach alpha statistic for subjective norms and attitudes toward eating breakfast at time 1 and time 2 are presented in Table A-5. Sources of social influence over breakfast consumption included parents, teachers, and friends. Subjective norms regarding eating breakfast were 0.68 and 0.67 respectively. Attitudes about the value of eating breakfast were .89 and .90 respectively.

Attitude

The twelve-item attitude towards eating breakfast scale underwent separate principal components analysis for responses at time 1 and time 2. For time 1, two factors were produced, under the minimum eigenvalue of 1.0. The first factor explained 54.9% of the variance in the twelve items. However, the second factor was largely driven by one item, “I think that eating breakfast every day will make me healthier”. This factor explained only 4% of the variance in the nine items. Only the first factor was retained for further analyses. A Cronbach’s alpha on those items that loaded high (0.600 or greater) on the first factor produced 0.89. At time 2 a single factor was produced, explaining 57.5% of the variance in the nine items; all items loaded greater than 0.600 on this factor

except for one item “I think that skipping breakfast every day will make me gain weight”. A Cronbach’s alpha on those produced 0.90.

Subjective norms

The three items reflecting subject norms underwent separate principal components analyses for time 1 and time 2, respectively. Each analysis produced a single factor, each of which explained more than 61% of the variance in the three items. Cronbach’s alpha for these items was .56 and .75 respectively.

Intention and perceived behavioral control

Two survey questions reflected intention and perceived behavioral control. Means were computed for each pair of questions. The means for intention at time 1 and time 2 were 4.90 (SD=2.013) and 5.34 respectively (SD=1.695). Perceived behavioral control means were 11.56 (SD=11.469) and 12.81 (SD=9.973) for time 1 and time 2 respectively.

Regression analysis

Intention to eat breakfast every day at time 2 was regressed on intention to do so at time 1 along with changes in attitude towards eating breakfast, subjective norms, and perceived behavioral control. Group (treatment and control) and gender were also in the model. Results are presented in Table A-6. Intention at time 1 was found to be significant ($p < .0001$) in predicting intention to eat breakfast at a later time. The variance explained in intention at time 2 was low ($r^2 = .35$). However, as this model does not differentiate changes in attitudes, subjective norms, or perceived behavioral control by group, additional models were run with interactions between group (treatment

versus control) and these three change variables. Results showed no significant interactions.

DISCUSSION

Breakfast may be considered the most important meal of the day yet many people skip it and adolescents are no exception. Our study examined whether a nutrition education intervention based on the Theory of Planned Behavior could change the breakfast behavior of predominately, low-income, Hispanic, adolescents. To our knowledge, this study is the first of its kind. It is well-known that the use of the Theory of Planned Behavior is useful in identifying predictors of healthful dietary practices among adolescents and adults from different ethnic groups (42, 105, 109-112) but these studies included no interventions.

Breakfast consumption patterns among children and adolescents are of concern to public health experts, given the association of breakfast consumption with overall diet quality and nutritional adequacy (17, 23, 32, 93), school performance (7, 57) and the relationship with overweight and obesity (5, 15, 20, 25, 58). Data from the Nationwide Food Consumption Surveys for 1965-1966, 1977-1978 (18, 59) and the 1989, 1990, and 1991 Continuing Surveys of Food Intakes by Individuals (18, 59) document a decline in breakfast consumption by youth in the United States.

There have been a few interventions delivered to adolescents which used the TPB as a conceptual framework. One tested the effectiveness of an intervention program to change adolescents' healthy eating attitudes and behavior (36). Results showed the intervention was effective in improving attitudes toward healthy eating.

Another study examined the effect of a condom promotion leaflet and 20-minute intervention on adolescents intention and attitude toward using a condom (37). Results showed after the intervention, attitude toward using a condom with new partners increased along with intention to use condoms. In an examination of the efficacy of an intervention designed to positively influence physical activity behavior among pediatric cancer survivors, researchers found that the intervention had a small yet meaningful impact after one year (38).

As seen in previous studies, our results showed attitude, subjective norms, and perceived behavioral control were significant predictors in intention to eat breakfast at time 1 and time 2. However, contrary to our hypothesis, results showed no significance in changing intention to eat breakfast as a result of changes in attitude, subjective norms, or perceived behavioral control.

Although breakfast consumption has favorable implications, research shows breakfast consumption decreases from childhood through adolescence (6, 25). Reasons include more frequent snacking, lack of time, lack of hunger and/or dieting to maintain or lose weight (7, 26, 32). When addressing barriers to consuming breakfast, we found these to be the same reasons breakfast was skipped. However, we would like to note that “lack of food in the home” was a consistent reason breakfast was not being eating by these adolescents.

Caution should be exercised in interpreting the findings from this study due to several limitations. Our participants were primarily low-income, Hispanic adolescents in Los Angeles County which is not representative of all adolescents in the United

States. Adolescents were part of an after-school program and may not have been attentive when completing questionnaires. Another limitation was participant attrition. We lost 30% of our participants between the start of the program and completion of the post-intervention survey at week 7. Attrition in after-school programs occurs frequently in this geographic area and is usually because parents cannot afford to have their child in after-school care. The study faced other obstacles when delivering the intervention, namely, after-school staff allowed participants to leave the after-school site as they pleased and after-school staff rewarded adolescents with candy for good behavior.

In conclusion, research to date has been primarily cross-sectional when examining breakfast consumption patterns among youth. Breakfast history may impact overall health indicators. Eating breakfast on a consistent basis over time could be important for example, in weight management. Future research should target low-income, minority youth as they have a higher incidence of overweight and obesity.

4. PAPER 2: LOW-FAT DAIRY

INTRODUCTION

Overweight and obesity are a result of energy imbalance. Several factors play a role including dietary habits, larger portion sizes, consumption of fast food, lack of physical activity at school and in the home, and availability of high-calorie nutrient-poor foods (1). Addressing adolescent overweight is critical because it is associated with an increased risk of obesity into adulthood (2) but also independently is related to morbidity and mortality in adulthood (3). Adolescence is the period between puberty and adulthood.

Between the NHANES surveys of 1976-1980 and 2003-2006, prevalence of obesity increased from 6.5% to 17% among 6-11 year olds and 5% to 17.6% among those aged 12- to 19-years (4). Although attention focused on causes of increasing obesity rates, limited attention has been given to behavioral factors which may increase the risk of obesity. These include skipping breakfast, choosing high-fat dairy products over low-fat counterparts, and choosing refined grains over whole-grain products.

Skipping breakfast has increased over time and may be more common among certain ethnic or low-socioeconomic groups in the adolescent population (20). Considering that skipping breakfast is associated with obesity risk and perhaps the under-consumption of some essential nutrients, it is more important than ever that adolescents consume a healthy and nutritious breakfast every day (5-7). Of particular interest is the impact that breakfast skipping may have on low fat diary consumption.

Research indicates skipping breakfast is associated with a lower intake of calcium among the adolescent population (5, 20).

In an analysis of NHANES III and NHANES 1999-2002 data, adolescents who consumed the least amount of dairy had a higher BMI along with a higher percentage of body fat (8). Another study showed consumption of flavored milks was not associated with higher BMI among youth aged 6-11 years and 12- to 18-years while both female and male non-milk drinkers had higher BMIs (9).

The Dietary Guidelines for Americans (30) recommend adolescents consume three cups per day of fat-free or low-fat milk or equivalent milk products. Overall, only 30% of the United States population aged 2 and older obtain the recommended levels of calcium (31). Research shows compared to breakfast skippers, mean daily intakes of calcium were higher in adolescents who consume breakfast regularly (7, 32). Research shows mean daily intakes of calcium were higher in adolescents who consume breakfast regularly, compared to breakfast skippers (5, 7, 31-32). Calcium intake among adolescents is significantly and positively associated with eating breakfast, socioeconomic status, social support for healthful eating, body mass index and the availability of milk at meals (8-9, 33). The question remains however, does intake of low-fat dairy during the breakfast meal correlate with BMI? As early as 1984, data from the first NHANES showed calcium intake was correlated with BMI (34). In 2000 it was reported fat acid synthesis and thus adiposity was regulated at the cellular level by dietary calcium (35).

CONCEPTUAL FRAMEWORK

The present study examines the impact of an after-school based intervention designed to improve consumption of low-fat dairy at the breakfast meal among adolescents. The purpose is to increase low-fat dairy consumption in a predominantly low-income, Hispanic, adolescent population. The intervention was grounded in the Theory of Planned Behavior (TPB). The conceptual model guiding the intervention is presented in **Figure B-1**.

There have been few interventions delivered to adolescents which used the TPB as a conceptual framework. One tested the effectiveness of an intervention program to alter adolescents' healthy eating attitudes and behavior (36). Results showed the intervention was effective in improving attitudes toward healthy eating. Another study examined the effect of a condom promotion leaflet and 20-minute intervention on adolescents intention and attitude toward using a condom (37). Results showed after the intervention, attitude toward using a condom with new partners increased along with intention to use condoms. In an examination of the efficacy of an intervention designed to positively influence physical activity behavior among pediatric cancer survivors, researchers found that the intervention had a small yet meaningful impact after one year (38).

METHODS

The objective was to test the effectiveness of an after-school based intervention designed to improve breakfast behavior and habits among adolescents. The purpose was to increase consumption of low-fat dairy (milk, cheese, and yogurt). The effects of

attitude, social and personal factors, personal characteristics, self-efficacy, parental influence, and individual determinants on intention to predict change in consumption of low-fat dairy frequency was examined. To accomplish this, a seven-week curriculum was delivered to participants.

Focus group study

The purpose of the focus group study was to collect information and suggestions from representatives of members in the target community to aid in improving and fine-tuning the intervention program. Three focus group discussions were conducted. The first consisted of the administration and staff of the after-school program (n = 4; n = 2 respectively). The second two focus group discussions were conducted with adolescents at two different schools (n = 10; n = 7 participants respectively). Focus group discussions took less than 60 minutes to complete. Focus group discussions took less than 60 minutes to complete. Six questions were asked (see Table A-1). Focus groups were not audio recorded because parents.

Intervention participants

Adolescents 11 to 15 years old (n = 106) and their parents were recruited from after-school programs located in Los Angeles County, California. Children were primarily Hispanic and from low socioeconomic families. Parental consent (passive) was obtained for all participants. Adolescents provided assent. The research study protocol was approved by the Texas A&M University Institutional Review Board of Human Subjects.

Intervention

Participants were assigned by after-school site to either the treatment group or control group. Within the treatment group (*n* = 57), participants were assigned to groups based on grade to facilitate discussion and to allow for easy group interaction (see **Figure B-2)**. Each group met for 60 minutes, once weekly, for seven weeks. Two weeks were set aside for completion of the survey (pre-intervention and post-intervention). The curriculum focused on identifying the influences of and changing behaviors of attitude, subjective norms, and perceived behavioral control. Nutrition education lessons are identified in Table A-2. The first three lessons focused on basic nutrition concepts to include the food guide pyramid and the importance of consuming low-fat dairy to overall health and well-being. The later lessons focused on identifying barriers and overcoming barriers, goal-setting, and identifying methods to stay motivated.

During weeks two through seven, to increase self-efficacy (perceived behavioral control) adolescents were provided the opportunity to taste various whole-grain breakfast cereals and cereal bars, and low-fat milk and dairy products, and a variety of low-fat/fat-free yogurt and low-fat string cheese.

Survey Questions

Questionnaires were administered by trained staff to adolescents in the control and treatment groups and self-administered to both parents of each group (in two-parent households). Questionnaires were administered at baseline and post-intervention (seven weeks after the program had started). The principle investigator was present at all times

during survey completion by adolescents to avoid inconsistencies of administration. All constructs of the Theory of Planned Behavior (TPB) were developed based on the guidelines described by Ajzen (115). In total, 76 questions addressed salient, behavioral, normative, and control beliefs relative to the dependant variable (breakfast) in the adolescent survey. Each belief was paired with a corresponding value statement of that belief. For example, the statement "I think drinking 2% milk every day is good for me" was paired with a corresponding value statement of this belief: "I think drinking 2% milk every day will help me to do better in school".

Behavioral intention – milk (skim, 1%, and 2%)

Intention was measured by six questions on a 7-point, unipolar scale scored from +1 to +7. Higher scores indicated a stronger intention (e.g., I intend to drink skim milk every day… 'strongly disagree – strongly agree').

Behavioral intention – low-fat cheese and yogurt

Intention was measured by four questions on a 7-point, unipolar scale scored from +1 to +7. Higher scores indicated a stronger intention (e.g., I intend to eat low-fat yogurt… 'strongly disagree – strongly agree').

Attitude – milk (skim, 1%, and 2%)

Attitude toward drinking milk (behavioral belief) was measured by nine questions using a 7-point, unipolar scale indicating a more positive attitude (e.g., I think that drinking skim milk is good for me… 'strongly disagree – strongly agree'). Attitude toward the value of eating whole-grains was measured on a bipolar bad-good scale

scored from -3 to +3 (e.g., I think that drinking skim milk will provide important nutrients to my diet … ‘strongly disagree – strongly agree’).

Attitude – low-fat cheese and yogurt

Attitude toward eating low-fat dairy products (behavioral belief) was measured by six questions using a 7-point, unipolar scale indicating a more positive attitude (e.g., I think that eating low-fat cheese is good for me… ‘strongly disagree – strongly agree’). Attitude toward the value of eating low-fat dairy was measured on a bipolar bad-good scale scored from -3 to +3 (e.g., I think that eating low-fat cheese will make me healthier… ‘strongly disagree – strongly agree’).

Subjective norm – milk (skim, 1%, and 2%)

Subjective norm was measured by three questions using a 7-point unipolar disagree-agree scale scored +1 to +7 with higher scores indicating more pressure from others (normative belief). Motivation to do what each referent thinks (motivation to comply) was measured by using a 7-point unipolar disagree-agree scaled scored +1 to +7 (e.g., I think it is important to do what my parents want me to do ... ‘strongly disagree – strongly agree’).

Subjective norm – low-fat cheese and yogurt

Subjective norm was measured by three questions using a 7-point unipolar disagree-agree scale scored +1 to +7 with higher scores indicating more pressure from others (normative belief). Motivation to do what each referent thinks (motivation to comply) was measured on using a 7-point unipolar disagree-agree scaled scored +1 to +7

(e.g., I think it is important to do what my parents want me to do ... ‘strongly disagree – strongly agree’).

Perceived behavioral control – milk (skim, 1%, and 2%)

Perceived behavioral control over performing the behavior was measured by four questions on a semantic differential scale (e.g., I believe it is “up to me” … “not up to me” to eat low-fat dairy). The perceived ease or difficulty of performing the behavior (perceived power) was measured using a bipolar difficult-easy scale scored -3 to +3 (e.g., I think it is ‘easy’ to drink a glass of milk with every meal).

Perceived behavioral control – low-fat cheese and yogurt

Perceived behavioral control over performing the behavior was measured by one question on a semantic differential scale (e.g., I believe it is “up to me” … “not up to me” to eat low-fat dairy). The perceived ease or difficulty of performing the behavior (perceived power) was measured using a bipolar difficult-easy scale scored -3 to +3 (e.g., I think it is ‘easy’ to eat low-fat dairy products).

Demographic characteristics

Adolescents self-reported race, ethnicity, age at time of questionnaire completion.

Statistical analysis

Data were analyzed using the SAS statistical analysis program (v. 9.2). Standard descriptive statistics were obtained for all variables. The Cronbach alpha test was used to measure internal consistency, and thus the reliability, of the items that measure the constructs in the TPB. A given set of items is needed to produce an alpha of 0.70 or

greater to be considered internally consistent (116). Regression analysis was used to determine the predictors of participants' intention to eat whole-grains. Predictors in these models included attitudes, subjective norms, perceived behavioral control, and control variables representing the adolescent's gender and whether they were in the treatment or control groups. A *p*-value of .05 was considered to indicate a statistical significance. Where multiple measures of a given construct were present, a Cronbach's alpha was generated to test for internal consistency, with an alpha of .70 or above considered acceptable.

Variable creation

The behavioral, normative, and control scores were determined by multiplying each belief statement by the corresponding value statement (e.g., "My friends think it is important to drink milk with every meal" multiplied by "I think it is important to do what my friends want"). Principal component analysis was run as a variable reduction procedure (See Appendix D). Factors produced by these analyses were accepted if they met the minimum eigenvalue of 1.0 and if they explained at least 10% of the variance in the items; a variable was considered to load on a given factor if the loading was equal to or greater than .600. Finally, interaction variables were created between group (treatment vs. control) and attitude, group and subjective norms, group and perceived behavioral control, group and change in attitude, group and change in subjective norms, and group and change in perceived behavioral control.

Power

To determine power and effect size, the tables from Clark-Carter (117) were used. The tables for regression analysis are based on the number of variables. A regression model with six predictors that explains a modest amount of variance (around 15%) produces statistical power of .88 with a sample size of 100 (treatment plus control group). A regression model with eight independent variables or predictors that explains a modest amount of variance (around 15%) would achieve statistical power of .72 with a sample size of 80.

RESULTS

Baseline characteristics of our study population are shown in Table A-3. Eighty-eight percent of participants were Hispanic, 55% were girls and mean age was 12 years. One-hundred six adolescents completed the questionnaire pre-intervention and 75 completed the questionnaire post-intervention (70%). Results of this study were based only on the 75 cases with the complete data. Missing data were the result of participation attrition in the after-school program. Attrition in after-school programs occurs frequently in this geographic area and is usually because parents cannot afford to have their child in after-school care during that particular month. Chi-square analyses revealed no significant (ns) differences ($p > 0.05$) between the treatment and intervention groups ($\chi^2 = 1, 106$) or gender ($\chi^2 = 1, 106$). Significance was seen in race with the majority of participants comprised of Hispanics ($\chi^2 = 3, 106$) $p < .0001$ (see Table A-4).

Outcome measures: item analysis

The Cronbach alphas for time 1 and time 2 are presented in Table A-7. Sources of social influence over low-fat diary consumption included parents, teachers, and friends. Subjective norms regarding drinking low-fat or skim dairy were 0.82 and 0.87, and .82 and .81 for eating low-fat cheese and yogurt, respectively. Attitudes about the value of drinking skim milk were .87 and .90 respectively; 1% milk were .76 and .87 respectively; 2% milk were .78 and .86 respectively; low-fat cheese were .74 and .85 respectively; and low-fat yogurt were .75 and .81 respectively.

Attitude – milk (skim, 1%, and 2%)

The nine-item attitude towards drinking skim or low fat milk scale underwent separate principal components analysis for responses at time 1 and time 2. For time 1, five factors were produced under the minimum eigenvalue of 1.0. The second factor explained 44% of the variance in the nine items. The remaining four factors were largely driven by one item each. Factor 1, “I think drinking skim milk will make my bones stronger” explained 5% of the variance. Factors 3 and 4 explained 11% and 8% of the variance respectively and were driven by “consumption of low-fat dairy will help me maintain my body weight”. Factor 5 explained 6% of the variance, “I think drinking low-fat milk will make my bones stronger”. At time 2, similar patterns were observed. Factor two explained 58% of the variance in the nine items. A Cronbach’s alpha on those items that loaded high (0.600 or greater) produced 0.87 at time 1 and 0.90 at a time 2. All factors were retained for further analysis.

Attitude – low-fat cheese

The three-item attitude towards eating low-fat scale underwent separate principal components analysis for responses at time 1 and time 2. For time 1 and time 2, one factor respectively was produced under the minimum eigenvalue of 1.0. At time 1, 66% of the variance was explained by "I think it eating low-fat cheese will make me healthier" and 34% of the variance was explained by "I think choosing low-fat diary products will help me to maintain my weight". At time 2, 77% of the variance was explained by "eating low-fat cheese will make me healthier". All factors were retained further analyses. A Cronbach's alpha on those items that loaded high (0.600 or greater) produced 0.74 at time 1 and 0.85 at a time 2.

Attitude – low-fat yogurt

The three-item attitude towards eating low-fat yogurt scale underwent separate principal components analysis for responses at time 1 and time 2. For time 1 and time 2 one factor respectively was produced, under the minimum eigenvalue of 1.0. At time 1, 78% of the variance was explained by "I think it eating low-fat yogurt will make me healthier" and 23% of the variance was explained by "I think choosing low-fat dairy products will help me to maintain my weight". At time 2, 78% of the variance was explained by "eating low-fat yogurt will make me healthier". All factors were retained further analyses. A Cronbach's alpha on those items that loaded high (0.600 or greater) produced 0.75 at time 1 and 0.80 at a time 2.

Subjective norms – skim/low-fat milk

For time 1 and time 2, two factors respectively, were produced, under the minimum eigenvalue of 1.0. At time 1, 84% of the variance was explained by “My parents, teachers, and friends think it is important to drink a glass of milk with every meal” and 12% of the variance was explained by “My parents, teachers, and friends think it is important to choose low-fat dairy products over whole-milk dairy products”. At time 2 only one factor was produced. Eighty-four percent of the variance was explained by “My parents, teachers, and friends think it is important to drink a glass of milk with every meal”. All factors were retained further analyses. Cronbach’s alpha for these items was .82 and .87 respectively.

Subjective norms – low-fat cheese and yogurt

For time 1 and time 2, two factors respectively, were produced, under the minimum eigenvalue of 1.0. At time 1, 84% of the variance was explained by “My parents, teachers, and friends think it is important to drink a glass of milk with every meal” and 12% of the variance was explained by “My parents, teachers, and friends think it is important to choose low-fat dairy products over whole-milk dairy products”. At time 2 only one factor was produced. Eighty-four percent of the variance was explained by “My parents, teachers, and friends think it is important to drink a glass of milk with every meal”. All factors were retained further analyses. Cronbach’s alpha for these items was .82 and .81 respectively.

Intention and perceived behavioral control – milk (skim, 1%, and 2%)

Two survey questions reflected intention and perceived behavioral control each for skim, 1%, and 2% milk. Means were computed for each pair of questions. Means for intention to drink skim, 1%, and 2% milk at time 1 were 2.180 (SD=1.629), 3.305 (SD=2.019), and 4.376 (SD=2.13) respectively. At time 2 means for intention to drink skim, 1%, and 2% milk were 3.033 (SD=1.89), 3.655 (SD=2.09), and 4.702 (SD=1.95) respectively. Perceived behavioral control means toward drinking skim, 1%, and 2% milk at time 1 were 6.933 (SD=10.46), 6.933 (SD=10.46), and 6.810 (SD=11.67) respectively and at time 2 were 9.121 (SD=10.55), 9.121 (SD=10.55), and 9.622 (SD=10.74) respectively.

Intention and perceived behavioral control – low-fat cheese and yogurt

Two survey questions each reflected intention for low-fat cheese and low-fat yogurt. Means were computed for each pair of questions. There was only one question to measure perceived behavioral control, therefore means could not be computed. Means for intention to eat low-fat cheese at time 1 were 3.457 (SD=1.99) and 4.122 (SD=1.95) at time 2.

Regression analysis – milk (skim, 1%, and 2%)

Intention to drink skim, 1%, and 2% milk at time 2 was regressed on intention to do so at time 1 along with changes in attitude towards drinking skim, 1%, and 2% milk, subjective norms, and perceived behavioral control respectively. Group (treatment and control) and gender were also in the model. Results are presented in Table A-8. Perceived behavioral control at time 2 was significant in predicting intention to drink

skim, 1%, and 2% milk at a later time ($p < .05$; $p < .0001$; $p < .001$ respectively). Interaction models between group and attitude, subjective norms, and perceived behavioral control respectively were analyzed. Results are presented in Table A-9. However, as these models do not differentiate changes in attitudes, subjective norms, or perceived behavioral control by group, additional models were run with interactions between group (treatment versus control) and these three change variables. Results of these analyses are presented in Table A-10. Changes in perceived behavioral control among participants in the control group (**Figures B-3, B-4, B05**) to drink skim milk, 1% milk, and 2% milk produced significant results ($p < .05$; $p < .001$; $p < .001$ respectively). Changes in attitude among participants in the control group (**Figure B-6**) to drink skim milk produced significant results ($p < .05$). Additional interaction models with attitude change, subjective norm change, and perceived behavioral control change were run with significant results ($p < .05$) seen in perceived behavioral control among participants in the control group to drink 1% and 2% milk respectively (**Figures B-7, B-8**).

Regression analysis – low-fat cheese and yogurt

Intention to eat low-fat cheese or yogurt at time 2 was regressed on intention to do so at time 1 along with changes in attitude towards eating low-fat cheese or yogurt, subjective norms, and perceived behavioral control respectively. Group (treatment and control) and gender were also in the model. Results are presented in Table A-8. Attitude toward eating low-fat cheese and yogurt at a later time was predicted by attitude at time 1 for both ($p < .0001$). Attitude at time 2 was significant in predicting intention to eat low-fat cheese at a later time ($p < .0001$). At time 2, attitude and subjective norms were

significant in predicting intention toward eating low-fat yogurt at a later time ($p < .001$ and $p < .05$ respectively). However, as these models do not differentiate changes in attitudes, subjective norms, or perceived behavioral control by group, additional models were run with interactions between group (treatment versus control) and these three change variables. No significant results were seen.

DISCUSSION

Our study examined whether a nutrition education intervention based on the Theory of Planned Behavior could change the behavior toward consuming low-fat dairy food items by predominately, low-income, Hispanic, adolescents. To our knowledge, this study is the first of its kind. Previous research shows the use of the Theory of Planned Behavior is effective in identifying predictors of healthful dietary practices among adolescents and adults from different ethnic groups (42, 105, 109-112) but these studies included no interventions. Given that consumption of low-fat dairy is associated with a lower body mass index and greater intake of calcium among adolescents (5, 20), it is more important than ever that public health practitioners design interventions that emphasize consumption of low-fat dairy as part of the breakfast meal.

According to the TPB, attitude is defined as the overall evaluation of behavior and refers to the degree to which a person has a favorable or unfavorable assessment of the behavior in question (behavioral beliefs) and how much value is placed on the behavioral outcome (evaluation) (45). Our results showed a post-intervention improvement in the attitude toward consuming low-fat milk among participants in the treatment group suggesting the intervention contributed to this change. This may be

explained, in part, to the introduction of low-fat milk, fat-free chocolate milk, and soy milk (vanilla and chocolate) during the course of the intervention.

Subjective norm is defined as the perceived belief about whether most people approve or disapprove of the behavior and refers to the perceived social pressure to perform or not perform the behavior (39). This concept is centered on how one "should" act in response to the views and opinions of others (normative belief) and the desire to do what others think (motivation to comply). The strongest influences include family and friends (39). Our results showed subjective norms significantly affected attitude toward drinking low-fat milk; however, no change in attitude was seen as a result of changes in subjective norms. Significant differences in intention to drink 1% milk, and consume low-fat cheese and low-fat yogurt was observed post-intervention among participants in the treatment group however, this may be explained in part, by the introduction of low-fat milk products along with a variety of low-fat and fat-free yogurt products, and low-fat string cheese.

How much control a person has in performing a behavior (e.g., it is easy for me to eat low-fat cheese) refers to the third construct of the TPB – perceived behavioral control (39). Significant change in perceived behavioral control was seen in the treatment group toward drinking skim, 1% and 2% milk. The lessons on overcoming barriers to consuming low-fat dairy seemed to contribute to improvement in the participants' perception of their ability to control their behavior.

Several limitations warrant mention. First, adolescents were part of an after-school program and may not have been attentive when completing questionnaires.

Second, after-school programs are a place of fun and not work, and completing a 76-question survey at two time points could lead to some merely checking boxes and not reading the questions in an effort to escape. Another limitation was participant attrition. We lost 30% of our participants between the start of the program and completion of the post-intervention survey at week 7. Attrition in after-school programs occurs frequently in this geographic area and is usually because parents cannot afford to have their child in after-school care for that particular month. The study faced other obstacles when delivering the intervention; namely, after-school staff allowed participants to leave the after-school site as they pleased and after-school staff rewarded adolescents with candy for good behavior. Finally, the results may not be generalizable to other adolescents.

While our study has a number of limitations, it is important to point out the strengths. To our knowledge, this is the first study involving an intervention developed around the constructs of the TPB aimed at improving low-fat dairy consumption among a predominately low-socioeconomic, Hispanic adolescent population in Los Angeles County. Although results may not be generalizable to all youth in the United States, it is important to note significant improvements in change in attitude and intention to consume skim, 1%, and 2% milk along with low-fat cheese and yogurt occurred as a result of the intervention. Including a 7-week intervention targeting behavior and the introduction of various reduced-fat dairy products are also strengths of this study.

Based on our findings, interventions for change of adolescents' attitudes should include strategies that enhance interest in information along with benefits of healthy eating. The TPB has rarely been applied to intervention studies. In previous studies

looking at nutrition behaviors, researchers relied on self-report by the adolescents along with demonstrating predictability of the constructs in the TPB framework (41-42, 104-112). Our study included a 7-week intervention that identified the influences of and changing behaviors of attitude, subjective norms, and perceived behavioral control. The identification of barriers and overcoming them, along with goal setting and staying motivated to consume low-fat dairy products were addressed. Overall, the intervention as applied was somewhat effective in changing attitudes about participants behavior strength, intention, subjective norms, and perceived behavioral control.

5. PAPER 3: WHOLE-GRAINS

INTRODUCTION

Overweight and obesity are a result of energy imbalance. Several factors play a role including dietary habits, larger portion sizes, consumption of fast food, lack of physical activity at school and in the home, and availability of high-calorie nutrient-poor foods (1). Addressing adolescent overweight is critical because it is associated with an increased risk of obesity into adulthood (2) but also independently is related to morbidity and mortality in adulthood (3). Adolescence is the period between puberty and adulthood.

Between the NHANES surveys of 1976-1980 and 2003-2006, prevalence of obesity increased from 6.5% to 17% among 6-11 year olds and 5% to 17.6% among those aged 12- to 19-years (4). Limited attention has been given to behavioral factors which may increase the risk of obesity. These include skipping breakfast, choosing high-fat dairy products over their low-fat counterparts, and choosing refined grains over whole-grain products.

Skipping breakfast has increased over time and may be more common among certain ethnic or low-socioeconomic groups in the adolescent population. Considering that skipping breakfast is associated with obesity risk and perhaps the under-consumption of some essential nutrients, it is more important than ever that adolescents consume a healthy and nutritious breakfast every day (5-7). Of particular interest is the impact that breakfast skipping may have on whole-grain consumption as whole-grain

intake is associated with lower body mass and greater insulin sensitivity among adolescents (10). Research indicates skipping breakfast is associated with a lower intake of whole-grains among the adolescent population (5, 20).

There is limited literature that examines the benefit of including whole-grains in the breakfast meal in terms of meeting the daily recommended intakes of dietary fiber, vitamins and minerals in the adolescent population. Cross-sectional surveys with adolescents in the United States have found that inadequate dietary fiber intakes could be improved by increasing the consumption of whole-grains (30). In a study conducted by Affentio et al., (5), it was reported that adolescents who eat breakfast had increased intakes of calcium and fiber. The Dietary Guidelines for Americans (30) recommend that children and adolescents should consume whole-grain products often and that at least half of the grains in the diet should be whole grains. Diets rich in whole-grains provide a host of potential benefits to overall health including reducing the risk of heart disease, helping with weight maintenance, and lowering the risk of other chronic diseases (30).

Most nutrition education efforts have examined the health benefits of eating breakfast to increase nutrition knowledge and awareness. Few studies have explored the value and effect of designing interventions to examine the influences of peers and family on predicting and explaining intention and behavior to include whole-grains in the breakfast meal. In the long-term this is important because intention is not only influenced by peers and family but is an indicator of how hard a person is willing to try and how much effort a person will exert toward performing a behavior. It is also

important to gain an understanding of attitude toward eating breakfast because changing knowledge and behavior is not enough; the ultimate goal is to effect lifelong knowledge and behavior. Educating and motivating adolescents about the long-term benefits of consuming whole-grains and consuming a breakfast that is rich in whole-grains could have a significant impact on overall health and well-being among this age group.

CONCEPTUAL FRAMEWORK

The present study examines the impact of an after-school based intervention designed to improve consumption of whole-grains at the breakfast meal among adolescents. The purpose is to increase whole-grain eating in a predominantly low-income, Hispanic, adolescent population. The intervention was grounded in the Theory of Planned Behavior (TPB). The conceptual model guiding the intervention is presented in **Figure B-1**.

There have been few interventions delivered to adolescents which used the TPB as a conceptual framework. One tested the effectiveness of an intervention program to alter adolescents' healthy eating attitudes and behavior (36). Results showed the intervention was effective in improving attitudes toward healthy eating. Another study examined the effect of a condom promotion leaflet and 20-minute intervention on adolescents intention and attitude toward using a condom (37). Results showed after the intervention, attitude toward using a condom with new partners increased along with intention to use condoms. In an examination of the efficacy of an intervention designed to positively influence physical activity behavior among pediatric cancer survivors,

researchers found that the intervention had a small yet meaningful impact after one year (38).

METHODS

The objective was to test the effectiveness of an after-school based intervention designed to improve breakfast behavior and habits among adolescents. The purpose was to increase breakfast eating. The effects of attitude, social and personal factors, personal characteristics, self-efficacy, parental influence, and individual determinants on intention to predict change in breakfast consumption frequency was examined. To accomplish this, a seven-week curriculum was delivered to participants.

Focus group study

The purpose of the focus group study was to collect information and suggestions from representatives of members in the target community to aid in improving and fine-tuning the intervention program. Three focus group discussions were conducted. The first consisted of the administration and staff of the after-school program (n = 4; n = 2 respectively). The second two focus group discussions were conducted with adolescents at two different schools (n = 10; n = 7 participants respectively). Focus group discussions took less than 60 minutes to complete. Focus group discussions took less than 60 minutes to complete. Six questions were asked (see Table A-1). Focus groups were not audio recorded because parents refused consent.

Intervention participants

Adolescents 11 to 15 years old (n = 106) and their parents were recruited from after-school programs located in Los Angeles County, California. Children were

primarily Hispanic and from low socioeconomic families. Parental consent (passive) was obtained for all participants. Adolescents provided assent. The research study protocol was approved by the Texas A&M University Institutional Review Board of Human Subjects.

Intervention

Participants were assigned by after-school site to either the treatment group or control group. Within the treatment group (*n* = 57), participants were assigned to groups based on grade to facilitate discussion and to allow for easy group interaction (see **Figure B-2**). Each group met for 60 minutes, once weekly, for seven weeks. Two weeks were set aside for completion of the survey (pre-intervention and post-intervention). The curriculum focused on identifying the influences of and changing behaviors of attitude, subjective norms, and perceived behavioral control. Nutrition education lessons are identified in Table A-2. The first three lessons focused on basic nutrition concepts to include the food guide pyramid and the importance of consuming whole-grains to overall health and well-being. The later lessons focused on identifying barriers and overcoming barriers, goal-setting, and identifying methods to stay motivated.

During weeks two through seven, to increase self-efficacy (perceived behavioral control) adolescents were provided the opportunity to taste various whole-grain breakfast cereals and cereal bars, and low-fat milk and diary products, and different flavors of soy milk.

Survey questions

Questionnaires were administered by trained staff to adolescents in the control and treatment groups and self-administered to both parents of each group (in two-parent households). Questionnaires were administered at baseline and post-intervention (seven weeks after the program had started). The principle investigator was present at all times during survey completion by adolescents to avoid inconsistencies of administration. All constructs of the Theory of Planned Behavior (TPB) were developed based on the guidelines described by Ajzen (115). In total, 76 questions addressed salient, behavioral, normative, and control beliefs relative to the dependant variable (breakfast) in the adolescent survey. Each belief was paired with a corresponding value statement of that belief. For example, the statement "I think eating whole-grains every day is good for me" was paired with a corresponding value statement of this belief: "I think eating whole-grains every day will help me to do better in school".

Behavioral intention

Intention was measured by one question on a 7-point, unipolar scale scored from +1 to +7. Higher scores indicated a stronger intention (e.g., I intend to eat whole-grains in the breakfast meal every day… 'strongly disagree – strongly agree').

Attitude

Attitude toward eating whole-grain cereal (behavioral belief) was measured by three questions using a 7-point, unipolar scale indicating a more positive attitude (e.g., I think that eating whole-grains is good for me… 'strongly disagree – strongly agree'). Attitude toward the value of eating whole-grains was measured on a bipolar bad-good

scale scored from -3 to +3 (e.g., I think that eating whole-grains will provide important nutrients to my diet … ‘strongly disagree – strongly agree’).

Subjective norm

Subjective norm was measured by six questions using a 7-point unipolar disagree-agree scale scored +1 to +7 with higher scores indicating more pressure from others (normative belief). Motivation to do what each referent thinks (motivation to comply) was measured by using a 7-point unipolar disagree-agree scaled scored +1 to +7 (e.g., I think it is important to do what my parents want me to do ... ‘strongly disagree – strongly agree’).

Perceived behavioral control

Perceived behavioral control over performing the behavior was measured by two questions on a semantic differential scale (e.g., I believe it is “up to me” … “not up to me” to eat whole-grains). The perceived ease or difficulty of performing the behavior (perceived power) was measured using a bipolar difficult-easy scale scored -3 to +3 (e.g., I think it is ‘easy’ to eat whole-grains).

Demographic characteristics

Adolescents self-reported race, ethnicity, age at time of questionnaire completion.

Statistical analysis

Data were analyzed using the SAS statistical analysis program (v. 9.2). Standard descriptive statistics were obtained for all variables. The Cronbach alpha test was used to measure internal consistency, and thus the reliability, of the items that measure the

constructs in the TPB. A given set of items is needed to produce an alpha of 0.70 or greater to be considered internally consistent (116). Regression analysis was used to determine the predictors of participants' intention to eat whole-grains. Predictors in these models included attitudes, subjective norms, perceived behavioral control, and control variables representing the adolescent's gender and whether they were in the treatment or control groups. A *p*-value of .05 was considered to indicate a statistical significance. Where multiple measures of a given construct were present, a Cronbach's alpha was generated to test for internal consistency, with an alpha of .70 or above considered acceptable.

Demographic characteristics

Adolescents self-reported race, ethnicity, age at time of questionnaire completion.

Variable creation

The behavioral, normative, and control scores were determined by multiplying each belief statement by the corresponding value statement (e.g., "My friends think it is important to eat whole-grains" multiplied by "I think it is important to do what my friends want"). Principal component analysis was run as a variable reduction procedure (Appendix D). Factors produced by these analyses were accepted if they met the minimum eigenvalue of 1.0 and if they explained at least 10% of the variance in the items; a variable was considered to load on a given factor if the loading was equal to or greater than .600. Finally, interaction variables were created between group (treatment vs. control) and attitude, group and subjective norms, group and perceived behavioral

control, group and change in attitude, group and change in subjective norms, and group and change in perceived behavioral control.

Power

To determine power and effect size, the tables from Clark-Carter (117) were used. The tables for regression analysis are based on the number of variables. A regression model with six predictors that explains a modest amount of variance (around 15%) produces statistical power of .88 with a sample size of 100 (treatment plus control group). A regression model with eight independent variables or predictors that explains a modest amount of variance (around 15%) would achieve statistical power of .72 with a sample size of 80.

RESULTS

Baseline characteristics of our study population are shown in Table A-3. Eighty-eight percent of participants were Hispanic, 55% were girls and mean age was 12 years. One-hundred six adolescents completed the questionnaire pre-intervention and 75 completed the questionnaire post-intervention (70%). Results of this study were based only on the 75 cases with the complete data. Missing data were the result of participation attrition in the after-school program. Attrition in after-school programs occurs frequently in this geographic area and is usually because parents cannot afford to have their child in after-school care during that particular month. Chi-square analyses revealed no significant (ns) differences ($p > 0.05$) between the treatment and intervention groups ($\chi^2 = 1, 106$) or gender ($\chi^2 = 1, 106$). Significance was seen in race with the majority of participants comprised of Hispanics ($\chi^2 = 3, 106$) $p < .0001$ (see Table A-4).

Outcome measures: item analysis

The Cronbach alphas for time 1 and time 2 are presented in Table A-11. Sources of social influence over breakfast consumption included parents, teachers, and friends. Subjective norms regarding eating whole-grains were 0.68 and 0.67 respectively. Attitudes about the value of eating breakfast were .89 and .90 respectively.

Attitude

The two-item attitude towards eating whole-grains scale underwent separate principal components analysis for responses at time 1 and time 2. For time 1 and time 2 one factor respectively was produced, under the minimum eigenvalue of 1.0. At time 1, 77.5% of the variance was explained by "I think it eating whole-grains will make me healthier" and 22.5% of the variance was explained by "I think choosing whole-grains will help me to maintain my weight". At time 2, 81.7% of the variance was explained by "eating whole-grains will make me healthier". All factors were retained further analyses. A Cronbach's alpha on those items that loaded high (0.600 or greater) produced 0.71 at time 1 and 0.78 at a time 2.

Subjective norm

For time 1 and time 2 one factor respectively were produced, under the minimum eigenvalue of 1.0. At time 1, 64.7% of the variance was explained by "I think it is important to do what my parents want me to do", 23.7% of the variance was explained by "I think it is important to do what my teachers want me to do", and 11.6% of the variance was explained by "I think it is important to do what my friends want me to do".

Similar results were seen at time 2. All factors were retained further analyses. Cronbach's alpha for these items was .68 and .66 respectively.

Intention and perceived behavioral control

Two survey questions reflected intention and perceived behavioral control. Means were computed for each pair of questions. Mean value for intention at time 1 was 4.686 (SD=1.720) and time 2 was 5.180 (SD=1.453). Perceived behavioral control mean at time 1 was 9.438 (SD=11.626) and 12.621 (SD=9.960) at time 2.

Regression analysis

Intention to eat whole-grains every day at time 2 was regressed on intention to do so at time 1 along with changes in attitude towards eating whole-grains, subjective norms, and perceived behavioral control. Group (treatment and control) and gender were also in the model. Results are presented in Table A-12. Attitude at time 2 was found to be significant ($p < .0001$) in predicting attitude to eat whole-grains at a later time. Intention at time 2 to eat whole-grains was significant ($p < .05$) at time 2 when predicted by subjective norms at Time 2. The variance explained in attitude and intention at time 2 was low ($r^2 = .22$ and $r^2 = .38$ respectively). Additional models were run examining the interaction between group and attitudes, subjective norms and perceived behavioral control. In the first model, group times attitude toward eating grains at time 2 produced significant results ($p < .0001$). An additional model looking at the interactions between group and subjective norms at time 2 produced significant results in the interaction term ($p < .05$), group ($p < .01$), and perceived behavioral control toward eating whole-grains at time 1 ($p < .05$). However, these models do not differentiate changes in attitudes,

subjective norms, or perceived behavioral control by group; therefore additional models were run with interactions between group (treatment versus control) and these three change variables. No model produced significant results.

DISCUSSION

Our study, using a randomized controlled trial design, examined whether a nutrition education intervention based on the Theory of Planned Behavior could change the behavior toward eating whole-grains by predominately, low-income, Hispanic, adolescents. To our knowledge, this study is the first of its kind. It is well-known that the use of the Theory of Planned Behavior is effective in identifying predictors of healthful dietary practices among adolescents and adults from different ethnic groups (42, 105, 109-112) but these studies included no interventions. Given that consumption of whole grain is associated with a lower body mass index and greater insulin sensitivity among adolescents (10), it is more important than ever that public health practitioners design interventions that emphasize consumption of whole-grain cereals as part of the breakfast meal.

As a result of the intervention, significant changes in attitude were seen. At time 1, both groups had a similar attitude toward eating whole-grains; at the conclusion of the intervention, the treatment group had a significantly more positive attitude toward eating whole-grains. It should be noted however, while the intervention could have made such a significant impact, also instrumental in changing attitude was introducing the adolescents to various whole-grain cereals, cereal bars, and crackers.

It is known that parents play a role in adolescent food choices and that their feeding styles and expectations influence the development of their children's eating habits, especially through their child-feeding practices (69-70, 72). The influence of peers is less studied, but research shows in the presence of certain others peers, food choices including amount of food consumed changes (87-88, 90, 118). Social Cognitive Theory has shown teacher modeling can be an effective method to encourage youth to accept foods (91-92) but no research exists using the TPB. Our study showed that important others (subjective norms – parents, teachers, and friends) significantly changed intention to consume whole-grains at time 2.

There are several limitations that warrant mention. First, adolescents were part of an after-school program and may not have been attentive when completing questionnaires. Second, after-school programs are a place of fun and not work, and completing a 76-question survey at two time points could lead to some merely checking boxes and not reading the questions in an effort to escape. Another limitation was participant attrition. We lost 30% of our participants between the start of the program and completion of the post-intervention survey at week 7. Attrition in after-school programs occurs frequently in this geographic area and is usually because parents cannot afford to have their child in after-school care for that particular month. Finally, the study faced other obstacles when delivering the intervention; namely, after-school staff allowed participants to leave the after-school site as they pleased and after-school staff rewarded adolescents with candy for good behavior.

While our study has a number of limitations, it is important to point out the strengths. To our knowledge, this is the first study involving an intervention developed around the constructs of the TPB aimed at improving whole-grain consumption among a predominately low-socioeconomic, Hispanic adolescent population in Los Angeles County. While results may not be generalizable to all youth in the United States, it is important to note significant improvements in change in attitude and intention to consume whole-grains occurred as a result of the intervention. These results may be due in part to the introduction of whole-grain cereals, cereal bars, and crackers during the course of the intervention. Another strength of this study was the inclusion of a 7-week randomized controlled trial intervention designed to target the constructs of the TPB to effect change in consumption of whole-grains.

6. SUMMARY AND CONCLUSIONS

Breakfast may be considered the most important meal of the day yet many people skip it and adolescents are no exception. Our study examined whether a nutrition education intervention based on the Theory of Planned Behavior could change the breakfast behavior to include consumption of low-fat dairy and whole-grains of a predominately, low-income, Hispanic adolescent population. To our knowledge, this study is the first of its kind. Previous research shows the use of the Theory of Planned Behavior is effective in identifying predictors of healthful dietary practices among adolescents and adults from different ethnic groups (42, 105, 109-112) but these studies included no interventions. Given that consumption of breakfast along with low-fat dairy and whole-grains are associated with a lower body mass index and greater intake of nutrients among adolescents (5, 20, 31-32, 63, 95), it is more important than ever that public health practitioners design interventions that emphasize consumption of breakfast along with consuming low-fat dairy and whole-grains as part of the breakfast meal.

Overall, our results are promising. Like previous research, our results showed the TPB model significantly predicted intention to consume breakfast along with low-fat dairy and whole-grains. However, the purpose of our research was to effect change in attitude, subjective norms, and perceived behavioral control. Change was not significantly predicted in breakfast , low-fat cheese, low-fat yogurt, and whole-grain consumption. Significant change results were observed in low-fat dairy (e.g., skim milk, 1% milk, and 2% milk).

Several limitations are worth mentioning. First, adolescents were part of an after-school program and may not have been attentive when completing questionnaires. Completing a 76-question survey at two time points may have led to some adolescents merely checking boxes and not reading the questions in an effort to escape. Another limitation was participant attrition. We lost 30% of our participants between the start of the program and completion of the post-intervention survey. Attrition in after-school programs occurs frequently in this geographic area and it usually because parents cannot afford to have their child in after-school for that particular month. The researcher faced other obstacles when delivering the intervention; namely, after-school staff allowed participants to leave the after-school site a they pleased and staff rewarded adolescents with candy for good behavior.

Although our study has several limitations, it is important to point out the strengths. To our knowledge, this is the first study using an intervention that centers on the constructs of the TPB aimed at changing consumption of breakfast, low-fat diary, and whole-grains among a predominately low-socioeconomic, Hispanic adolescent population. Results are not generalizable to all youth in the United States. Including a 7-week intervention targeting behavior and the introduction of various whole-grain and low-fat dairy products are also strengths of this study.

Most nutrition education efforts have examined the health benefits of eating breakfast to increase nutrition knowledge and awareness. Few studies have explored the value and effect of designing interventions to examine the influences of peers and family on predicting and explaining intention and behavior to eat breakfast. In the long-term

this is important because intention is not only influenced by peers and family but is an indicator of how hard a person is willing to try and how much effort a person will exert toward performing a behavior. It is also important to gain an understanding of attitude toward eating breakfast because changing knowledge and behavior is not enough; the ultimate goal is to effect lifelong knowledge and behavior. Educating and motivating adolescents about the long-term benefits of consuming breakfast and consuming a breakfast that is rich in whole-grain and low-fat dairy could have a significant impact on overall health and well-being among this age group.

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APPENDIX A

LIST OF FIGURES

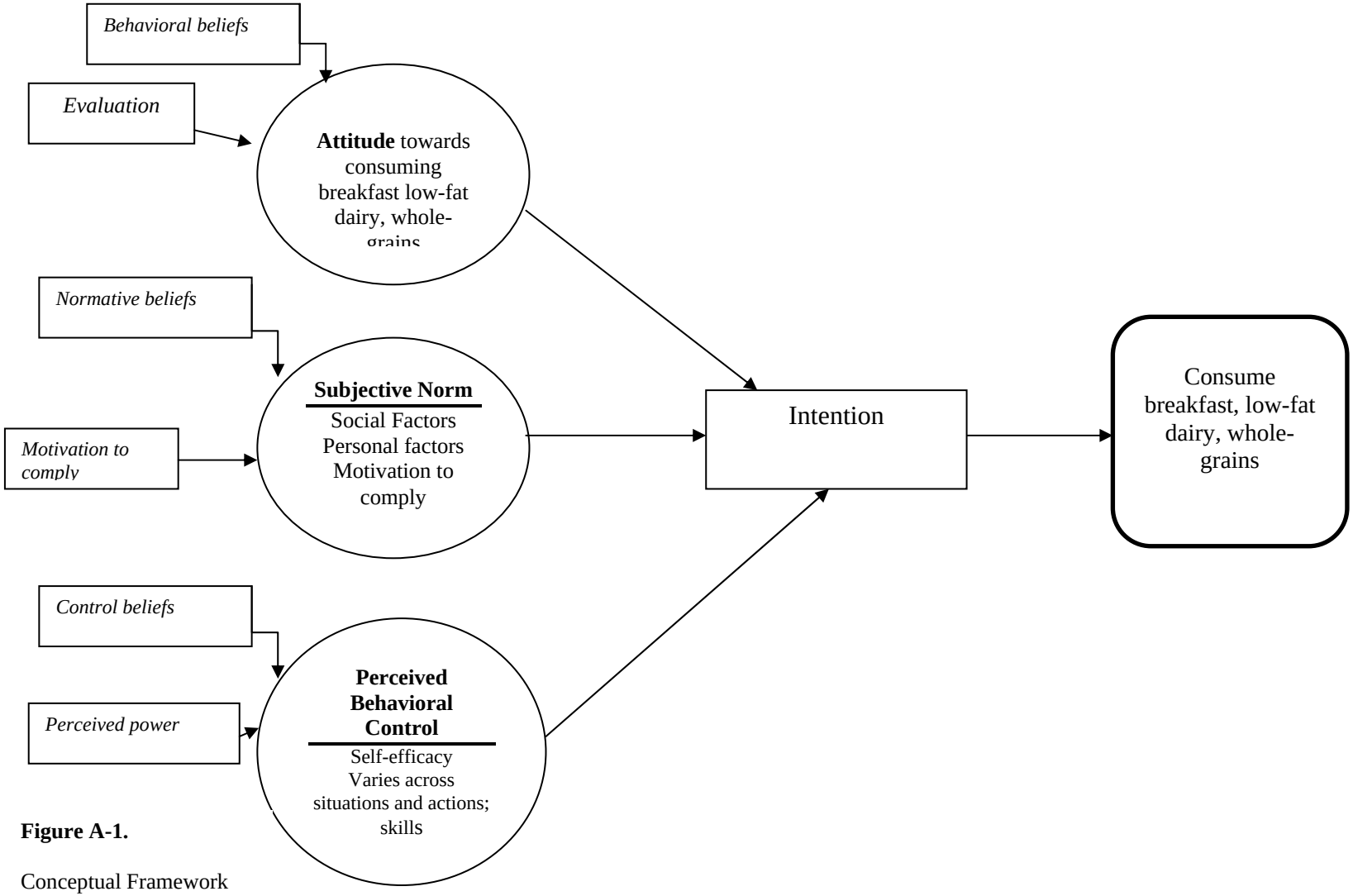

Figure A-1.

Conceptual Framework

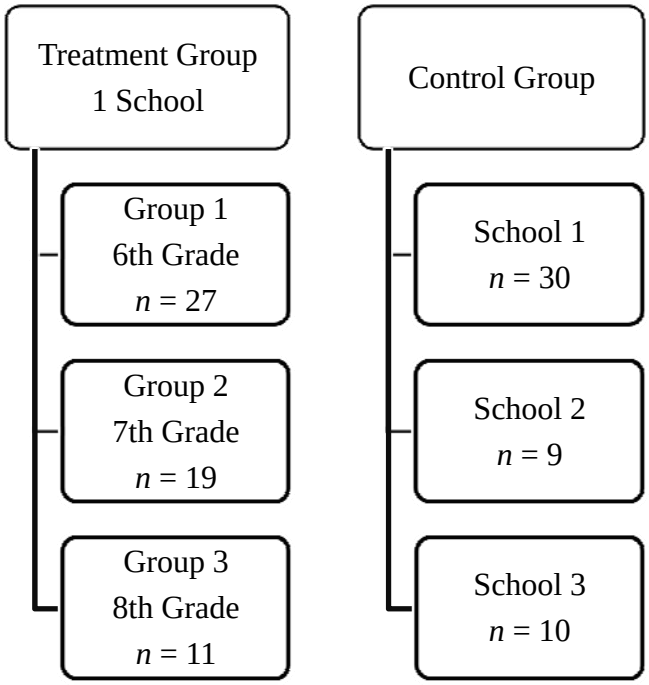

Figure A-2.

Study Design

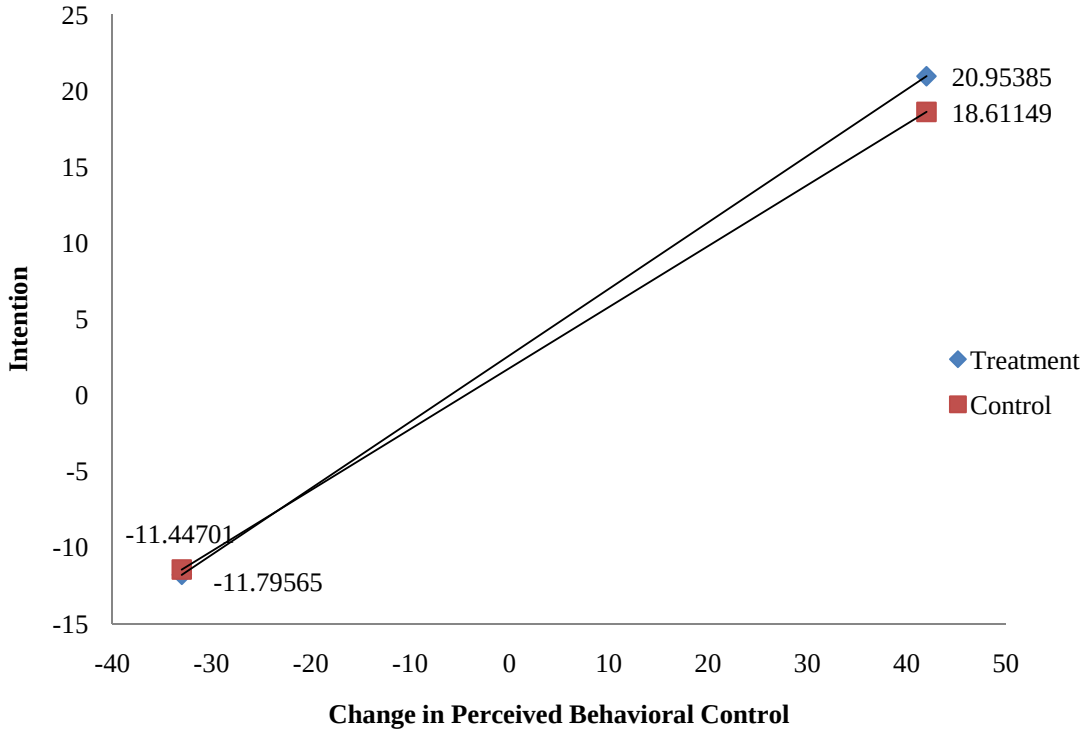

Figure A-3.

Change in intention to drink skim milk regressed on change in perceived behavioral control. The change is significantly different for the treatment group as compared with the control group, $p < .05$, $R^2 = .25$.

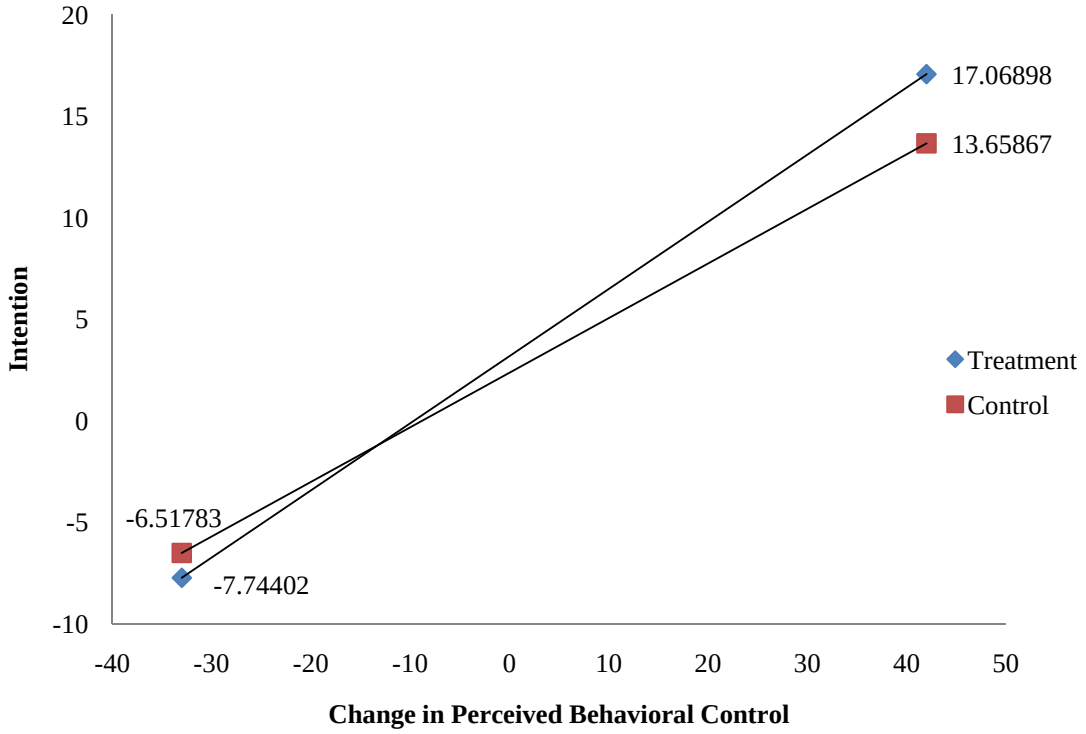

Figure A-4.

Change in intention to drink 1% milk regressed on change in perceived behavioral control. The change is significantly different for the treatment group as compared with the control group, $p < .001$, $R^2 = .29$.

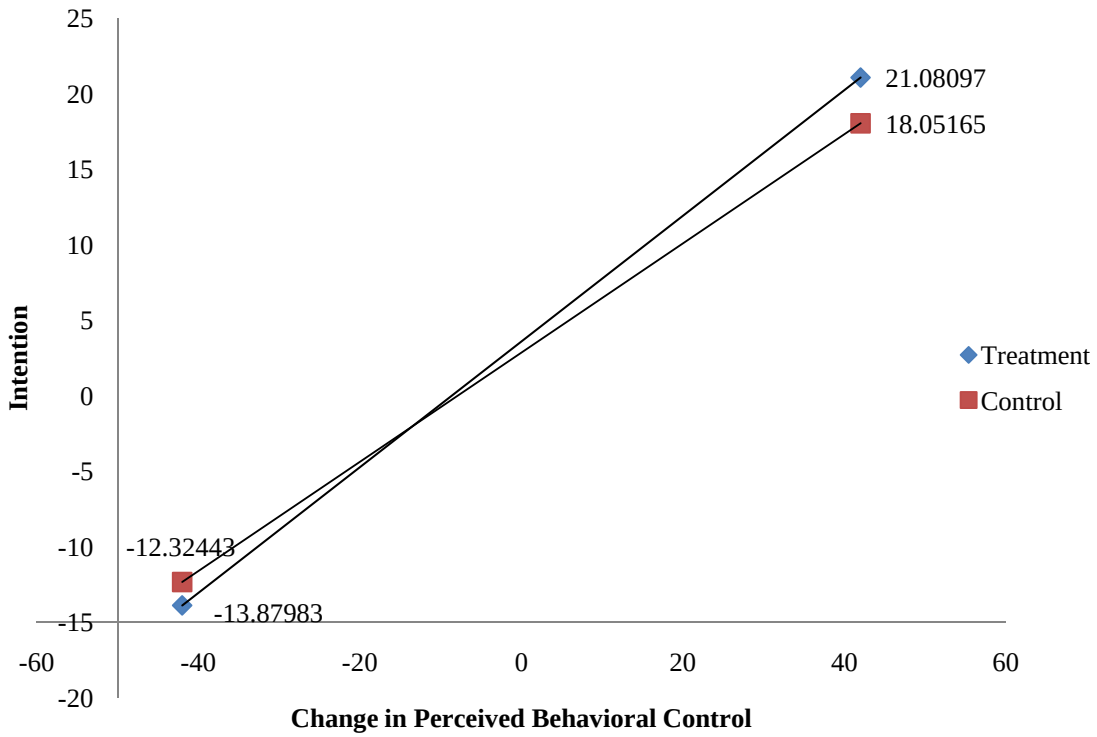

Figure A-5.

Change in intention to drink 2% milk regressed on change in perceived behavioral control. The change is significantly different for the treatment group as compared with the control group, $p < .001$, $R^2 = .36$.

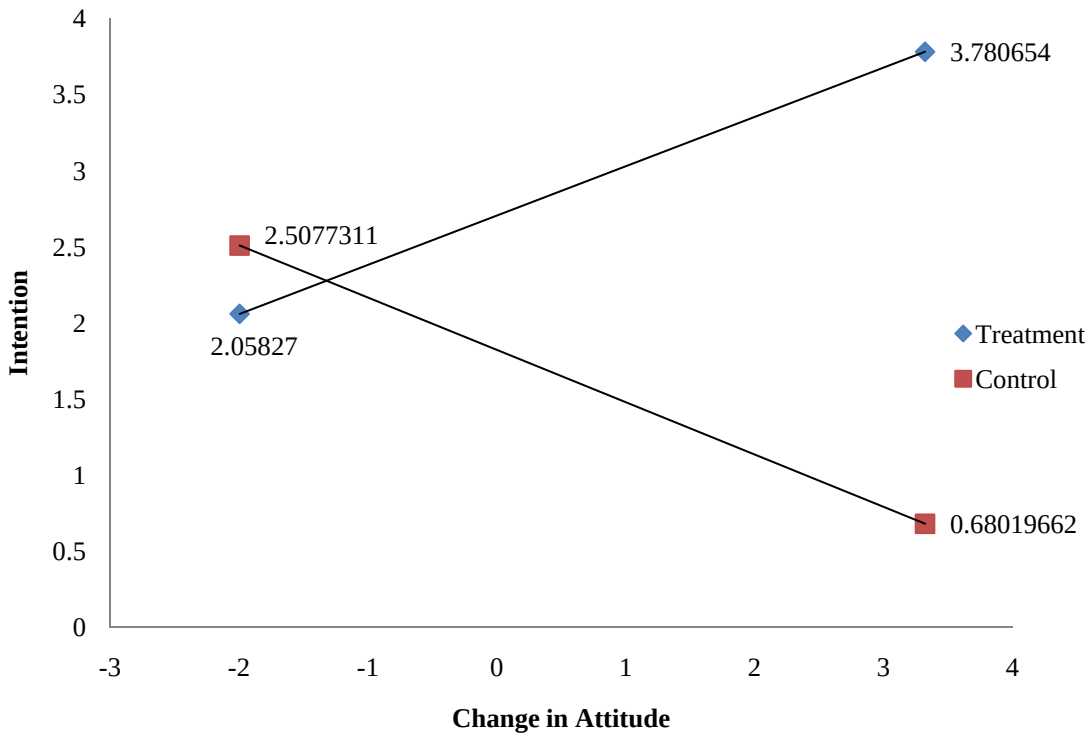

Figure A-6.

Change in intention to drink skim milk regressed on change in attitude. The change is significantly different for the treatment group as compared with the control group, $p < .05$, $R^2 = .33$.

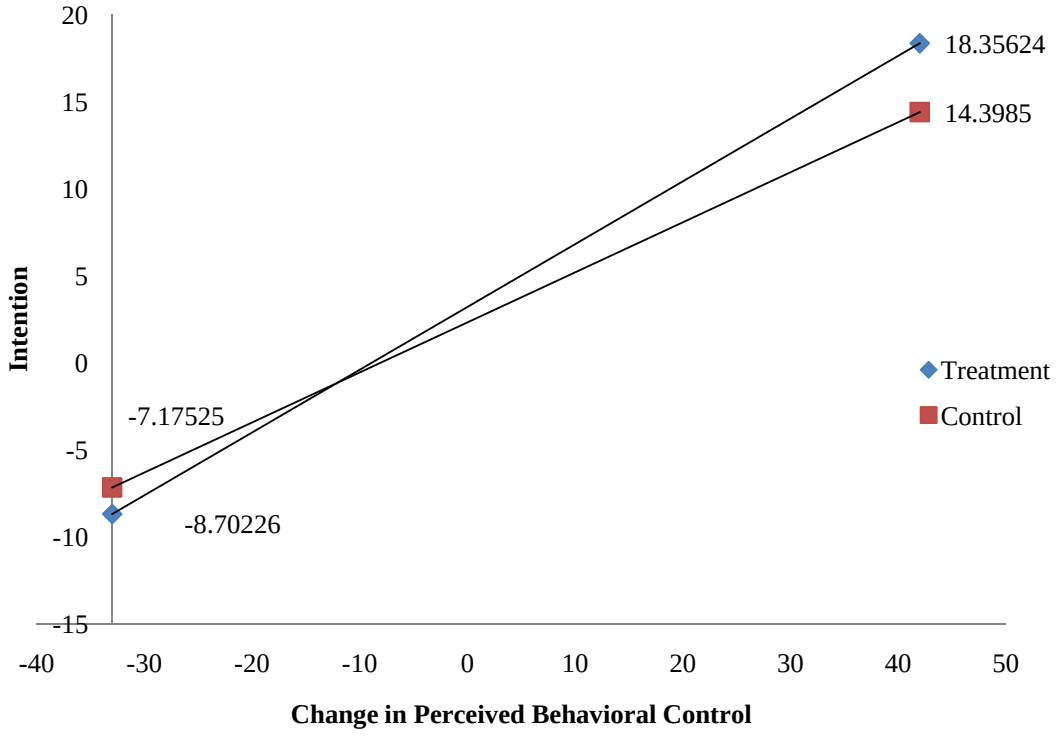

Figure A-7.

Change in intention to drink 1% milk regressed on change in perceived behavioral control, attitude, and subjective norms. The change is significantly different for the treatment group as compared with the control group, $p < .001$, $R^2 = .33$.

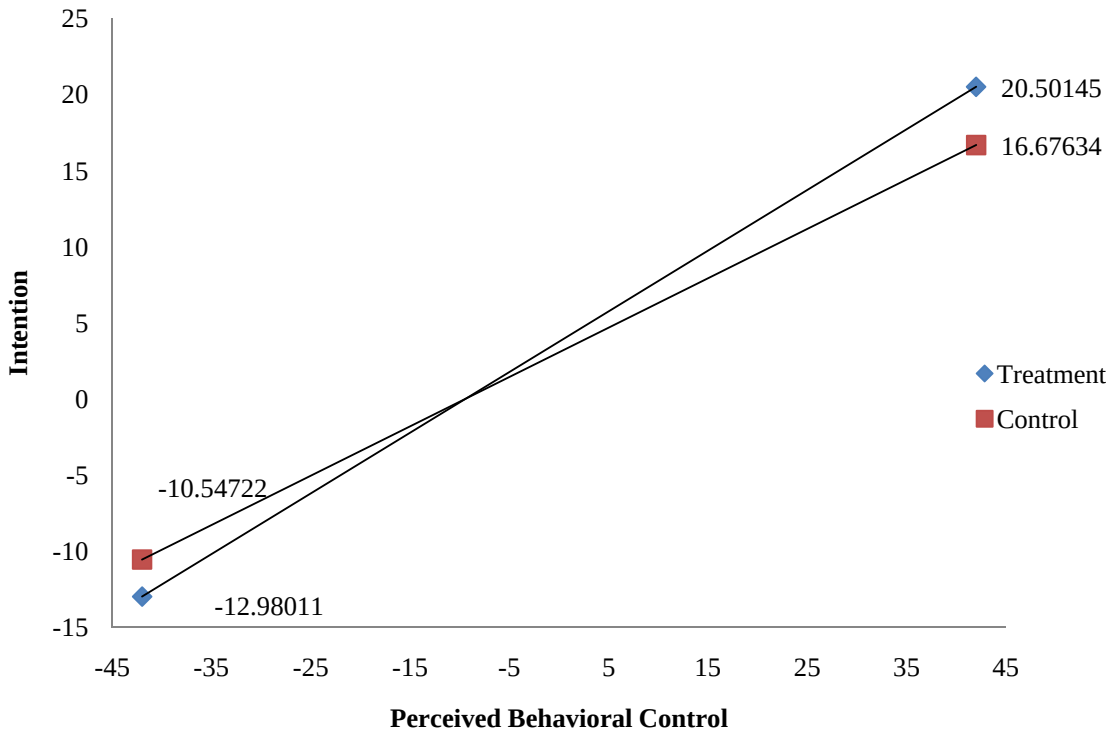

Figure A-8.

Change in intention to drink 2% milk regressed on change in perceived behavioral control, attitude, and subjective norms. The change is significantly different for the treatment group as compared with the control group, $p < .001$, $R^2 = .39$.

APPENDIX B

LIST OF TABLES

Table B-1

Focus group interview questions

1. Some of you mentioned that you eat breakfast every day. Why do you do so?
2. Some of you mentioned that you do not eat breakfast very often. Why?
3. Tell me about breakfast in your home.
4. What comes to mind when I say breakfast?
5. What foods in particular are important to you and your family when it comes to breakfast?
6. What are your usual food choices for breakfast?

Table B-2

Nutrition Education Intervention Curriculum and Constructs of the Theory of Planned Behavior

Week	Session Title	Constructs TPB
1	Let's Get Acquainted	Attitude
	What is Nutrition?	Behavioral Beliefs
	What is Health?	Subjective Norms
	Health Benefits of Nutrition	
2	Breakfast and You	Attitude
	Why is Breakfast So Important?	Behavioral Beliefs
		Behavioral Intention
3	The Food Guidance System	Attitude
	Low-Fat Dairy	Behavioral Beliefs
	Whole-Grains	
4	Breaking Down Barriers	Subjective Norms
	Identifying Barriers to Eating Breakfast	Normative Beliefs
	Discuss Solutions	Perceived Power
		Motivation to Comply
5	Make it Happen	Perceived Behavioral Control
	Choosing Healthy Breakfast Foods	Self-Efficacy
	Goal Setting	Motivation to Comply
6	Planning Ahead	Perceived Behavioral Control
	Setbacks	(Perceived Difficulty)
	Difficult situations	Subjective Norms
		Motivation to Comply

Week	Session Title	Constructs TPB
7	Staying Motivated	Perceived Behavioral Control
	What Will it Take?	(Perceived Difficulty)
	Just Do It	Subjective Norms
		Motivation to Comply

Table B- 3

Participant characteristics

	Treatment Group (*n* = 57)	Control Group (*n* = 49)
	n	*n*
Total		
Adolescent Boys	27	21
Race-ethnicity		
White	3	2
Asian	3	1
Hispanic	21	18
Age		
11 years	8	4
12 years	10	8
13 years	7	9
14 years	2	0

Treatment Group (*n* = 57) Control Group (*n* = 49)

	n	*n*
Total		
Adolescent Girls	30	28
Race-ethnicity		
White	0	2
Asian	0	1
Hispanic	29	25
Other	1	0
Age		
11 years	11	5
12 years	14	9
13 years	3	7
14 years	1	3
15 years	1	0

Table B-4
Chi-Square Test for Equal Proportions

Variable	χ_x	**DF**	***n***	***p***
Gender	.0434	1	106	.3314
Group	.6038	1	106	.4371
Race	223.2075	3	106	**<.0001**

Table B-5
Cronbach alpha statistic for Subjective Norms and Attitudes Toward Eating Breakfast at Time 1[a] and Time 2

Construct	**Cronbach alpha Time 1**	**Cronbach alpha Time 2**
Subjective Norms	.68	.67
Attitude	.89	.90

[a]Time 1 = pre-intervention; Time 2 = post-intervention

Table B-6

Main treatment effects on outcome measures breakfast: parameter estimates with standard errors

	Parameter (β)	SE
Attitude Toward Eating Breakfast at T2		
Attitude T1	0.59	0.10
Group	**0.26*** **	0.21
Gender	-0.12	-0.61
Intention Toward Eating Breakfast at T2		
Attitude T2	**0.87** **	0.28
Subjective Norms T2	-0.06	0.23
Perceived Behavioral Control T2	0.03	0.23
Group	0.58	0.35
Gender	0.24	0.33
Intention Toward Eating Breakfast at T2		
Intention T1	0.19	0.08
Attitude T2	**0.73***	0.28
Subjective Norms T2	-0.00	0.22
Perceived Behavioral Control T2	0.04	0.02
Group	**0.75***	0.34
Gender	0.24	0.32
Intention Toward Eating Breakfast at T1		
Attitude T1	**0.90***	0.38
Subjective Norms T1	0.01	0.24
Perceived Behavioral Control T1	**0.05***	0.02
Group	0.82	0.36
Group * Attitude T1	-0.64	0.19

	Parameter (β)	SE
Intention Toward Eating Breakfast at T2		
Attitude T2	**0.90****	0.30
Subjective Norms T2	-0.05	0.38
Perceived Behavioral Control T2	0.03	0.93
Group	0.68	0.70
Gender	0.27	0.33
Group * Subjective Norms T2	0.67	0.41
Group * Perceived Behavioral Control T2	-0.01	0.04
Intention Toward Eating Breakfast at T2		
Intention T1	**0.30***	0.11
Attitude T2 – Attitude T1	-0.50	0.47
Subjective Norm T2 – Subjective Norm T1	0.32	0.20
Perceived Behavioral Control T2 – Perceived Behavioral Control T1	-0.00	0.02
Group	0.62	0.41
Gender	-0.28	0.41
Group * Attitude Change (attitude T2 – attitude T1)	1.04	0.54

* $p < .05$

** $p < .001$

*** $p < .0001$

Table B-7

Cronbach alpha statistic for Subjective Norms and Attitudes Toward Consuming Low-Fat Diary at Time 1[a] and Time 2

Construct	**Cronbach alpha Time 1**	**Cronbach alpha Time 2**
Low-fat milk		
Subjective Norms	.82	.87
Skim milk		
Attitude	.87	.90
1% milk		
Attitude	.76	.87
2% milk		
Attitude	.78	.86
Low-fat cheese and yogurt		
Subjective Norms	.82	.81
Low-fat cheese		
Attitude	.74	.85
Low-fat yogurt		
Attitude	.75	.80

[a]Time 1 = pre-intervention; Time 2 = post-intervention

Table B-8

Main treatment effects on outcome measures milk: parameter estimates with standard errors

	Parameter (β)	SE
Intention Toward Drinking Skim Milk at T2		
Attitude T2	0.15	0.23
Subjective Norms T2	0.36	0.27
Perceived Behavioral Control T2	**0.05***	0.02
Group	0.82	0.46
Gender	-0.21	0.42
Intention Toward Drinking 1% Milk at T2		
Attitude T2	0.07	0.24
Subjective Norms T2	0.35	0.28
Perceived Behavioral Control T2	**0.09*****	0.03
Group	0.39	0.48
Gender	0.28	0.43
Intention Toward Drinking 2% Milk at T2		
Attitude T2	0.17	0.23
Subjective Norms T2	0.01	0.26
Perceived Behavioral Control T2	**0.08****	0.02
Group	0.55	0.46
Gender	0.05	0.42

	Parameter (β)	SE
Intention Toward Drinking Skim Milk at T2		
Intention T1	0.36	0.14
Attitude T2	0.09	0.23
Subjective Norms T2	0.31	0.26
Perceived Behavioral Control T2	**0.05***	0.02
Group	**0.87***	0.44
Gender	-0.14	0.41
Intention Toward Drinking 1% Milk at T2		
Intention T1	0.21	0.11
Attitude T2	-0.03	0.24
Subjective Norms T2	0.31	0.27
Perceived Behavioral Control T2	**0.36****	0.23
Group	0.09	0.49
Gender	0.22	0.43
Intention Toward Drinking 2% Milk at T2		
Intention T1	**0.31***	0.09
Attitude T2	0.11	0.22
Subjective Norms T2	-0.01	0.25
Perceived Behavioral Control T2	**0.07****	0.02
Group	0.65	0.43
Gender	-0.17	0.40

	Parameter (β)	SE
Attitude Toward Drinking Low-Fat Milk at T2		
Attitude T1	-0.05	0.07
Group	0.26	0.15
Gender	-0.20	0.15
Group * Attitude T2	**1.00*** **	0.09
Intention Toward Drinking 1% Milk at T2		
Attitude T2	0.06	0.26
Subjective Norms T2	-0.41	0.48
Perceived Behavioral Control T2	**0.12***	0.04
Group	1.01	0.73
Gender	0.12	0.44
Group * Subjective Norms T2	**1.08***	0.54
Intention Toward Drinking 2% Milk at T2		
Attitude T1	**-1.95***	0.49
Subjective Norms T1	0.35	0.26
Perceived Behavioral Control T1	-0.00	0.03
Group	**1.18***	0.60
Gender	0.30	0.47
Group * Attitude T1	**0.60***	0.30

	Parameter (β)	SE
Intention Toward Drinking 2% Milk at T2		
Attitude T2	0.33	0.24
Subjective Norms T2	-0.45	0.43
Perceived Behavioral Control T2	**0.17*** **	0.04
Group	2.00	0.66
Gender	-0.06	0.42
Group * Attitude T2	**0.50***	0.23
Group * Perceived Behavioral Control T2	**-0.14***	0.05

* $p < .05$

** $p < .001$

*** $p < .0001$

Table B-9

Main treatment effects on change interaction measures milk: parameter estimates with standard errors

	Parameter (β)	SE
Change in perceived behavioral control to drink skim milk at a later time		
Intention T1		
Attitude T2 – Attitude T1	**0.40***	0.14
Subjective Norms T2 – Subjective Norms T1	0.16	0.16
Perceived Behavioral Control T2 –		0.10
Perceived Behavioral Control T1	0.16	
Group	**0.04***	0.02
Gender	0.84	0.48
	-0.29	0.43
Change in perceived behavioral control to drink 1% milk at a later time		
Intention T1		
Attitude T2 – Attitude T1	**0.27***	0.12
Subjective Norms T2 – Subjective Norms T1	-0.07	0.18
Perceived Behavioral Control T2 –	0.15	0.18
Perceived Behavioral Control T1		
Group	**0.06****	0.01
Gender	0.81	0.53
	-0.20	0.46

	Parameter (β)	SE
Change in perceived behavioral control to drink 2% milk at a later time		
Intention T1		
Attitude T2 – Attitude T1	**0.36****	0.10
Subjective Norms T2 – Subjective Norms T1	0.12	0.16
Perceived Behavioral Control T2 – Perceived Behavioral Control T1	-0.01	0.16
Group	**0.05****	0.01
Gender	0.74	0.55
	0.40	0.41
Change in attitude to drink skim milk at a later time		
Intention T1	**0.37***	0.14
Attitude T2 – Attitude T1	-0.34	0.25
Subjective Norms T2 – Subjective Norms T1	0.14	0.16
Perceived Behavioral Control T2 – Perceived Behavioral Control T1	0.02	0.02
Group	0.88	0.45
Gender	-0.48	0.42
Attitude Change * group	**0.69***	0.32
Perceived Behavioral Control Change *group	0.04	0.03

	Parameter (β)	SE
Change in perceived behavioral control to drink 1% milk at a later time		
Intention T1		
Attitude T2 – Attitude T1	**0.29***	0.12
Subjective Norms T2 – Subjective Norms T1	-0.49	0.29
Perceived Behavioral Control T2 – Perceived Behavioral Control T1	0.23	0.30
Group	**0.07****	0.02
Gender	0.89	0.54
Attitude Change * group	-0.36	0.47
Subjective Norms Change * group	0.68	0.37
Perceived Behavioral Control Change * group	-0.09	0.38
	-0.03	0.04
Change in perceived behavioral control to drink 2% milk at a later time		
Intention T1		
Attitude T2 – Attitude T1	**0.32***	0.10
Subjective Norms T2 – Subjective Norms T1	-0.13	0.25
Perceived Behavioral Control T2 – Perceived Behavioral Control T1	0.22	0.26
Group	**0.07****	0.02
Gender	0.70	0.46
Attitude Change * group	-0.32	0.42
Subjective Norms Change * group	0.39	0.32
Perceived Behavioral Control Change * group	-0.32	0.33
	-0.03	0.03

* $p < .05$

** $p < .001$

*** $p < .0001$

Table B-10

Main treatment effects on outcome measures cheese and yogurt: parameter estimates with standard errors

	Parameter (β)	SE
Attitude Toward Eating Low-Fat Cheese at T1		
Attitude T1	**-0.42*** **	0.11
Group	0.30	0.22
Gender	-0.02	0.22
Attitude Toward Eating Low-FatYogurt at T1		
Attitude T1	**-0.59*** **	0.12
Group	0.40	0.23
Gender	-0.12	0.23
Intention Toward Eating Low-Fat Cheese at T2		
Attitude T2	**1.00*** **	0.23
Subjective Norms T2	0.39	0.24
Group	0.63	0.39
Gender	0.11	0.36
Intention Toward Eating Low-Fat Yogurt at T2		
Attitude T2	**0.63** **	0.19
Subjective Norms T2	**0.61* **	0.20
Group	0.20	0.31
Gender	0.10	0.29

	Parameter (β)	SE
Intention Toward Eating Low-Fat Cheese at T2		
Attitude T2	0.47	0.43
Subjective Norms T2	**1.41***	0.44
Group	0.46	0.39
Gender	0.10	0.35
Group * Subjective Norms T2	**-1.06***	0.53
Intention Toward Eating Low-Fat Yogurt at T2		
Attitude T1	0.45	0.37
Subjective Norms T1	-0.20	0.40
Group	**0.86***	0.37
Gender	0.16	0.37
Group * Subjective Norms T1	**0.97***	0.46

* $p < .05$

** $p < .001$

*** $p < .0001$

Table B-11

Cronbach alpha statistic for Subjective Norms and Attitudes Toward Eating Whole-Grains at Time 1[a] and Time 2

Construct	**Cronbach alpha Time 1**	**Cronbach alpha Time 2**
Subjective Norms	.68	.66
Attitude	.71	.78

[a]Time 1 = pre-intervention; Time 2 = post-intervention

Table B-12

Main treatment effects on outcome measures – whole-grains: parameter estimates with standard errors

	Parameter (β)	SE
Attitude Toward Eating Whole-Grains at T2		
Attitude T1	**0.45****	0.12
Group	0.27	0.22
Gender	-0.01	0.22
Intention Toward Eating Whole-Grains at T2		
Attitude T2	0.38	0.20
Subjective Norms T2	**0.50***	0.17
Perceived Behavioral Control T2	0.01	0.02
Group	0.32	0.30
Gender	0.10	0.29
Intention Toward Eating Whole-Grains at T2		
Intention T1	0.10	0.09
Attitude T2	0.39	0.20
Subjective Norms T2	**0.47***	0.18
Perceived Behavioral Control T2	0.01	0.02
Group	0.41	0.31
Gender	0.07	0.29
Attitude Toward Eating Whole-Grains at T2		
Attitude T1	0.13	0.07
Group	0.18	0.14
Gender	-0.08	0..13
Group * Attitude T1	**0.93****	0.90

	Parameter (β)	SE
Intention Toward Eating Whole-Grains at T2		
Attitude T1	0.28	.34
Subjective Norms T1	-0.60	0.48
Perceived Behavioral Control T1	**0.08***	0.04
Group	**1.33***	0.55
Gender	-0.68	0.34
Group * Subjective Norms T1	**1.13***	0.56

* $p < .05$

** $p < .0001$

APPENDIX C

SURVEY INSTRUMENT

Teens, please complete this form. All of the information is confidential. The information in this survey will be used as part of a research study being conducted at your after-school program. You do not have to answer any question that you do not want to, however, answering every question will help the researchers, and Stone Soup Childcare Programs develop future programs for teens your age.

A. BASIC BACKGROUND INFORMATION

1. Your name: _____
   First *Last*

2. Parent or guardian name: _____
   First *Last*

3. Home address: _____
   Street *Apt #*

   City: _____ Zip Code _____

4. Home phone number: _____
   Area Code *Phone Number*

5. How old are you? _____

6. What is your race ?
   Choose all that apply.

   ☐ 1 White
   ☐ 2 Black or African-American
   ☐ 3 American Indian or Alaskan native
   ☐ 4 Hispanic or Latino
   ☐ 5 Asian or Pacific Isl
   Other ☐ ***(please specify)*** _____

7. Which of the following describes your ethnicity? *Choose all that apply.*

   ☐ 1 African ***(please specify)*** _____
   ☐ 2 West Indian/Caribbean ***(please specify)*** _____
   ☐ 3 Mexican/Mexican-American/Chicano
   ☐ 4 Puerto Rican
   ☐ 5 Cuban
   ☐ 6 Central American
   ☐
   ☐ 10 Chinese
   ☐ 11 Korean
   ☐ 12 Filipino
   ☐ 13 Vietnamese
   ☐ 14 Other Asian ***(please specify)*** _____
   ☐ 15 Native Hawaiian
   ☐ 16 Samoan

7 Other Latino/Hispanic ***(please specify)***
_____

☐ 8 Asian Indian

☐ _____
9 Japanese

☐ 17 Tongan

☐ 18 Other ***(please specify):***

☐ 19 NONE OF THE ABOVE

B. TPB Survey

Teens, read each question and then circle the answer that best describes how you feel. There are no right or wrong answers.

Behavioral Intentions	Extremely unlikely			Some-what Likely			Very likely
1. I plan to eat breakfast every day.	A	B	C	D	E	F	G
2. I plan to drink 2% milk every day.	A	B	C	D	E	F	G
3. I plan to drink 1% milk every day.	A	B	C	D	E	F	G
4. I plan to drink skim every day.	A	B	C	D	E	F	G
5. When I eat yogurt, I plan to choose low-fat yogurt every time.	A	B	C	D	E	F	G
6. When I eat cheese, I plan to choose low-fat cheese every time.	A	B	C	D	E	F	G
7. How likely is it that you will eat breakfast every day?	A	B	C	D	E	F	G
8. How likely is it that you will choose 2% milk?	A	B	C	D	E	F	G
9. How likely is it that you will choose 1% milk?	A	B	C	D	E	F	G
10. How likely is it that you will choose skim milk?	A	B	C	D	E	F	G
11. How likely is it that you will choose low-fat yogurt?	A	B	C	D	E	F	G
12. How likely is it that you will choose low-fat cheese?	A	B	C	D	E	F	G
13. How likely is it that you will choose whole grains?	A	B	C	D	E	F	G

Attitude
Direct Measure

19. I think that eating breakfast every day is:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

20. I think that drinking 2% milk every day:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

21. I think that drinking 1% milk every day is:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

22. I think that drinking skim milk every day is:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

23. I think that eating whole-grain cereal is:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

24. I think that eating low-fat yogurt is:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

25. I think that eating low-fat cheese is:

A	B	C	D	E	F	G
Really bad for me			**Does not matter**			**Really good for me**

Attitude Evaluation	Strongly disagree			Do not agree or disagree			Strongly agree
26. I think that eating breakfast every day will provide important nutrients to my diet.	A	B	C	D	E	F	G
27. I think that eating breakfast every day will help me to do better in school.	A	B	C	D	E	F	G
28. I think that eating breakfast every day will help me maintain my body weight.	A	B	C	D	E	F	G
29. I think that eating breakfast every day will help me perform better in sports (football, soccer, etc).	A	B	C	D	E	F	G
30. I think that eating breakfast every day will help me to get higher scores on tests.	A	B	C	D	E	F	G
31. I think that eating breakfast every day will give me more energy while I am in school.	A	B	C	D	E	F	G
32. I think that eating breakfast every day will help my jeans to fit better.	A	B	C	D	E	F	G
33. I think that eating breakfast every day will make me healthier.	A	B	C	D	E	F	G
34. I think that drinking 2% milk will make me healthier.	A	B	C	D	E	F	G
35. I think that drinking 1% milk will make me healthier.	A	B	C	D	E	F	G
36. I think that drinking skim milk will make me healthier.	A	B	C	D	E	F	G
37. I think that eating low-fat yogurt will make me healthier.	A	B	C	D	E	F	G
38. I think that eating low-fat cheese will make me healthier.	A	B	C	D	E	F	G
39. I think that eating whole grain cereal will make me healthier.	A	B	C	D	E	F	G
40. I think that drinking low fat milk will make my bones stronger.	A	B	C	D	E	F	G
41. I think that drinking skim milk will make my bones stronger.	A	B	C	D	E	F	G
42. I think that drinking milk every day will make me healthier.	A	B	C	D	E	F	G
43. I think that eating and drinking low-fat milk products will help me maintain my body weight.	A	B	C	D	E	F	G

Attitude Evaluation	Strongly disagree			Do not agree or disagree			Strongly agree
44. I think eating breakfast will make me gain weight.	A	B	C	D	E	F	G
45. I think skipping breakfast will make me gain weight.	A	B	C	D	E	F	G
46. I think skipping breakfast will make me do worse on tests.	A	B	C	D	E	F	G
47. I think choosing low-fat milk products will help me to lose weight.	A	B	C	D	E	F	G
48. I think that choosing whole-grain cereals will help me to maintain my weight..	A	B	C	D	E	F	G
Subjective Norm Normative Belief	**Strongly disagree**			**Do not agree or disagree**			**Strongly agree**
49. My parents think it is important that I eat breakfast every day.	A	B	C	D	E	F	G
50. I think it is important to do what my parents want me to do.	A	B	C	D	E	F	G
51. My teachers think it is important that I eat breakfast every day.	A	B	C	D	E	F	G
52. I think it is important to do what my teachers want me to do.	A	B	C	D	E	F	G
53. My friends think it is important that I eat breakfast every day.	A	B	C	D	E	F	G
54. I think it is important to do what my friends want me to do.	A	B	C	D	E	F	G
55. My parents think it is important that I drink a glass of milk with every meal.	A	B	C	D	E	F	G
56. My teachers think it is important to drink a glass of milk with every meal.	A	B	C	D	E	F	G
57. My friends think it is important to drink a glass of milk with every meal.	A	B	C	D	E	F	G
58. My parents think it is important to drink low-fat or skim milk products instead of whole milk products.	A	B	C	D	E	F	G
59. My teachers think it is important to choose low-fat/skim milk products instead of whole-milk products.	A	B	C	D	E	F	G
60. My friends think it is important to choose low-fat/skim milk products instead of whole-milk products.	A	B	C	D	E	F	G

Subjective Norm Normative Belief	Strongly disagree			Do not agree or disagree			Strongly agree
61. My parents think it is important to choose whole-grain cereals.	A	B	C	D	E	F	G
62. My teachers think it is important to choose whole-grain cereals.	A	B	C	D	E	F	G
63. My friends think it is important to choose whole-grain cereals.	A	B	C	D	E	F	G
Perceived Behavioral Control Direct Measure	Not true at all			Neutral			Very true
64. I think it is up to me to eat breakfast every day.	A	B	C	D	E	F	G
65. I think it is up to me to choose 1% milk.	A	B	C	D	E	F	G
66. I think it is up to me to choose 2% milk.	A	B	C	D	E	F	G
67. I think it is up to me to choose skim milk.	A	B	C	D	E	F	G
68. I think it is up to me to choose whole-grain cereals.	A	B	C	D	E	F	G
Perceived Behavioral Control Perceived Power	Not true at all			Neither true or false			Very true
69. I think it is easy for me to eat breakfast every day.	A	B	C	D	E	F	G
70. I think it is easy for me to drink a glass of milk with every meal.	A	B	C	D	E	F	G
71. I think it is easy for me to choose low-fat/skim milk products over whole-milk products.	A	B	C	D	E	F	G
72. I think it is easy for me to choose whole-grain cereals.	A	B	C	D	E	F	G

C. FFQ/Availability Survey

1. How many times a day do you drink a glass of milk? Check all that apply.

☐ **Breakfast** ☐ **Lunch** ☐ **Dinner** ☐ **Snack**

2. Milk is served with meals in my home.

A	B	C	D	E
Always	**Never**			**Sometimes**

3. During the past week, how many days did you eat breakfast?

1	2	3	4	5	6	7

APPENDIX D

PRINCIPAL COMPONENT ANALYSIS

Table D-1
Results of Principal Components Analysis of Attitude Items toward Eating Breakfast at Time 1

	Factor 1	Factor 2	Variance
I think eating breakfast every day will provide important nutrients to my diet	**0.72196**	0.33373	55%
I think eating breakfast every day will help me to do better in school	**0.77857**	0.20784	11%
I think eating breakfast every day will help me maintain my body weight	0.30119	**0.73801**	8%
I think that eating breakfast every day will help me perform better in sports (football, soccer, etc.)	0.50601	**0.61305**	7%
I think that eating breakfast every day will help me to get higher scores on tests	**0.79591**	0.31783	5%
I think that eating breakfast every day will give me more energy while I am in school	**0.84915**	0.23491	4%
I think that eating breakfast every day will help my jeans to fit better	0.04453	**0.83201**	3%
I think that eating breakfast every day will make me healthier	0.52064	0.58564	2%

Bold items indicate highest factor loadings for given items

Table D-2
Results of Principal Components Analysis of Attitude Items toward Eating Breakfast at Time 21

	Factor 1	Variance
I think eating breakfast every day will provide important nutrients to my diet	0.81052	58%
I think eating breakfast every day will help me to do better in school	0.81917	10%
I think eating breakfast every day will help me maintain my body weight	0.77584	9%
I think that eating breakfast every day will help me perform better in sports (football, soccer, etc.)	0.75402	7%
I think that eating breakfast every day will help me to get higher scores on tests	0.84146	6%
I think that eating breakfast every day will give me more energy while I am in school	0.83101	4%
I think that eating breakfast every day will help my jeans to fit better	0.65959	4%
I think that eating breakfast every day will make me healthier	0.83014	2%

Table D-3
Results of Principal Components Analysis of Subjective Norm Items toward Eating Breakfast at Time 1

	Factor 1	Variance
My parents this it is important that I eat breakfast every day & I think it is important to do what my parents want me to do	0.73445	61%
My teachers think it is important that I eat breakfast every day & I think it is important to do what my teachers want me to do	0.82838	22%
My friends think it is important that I eat breakfast every day & I think it is important to do what my friends want me to do	0.78473	16%

Table D-4
Results of Principal Components Analysis of Subjective Norm Items toward Eating Breakfast at Time

	Factor 1	Variance
My parents this it is important that I eat breakfast every day & I think it is important to do what my parents want me to do	0.81921	61%
My teachers think it is important that I eat breakfast every day & I think it is important to do what my teachers want me to do	0.91453	29%
My friends think it is important that I eat breakfast every day & I think it is important to do what my friends want me to do	0.57098	10%

Table D- 5
Results of Principal Components Analysis of Attitude Items toward Consuming Low-Fat Milk at Time 1

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Variance
I think that drinking 2% milk every day is (really bad for me…really good for me) multiplied by attitude evaluation items:						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Variance
I think drinking 2% milk will make me healthier	-0.04777	**0.61353**	0.16056	0.13824	0.46177	44%
I think that that drinking milk every day will make me healthier	-0.05205	**0.87764**	0.21303	0.07647	0.15812	13%
I think that eating and drinking low-fat milk products will help me maintain my body weight	-0.00676	0.23911	**0.75264**	0.26415	0.41352	11%
I think choosing low-fat milk products will help me to lose weight	0.11034	0.11082	0.12679	**0.90942**	0.18844	8%
I think that drinking low-fat milk will make my bones stronger	0.17806	0.15010	0.22297	0.16075	**0.88482**	6%
I think that drinking skim milk will make my bones stronger	**0.89450**	0.08008	0.01887	0.16395	0.16585	5%
I think that eating drinking 1% milk every day is (really bad for me…really good for me) multiplied by attitude evaluation items:						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Variance
I think that drinking 1% milk will make me healthier	0.28193	**0.61169**	0.05103	0.12189	0.09544	4%

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Variance
I think that drinking milk every day will make me healthier	0.08965	**0.87344**	0.17645	0.03818	0.08592	3%
I think that eating and drinking low-fat milk products will help me maintain my body weight	0.07939	0.26330	**0.75299**	0.24184	0.35656	2%
I think choosing low-fat milk products will help me to lose weight	0.08385	0.08665	0.12167	**0.91401**	0.22565	2%
I think that drinking low-fat milk will make my bones stronger	0.29418	0.16447	0.15636	0.18141	**0.84459**	1%
I think that drinking skim milk will make my bones stronger	**0.88107**	0.08967	0.02411	0.09020	0.22816	1%

I think that eating drinking 1% milk every day is (really bad for me…really good for me) multiplied by attitude evaluation items:

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Variance
I think that drinking skim milk will make me healthier	0.54771	0.29264	0.49625	0.15790	-0.03849	< 1%
I think that drinking milk every day will make me healthier	0.37855	**0.68203**	0.44915	0.03931	-0.04575	< 1%
I think that eating and drinking low-fat milk products will help me maintain my body weight	0.30254	0.26939	**0.85829**	0.19728	0.13275	< 1%
I think choosing low-fat milk products will help me to lose weight	0.23411	0.09194	0.27763	**0.85179**	-0.02988	< 1%

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Variance
I think that eating and drinking low-fat milk products will help me maintain my body weight	0.51569	0.14182	0.40765	0.04603	0.55204	< 1%
I think choosing low-fat milk products will help me to lose weight	**0.87416**	0.08689	0.25381	0.12242	0.11009	< 1%

Bold items indicate factor loading cut-off points:

Table D-6
Results of Principal Components Analysis of Attitude Items toward Consuming Low-Fat Milk at Time 2

	Factor 1	Factor 2	Factor 3	Factor 4	Variance
I think that drinking 2% milk every day is (really bad for me…really good for me) multiplied by attitude evaluation items:					
	Factor 1 Variance	Factor 2	Factor 3	Factor 4	
I think drinking 2% milk will make me healthier	0.04771	**0.62275**	0.43878	0.20961	58%
I think that that drinking milk every day will make me healthier	0.31246	**0.87829**	0.11046	0.1300	10%
I think that eating and drinking low-fat milk products will help me maintain my body weight	**0.80673**	0.29347	0.25488	0.14644	8%
I think choosing low-fat milk products will help me to lose weight	0.35224	0.19365	**0.86828**	0.14096	6%
I think that drinking low-fat milk will make my bones stronger	**0.64099**	0.37555	0.30238	0.24839	5%
I think that drinking skim milk will make my bones stronger	**0.59012**	0.05120	0.14044	**0.70315**	5%
I think that eating drinking 1% milk every day is (really bad for me…really good for me) multiplied by attitude evaluation items:					
	Factor 1	Factor 2	Factor 3	Factor 4	Variance
I think that drinking 1% milk will make me healthier	0.00875	0.34163	0.17811	0.78417	3%

	Factor 1	Factor 2	Factor 3	Factor 4	Variance
I think that drinking milk every day will make me healthier	0.33576	**0.85794**	0.18813	0.17176	3%
I think that eating and drinking low-fat milk products will help me maintain my body weight	**0.76905**	0.32911	0.28521	0.17079	1%
I think choosing low-fat milk products will help me to lose weight	0.27399	0.24421	**0.88579**	0.12443	1%
I think that drinking low-fat milk will make my bones stronger	0.56876	0.47557	0.32873	0.27771	< 1%
I think that drinking skim milk will make my bones stronger	0.25224	0.14066	0.08122	**0.91606**	< 1%

I think that eating drinking 1% milk every day is (really bad for me…really good for me) multiplied by attitude evaluation items:

	Factor 1	Factor 2	Factor 3	Factor 4	Variance
I think that drinking skim milk will make me healthier	0.30608	0.30327	0.29039	0.41480	< 1%
I think that drinking milk every day will make me healthier	0.35964	**0.77172**	0.21226	0.23603	< 1%
I think that eating and drinking low-fat milk products will help me maintain my body weight	**0.79115**	0.23380	0.33569	0.19447	< 1%
I think choosing low-fat milk products will help me to lose weight	0.29735	0.20096	**0.88392**	0.16479	< 1%

	Factor 1	Factor 2	Factor 3	Factor 4	Variance
I think that eating and drinking low-fat milk products will help me maintain my body weight	**0.59510**	0.46300	0.37067	0.32802	< 1%
I think choosing low-fat milk products will help me to lose weight	**0.61545**	0.13251	0.13543	**0.60627**	< 1%

Bold items indicate factor loading cut-off points:

Table D-7
Results of Principal Components Analysis of Subjective Norm Items toward Drinking Low-Fat Dairy at Time 1

	Factor 1	Factor 2	Variance
My parents think it is important that I drink a glass of milk with every meal.	0.45985	**.72818**	55%
My teachers think it is important that I drink a glass of milk with every meal.	**0.73575**	0.44943	20%
My friends think it is important that I drink a glass of milk with every meal.	**0.81879**	0.17071	10%
My parents think it is important to choose low-fat or skim milk products instead of whole-milk products.	**0.76952**	-0.47557	7%
My teachers think it is important to choose low-fat or skim milk products instead of whole-milk products.	**0.77511**	-0.44555	5%
My friends think it is important to choose low-fat or skim milk products instead of whole-milk products.	**0.80516**	-0.11673	4%

Bold items indicate highest factor loadings for given items

Table D-8
Results of Principal Components Analysis of Subjective Norm Items toward Drinking Low-Fat Dairy at Time 2

	Factor 1	Variance
My parents think it is important that I drink a glass of milk with every meal.	0.66844	60%
My teachers think it is important that I drink a glass of milk with every meal.	0.84678	14%
My friends think it is important that I drink a glass of milk with every meal.	0.85898	11%
My parents think it is important to choose low-fat or skim milk products instead of whole-milk products.	0.67802	8%
My teachers think it is important to choose low-fat or skim milk products instead of whole-milk products.	0.79167	5%
My friends think it is important to choose low-fat or skim milk products instead of whole-milk products.	0.78164	3%

Table D-9
Results of Principal Components Analysis of Attitude Items toward Consuming Low-Fat Cheese at Time 1

	Factor 1	Variance
I think eating low-fat cheese is “really good… really bad for me”	0.74499	58%
I think eating low-fat cheese will make me healthier	0.84198	19%
I think eating and drinking low-fat milk products will help me maintain my body weight	0.79447	13%
I think choosing low-fat milk products will help me lose weight	0.65758	10%

Table D-10
Results of Principal Components Analysis of Attitude Items toward Consuming Low-Fat Cheese at Time 2

	Factor 1	Variance
I think eating low-fat cheese is “really good… really bad for me”	0.70139	62%
I think eating low-fat cheese will make me healthier	0.82849	18%
I think eating and drinking low-fat milk products will help me maintain my body weight	0.77421	12%
I think choosing low-fat milk products will help me lose weight	0.83056	8%

Table D-11
Results of Principal Components Analysis of Attitude Items toward Consuming Low-Fat Yogurt at Time 1

	Factor 1	Variance
I think eating low-fat yogurt is “really good… really bad for me”	0.77082	58%
I think eating low-fat yogurt will make me healthier	0.80419	17%
I think eating and drinking low-fat milk products will help me maintain my body weight	0.74074	14%
I think choosing low-fat milk products will help me lose weight	0.70443	11%

Table D-12
Results of Principal Components Analysis of Attitude Items toward Consuming Low-Fat Yogurt at Time 2

	Factor 1	Variance
I think eating low-fat yogurt is “really good… really bad for me”	0.78947	67%
I think eating low-fat yogurt will make me healthier	0.86131	14%
I think eating and drinking low-fat milk products will help me maintain my body weight	0.81204	11%
I think choosing low-fat milk products will help me lose weight	0.80314	9%

Table D-13
Results of Principal Components Analysis of Subjective Norm Items toward Consuming Whole-Grains at Time 1

	Factor 1	Variance
My parents think it is important to choose whole-grain cereals and it is important to me to do what my parents want	0.83031	65%
My teachers think it is important to choose whole-grain cereals and it is important to me to do what my teachers want	0.88057	24%
My friends think it is important to choose whole-grain cereals and it is important to me to do what my friends want	0.68896	12%

Table D-14
Results of Principal Components Analysis of Subjective Norm Items toward Consuming Whole-Grains at Time 1

	Factor 1	Variance
My parents think it is important to choose whole-grain cereals and it is important to me to do what my parents want	0.83031	65%
My teachers think it is important to choose whole-grain cereals and it is important to me to do what my teachers want	0.88057	24%
My friends think it is important to choose whole-grain cereals and it is important to me to do what my friends want	0.68896	12%

Table D-15
Results of Principal Components Analysis of Subjective Norm Items toward Consuming Whole-Grains at Time 2

	Factor 1	Variance
My parents think it is important to choose whole-grain cereals and it is important to me to do what my parents want	0.84006	70%
My teachers think it is important to choose whole-grain cereals and it is important to me to do what my teachers want	0.89107	20%
My friends think it is important to choose whole-grain cereals and it is important to me to do what my friends want	0.76666	11%

Table D-16
Results of Principal Components Analysis of Attitude Items toward Consuming Whole-Grains at Time 1

	Factor 1	Variance
I think eating whole-grain cereal will make me healthier	0.88016	77%
I think choosing whole-grain cereal will help me to maintain my weight	0.88016	23%

Table D-17
Results of Principal Components Analysis of Attitude Items toward Consuming Whole-Grains at Time 2

	Factor 1	Variance
I think eating whole-grain cereal will make me healthier	0.90396	82%
I think choosing whole-grain cereal will help me to maintain my weight	0.90396	19%

APPENDIX E

VARIABLE SCORING KEY

VARIABLE SCORING KEY

Breakfast (variables for milk, cheese, yogurt, whole-grains were scored similarly)

Question Numbers	**Response format**	**Items requiring reverse scoring**	**Items requiring internal consistency analysis**	**Items requiring multiplication**	**Construct measured**
1, 7	+1 to +7				Intention

19	-3 to +3			attt1=q19t1*q26t1;
				attt2=q19t1*q27t1;
				attt3=q19t1*q28t1;
				attt4=q19t1*q29t1;
				attt5=q19t1*q30t1;
				attt6=q19t1*q31t1;
				attt7=q19t1*q32t1;
				attt8=q19t1*q33t1;
				attt9=q19t1*q46t1;
					Attitude

26, 27, 82, 29, 30, 31, 32, 33, 44, 45, 46	-3 to +3	44, 45, 46			Attitude (Evaluation)

49, 50, 51, 52, 53, 54	-3 to +3			sn1=q49t1*q50t1;
				sn2=q51t1*q52t1;
				sn3=q53t1*q54t1;
				*sn4=q50t1*q55t1;
				*sn5=q52t1*q56t1;
				*sn6=q54t1*q57t1;
				*sn7=q50t1*q58t1;
				*sn8=q52t1*q59t1;
				*sn9=q54t1*q60t1;
				*sn10=q54t1*q61t1;
				*sn11=q52t1*q62t1;
				*sn12=q54t1*q63t1;
					Subjective Norm

64, 66	-3 to +3				Perceived Behavior Control (Direct Measure & Perceived Power)

VITA

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