8-1-2010

THE EFFECTS OF A COMMUNITY-BASED LIFESTYLE

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THE EFFECTS OF A COMMUNITY-BASED LIFESTYLE INTERVENTION ON SNACKING PATTERNS, SCREEN TIME PATTERNS, AND PHYSICAL ACTIVITY LEVELS AMONG ADOLESCENTS WHO ARE "AT-RISK" FOR TYPE 2 DIABETES

By

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B.S., Southern Illinois University Carbondale, 2007

A Thesis

Submitted in Partial Fulfillment of the Requirements for the

Masters of Science Degree

Department of Animal Science, Food and Nutrition
in the Graduate School
Southern Illinois University Carbondale
August 2010

THESIS APPROVAL

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for the Degree of

Master of Science
in the field of Food & Nutrition

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Southern Illinois University Carbondale
November, 2009

AN ABSTRACT OF THE THESIS OF

Cassidy Scoggins, for the Masters of Science degree in Food and Nutrition, presented on November 19, 2009, at Southern Illinois University Carbondale.

TITLE: THE EFFECTS OF A COMMUNITY-BASED LIFESTYLE INTERVENTION ON SNACKING PATTERNS, SCREEN TIME PATTERNS, AND PHYSICAL ACTIVITY LEVELS AMONG ADOLESCENTS WHO ARE AT-RISK FOR TYPE 2 DIABETES MELLITUS

MAJOR PROFESSOR: Dr. Sharon Peterson

Previous research has shown that overweight and obesity in adolescents is one of the leading risk factors for developing Type 2 Diabetes Mellitus (T2DM). There are several risk factors for obesity that are modifiable in adolescents. Of these, snacking patterns, screen time, and lack of physical activity have an impact on the body weight and overall health of adolescents.

The design of this "R.U.A. Healthy Kid?" study was a prospective cohort of 16 free-living adolescents at-risk for T2DM. Each participant was previously screened and found to have two or more risk factors for T2DM. The intervention targeted several components, however snacking patterns, physical activity levels and screen time levels mold the foundation for the current study.

An overall "snacking score" was developed to measure the frequency and quality of snacking patterns of participants. After three months of intervention, participants' overall snacking score increased. Many significant relationships were found between the overall snack score, physical activity, and screen time questions, such as negative relationships between: "time on TV" and total snacking score and "time spent walking,

biking, or jogging" and "unhealthy" snacking score. These results show how community-based lifestyle interventions that address adolescents' snacking patterns, screen time levels, and physical activity levels are crucial in the fight to overcome the T2DM epidemic now prevalent in adolescents.

ACKNOWLEDGMENTS

I would like to give my gratitude to Dr. Sharon Peterson, my chair. Her time, effort, and guidance made this experience a positive one. She has shown me many things that I will carry with me for the rest of my life. I would also like to thank my thesis committee Dr. Sara Long and Dr. Leslie Lloyd for their support and expertise throughout my research. Last but certainly not least, I would like to give a special thanks to Afroza Hasin for her time and energy. I could not have done this without her help.

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CHAPTER 1

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a disease that develops over time when the body is not using insulin correctly or cannot make enough insulin. When there is not enough insulin, blood glucose levels start to rise. Several problems can arise from excess blood glucose levels if left untreated: heart disease, kidney failure, stroke, nerve damage, and blindness.

T2DM has been previously named "adult onset diabetes," due to the fact that few adolescents were diagnosed with this disease. However, T2DM is becoming more prevalent in children. Excess body weight increases a child's risk for developing T2DM. Overweight and obese adolescents exist in all racial and ethnic groups; however, it is more prevalent in low-income families and minority groups. Adolescents living in poverty may be at higher risk for being overweight or obese due to lack of access to nutritious foods and lower education level of their primary caregiver.

During the adolescent years, children become more independent. This is because adolescents are starting to participate in after-school activities, giving them a sense of personal responsibility. They make many of their own nutritional choices, thus molding their eating patterns for life. Poor eating patterns can result in obesity and other chronic diseases (such as T2DM) in adulthood. Adolescent years are a good time to intervene and target poor dietary habits before behaviors are well established. When observing adolescents, snacks and meals should be assessed separately as determinants of the behaviors relative to meals and snacks may be different.

Good nutrition alone is not enough to live a healthy lifestyle. Exercise has to be added into the equation. What adolescents do with their free time is a piece of the obesity puzzle needing further attention. The average American child watches three to four-and-a-half hours of television every day (1). The problem is not only that they are watching too much television and not moving, but they are often snacking *while* watching television. Computers and video games also keep children glued to screens. The amount of time spent watching TV, playing video games, Internet usage, and/or cell phone texting is now commonly referred to as "screen time". These new screen-based technologies and associated snacking habits lead to "mindless eating," which contributes to overeating.

Even if cases of childhood T2DM are detected and diagnosed, little resources are available to the family. The entire community must get involved. Making sure schools, parents and the at-risk children are doing their part is the next necessary step.

Statement of the Problem

Overweight adolescents are at greater risk for developing T2DM. Snacking patterns, screen time, and lack of physical activity have an impact on their overall health and contribute to increased weight gain and being at-risk for T2DM.

Purpose of the Study

The purpose of this study was to analyze changes in some of the key factors contributing to risk for T2DM in rural, low-income, Caucasian children after a community-based intervention. I will assess changes from baseline to three months in: snacking patterns, screen time patterns, and physical activity levels and relationships among these factors in at-risk 5th - 8th graders.

Research Questions (RQ)

1. What are the baseline snacking patterns, and are there any significant changes in snacking patterns after three months of intervention in Vienna adolescents at-risk for Type 2 Diabetes Mellitus?

2. What are the baseline physical activity levels and screen time patterns, and are there any significant changes in physical activity levels and/or screen time patterns after three months of intervention in Vienna adolescents at-risk for Type 2 Diabetes Mellitus?

3. Is there a relationship between screen time and overall snacking patterns and does it change from baseline to three months in Vienna adolescents at-risk for Type 2 Diabetes Mellitus?

4. Is there a relationship between physical activity levels and overall snacking patterns and does it change from baseline to three months in Vienna adolescents at-risk for Type 2 Diabetes Mellitus?

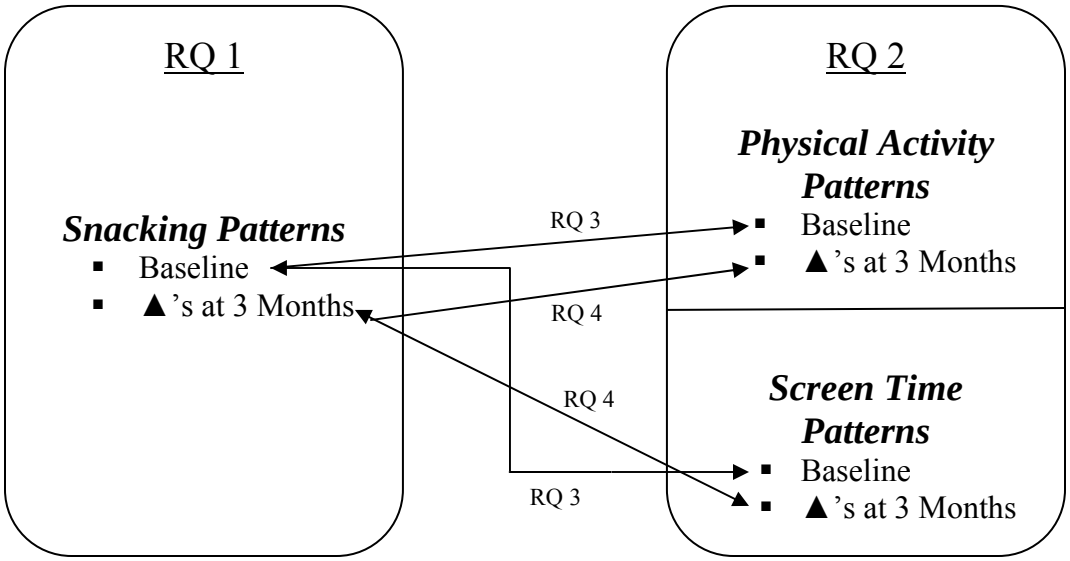

Figure 1

Definitions

Acanthosis Nigricans: Darkened pigmentation around the neck, arm pit, groin, or elbows of a person. This is a sign of insulin resistance.

At-risk: Having a certain number of risk factors for developing a disease, but has not yet developed it. For this study, the participant must have two or more risk factors to be considered at risk for Type 2 Diabetes Mellitus.

Body Mass Index (BMI): A calculation derived from a person's body weight and height. BMI provides a reliable indicator of body fat.

Free-living: Not having control over participants during a research project.

Healthy weight: For children, between the 5th percentile to less than the 85th percentile according to CDC guidelines.

Obese: Ages 6-19 years of age, a BMI for age/gender equal to or greater than the 95th percentile.

Overweight: Ages 6-19 years of age, a BMI for age/gender between the 85th to less than the 94th percentile according to CDC guidelines.

Physical activity levels: The amount of time during the day that a person is physically active. It is recommended that adolescents engage in at least 60 minutes of moderate to vigorous physical activity each day.

Prevalence: The number of cases of an illness or condition that exists as a particular time in a defined population.

Prospective cohort: A study that examines a group of individuals with similar characteristics over a period of time.

Screen time: Amount of time per day spent watching television, playing

video/computer games, Internet usage, and/or cell phone “texting”. It is recommended adolescents limit screen time to a maximum of two hours per day.

Snack: Any food eaten outside of a meal.

Type 2 Diabetes Mellitus: Disease that develops, in part, because extra fat tissue puts excessive demands on the body to make insulin, resulting in insulin resistance.

CHAPTER 2

REVIEW OF LITERATURE

History of Type 2 Diabetes & Risk Factors for Children

It is estimated that globally the number of people with Type 2 diabetes mellitus (T2DM) will increase from 140 million to over 300 million by 2030 (2). From 1980 through 2003, the number of American adults diagnosed with T2DM rose from 5.8 million to 14.7 million. However, the total number is estimated to be more than 19 million, as 5.2 million cases are undiagnosed (3). An estimated one third of Americans with T2DM don't even know they have it until is causes a medical crisis (4). In 2006, diabetes was the seventh leading cause of death in the United States (5). Risk of death among individuals with diabetes is two times higher than those without diabetes (3).

T2DM, historically called "adult-onset diabetes" is increasing in children and adolescents. The prevalence of childhood T2DM has increased by 33 percent over the last 15 years (4). According to the Centers for Disease Control (6), one in three children born after the year 2000 will develop some form of diabetes. The new generation of patients consists of people in their teens and twenties; some are as young as nine or ten. The majority of children who initially seek treatment for T2DM are approximately 13 years of age and in midpuberty. During puberty, these children develop an increased resistance to insulin resulting in hyperinsulinemia. T2DM disproportionably affects minority children and females as girls are 1.7 times more likely to develop T2DM than boys (7). As the childhood population becomes increasingly overweight, T2DM may be expected to occur in younger, prepubertal children (6).

T2DM results from the interaction of genetic and environmental factors (8). However, expression of T2DM seems to be determined by environmental factors, such as obesity, physical inactivity, and a diet high in fat and refined carbohydrates and low in fiber (6). Because of these trends, age of onset of T2DM is shifting downward and is increasingly being diagnosed in children between the ages of 10 and 19 years (9, 10).

Almost all children with T2DM are overweight or obese (4). Prevalence of overweight in adolescents is higher than it was 20 years ago in all ethnic groups, and the rate of childhood overweight is increasing yearly, especially among minority and low-income children (8). The 1999-2000 National Health and Nutrition Examination Survey (NHANES), estimated that 15% of adolescents between nine and 19 years old were obese and 22% of low-income children under the age of five were overweight (4). Childhood obesity is now a global epidemic (11).

Due to the prevalence of childhood overweight and obesity, negative health effects have become public health issues resulting in the need for prevention and treatment (12). Because the number of adolescents developing T2DM is increasing rapidly, screening for risk factors has become more common. Whitaker et al., (6) stated there is a need for screening in seventh graders for T2DM. Screening can lead to early detection, making treatment more rapid, and decreasing the incidence of diabetes and the problems associated with it. According to the *Healthy People 2010* objectives, as a nation, we are striving towards reducing the prevalence of obesity among children and adolescents (13).

There are several risk factors associated with T2DM. They include: Acanthosis Nigricans (AN), a skin lesion characterized by hyper-pigmentation and a velvety

thickening around the neckline, armpits, and/or groin (14); systolic or diastolic blood pressure greater than the 95th percentile; BMI greater than or equal to the 85th percentile; person of an ethnic minority; and a person with a positive family history of T2DM. Guidelines of the American Diabetes Association (ADA) state at-risk children have a BMI greater than the 85th percentile, plus two other risk factors. In general, the greater the number of risk factors, the greater chance of developing the disease (15).

If the increase of childhood T2DM cannot be reversed, society will face major challenges (6). The burden of diabetes and its complications will affect many more individuals than currently anticipated, and the cost of diabetes to our society will result in major use of resources. In 2001, the American Dietetic Association (ADA) released a position statement recommending diabetes screening in children be performed in health care settings because early detection and prompt treatment may reduce the burden of diabetes and its complications.

Pan and Pratt (16) looked at Metabolic Syndrome (a clustering of risk factors for T2DM) and its association with diet and physical activity in a national sample of 4,450 American adolescents, ranging from 12-19 years old. Diets high in fruit and vegetable consumption were related to a lower prevalence of Metabolic Syndrome. Most adolescents who had Metabolic Syndrome were overweight, therefore interventions should educate and encourage adolescents to consume diets high in fruit and vegetable intake, and increase physical activity for appropriate energy balance.

Urrutia-Rojas and Manchaca (3) assessed prevalence of risk factors for T2DM in adolescents including: BMI, AN, blood pressure, physical activity, and television viewing/video game behaviors. Adolescents who self-reported watching television and

playing video games two or more hours per day were 73% more likely to be at-risk for developing T2DM. Intervention and prevention programs need to be put in place at the community level that includes strategies to reduce sedentary behaviors to help prevent T2DM.

Nobody knows *exactly* how much computers and video games might be contributing to the childhood obesity epidemic. However studies are trying to paint a clear picture. A study of 2,318 children aged 9-11 living in a low-income area of Montreal found playing video games every day more than doubled the risk of gaining excess weight over the next year (17).

In 2001 a study of seventh graders in Pennsylvania determined if a screening program for T2DM was warranted as well as to increase overall awareness. A questionnaire was mailed to all participants, one question addressed activity levels of this seventh grade population. As these children aged, their activity levels decreased which could lead to an increase in risk factors. In addition, the researchers stated "activity level" should be further studied (6). They suggested measuring amount of time spent on a computer, watching TV, and playing video games would provide a more accurate determination of activity level.

These studies are consistent with previous research on school-aged adolescents who are at-risk for developing T2DM. It is undeniably important that at-risk adolescents are properly identified, and prevention/intervention programs are put into place to give these adolescents a better chance at reducing risk factors.

Intervention Programs for At-Risk Youth

With the rise of T2DM, and knowledge for the need of screening, it is also important to have intervention programs in place for at-risk adolescents. An extensive amount of research on adult screening and prevention programs exists. However, it is now evident similar community-based intervention programs are necessary for adolescents to aid in the prevention of T2DM.

There have been a few school-based diabetes education/prevention programs for high risk adolescents. At the school, children are a captive audience which increases number of participants, and provide the ability to interact with a large number of students at one time. Having the program at the school itself accounts for a convenience factor since most U.S. children attend school for five days per week. However, mixed results have been reported for school-based interventions (18).

Cook and Hurley (19) looked at prevention of T2DM in Pima children in central Arizona. This school-based program provided an educational component called “Quest”, for Kindergarten, 1st and 2nd grade students in the Pima community. The Quest program was developed by a registered dietitian (RD) and a pediatric nurse practitioner (PNP). Quest focused on anthropometric and biochemical assessment, physical activity, classroom instruction about diabetes prevention, and partnering with the school's breakfast and lunch program. One change the lunchroom made was serving 1% milk instead of 2%. The children accepted this change but most parents did not. School staff was given a written assessment to collect information on their knowledge of diabetes prevention. Topics in the curriculum were based on what children, parents, and teachers needed to know about diabetes. This study reported no significant findings but concluded

how important it is that the child, community, and school work together to reduce the risk of T2DM in adolescents.

Another school-based diabetes prevention program by Ritenbaugh et al. (20) was designed for high school students on the Zuni Indian reservation in New Mexico. This prevention program focused on need for community awareness to increase physical activity in adolescents. The goal of this program was to reduce risk factors for T2DM in Zuni high school youths. Information on benefits of increased physical activities, decreased consumption of beverages high in sugar, and overall knowledge of diabetes was addressed. Four intervention strategies were incorporated: establish supportive social networks, establish a school-based wellness center, diabetes education with specified curriculum, and to modify food availability to teens while in school. Plasma insulin and glucose levels were tested in all participants. Family history of T2DM, height and weight were also collected in order to calculate BMI. The study used a multiple cross-sectional model and assessed three different times during the four year project. Results showed a significant decrease in soft drink consumption and an increase in blood glucose/insulin ratios, which may suggest there was a decline in the incidence of hyperinsulinemia (20). A lifestyle intervention that addresses the environment and education may reduce the risk of T2DM among at-risk youth.

Grey and colleagues (21) developed a comprehensive after-school intervention for at-risk children ages 10 to 14 with a BMI greater than or equal to the 95th percentile for age and gender, along with a positive family history of diabetes. The intervention provided nutrition education and physical activity components to both the experimental and control groups. Participants took part in two 45-minute physical activity sessions per

week for 16 weeks with a personal trainer. The intervention group was also taught Coping Skills Training (CST) during the nutrition education classes. CST incorporated influences on irrational self-talk, emotions that inhibit food consumption, skills training and goal setting. The research team made weekly phone calls to participants to reinforce nutrition and physical activity goals.

Another school-based intervention developed by Saksvig and colleagues (22), was developed for 3rd, 4th, and 5th grade Canadian children. The programs goals were to improve diet, food knowledge and self-efficacy. This study was a pre-test/post-test, single sample design conducted in 1998-1999. There were four measurements (anthropometry, 24-hour recall, and 2 questionnaires) completed at baseline and follow-up, by a total of 122 students. Intervention participation was significantly associated with being in the highest category for knowledge about foods that were low in fat, and also for dietary self-efficacy. This program improved knowledge and psychosocial factors related to healthy eating and dietary fiber intake (22).

Rosenbaum and colleagues (23) examined effects of a three to four month school-based intervention on diabetes risks, consisting of health, nutrition, and exercise classes. This was a randomized before/after controlled trial of 73, eighth graders in a predominately Hispanic New York City public school. Students were divided into two groups, a control (studied twice without receiving the intervention) and an experimental (studied before and after the intervention). Classroom intervention was integrated into their science classes, 45-minutes in duration, and offered once per week. Participation in the intervention was associated with significant reduction in body fat and insulin resistance. The research team concluded that a short-term, school-based health, nutrition,

and exercise intervention is beneficial to all students and affects multiple diabetes risk factors.

Gittelsohn and Kumar (18) summarized review articles that had been published since 2004 on school-based diabetes prevention programs. All seven peer-reviewed studies targeted high risk populations for diabetes. All were pilot studies and had a mixture of weak results which may indicate school-based programs are not effective. Most of the school-based prevention programs took place entirely within the schools and did not take advantage of the school food service or community resources. Gittlesohn and Kumar recommend future adolescent T2DM prevention programs go beyond the school. The reasoning is because children get the majority of their calories outside of the school day. They spend a significant amount of time outside of school, and school-based programs limit involvement from the parent or guardian.

There have been very few community-based interventions that focus strictly on prevention of T2DM in at-risk adolescents. Marlow, Melkus, & Bosma (24) studied prevention of T2DM in Native American adolescents using an educational model. This was a pilot study called “STOP” Diabetes (Students Teaching Others to Prevent), developed in Winnebago, Nebraska by Winnebago adolescents for their peers. The program consisted of adolescents attending a half-day workshop which involved playing games and preparing healthy foods. Program results were measured by having participants complete a pre- and post-workshop knowledge questionnaire and evaluation. Mean score for the pre-test was 49% and the mean score for the post-test was 90%. Nine out of 10 participants that completed the questionnaire had a positive learning experience at the workshop.

Paradis, Levesque, Macaulay, Cargo (25) report the impact on body size, physical activity and fitness, and diet patterns of a community-based diabetes prevention program for elementary-school children in a Mohawk community in Canada. The Kahnawake School Diabetes Prevention Project (KSDPP) used a participatory approach emphasizing community ownership. From 1994-2002 data were collected on all elementary-aged school children in the intervention community including: skinfold measurement, BMI, weekly number of 15-minute episodes of physical activity, run/walk test times, TV watching, and consumption of sugary foods, fatty foods, and fruits and vegetables. Longitudinal data showed some early positive effects of the program on skinfold measurement but not BMI, physical activity, fitness, or diet. Specific high-fat and high-sugar foods consumption decreased as did consumption of fruits and vegetables. Although early results showed some success in reducing risk factors for T2DM, those benefits were not maintained over the 8 year program period.

Another school-based diabetes prevention program (26) included home and after-school components designed specifically for African American children. “NEEMA” was a seven-week intervention program with 58 fourth grade participants that was implemented using four social networks: classroom, after-school, home, and school cafeteria. Data were collected by interviewing physical education teachers and administering pre- and post-tests to measure biological impact on participants. From baseline to follow-up, fasting capillary glucose and BMI significantly decreased and fitness laps significantly increased. According to the physical education teachers, one limitation to implementing this program was large class sizes and short class periods.

Given the nature of these interventions and results found, valuable information for

future programs can be generalized. Gaps found in many of these programs can be addressed in future interventions. Of the school-based programs, most were directed at specific ethnic minority groups that have a high risk for T2DM. None of the previous research was designed to specifically observing screen time behaviors along with levels of physical activity or snacking patterns and how these specific behaviors relate to adolescents who are at-risk for T2DM. The previous research has proven that community-based interventions are needed.

Screen Time, Physical Activity Patterns and Snacking Habits of U.S. Adolescents

Screen Time

Researchers have identified modifiable risk factors that can lead to overweight and obesity in adolescents. Prominent among these are television viewing (27) and physical inactivity (28). Public health strategies to prevent T2DM in children should not only focus on increasing physical activity, but also on decreasing sedentary behaviors like television viewing time (29). Decreasing television and video game use may be effective in a population-based approach to help prevent childhood obesity (30). Some studies have targeted reducing the amount of television viewing while increasing physical activity in overweight children (31, 32, 33). These studies show that having a reward system for participating in physical activity decreases screen time while increasing physical activities.

A sedentary practice such as TV watching for more than two hours per day is associated with being overweight (3). Television may contribute to development of overweight in many ways: by reducing physical activity, through commercials that

promote sugary foods, and/or by mindless snacking which leads to overeating. Increasing physical activity while reducing screen time may not only help fight obesity, but may also help prevent or delay T2DM.

The American Academy of Pediatrics theorized there is a direct link between television viewing and rates of childhood obesity (34). Every hourly increment of television watching was associated with a one to two percent increase in prevalence of childhood obesity (35). A number of studies conducted between 1980 and 2000 found an inverse significant relationship between television viewing and the child's level of fitness. However, more recent studies have not found this same relationship between television viewing and obesity (36).

Kunkel et al. suggested the relationship between obesity and television usage is better explained by "what" is being watched (37). The more commercials viewed, especially food-related advertising, the stronger the relationship with obesity becomes. The average child will see about 40,000 television commercials per year, with the majority being food-related advertisements (38). Children naturally prefer sweet and high-fat foods (39) and tend to request these foods more often than healthful foods (69). In relation, these requests may stem from the reality that these foods are regularly advertised during children's programs (40-42).

Boynton-Jarrett et al. (43) examined the relationship between hours of television and video use per day and fruit and vegetable consumption. The study included 548 students from four different Massachusetts communities. For every hour of television use per day, there was a significant decrease ($p=0.008$) in fruit and vegetable consumption. Not only did increase in television viewing decrease intake of important nutrients from

fruits and vegetables, a decrease in physical activity was also noted.

Francis, Lee, and Birch (44) examined whether TV viewing provides a background for snacking patterns in overweight young girls. This was a longitudinal study of 173 non-Hispanic white girls. Participants were assessed at ages 5, 7, and 9. Analysis was used to test patterns of relationships among girls' TV viewing, snacking while watching TV, snacking frequency, fat intake from energy-dense snack food, and girls' increase in BMI from age 5-9. Girls who watched more television consumed more snacks in front of the television. Results of this study support previous findings that have shown that snacking patterns and excessive TV viewing are risk factors for becoming overweight as an adolescent.

Vader et. al. (45) examined relationships between television viewing, snack consumption, and consumption of foods advertised on TV, and overweight status of a multi-ethnic sample of 11,594 4th and 8th grade Texas children. Their study was a secondary analysis of data from the School Physical Activity and Monitoring system. The children were categorized from their self-reported daily TV watching, snack consumption, and consumption of foods advertised on TV. Television viewing, frequency of snack consumption, and consumption of foods advertised on TV were all positively related.

Healthy People 2010 has for the first time established reducing youth's TV watching as a physical activity and fitness objective (13). The average American child watches three to four-and-a-half hours of television every day. A full 25 percent of children view between four and eleven hours of television every day. TV watching generally increases through early to middle childhood, peaking between the ages of 10

and 14 years (46, 47). It is recommended that children should limit their TV viewing time to two hours per day and engage in a total of 60 minutes of moderate to vigorous exercise per day (48). Much of the research has ignored the potential contribution of Internet, computer and cell phone usage on adolescent health and has instead focused solely on television viewing.

The 1999 Kaiser Family Foundation report, "Kids and Media Use", defines "screen time" as the amount of time per day spent watching television, playing video and/or computer games, and phones. Also discussed in this report is the fact that today's children are no longer just watching television, but are spending over six and a half hours a day with various forms of media. Today's adolescents are referred to as "Generation-M", because today's media-saturated youth are on the Internet while the television is playing in the background and they are talking on cell phones (49). Children's use of media may be one of the primary contributors to poor fitness and obesity of today's adolescents (50).

A single-subject research study conducted in 2008, examined the potential of increasing physical activity and decreasing media usage in a 14-year-old adolescent female by making time spent on the Internet and/or cell phone dependent on physical activity. Requiring the participant to "earn" her media usage time did correspond with an increase in physical activity and a decrease in media-usage time (32).

Lajunen and colleagues (51) assessed a population-based sample of Finnish twins, aged seventeen years through self-report questionnaires. The association of overweight with computer and cell phone use and ownership was analyzed by logistic regression and their association with BMI by linear regression models. Having a home computer with no

internet connection was associated with a higher risk of overweight and BMI. However, having a home computer with an internet connection was not associated with weight status. There was also a positive linear trend of increasing monthly phone bill with BMI, but the association of a cell phone bill with overweight was very weak. Researchers concluded that time spent using a home computer was associated with an increased risk of overweight and communication technology may be related to the obesity epidemic among adolescents.

A report by the U.S. Entertainment and Media Consumer Survey indicates American children are spending as much time on the Internet on a weekly basis as they are in front of the television (32). Because children can communicate with a number of friends at one time through instant-messaging services, they are spending increasingly more time on the Internet whereas the television is merely background noise. This change in media usage by adolescents might help explain why the once reliable relationship between television and negative health outcomes has weakened as the presence of the computer/Internet in the home has steadily grown in the last few years. Because today's children are concurrently engaged in multiple forms of media use, these multiple forms of media (cell phones, computers, television and video games) should all be considered when studying the relationship between media usage and adolescent health (32).

Physical Activity Patterns

Though benefits of regular physical activity are well established, levels of physical activity remain below recommended levels. Dietary modifications and consistent exercise are two recommendations classically given by pediatricians to adolescents who

are either at-risk for, or currently diagnosed with obesity, metabolic syndrome, and/or insulin resistance (52). Substantial attention has been paid to activity levels of children and adolescents largely because of changing lifestyles that have threatened the opportunity to be active and also introduced attractive sedentary alternatives such as playing computer, and/or video games. Overweight and obesity are end points of physical inactivity. A child's physical inactivity increases his/her chances of overweight (3) and T2DM (55). Reducing impaired glucose tolerance with physical activity may aid in prevention or delaying the development of T2DM in at-risk adolescents (53).

A study using data from NHANES 1999-2004 concluded that sugar-sweetened beverage intake and physical activity levels are each independently associated with insulin resistance (53). Furthermore, low sugar-sweetened beverage intake and high physical activity levels seem to enhance each others' effects on numerous health-related outcomes. Researchers concluded by saying pediatricians should continue to promote lifestyle modifications in efforts to improve overall health.

Kantomaa and colleagues (54) examined 5,457 adolescents aged 15-16 years and their parents. Associations between social background and adolescents' physical activity were analyzed using cross-tabulations and logistic regression. High parental education was associated with adolescents being physically active. High family income was associated with being an active sports club member. They concluded high family income and parent's education level were positively associated with levels and types of physical activity in adolescents.

Powell et al. (55) reported on the association between availability of commercial physical activity-related facilities and self-reported physical activity behavior in 8^{th}, 10^{th},

and 12th grade adolescents. Results showed a significant association between local-area per capita availability of commercial physical activity-related facilities and physical activity behavior among U.S. adolescents. Availability of commercial physical activity-related opportunities among underserved populations may help increase activity levels among adolescents.

Gutin et al. (56) researched effects of body fat, fitness, and fat distribution in 57 children with risk factors of T2DM. Body fat percent and aerobic capacity (a measure of fitness) was inversely related to insulin levels. Increasing physical activity may alter two of the contributing factors related to insulin levels- 1) increasing aerobic capacity and 2) decreasing percent body fat, two risk factors known to be associated with T2DM.

A study conducted by Pan and Pratt (16) found engaging in moderate to vigorous exercise can help lower prevalence of Metabolic Syndrome. Physical inactivity could be a result of increased screen time and a decrease in availability of physical activity in schools and communities. The study concluded with a statement explaining that if Metabolic Syndrome in the U.S. young population is to be decreased then lifestyle changes of diet and exercise should be top priority for interventions.

It has been established that increased screen time is associated with decreased physical activity in children. Gable, Chang, and Krull (57) examined the relationship of physical activity-related variables, and onset and persistence of overweight. Kindergarten through 3rd grade students who ate fewer family meals and watched more television in kindergarten and 1st grade were more likely to be overweight by the time they reached 3rd grade. This is an example of how screen time levels can be associated with physical activity. Therefore, examining screen time along with physical activity in adolescent is

imperative when designing and implementing a community-based intervention program.

Schmitz et al. (58) examined data from 355 non-diabetic adolescents who were 10-16 years of age. This study examined the association of physical activity and insulin resistance in children who were not overweight. Physical activity was significantly correlated with lower fasting insulin and greater insulin sensitivity in childhood. This relationship was significantly higher in children who had a higher systolic blood pressure. This study demonstrates the importance of physical activity in adolescents with high blood pressure, which is a risk factor for T2DM. This study concluded that physical activity not only benefits obese and overweight adolescents but also those who are not. Therefore increasing physical activity in adolescents could decrease prevalence of T2DM in all adolescents.

Snacking Habits

Not only is too much screen time associated with decreased physical activity but children are also snacking while watching television. This "mindless eating" is a trap for consuming excess calories that may lead to overweight and obese adolescents. The nutritional status of U.S. adolescents is often described as "poor" (59) because their diets are often low in calcium, fiber, fruits and vegetables. During the adolescent years the child is becoming more independent in decision-making which includes deciding what foods to eat. Eating habits are learned mostly at home from family norms and social environments (60). Due to the thousands of food advertisements seen by U.S. children, interest in eating unhealthy snacks, fast foods, and sweetened drinks has increased (61). Adolescence could be the optimal time to target and correct poor eating patterns before

the behavior is well established.

Convenience store or fast food restaurants within walking distance of schools as well as ala carte options and vending machines inside schools represent other sources of exposure for less healthy snacking for school-aged children. If a child sees several vending machines at their school they may think these snacks are "OK" to consume. When adolescents have a basic knowledge of nutrition, healthy food options, and positive role models, they are more inclined to make better decisions. A school's learning environment should provide a comprehensive learning environment including nutrition education, not just the mandated curriculum.

One of the factors believed to contribute to increase in caloric intake is increased size of packages (62) and food portions (63). Obesity-promoting dietary environments are thought to increase calorie intake among adolescents by offering convenient access to large portions of energy-dense foods (64). For food consumed at home never has so much food been readily available to so many, at low cost and in ready-to-eat form (64).

Another trend toward convenience is an increased interest, among all age groups, of frequent snacking and deriving a large proportion of one's total daily calories from energy-dense snacks (65). Growing adolescents need snacks in addition to regular meals. However, snack foods generally have low nutritional value, and energy intake from snack foods has increased in the same time period as prevalence of overweight has increased (66). Cultural changes in food patterns, such as the shift from meals to snacking, might also contribute to the increasing weight of adolescents. This amplified snacking habit has probably contributed to the increase in children's caloric intake.

Previous research which examined food preferences and regularity of consuming

certain meals and snacks without complete information collected from diet records, recalls, or food frequencies have contributed to the idea that U.S. adolescents had poor eating patterns (67, 68). In Bogalusa, LA, Nicklas and colleagues (69) collected a 24-hour dietary recall on a cross-sectional sample of 1,562 children 10 years of age over a 21-year period. The purpose of their study was to examine the association between eating patterns and overweight status in children. Consumption of sweetened beverages, sweets, and total consumption of low quality foods were positively related to being overweight. Total amount of food consumed specifically from snacks was also positively associated with being overweight.

A survey conducted in 1994 reported two percent of school-aged respondents never snacked, while 29 percent said they snacked four times per day (70). Overall, sweet snacks were the most popular, followed by meal-type food, and then crunchy/salty snacks. The quality most desired in the snack was taste, followed by cleanliness, and nutrition. Adolescents are seeking out more and more treats leaving healthier options behind and decreasing their levels of physical activity. This combination has a negative impact on adolescent health and becoming at-risk for T2DM.

Summary

Given that childhood obesity is contributing to risk for T2DM, steps need to be taken to gain control of developing risks for T2DM. The greater the number of risk factors, the greater chance of developing the disease. Several of these risk factors are preventable in adolescents. Adolescents are establishing lifestyle behaviors and should have the opportunity to learn from decisions they make. Food selection is a major

ongoing decision. Giving adolescents proper knowledge and support may enable them to make proper food choices.

Increase in technology and decrease in physical activity have contributed to the obesity epidemic within the youth population. Making simple changes will set a positive example for the children who are the future of America. Relevant community-based interventions for at-risk adolescents are needed, and should address physical activity and screen time patterns, as well as snacking habits of today's youth who are at-risk for T2DM.

CHAPTER 3

METHODOLOGY

The Vienna, IL community, with a population of 1,234 is located in the southern-most tip of Illinois. Vienna is an extremely rural, low-income, predominantly Caucasian community. According to the 2000 census, 20 percent of the population is below the poverty line, including 27 percent of those under age 18. Given this data, a diabetes prevention program focusing on at-risk adolescents would be beneficial.

Selection Criteria

Previous screening for T2DM was conducted in August of 2008 at Vienna Grade School in Vienna, IL. Parental consent and child assent were obtained from those participating. Parents were asked about their child's family history of T2DM and race/ethnicity of their child. Specific anthropometric measurements were conducted to measure height, weight, blood pressure, BMI and to check for Acanthosis Nigricans (AN). Adolescents (5^{th}-8^{th} graders) with two or more of the following risk factors were eligible to participate in this community-based lifestyle intervention ("R.U.A. Healthy Kid?"): 1) Family history of T2DM, 2) Race/ethnicity, 3) BMI $\geq 85^{th}$ percentile for age/gender, 4) Blood pressure $\geq 95^{th}$ percentile, 5) and/or signs of Acanthosis Nigricans.

Intervention

Students found to be at-risk for T2DM were recruited for the intervention through flyers sent to the home. Parent consent (Appendix A) and child assent (Appendix B) were

obtained at the time of enrollment at the initial intervention.

Three, 4-hour interventions were held on Saturday afternoons at Vienna Grade School. Interventions took place over a six month period: baseline= October, 3 months= January, and 6 months= April. This particular study will compare data from baseline and three months. Some participants attended baseline in October and three months in January, while others attended baseline in January and three months in April (Appendix C).

At the interventions, four main components were incorporated: Healthy Snacks, Family Meals, Physical Activity, and "Unique U" (emotional eating, self-esteem, and body image). The Healthy Snack section included games to learn about which options to choose, take-home packets with healthy recipes, and food stations that included nutrition education such as label reading. The Physical Activity section included a variety of active games, inflatables and Wii Fit. Detailed schedules for the interventions can be found in Appendix D. All participants were offered a free six-month membership to the local gym in Vienna, IL.

At each intervention, adolescents participated in several stations, each focusing on a different component listed above. Stations activities were conducted by a team of nutrition undergraduate students, graduate students, and/or other health professionals. The purpose of each station was to increase knowledge on a particular nutrition topic that participants will find to be beneficial in their day-to-day lives.

Research Design

This was a prospective cohort of free-living middle school males and females at-risk for T2DM. The ages of participants ranged from 9-14. Total number of participants registered (with a signed parent consent form) was18. Total number of participants who attended a baseline and a three month intervention was 16. The Human Subjects Committee at Southern Illinois University Carbondale granted approval for this study.

Data Collection

Data were collected on every participant as baseline and three months at the beginning of each intervention through anthropometric measurements (height, weight, percent body fat, blood pressure) and a self-reported questionnaire. The questions were prepared by a registered dietitian and pre-tested on a sample of adolescents and assessed physical activity levels, snacking patterns, screen-time, family meal habits, emotional eating, body image and self esteem (Appendix E). To decrease respondent burden, three stations were used for "form stations" with only two pages completed at a time for each station. The purpose of these questions was to determine if the intervention had an effect on participants' physical activity patterns, snacking habits, and amount of self-reported screen time.

Weight in pounds, percent body fat, and fat free mass of the participants were measured using a portable Tanita body composition analyzer (Tanita Model TBF-300A). Blood pressure was measured twice and averaged at every intervention by a trained nutrition graduate student. Height was measured to the nearest tenth of an inch by a trained nutrition graduate student. During the six months the intervention was taking

place, participants were contacted by telephone once per week and asked a series of questions regarding physical activity, family meal times, snacking patterns, and emotional eating questions. This protocol was put in place to record the progress of each participant and to maintain contact with participants between interventions.

In order to further describe and quantify participants' overall snacking patterns, a "snacking score" for each participant was calculated from their self-reported frequency of selected snacks/beverages. Of the 32 items listed on the questionnaire, some were not included for this snacking score: diet soda pop, coffee, cappuccino, vitamin D whole milk, and energy drinks (27 total items analyzed). These responses were not analyzed due to the controversy of their nutritional quality. Two categories were created, "healthy" snacks and "unhealthy" snacks. Each item was given either a negative (-) number for the "unhealthy" category or a positive number (+) for the "healthy" category. Each frequency category was scored as follows: (-/+) 3= daily/often, (-/+) 2= sometimes, (-/+) 1= rarely, 0= never. Total score was determined by comparing their frequency of "healthy" versus "unhealthy" snacks and beverages (Appendix F). This measure of overall snacking patterns provided a way to compare type of snack and frequency of consumption within the "healthy" and "unhealthy" categories.

For example, if the participant chose:

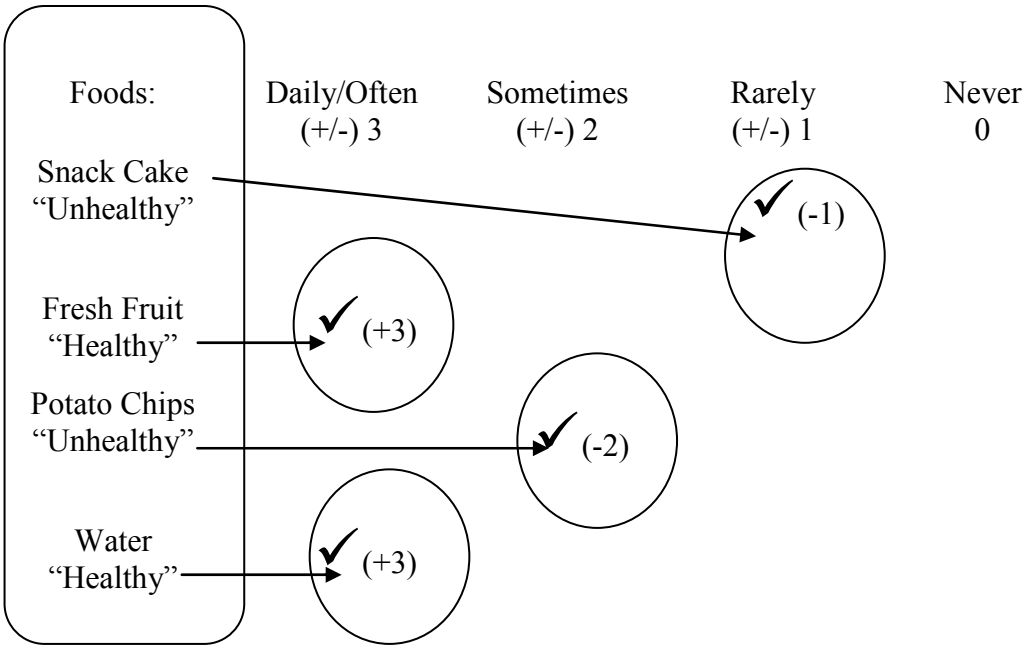

Figure 2

In this example, the total score would be "3" because -1 + 3 + -2 + 3= 3. The higher the score, the "healthier" the overall snacking pattern of each participant. A "healthy", "unhealthy" and total snacking score was calculated for each participant. When interpreting the results of this study, it is important to remember the concept behind the "snacking score". In regards to the "unhealthy" snacking score, the lower a score, the more frequent consumption of less healthful foods is taking place. In regards to the "healthy" snacking score, the higher a score, the more frequent consumption of healthful foods is taking place.

Statistical Analysis

All data were analyzed using SPSS version 17.0 (Chicago, IL). Descriptive

statistics and frequencies were analyzed to determine demographic data of participants at baseline. Frequency distributions were used to analyze characteristics of various snacking and physical activity questions at baseline and three months for all participants. Cross tabulations were used to analyze self-reported responses on selected screen time and physical activity questions at baseline and three months. Paired sample t-test were used to find individual changes between responses from baseline to three month (significant at $p<.05$). Pearson's correlations were used to analyze the relationships between selected physical activity, screen time, and snacking scores at baseline and three months (significant at $p<.05$).

CHAPTER 4

RESULTS

Descriptive demographic data are shown in Table 1. Participants for this baseline analysis consisted of 18 participants, 11 (61.1%) males and 7 (38.9%) females with a mean age of 11.8 years. Participants' racial background included 77.7% Caucasian, 16.6% Latino, and 5.5% Bi-racial. "Parent Education Level" was collected from the parent, and consisted of: 11.1% attended school to 8th grade or less, 11.1% attended "some high school", 22.2% received their high school diploma or GED, 22.2% attended "some college", and 33.3% graduated college. The most common reported annual household income was $20,000-25,999 (27.7%) while $40,000-45,999 was second most common. Of note, 49% of parents reported having an annual income of less than $26,000.

Descriptive anthropometric data are shown in Table 2. Average weight of participants was 160 pounds. Almost three-fourths of participants had a BMI above the 95th percentile ("obese"). Almost half (45%) of the participants had greater than 40% body fat, and over one-third had 75.1 or more pounds of fat. The recommended percent body fat level is <14% for boys and <20% for girls (73). Most (83%) of our participants had >30% body fat.

Table 1: Baseline Demographic Information of Vienna Adolescents At-Risk for T2DM (N=18)

Variable	Frequency	Percent
Gender		
Male	11	61.1
Female	7	38.9
*Age (*years) Mean= 11.8		
9	1	5.5
10	1	5.5
11	5	27.8
12	6	33.3
13	4	22.2
14	1	5.5
Race/Ethnicity		
African American	0	0
Native American	0	0
Bi-racial	1	5.56
Caucasian	14	77.78
Latino	3	16.67
Parent Education Level		
Less than 8th Grade	2	11.1
Some High School	2	11.1
High School Diploma or GED	4	22.2
Some College	4	22.2
College Graduate	6	33.3
Family Yearly Income		
10,000-or less	2	11.1
10,001-14,999	1	5.56
15,000-19,999	1	5.56
20,000-25,999	5	27.7
26,000-29,999	1	5.56
30,000-35,999	1	5.56
40,000-45,999	4	22.2
50,000-or more	3	16.67

Table 2: Baseline Anthropometric Data of Vienna Adolescents At-Risk for T2DM (N=18)

Variable	Frequency	Percent
Weight (pounds) Mean=160		
99-115	2	11.1
115.1-145	8	44.4
145.1-175	2	11.1
175.1-205	2	11.1
205.1-235	4	22.2
BMI Percentiles		
Below 85th percentile	2	11.1
85th-95th percentile	3	16.7
Above 95th percentile	13	72.2
Percent body fat		
≤ 30%	3	16.7
30.1 – 40%	7	38.9
>40%	8	44.4

RQ #1: What are the baseline snacking patterns, and are there any significant changes in snacking patterns after three months of intervention in Vienna adolescents at-risk for Type 2 Diabetes? (Tables 3-11)

Frequency of self-reported snacks and beverages at baseline is shown in Table 3, and at three months shown in Table 4. At baseline, 12.5% of participants reported that they consume donuts daily/often. However, at three months no participants reported consuming donuts daily/often. Daily/often consumption of potato chips also decreased from baseline to three months. At baseline, 37.5% of participants reported eating chocolate candy daily/often. However, at three months that percent was decreased to 6.2%. At baseline, 33.3% of participants reported eating ice-cream daily/often, at three months however, 6.2% of participants reported eating ice-cream daily/often. Also at baseline, half the participants reported consuming regular soda pop daily/often while only 18.8% reported at three months. Baseline to three months, daily/often consumption of low-fat milk and 100% fruit juice both decreased. However, at baseline 33.3% reported consuming fresh vegetables daily/often, while at three months 50% reported consuming fresh vegetables daily/often.

Table 3: Descriptive Statistics of Self-Reported Frequencies of Snacks and Beverages at Baseline (N=16)

Variables	Daily/Often N(%)	Sometimes N(%)	Rarely N(%)	Never N(%)
Snack Cake or Pies	**1 (6.2)**	**6 (37.5)**	**5 (31.2)**	**4 (25)**
Donuts or Sweet Rolls	**2 (12.5)**	**4 (25)**	**7 (43.8)**	**3 (18.8)**
Cake	**1 (6.2)**	**5 (31.2)**	**6 (37.5)**	**4 (25)**
French Fries[a]	**2 (13.3)**	**8 (53.3)**	**4 (26.7)**	**1 (6.7)**
Potato Chips	**1 (6.2)**	**8 (50)**	**5 (31.2)**	**2 (12.5)**
Tortilla Chips	**3 (18.8)**	**3 (18.8)**	**8 (50)**	**2 (12.5)**
Chocolate Candy	**6 (37.5)**	**2 (12.5)**	**6 (37.5)**	**2 (12.5)**
Hard or Chewy Candy	**4 (25)**	**7 (43.8)**	**5 (31.2)**	**0**
Cookies	**4 (25)**	**7 (43.8)**	**4 (25)**	**1 (6.2)**
Ice Cream[a]	**5 (33.3)**	**6 (40)**	**4 (26.7)**	**0**
Cereal Bar/Protein Bar	**0**	**8 (50)**	**2 (12.5)**	**6 (37.5)**
Trail Mix[a]	**2 (13.3)**	**2 (13.3)**	**6 (40)**	**5 (33.3)**
Cheese Stick or Cubes	**1 (6.2)**	**7 (43.8)**	**2 (12.5)**	**6 (37.5)**
Soy Milk	**2 (12.5)**	**1 (6.2)**	**4 (25)**	**9 (56.2)**
Soy Nuts	**1 (6.2)**	**1 (6.2)**	**4 (25)**	**10 (62.5)**
Yogurt Cup	**4 (25)**	**6 (37.5)**	**4 (25)**	**2 (12.5)**
Fruit Cup[b]	**3 (21.4)**	**5 (35.7)**	**5 (35.7)**	**1 (7.1)**
Fresh Fruit	**7 (43.8)**	**8 (50)**	**1 (6.2)**	**0**
Fresh Veggies[a]	**5 (33.3)**	**7 (46.7)**	**2 (13.3)**	**1 (6.7)**
Low-fat Popcorn	**1 (6.2)**	**7 (43.8)**	**3 (18.8)**	**5 (31.2)**
Nuts	**3 (18.8)**	**3 (18.8)**	**6 (37.5)**	**4 (25)**
Water	**11 (68.8)**	**4 (25)**	**0**	**1 (6.2)**
Low-fat Milk (2%)	**11 (68.8)**	**4 (25)**	**0**	**1 (6.2)**
Fat-free Milk	**6 (37.5)**	**2 (12.5)**	**3 (18.8)**	**5 (31.2)**
100% Fruit Juice	**6 (37.5)**	**7 (43.8)**	**3 (18.8)**	**0**
Fruit Drinks	**3 (18.8)**	**10 (62.5)**	**3 (18.8)**	**0**
Regular Soda Pop[b]	**7 (50)**	**3 (21.4)**	**2 (14.3)**	**2 (14.3)**

[a] 1 Participant failed to answer therefore N=15

[b] 2 Participants failed to answer therefore N=14

Table 4: Descriptive Statistics of Self-Reported Frequencies of Snacks and Beverages at Three Months (N=16)

Variables	Daily/Often N(%)	Sometimes N(%)	Rarely N(%)	Never N(%)
Snack Cake or Pies	**1 (6.2)**	**3 (18.8)**	**6 (37.5)**	**6 (37.5)**
Donuts or Sweet Rolls	**0**	**3 (18.8)**	**8 (50)**	**5 (31.2)**
Cake[a]	**0**	**3 (18.8)**	**8 (50)**	**4 (25)**
French Fries[a]	**2 (12.5)**	**6 (37.5)**	**7 (43.8)**	**0**
Potato Chips[c]	**0**	**10 (62.5)**	**1 (6.2)**	**2 (12.5)**
Tortilla Chips	**1 (6.2)**	**7 (43.8)**	**4 (25)**	**4 (25)**
Chocolate Candy	**1 (6.2)**	**4 (25)**	**8 (50)**	**3 (18.8)**
Hard or Chewy Candy	**1 (6.2)**	**4 (25)**	**7 (43.8)**	**4 (25)**
Cookies	**2 (12.5)**	**10 (62.5)**	**3 (18.8)**	**1 (6.2)**
Ice-cream	**1 (6.2)**	**7 (43.8)**	**7 (43.8)**	**1 (6.2)**
Cereal/Protein Bar[a]	**5 (31.2)**	**3 (18.8)**	**4 (25)**	**3 (18.8)**
Trail Mix	**1 (6.2)**	**3 (18.8)**	**5 (31.2)**	**7 (43.8)**
Cheese Stick or Cubes	**3 (18.8)**	**5 (31.2)**	**6 (37.5)**	**2 (12.5)**
Soy Milk[b]	**1 (6.2)**	**1 (6.2)**	**0**	**12 (75)**
Soy Nuts	**1 (6.2)**	**2 (12.5)**	**1 (6.2)**	**12 (75)**
Yogurt Cup	**3 (18.8)**	**5 (31.2)**	**5 (31.2)**	**3 (18.8)**
Fruit Cup	**3 (18.8)**	**3 (18.8)**	**6 (37.5)**	**4 (25)**
Fresh Fruit	**7 (43.8)**	**5 (31.2)**	**2 (12.5)**	**2 (12.5)**
Fresh Veggies	**8 (50)**	**7 (43.8)**	**1 (6.2)**	**0**
Lower-fat Popcorn	**1 (6.2)**	**5 (31.2)**	**5 (31.2)**	**5 (31.2)**
Nuts	**1 (6.2)**	**5 (31.2)**	**5 (31.2)**	**5 (31.2)**
Water[a]	**10 (62.5)**	**3 (18.8)**	**2 (12.5)**	**0**
Low-fat Milk (2%)	**6 (37.5)**	**4 (25)**	**3 (12.5)**	**4 (25)**
Fat-free Milk	**3 (18.8)**	**2 (12.5)**	**2 (12.5)**	**9 (56.2)**
100% Fruit Juice[a]	**3 (18.8)**	**7 (43.8)**	**3 (18.8)**	**2 (12.5)**
Fruit Drinks	**6 (37.5)**	**1 (6.2)**	**8 (50)**	**1 (6.2)**
Regular Soda	**3 (18.8)**	**8 (50)**	**2 (12.5)**	**3 (18.8)**

[a] 1 Participant failed to answer therefore N=15

[b] 2 Participants failed to answer therefore N=14

[c] 3 Participants failed to answer perhaps due to a flaw in the form itself (a line was not visible for a place to make their mark) therefore N=13

Paired-sample t-tests were analyzed to determine significant changes in selected snacks and beverages from baseline to three months. These results are presented in Table 5 (“healthy” snacks and beverages) and Table 6 (“unhealthy” snacks and beverages). There were no positive significant changes or trends in responses for selected “healthy” foods/beverages. A negative significant change was found for self-reported low-fat milk consumption. A statistical trend was also seen for 100% Fruit Juice, with a decrease in consumption from baseline to three months.

There was a positive significant change in hard candy and ice cream consumption from baseline to three months (Table 6). There was also a negative significant finding for the “unhealthy” snacks. A significant change from baseline to three months for the frequency of donuts or sweet rolls was found and a statistical trend was seen for potato chips in a negative direction.

Table 5: Paired Sample t-test of Selected, Self-Reported "Healthy" Snacking Intake at Baseline and Three Months (N=16)

Variable	Mean[a]	SE	T	df	p-value
Yogurt Cup					
Baseline	2.25	.250	-1.168	15	.261
3 Month	2.50	.258			
Fruit Cup					
Baseline	2.29	.244	-1.161	13	.266
3 Month	2.64	.289			
Fresh Fruit					
Baseline	1.63	.155	-1.431	15	.173
3 Month	1.94	.266			
Fresh Veggies					
Baseline	1.93	.228	1.323	14	.207
3 Months	1.60	.163			
Lower-fat Popcorn					
Baseline	2.75	.250	-.620	15	.544
3 Months	2.88	.240			
Nuts					
Baseline	2.69	.270	-.527	15	.606
3 Month	2.88	.240			
Protein/Cereal Bar					
Baseline	2.93	.248	1.718	14	.108
3 Month	2.33	.303			
Trail Mix					
Baseline	2.93	.267	-.845	14	.413
3 Month	3.20	.243			
Cheese Stick/Cubes					
Baseline	2.81	.262	1.103	15	.287
3 Month	2.44	.241			
Soy Milk					
Baseline	3.36	.289	-.718	13	.486
3 Month	3.64	.248			

[a] Means are coded 1= Daily/Often, 2= Sometimes, 3= Rarely, 4=Never
* Significant at $p<.05$
† Statistical Trend at $p\leq.10$

Table 5 Cont'd: Paired Sample t-test of Selected, Self-Reported "Healthy" Snacking Intake at Baseline and Three Months (N=16)

Variable	Mean[a]	SE	t	df	p-value
Soy Nuts					
Baseline	3.44	.223	-.235	15	.817
3 Month	3.50	.241			
Water					
Baseline	1.47	.215	.000	14	1.00
3 Month	1.47	.192			
Low-fat Milk (2%)					
Baseline	1.44	.292	-2.784	15	.014*
3 Month	2.25	.310			
Fat-free Milk (skim)					
Baseline	2.44	.329	-1.431	15	.173
3 Months	3.06	.309			
100% Fruit Juice					
Baseline	1.81	.188	-1.838	15	.086†
3 Month	2.44	.288			

[a] Means are coded 1= Daily/Often, 2= Sometimes, 3= Rarely, 4=Never
* Significant at $p<.05$
† Statistical Trend at $p\leq.10$

Table 6: Paired Sample t-test of Selected, Self-Reported "Unhealthy" Snacking Intake at Baseline and Three Months (N=16)

Variable	Mean[a]	SE	T	df	p-value
Snack Cake or Pie					
Baseline	2.75	.233	-1.56	15	1.36
3 Month	3.00	.232			
Donuts or Sweet Rolls					
Baseline	2.69	.237	-2.15	15	.048*
3 Month	2.36	.180			
Cake					
Baseline	2.80	.243	-1.17	14	.262
3 Month	3.07	.182			
French Fries					
Baseline	2.29	.221	-.434	13	.671
3 Month	2.36	.199			
Potato Chips					
Baseline	2.62	.213	1.90	12	.082†
3 Month	2.38	.213			
Tortilla Chips					
Baseline	2.56	.241	-.397	15	.697
3 Month	2.69	.237			
Chocolate Candy					
Baseline	2.25	.281	-1.60	15	.132
3 Month	2.81	.209			
Hard or Chewy Candy					
Baseline	2.06	.193	-2.78	15	.014‡
3 Month	2.88	.221			
Cookies					
Baseline	2.13	.221	-.436	15	.669
3 Month	2.19	.188			
Ice Cream					
Baseline	1.93	.206	-2.36	14	.033*
3 Month	2.53	.192			
Fruit Drinks					
Baseline	2.00	.158	-.889	15	.388
3 Month	2.25	.266			
Regular Soda Pop					
Baseline	1.92	.305	-1.39	13	.189
3 Month	2.35	.289			

[a] Means are coded 1= Daily/Often, 2= Sometimes, 3= Rarely, 4= Never
‡ Significant at $p<.05$
† Statistical Trend at $p\leq.10$

Descriptive statistics were used to compare self-reported responses of snack selection questions at baseline and three months (Table 7). When asked, “How often do you buy a snack from a vending machine or convenience store?” at baseline, 18.8% reported buying a snack one time a week while at three months that number was reduced to 6.2%. For that same question, 43.8% participants at baseline reported rarely/never buying a snack from a vending machine or convenience store, while the percent at three months reached 68.8%.

Table 8 shows results of a paired sample t-test on self-reported snack selection questions at baseline and three months. When asked, “How often do you buy a snack from a vending machine or convenience store?” positive significance was found at the $p<.05$ level meaning less snacks from a vending machine and/or convenience store were purchased at three months than at baseline. There were no significant changes on response to any other snacking selection questions.

Table 7: Self-Reported Responses of Snack Selection Questions at Baseline and Three Months of Vienna Adolescents At-Risk for T2DM (N=16)

Question:	Variables:	Baseline N(%)	Three month N(%)
How often do you buy a snack from a vending machine or convenience store?	Everyday	0	0
	2-4 times a week	2(12.5)	1(6.2)
	1 time a week	3 (18.8)	1(6.2)
	2-3 times a month	4(25.0)	3(18.8)
	Rarely/Never	7(43.8)	11(68.8)
How often do you look at the "Nutrition Facts" on food labels?	Never	4(25.0)	6(37.5)
	Sometimes	9(56.2)	6(37.5)
	Almost Always	3(18.8)	4(25.0)
How often do you choose "sugar-free", "fat-free" or "diet" snacks on purpose?	Never	3(18.8)	6(37.5)
	Sometimes	11(68.8)	8(50.0)
	Almost Always	2(12.5)	2(12.5)
How often do you think about portion size when deciding the amount of snack to eat?	Never	4(25)	5(33.3)
	Sometimes	9(56.2)	6(40.0)
	Almost Always	3(18.8)	4(26.7)

Table 8: Paired Sample t-test of Snack Selection Questions at Baseline and 3 Month from Vienna Adolescents At-Risk for T2DM (N=16)

Question	*Baseline* Mean[a/b](SE)	*3 Month* Mean(SE)	t	df	p-value
How often do you buy a snack from a vending machine or convenience store?	*4*.00[a](.274)	4.50[a](.224)	-2.24	15	.041*
How often do you look at the "Nutrition Facts" on food labels?	1.94[b](.170)	1.88[b](.202)	.324	15	.751
How often do you choose "sugar- free", "fat- free", or "diet" snacks?	1.94[b](.143)	1.75[b](.171)	1.38	15	.188
How often do you think about portion size when deciding the amount of snack to eat?	1.93[b](.182)	1.93[b](.206)	.000	14	1.00

[a] Means are coded 1= everyday, 2= 2-4 times/week, 3= once a week, 4=2-3 times/month, 5=rarely/never
[b] Means are coded 1= never, 2= sometimes, 3= almost always
* Significant at p<.05

Table 9 shows the frequencies of participant responses to selected snacking consumption questions. When asked “How many snacks did you have on a typical school day this week?” 31.2% at baseline reported they consumed two snacks on a typical school day; however 18.8% reported consuming two snacks at three months.

Table 9: Self-Reported Responses of Selected Snack Consumption at Baseline and Three Months of Vienna Adolescents At-Risk for T2DM (N=16)

Question:	Frequency	Baseline N(%)	Three Month N(%)
How many snack did you have on a typical school day this week?	0	0	4(25)
	1	9(56.2)	7(43.8)
	2	5(31.2)	3(18.8)
	3	1(6.2)	1(6.2)
	4	0	1(6.2)
	5	0	0
	6	1(6.2)	0
On a typical school day this week, how many ½ cup servings of fruit did you eat?	0	3(18.8)	0
	1	4(25)	7(43.8)
	2	4(25)	4(25)
	3	2(12.5)	3(18.8)
	4	2(12.5)	2(12.5)
	5	1(6.2)	0
	6	0	0
How many of these fruit servings were eaten as a snack?	0	2(12.5)	4(25)
	1	5(31.2)	4(25)
	2	5(31.2)	4(25)
	3	3(18.8)	2(12.5)
	4	1(6.2)	1(6.2)
	5	0	0
	6	0	1(6.2)
On a typical school day this week, how many ½ cup servings of vegetables did you eat?	0	3(18.8)	5(31.2)
	1	7(43.8)	5(31.2)
	2	2(12.5)	3(18.8)
	3	4(25)	2(12.5)
	4	0	1(6.2)
	5	0	0
	6	0	0
How many of these vegetable servings were eaten as a snack?	0	7(43.8)	8(50)
	1	8(50)	4(25)
	2	0	2(12.5)
	3	1(6.2)	2(12.5)
	4	0	0
	5	0	0
	6	0	0

Table 10 shows results of a paired sample t-test on snack consumption questions at baseline and three months. When asked “How many snacks did you have on a typical school day this week?” the mean decreased resulting in significance at $p<.05$. No other significant changes in responses to snack consumption questions were found.

To determine changes in the overall “snacking score”, t-tests were used to determine changes in participants’ total score at baseline and three months (Table 11). There were no significant changes from baseline to three months in “healthy” snack score. However, there was a positive significant change from baseline to three months in “unhealthy” snack scores meaning the participants reported snacking less “unhealthy”.

Table 10: Paired Sample t-test of Selected, Snack Consumption Questions at Baseline and Three Months from Vienna Adolescents At-Risk for T2DM (N=16)

Question	*Baseline* **Mean (SE)**	*3 Month* **Mean (SE)**	**t**	**df**	**p- value**
How many snacks did you have on a typical school day this week?	1.75(.323)	1.25(.281)	2.74	15	.015*
On a typical day this week, how many ½ cup servings of fruit did you eat?	1.94(.382)	2.00(.274)	-.148	15	.884
How many of these fruit servings were eaten as a snack?	1.75(.281)	1.75(.413)	.000	15	1.00
On a typical day this week, how many ½ cup servings of vegetables did you eat?	1.44(.273)	1.31(.313)	.397	15	.697
How many of these vegetable servings were eaten as a snack?	.688(.198)	.875(.272)	-.824	15	.423

* Significant at p<.05

Table 11: Paired Sample t-test of Overall "Snacking Score" at Baseline and Three Months of Vienna Adolescents At-Risk for T2DM (N=16)

Variable	Mean (SE)	t	df	p-value
"Unhealthy" Score				
Baseline	-19.5(1.67)	-2.4	15	.033*
3 Month	-16.0(1.19)			
"Healthy" Score				
Baseline	23.5(1.63)	1.2	15	.280
3 Month	21.1(1.94)			
Total Score				
Baseline	4.0(2.63)	-.42	15	.678
3 Month	5.1(2.10)			

* Significant at p<.05

RQ # 2: *What are the baseline physical activity levels and screen time patterns, and are there any significant changes in physical activity levels and/or screen time patterns after three months of intervention in Vienna adolescents at-risk for Type 2 Diabetes? (Tables 12-15)*

Cross tabulations were used to see the frequency of self-reported responses from questions regarding screen time patterns at baseline and three months (Table 12). When asked "On a typical school day this week, how much time did you spend watching TV shows or movies on TV?" zero participants reported "none" at baseline, while 12.5% of participants reported "none" at three months. When asked "On a typical school day this week, how much time did you spend on the computer?" 12.5% of participants reported "none" at baseline while 25% reported "none" at three months. Also decreasing from baseline to three months (by almost 20%), there was a downward shift of "½ - 1 hr" use of the computer reported by participants. When asked "On a typical school day this week, how much time did you spend playing video games?" 31.2% of participants reported "none" at baseline, while more than half of participants reported "none" at three months. Also to note, 18.8% of participants reported 3 or more hours of video game use at baseline, while zero participants reported 3 or more hours at three months. When asked "On a typical school day this week, how much time did you spend talking on the phone and texting?" the results were consistent for baseline and three months.

Table 12: Self-Reported Responses of Selected Screen Time Questions at Baseline and Three Months of Vienna Adolescents At-Risk for T2DM (N=16)

Question:	Variables:	Baseline N(%)	Three Month N(%)
On a typical school day this week, how much time did you spend watching TV shows or movies on TV?	None	0	2(12.5)
	15-30 min.	5(31.2)	2(12.5)
	½ -1 hr.	2(12.5)	3(18.8)
	1-2 hrs.	5(31.2)	3(18.8)
	2-3 hrs.	2(12.5)	4(25)
	3+ hrs.	2(12.5)	2(12.5)
On a typical school day this week, how much time did you spend on the computer (not related to school)?	None	2(12.5)	4(25)
	15-30 min.	4(25)	5(31.2)
	½ -1 hr.	6(37.5)	3(18.8)
	1-2 hrs.	4(25)	3(18.8)
	2-3 hrs.	0	1(6.2)
	3+ hrs.	0	0
On a typical school day this week, how much time did you spend playing video games?	None	5(31.2)	9(56.2)
	15-30 min.	5(31.2)	3(18.8)
	½ -1 hr.	2(12.5)	2(12.5)
	1-2 hrs.	1(6.2)	2(12.5)
	2-3 hrs.	0	0
	3+ hrs.	3(18.8)	0
On a typical school day this week, how much time did you spend talking on the phone and "texting"?	None	5(31.2)	6(40)[a]
	15-30 min.	4(25)	3(20)
	½ -1 hr.	1(6.2)	1(6.7)
	1-2 hrs.	3(18.8)	2(13.3)
	2-3 hrs.	0	1(6.7)
	3+ hrs.	3(18.8)	2(13.3)

[a] Percent for this does not equal 100, one participant failed to report.

Table 13 shows the results of a paired-sample t-test on selected questions regarding screen time from baseline and three months. Although our study found no significant results from baseline to three months, a sizeable decrease in self-reported time spent playing video games and time talking/texting on the phone should be noted.

Table 13: Paired Sample t-test of Selected, Self-Reported Screen Time at Baseline and Three Months from Vienna Adolescents At-Risk for T2DM (N=16)

Question:	*Baseline* **Mean[a] (SE)**	*3 Month* **Mean[a] (SE)**	**t**	**df**	**p-value**
On a typical school day this week, how much time did you spend watching TV shows or movies on TV?	3.63(.352)	3.69(.405)	-.222	15	.827
On a typical school day this week, how much time did you spend on the computer (not related to school)?	2.75(.250)	2.50(.316)	.808	15	.432
On a typical school day this week, how much time did you spend playing video games?	2.69(.463)	1.81(.277)	1.52	15	.150
On a typical school day this week, how much time did you spend talking on the phone and "texting"?	2.93(.502)	2.66(.485)	.531	14	.604

[a] Means are coded as 1= None, 2= 15-30 minutes, 3= ½-1 hour, 4= 1-2 hours, 5= 2-3 hours, 6= 3+ hours

Cross tabulations were used to see the frequency of self-reported responses from questions regarding physical activity levels at baseline and three months (Table 14). When asked "On a typical school day this week, how much time was spent skating or rollerblading on your own?" 94% of participants reported "none" at baseline while that number was approximately 60% at three months. When asked the question "During the past 7 day week, how many days did you do any combination of physical activities for a total of one hour or more each day?" 6.2% of participants reported at least 6 days of combined physical activities at baseline, while 25% reported at least 6 days of combined physical activities at three months.

For the questions, "On a typical school day this week, how much time did you spend walking, biking, or jogging on your own?" and "On a typical school day this week, how much time did you spend lifting weights or strength training?" the results stayed relatively the same for both baseline and three months.

Table 14: Self-Reported Responses of Selected Physical Activity Questions at Baseline and Three Months of Vienna Adolescents At-Risk for T2DM (N=16)

Question:	Variables:	Baseline N(%)	Three Month N(%)
On a typical school day this week, how much time did you spend doing an after-school sports team?	None	8(50.0)	7(46.7)
	15-30 min.	2(12.5)	1(6.7)
	½ -1 hr.	2(12.5)	1(6.7)
	1-2 hrs.	2(12.5)	3(20.0)
	2-3 hrs.	1(6.2)	2(13.3)
	3+ hrs.	1(6.2)	1(6.7)
On a typical school day this week, how much time did you spend in any activity-based lessons?	None	12(75.0)	9(56.2)
	15-30 min.	1(6.2)	1(6.2)
	½ -1 hr.	0	0
	1-2 hrs.	1(6.2)	4(25.0)
	2-3 hrs.	2(12.5)	2(12.5)
	3+ hrs.	0	0
On a typical school day this week, how much time did you spend walking, biking, or jogging on your own?	None	3(18.8)	3(18.8)
	15-30 min.	5(31.2)	4(25.0)
	½ -1 hr.	4(25.0)	3(18.8)
	1-2 hrs.	2(12.5)	4(25.0)
	2-3 hrs.	2(12.5)	2(12.5)
	3+ hrs.	0	0
On a typical school day this week, how much time did you spend skating or rollerblading on your own?	None	15(93.8)	10(62.5)
	15-30 min.	0	3(18.8)
	½ -1 hr.	1(6.2)	1(6.2)
	1-2 hrs.	0	0
	2-3 hrs.	0	2(12.5)
	3+ hrs.	0	0
On a typical school day this week, how much time did you spend lifting weights or strength training?	None	10(62.5)	10(62.5)
	15-30 min.	1(6.2)	2(12.5)
	½ -1 hr.	2(12.5)	2(12.5)
	1-2 hrs.	3(18.8)	2(12.5)
	2-3 hrs.	0	0
	3+ hrs.	0	0

Table 14 Cont'd: Self-Reported Responses of Selected Physical Activity Questions at Baseline and Three Months of Vienna Adolescents At-Risk for T2DM (N=16)

Question:	Variables:	Baseline N(%)	Three Month N(%)
During the past 7 day week, how many days did you do any combination of physical activities for a total of one hour or more each day?	0	1(6.2)	1(6.2)
	1 day	2(12.5)	0
	2 days	2(12.5)	5(31.2)
	3 days	4(25)	3(18.8)
	4 days	3(18.8)	3(18.8)
	5 days	3(18.8)	0
	6 days	0	1(6.2)
	7 days	1(6.2)	3(18.8)

Table 15 shows the results of a paired-sample t-test on selected questions regarding physical activity from baseline to three months. Our study found a significant change at $p<.05$ level from baseline to three months for the question "On a typical school day this week, how much time did you spend skating or rollerblading on your own?" the responses shifted upward from "none" to "15-30 minutes".

Table 15: Paired Sample t-test of Selected, Self-Reported Physical Activity Levels at Baseline and Three Months from Vienna Adolescents At-Risk for T2DM (N=16)

Question:	Baseline **Mean[a/b] (SE)**	3 Month **Mean[a/b] (SE)**	**t**	**df**	**p-value**
On a typical school day this week, how much time did you spend doing an after-school sports team?	2.27[a](.442)	2.67[a](.475)	-1.00	14	.334
On a typical school day this week, how much time did you spend in any activity-based lesson?	1.75[a](.371)	2.31[a](.416)	-1.59	15	.132
On a typical school day this week, how much time did you spend walking, biking, or jogging on your own?	2.69[a](.326)	2.88[a](.340)	-.545	15	.594
On a typical school day this week, how much time did you spend skating or rollerblading on your own?	1.13[a](.125)	1.81[a](.344)	-2.42	15	.029[*]
On a typical school day this week, how much time did you spend lifting weights or strength training?	1.88[a](.315)	1.75[a](.281)	.368	15	.718
During the past 7 day week, how many days did you do any combination of physical activities for a total of one hour or more each day?	4.25[b](.452)	4.63[b](.531)	-.667	15	.515

[a] Means are coded as 1= None, 2= 15-30 minutes, 3= ½-1 hour, 4= 1-2 hours, 5= 2-3 hours, 6= 3+ hours
[b] Means are coded as 1= 0 days, 2=1 day, 3=2 days, 4=3 days, 5=4 days, 6=5 days, 7=6 days, 8=7 days
[*] Significant at $p<.05$

RQ #3: Is there a relationship between screen time and overall snacking patterns and does it change from baseline to three months in Vienna adolescents at-risk for Type 2 Diabetes? (Tables 16-17)

A Pearson's Correlation was used to determine the relationship between selected screen time and snacking score questions at baseline (Table 16). There were no significant findings to note.

Table 17 shows the Pearson's Correlation used to find a relationship between screen time questions and snacking score at three months. There was a significant finding at the $p<.05$ level between the variables "time on TV" and total snack score. The r-value of -.484 shows a negative relationship meaning that the more time spent watching TV, the lower the total snack score.

Table 16: Relationships Between Selected Screen Time Questions and Snacking Scores at Baseline From Vienna Adolescents At-Risk for T2DM (N=16)

Variables	*"Unhealthy" Score*	*"Healthy" Score*	*Total Snack Score*	*… time on TV*	*… time on computer*	*… time playing video games*
"Healthy" Score	r=.318 p=.230					
Total Snack Score	r=.840** p=.000	r=.782** p=.000				
… time on TV	r=-.043 p=.876	r=-.041 p=.881	r=-.051 p=.850			
… time on computer	r=-.430 p=.097	r=-.069 p=.800	r=-.322 p=.224	r=.450 p=.081		
… time playing video games	r=-.283 p=.288	r=-.298 p=.263	r=-.357 p=.175	r=.284 p=.286	r=.171 p=.527	
… time on phone	r=.026 p=.923	r=-.236 p=.378	r=-.118 p=.663	r=-.094 p=.730	r=-.158 p=.558	r=-.297 p=.264

** Correlation is significant at the 0.01 level (2-tailed).

Table 17: Relationships Between Selected Screen Time Questions and Snacking Scores at Three Months From Vienna Adolescents At-Risk for T2DM (N=16)

Variables	*"Unhealthy" Score*	*"Healthy" Score*	*Total Snack Score*	*… time on TV*	*… time on computer*	*… time playing video games*
"Healthy" Score	r=-.161 p=.550					
Total Snack Score	r=.432 p=.095	r=.820** p=.000				
… time on TV	r=-.398 p=.126	r=-.277 p=.298	r=-.484* p=.057			
… time on computer	r=.-355 p=.177	r=-.049 p=.856	r=-.251 p=.348	r=-.016 p=.952		
… time playing video games	r=-.317 p=.232	r=.020 p=.941	r=-.165 p=.541	r=.225 p=.403	r=-.166 p=.538	
… time on phone	r=-.447 p=.095	r=.306 p=.267	r=.016 p=.956	r=.076 p=.789	r=.565* p=.028	r=-.192 p=.494

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

RQ #4: Is there a relationship between physical activity levels and overall snacking patterns and does it change from baseline to three months in Vienna adolescents at-risk for Type 2 Diabetes? (Tables 18-19)

A Pearson's Correlation was used to determine the relationship between selected physical activity and snacking score questions at baseline (Table 18). There was a significant relationship found between the variables "time spent walking, biking, or jogging" and "unhealthy" snacking score. The r-value shows a negative relationship between the two variables meaning the more time spent walking, biking, or jogging, the lower the "unhealthy" snacking score.

Table 18: Relationships Between Selected Physical Activity Questions and Snacking Scores at Baseline From Vienna Adolescents At-Risk for T2DM (N=16)

Variables	*"Unhealthy" Score*	*"Healthy" Score*	*Total Snack Score*	*…school sports team*	*…activity-based lesson*	*…walking, biking, or jogging*	*… skating or rollerblading*	*… lifting weights*
"Healthy" Score	r=.318 p=.230							
Total Snack Score	r=.840 p=.000	r=.782 p=.000						
…school sports team	r=-.147 p=.586	r=.124 p=.646	r=.026 p=.925					
… activity-based lesson	r=-.216 p=.423	r=-.193 p=.473	r=.253 p=.345	r=.737** p=.001				
… walking, biking, or jogging	r=-.549* p=.028	r=-.150 p=.580	r=.447 p=.083	r=.449 p=.081	r=.267 p=.317			
… skating or rollerblading	r=-.060 p=.825	r=.046 p=.866	r=-.013 p=.961	r=.110 p=.684	r=.045 p=.869	r=.064 p=.814		
… lifting weights	r=-.127 p=.639	r=.055 p=.840	r=-.052 p=.848	r=-.012 p=.965	r=-.161 p=.552	r=.422 p=.103	r=-.185 p=.492	
…physical activities for a total of one or more hours…	r=-.205 p=.447	r=.438 p=.090	r=.116 p=.668	r=.261 p=.329	r=.099 p=.714	r=.432 p=.095	r=-.184 p=.494	r=.044 p=.872

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

A Pearson's Correlation was used to determine the relationship between selected physical activity and snacking score questions at three months as shown in Table 19. Several statistically significant relationships were found. Between the variables "school sports team" and "unhealthy" snacking, the r-value shows a negative relationship, meaning the lower the amount of time spent involved in a school sports team, the more "unhealthy" the snacking score. There was also a negative significant relationship among "activity-based lessons" and "unhealthy" snacking score. Thus, the lower amount of time spent in activity-based lessons, the more "unhealthy" the snacking score. Another negative significant relationship exists between "lifting weights" and "unhealthy" snacking score, meaning the less time spent lifting weights, the more "unhealthy" the snacking score.

There was also a positive significant relationship between the variables "school sports team" and "healthy" snacking score, meaning the more time spent involved in a school sports team, the more "healthy" the participant reported snacking. Another positive finding was a statistical trend between the variables "physical activities for a total of one or more hours" and "healthy" snacking score. This means the more days spent doing physical activities, the more self-reported "healthy" snacking was taking place ($p<.059$). Also found to be a statistical trend was, "physical activities for a total of one or more hours" and total snacking score. Meaning the more days spent doing physical activities, the higher the total snacking score.

Table 19: Relationships Between Selected Physical Activity Questions and Snacking Scores at Three Months From Vienna Adolescents At-Risk for T2DM (N=16)

Variables	*"Unhealthy" Score*	*"Healthy" Score*	*Total Score*	*…school sports team*	*…activity-based lesson*	*…walking, biking, or jogging*	*… skating or rollerblading*	*… lifting weights*
"Healthy" Score	r=-.161 p=.550							
Total Score	r=.432 p=.095	r=.820** p=.000						
…school sports team	r=-.583* p=.022	r=.581* p=.023	r=.188 p=.503					
… activity-based lesson	r=-.566* p=.022	r=.437 p=.091	r=.071 p=.794	r=.897** p=.000				
… walking, biking, or jogging	r=-.165 p=.541	r=.288 p=.279	r=.168 p=.535	r=.561* p=.030	r=.608* p=.012			
… skating or rollerblading	r=-.439 p=.089	r=.269 p=.315	r=-.009 p=.974	r=.589* p=.021	r=.435 p=.092	r=.307 p=.247		
… lifting weights	r=-.674** p=.004	r=.008 p=.977	r=-.383 p=.143	r=.361 p=.186	r=.294 p=.269	r=.196 p=.467	r=.656** p=.006	
…physical activities for a total of one or more hours…	r=.099 p=.715	r=.482 p=.059†	r=.498 p=.050†	r=.409 p=.130	r=.262 p=.327	r=.306 p=.250	r=-.003 p=.992	r=-.014 p=.959

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

† Statistical Trend at p≤.10

CHAPTER 5

DISCUSSION

The main objective of this study was to describe the snacking patterns, the changes in snacking patterns after a community-based intervention, physical activity levels, and screen time patterns among low-income, predominately Caucasian adolescents who are at-risk for T2DM, and if there is an association between any or all of these variables. Previous studies have shown excess body weight increases a child's risk for developing T2DM. Research has also shown that overweight and obese adolescence exists in all racial and ethnic groups. However, it is commonly known that adolescents living in poverty may be at higher risk for overweight or obese due to lack of access to nutritious foods.

RQ1

- Our study showed that the overall "unhealthy" snacking score was found to have a positive significant change from baseline to three months after the community-based intervention, while the overall "healthy" snacking score remained stable.
- When asked the question "How often do you buy a snack from a vending machine or convenience store?" we found a positive significant change from baseline to three months, meaning the frequency of purchasing a snack from a vending machine or convenience store decreased.
- When asked "How often do you choose sugar-free, fat-free, or diet snacks on purpose?" the mean decreased from baseline to three months, meaning that at

baseline participants self-reported choosing these items more often than at three months.

- Our study found negative significant changes (a lower consumption) in low-fat milk and 100% fruit juice.
- Self-reported overall consumption of snacks "on a typical school day" significantly decreased from baseline to three months.

RQ 2

- Our participants had a relatively high rate of screen time and physical inactivity, particularly at baseline.
- Our study found a positive significant change from baseline to three months in the question "How much time did you spend skating or rollerblading?" however no other significant changes were found.
- Our study found no positive or negative significant findings from baseline to three months in regards to selected screen time questions

RQ 3

- No significant findings were found between screen time and overall snacking. We did however find a relationship at three months. The variables "time on TV" and total snacking score showed a negative relationship, meaning the more time spent watching TV, the lower the total snacking score. Therefore implying a *higher* "unhealthy" snacking score and a *lower* "healthy" snacking score.

RQ 4

- At baseline, "time spent walking, biking, or jogging" and "unhealthy" snacking score shows a negative significant relationship. Meaning the more time spent

walking, biking, or jogging, the lower the "unhealthy" snacking score. Therefore implying the higher the physical activity level, the more healthful snacking the participant reported.

Snacking Patterns of Adolescents

It has been established in the health profession that the nutritional status of U.S. adolescents is described as "poor" (63). Their diets are low in fruits and vegetables, calcium, and fiber yet high in sugar, refined carbohydrates, and fat. Our study showed that the overall "unhealthy" snacking score was found to have a positive significant change from baseline to three months after the community-based intervention, while the overall "healthy" snacking score remained stable. Some of these changes (significant or not) could be due to the thousands of food advertisements seen by U.S. children (65).

Previous research points out that factors believed to contribute to the increase in caloric intake is the increasing size of packaging (66) and food portions (67). The convenient access to large portions of energy-dense foods (68) has contributed to so much food being readily available, in ready-to-eat form (69). These factors are consistent with the types of snacks most frequently consumed in our study. Most of the "unhealthy" snacks listed on our questionnaires are pre-packaged, easy to eat foods that fit into the adolescent lifestyle. However, it takes time, money, and effort to purchase and prepare fresh fruit, fresh vegetables, etc. Our results showed lower consumption of fresh fruits and vegetables, and a higher consumption of less "healthy" options than the recommended levels.

When asked the question "How often do you buy a snack from a vending machine or convenience store?" we found a positive significant change from baseline to three months, meaning the frequency of purchasing a snack from a vending machine or convenience store decreased. When asked "How often do you choose sugar-free, fat-free, or diet snacks on purpose?" the mean decreased from baseline to three months, meaning that at baseline participants self-reported choosing these items more often than at three months.

Our study found negative significant changes (a lower consumption) in low-fat milk and 100% fruit juice. These findings correspond to the findings from those of Paradis et al. (28) who found that specific high-fat and high-sugar foods consumption decreased; nonetheless some "healthier" options had also decreased. This can possibly be explained by the participants perceived idea of what these selected foods/beverages actually are at baseline compared to the knowledge they gained from the intervention. For example, perhaps some of the participants were not fully aware of the differences (at baseline) between fat-free milk and vitamin D milk, or between fruit punch and 100% fruit juice.

Previous research (76) shows that consumption of sweetened beverages, sweets, and total consumption of low quality foods were positively related to being overweight. Although our study did not look at the relationship between overweight and snacking, we can note that 72.2% of our participants had a BMI above the 95th percentile.

Self-reported overall consumption of snacks "on a typical school day" significantly decreased from baseline to three months. This could be derived from the

higher level of knowledge about portion size, hunger cues, and benefits of fruits/vegetables that our intervention provided.

Our results were comparable to the results found by Cross et al. (77) being sweet snacks were most popular, followed by crunchy/salty. Our study found chocolate candy, hard candy, cookies, ice-cream, fruit drinks, and regular soda pop to be among the most consumed and trail mix, cheese stick, soy products, yogurt cup, fruit cup, fresh vegetables, and nuts to be among the least consumed. When adolescents have a basic knowledge of nutrition, healthy food options, and positive role models, they are more likely to make better decisions. Hence the "unhealthy" snacking score became significantly more healthful from baseline to three months.

Physical Activity Levels

A considerable decrease in the amount of physical activity adolescents are engaging in is contributing to the rapidly increasing number of adolescents who are obese and becoming diagnosed with T2DM. Previous studies have found physical inactivity is associated with overweight (3) and T2DM (57). Our study found a positive significant change from baseline to three months in the question "How much time did you spend skating or rollerblading?" however no other significant changes were found. With every participant receiving a free membership to a fitness center, it is difficult to understand why there were not more significant findings; especially in the questions regarding walking/biking/jogging, strength training, and/or a combination of physical activities. Regardless of the findings in our study, future community-based interventions should emphasize the importance of vigorously exercising for 60 minutes per day (51,52).

Research has found that high family income and education level are associated with the levels and types of physical activity (58). The higher the level of income and education of a parent, the higher the rate of physical activity. Though our study did not analyze this relationship, we can refer to the demographics in table 1 to see almost 45 percent of our participants' had a parent report their education level to be of high school or less, and 49 percent of parents reported having an income of $26,000 or less.

Prior research states physical inactivity could be a result of increased screen time (61). The results of our study agree. Our participants had a relatively high rate of screen time and physical inactivity, particularly at baseline. Due to this, our findings were not consistent with those of Powell et al. Their results demonstrate a significant association between local-area per capita availability of a commercial physical activity-related facility and physical activity levels among adolescents. The rates did however change over the intervention period. Some could argue the time of year (inclimate weather) could be a determinate of high levels of screen time versus low levels of physical activity, although the participants' had access to a free gym membership for the duration of the program.

Due to the changing lifestyles of adolescents, substantial attention has been paid to their physical activity levels. Since we know screen time lowers levels of physical activity, and we know screen time lowers levels of healthful foods, we can infer there is a relationship between snacking and physical activity. Our study found significant relationships at baseline and three months. At baseline, "time spent walking, biking, or jogging" and "unhealthy" snacking score shows a negative significant relationship. Meaning the more time spent walking, biking, or jogging, the lower the "unhealthy"

snacking score. Therefore implying the higher the physical activity level, the more healthful snacking the participant reported.

Screen Time

Our study found no positive or negative significant findings from baseline to three months in regards to selected screen time questions. A noteworthy observation is that of "How much time did you spend playing video games?" the amount of time was decreased from 18.8% reporting 3+ hours of video game use at baseline to none reporting 3+ hours at three months. These findings should be further explored in a larger sample size.

Research has shown that for every hour of TV use per day, there was a significant decrease in fruit and vegetable consumption (46). At baseline our study cannot support these findings, due to no significant findings in screen time and overall snacking. We did however find a relationship at three months. The variables "time on TV" and total snacking score showed a negative relationship, meaning the more time spent watching TV, the lower the total snacking score. Therefore implying a *higher* "unhealthy" snacking score and a *lower* "healthy" snacking score. This could be due in part to the convenience and packaging of snack foods, compared to having to "prepare" fruits and vegetables.

Limitations

When interpreting results it is important to be aware of limitations. To provide more accurate results for future studies. First, all measures other than body composition, were self-reported by the participant. The length of the questionnaire could also be a limitation, even though the questionnaire was split into three stations with fun, engaging

learning activities between them. The multiple answer formats proved to be inadequate at times, especially for the question regarding physical activity during recess, only two to three options should have been given, not six. This is because it is obvious it would be impossible to spend 2-3, or 3+ hours, etc., during recess engaging in physical activities. This question was thrown out for this study analysis due to obscure answers from participants. Also, for the questions with multiple answer formats, in some instances it proved difficult to analyze certain data. Due to the participants' ages they may have not fully understood what certain questions were and this could have an effect on the outcome of their responses. Finally, this study had no control group to compare our findings. Without a control group it is difficult to demonstrate the true impact of our intervention.

Delimitations

The baseline intervention was held on Saturday mornings/afternoons. This encountered conflicts with other weekend plans the family may have already had in place. For example, sports teams, Girl/Boy Scouts, church groups, etc., tend to have their meetings and events on weekends. Also, not all participants attended all interventions. This had an effect on our total *N*. Low parent involvement (which we experienced), a lack of transportation to the fitness center and/or the actual intervention, could have been other reasons for the small *N*. Needing to interact with non-English speaking parents also proved to be a delimitation for this study. Finally, I studied only 5-8th graders at Vienna Grade School and I analyzed only the data of the 5th-8th graders who were at-risk for T2DM.

Recommendations

Below is a list of recommendations to strengthen future community-based studies. These recommendations were accumulated after completion of all the interventions and interpretation of the results.

- Reformat questions with a ranking score format.
- Change the word order of the questions that start with "On a typical school day this week".

  For example: "On a typical school day this week, how much time did you spend watching TV shows or movies on TV?" The question should be "How much time did you spend watching TV shows or movies on TV on a typical school day this week?" This is because some participants may not have finished the question to the end, so they were missing important key words when reading the question.
- Change the answer choices on the questions that have unrealistic options.

  For example: On a typical school day this week, how much time did you spend doing physical activities during recess?

None	15-30 minutes.	Between ½ hour and 1 hour.	Between 1-2 hours.	Between 2-3 hours.	More than 3 hours.

  This question does not need the last 3 choices. As we know, recess typically lasts around 20-30 minutes. If a participant chose "more than 3 hours" then we can assume they did not fully read or understand the question, or simply made a mistake.
- Some could argue the question "During the past 7-day week, how many days did you do any combination of physical activities for a total of one hour or more each day?" is confusing and/or hard to comprehend. However, this question was adapted from the Youth Risk Behavioral Survey (YRSB).

- Increase team supervision during and after completion of forms in order to reduce obscure answers and/or missing data.
- Use incentives to increase parent and participant involvement in all interventions to incorporate a larger *N*.
- Continue to measure "unhealthy" and "healthy" snacks separately to distinguish changes within each group.
- To ensure a precise "score" when calculating the "Healthy" category vs. the "Unhealthy" category, include the same number of "items" for each category.
- For the food frequency form, clearly quantify what the terms are.

  For example:

"Daily"	"Often"	"Sometimes"	Rarely	Never
7 days per week	3-6 days per week	1-2 times per week	1-3 times per week	

CHAPTER 6

CONCLUSION

In conclusion, this study found that adolescents who are at-risk for T2DM tend to eat a higher consumption of "unhealthy" foods while staying consistent in their "healthy" eating patterns. Overall, we found a positive change from baseline to three months in several areas, including overall snacking patterns, a decrease in certain areas of screen time, and an increase in certain areas of physical activity. We also found a relationship among physical exercise and snacking, and among screen time and snacking. In general, the higher the level of physical activities, the higher the overall snacking score. The lower the amount of screen time, the higher the overall snacking score.

This study supports existing data in showing the many relationships among snacking, physical activity levels, and screen time. All of these variables can be modified, that is why it is so important to provide proper education to at-risk adolescents. Adolescents learn behaviors at home; this is why the need for parent education is also just as important. Parent involvement could quite possibly the barrier that needs to be further address when trying to solve the T2DM epidemic.

Further community-based intervention programs should further examine how screen time, snacking patterns, and physical activities relate to T2DM. More specifically, steps are needed to be able to evaluate the education learned from these interventions. Research is available on modifiable changes that can be done to reduce risk factors for T2DM in at-risk adolescents. The next step is to put these ideas into action.

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APPENDICES

APPENDIX A

Parent Consent Form

PARENT CONSENT FORM FOR THE "R. U. A. HEALTHY KID?" PROGRAM: PLEASE READ, SIGN THE BACK, AND RETURN THE SIGNED COPY TO US IN THE ENCLOSED ENVELOPE. YOU MAY KEEP THE SECOND COPY FOR YOUR RECORDS.

Dear Parent / Guardian,

My name is Dr. Sharon Peterson, and I am an Assistant Professor in Community Nutrition at Southern Illinois University in Carbondale. The school nurse, Ann Taylor, and my research team are inviting your child to participate in a fun and interactive research project to be held on Saturday, January 24, 2009 **at the Vienna Grade School Gym**.

The purpose of the "R. U. A. Healthy Kid?" project is to provide a community-based program to help middle school students who have been identified to be "at risk" for Type 2 Diabetes. Your child was found to have risk factors for Type 2 Diabetes during the screening process last fall and that is why your child has the opportunity to be involved in the upcoming "R. U. A. Healthy Kid?" session. Last fall, you should have received a letter from the school nurse, Ann Taylor explaining the risk factors that were identified for your child.

With your signed permission, your child will be able to participate in a 4-hour "hands-on" program on Saturday, January 24th and again in April. At these sessions, participants will learn how to assemble some healthy snacks and side dishes, and have the opportunity to taste their creations. They will also participate in some non-competitive, low-intensity physical activities, including a Human Hamster Ball, an Inflatable Twister game, and a Wii video game. We will also discuss topics such as Stress Management, Self-Esteem, Body Image, Food Journaling, and Goal Setting.

Because local TV and newspaper reporters often cover our program, prior to each of these sessions your child will be asked to give written permission to be videotaped or photographed. These videotapes and/or photos may also be used on our website or other print material without identifying them. We will use a color-coded name tag to indicate which participants can be photographed and/or videotaped and which participants cannot.

We will do everything in our power to keep your child safe. A discipline policy has been developed and will be followed during the sessions. If your child refuses to respect the discipline policy and is disruptive or unsafe, you will be called and asked to come and pick up your child. We do not anticipate this to happen.

After attending the session on January 24th, participants will get to use a FREE 3-month membership to the REAL Rehab fitness center. You will need to sign any required consent forms for your child at the fitness center, and we will monitor and record your child's attendance and progress. We will also be calling and/or emailing you and your child once a week to encourage your child and collect feedback on how they are doing with their goals, and discuss any problems that may have arisen. Your child will receive a total of 12 hours of face-to-face interaction with the research team, plus 10-15 minutes per week of phone/email contact time. This study will last from October to April. Participation is voluntary and your child may withdraw from the study at any time.

At the conclusion of the intervention, we would like to stay in contact with your child by phone or email once a month, to continue to encourage your child and collect feedback on the program's long-term impact on your child's health and wellness.

We will take all reasonable steps to protect your child's identity. All written responses will be kept confidential. A coding system will be used so that your child's responses will

not be easily identified. The master list of codes will be kept separate in a locked file accessible only to myself in a separate location to further protect your child's identify. Only those researchers directly involved with this project will have access to coded data. Upon completion of the study, the master list and the data will be destroyed.

If you have any questions about this project, please feel free to contact me:
Dr. Sharon Peterson, Ph.D., R.D.
Assistant Professor-Community Nutrition
Southern Illinois University Carbondale
sharonp@siu.edu OR (618) 453-7513

PLEASE SIGN BELOW AND RETURN THE SIGNED COPY.
YOU MAY KEEP THE SECOND COPY OF THIS FORM FOR YOUR RECORDS.

I have read this material and any questions that I asked have been answered to my satisfaction. I received an extra copy for the relevant information and phone numbers. I realize that my child may withdraw without consequence at any time.

I GRANT PERMISSION for my child, _____
(child's name here)
to participate in the "R.U.A. Healthy Kid?" research project.

Parent/Guardian Signature: _____
Date

I grant permission for my child to be videotaped and photographed for the TV/newspaper and for the purpose of promoting the program on their website.

Parent/Guardian Signature: _____

Emergency Phone Number(s) where you can be reached during the Saturday afternoon sessions: _____
_____
_____

Name(s) and phone number(s) of anyone else who has permission to pick up your child:
_____
_____
_____

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone (618) 453-4533. Email: **siuhsc@siu.edu**

APPENDIX B

Child Assent Form

Title of Research Project: "R. U. A. Healthy Kid?"---A community-based lifestyle Intervention for Vienna 5th-8th graders "at-risk" for Type 2 Diabetes.

Principal Investigator: Dr. Sharon Peterson, Ph.D., R.D., Assistant Professor in Food and Nutrition at Southern Illinois University Carbondale.
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Site where project will take place: Vienna Grade School in Vienna, IL

WHY ARE THESE PEOPLE HERE?

We are doing research to find out how we can help middle school students who have risk factors for Type 2 Diabetes become healthier.

WHAT WILL HAPPEN TO ME IF I AGREE TO BE IN THE STUDY?

You will get to participate in three sessions of fun and interactive "hands-on" activities that have something to do with healthy food choices and physical activities.
You will be taught how to choose healthy foods and set health-related goals. We will call you once a week in between these sessions to see how you are doing with your goals. You will be asked to write down some things each day in a journal. *We will have a video camera available in case you want to be videotaped, but allowing us to videotape you is not required to participate in the study.* We would like to stay in touch with you by phone for about 2 years after the study to see how you are doing. You will also get to go to the REAL Fit fitness center FREE for 6 months.

CAN ANYTHING BAD HAPPEN TO ME?

We do not know of any reason why participating would be harmful to you in any way. If you are putting yourself or someone else in danger, you may be asked to sit down and take a break from the activities.

CAN ANYTHING GOOD HAPPEN TO ME?

You will be helping us learn more about how to help kids your age get healthier in order to decrease their risk of getting Type 2 diabetes. You will find out important information about your health and learn how to get healthier. We hope you will have fun and make some new friends, too.

DO I HAVE TO BE IN THE STUDY? CAN I CHANGE MY MIND?

You can choose not to be in the study at any time. We have already received written permission from your parent. If you say "yes" now but change your mind later, that's okay too. All you have to do is tell us. Being in this study is up to you, and no one will be upset if you change your mind later.

WILL ANYONE KNOW THAT I AM IN THE STUDY?

The school nurse and the researchers and the other participants will know who participated in the study. When the study is finished, we will write a report about what we found out but we won't use your name in the report.

WHAT IF I HAVE QUESTIONS?

You can ask questions about this study at any time. Please feel free to contact me:

Dr. Sharon Peterson, Ph.D., R.D., Assistant Professor-Community Nutrition
Southern Illinois University Carbondale
sharonp@siu.edu OR **sharonlpeterson@hotmail.com**
(618) 453-7513 OR (618) 985-3885

This research project has been explained to me and I understand what is going to happen and why. I have talked to my parent(s)/guardian about this project and I have decided that I would like to participate in it.

___Yes, I want to be in this study.

___I give my permission to be photographed and videotaped and I understand that if I do get photographed or videotaped, it might be used for later promotional activities and/or put on their website, but will not identify me by name.

___No, I don't want to be videotaped or photographed.

_____
Student's Name

_____
Signature of student Date

I have explained this research study and believe that the student understands what is expected during this study.

_____
Signature of Person obtaining Assent Date

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone (618) 453-4533. Email: **siuhsc@siu.edu**

APPENDIX C

Participant Attendance

Participants'	Intervention #1 October	Intervention #2 January	Intervention #3 April
Participant 1	☺	☺	☺
Participant 2	☺	☺	☺
Participant 3	☺	☺	☺
Participant 4	~~☺~~		~~☺~~
Participant 5	☺	☺	☺
Participant 6		☺	☺
Participant 7		☺	☺
Participant 8		☺	☺
Participant 9	~~☺~~		~~☺~~
Participant 10		☺	☺
Participant 11	☺	☺	☺
Participant 12		☺	☺
Participant 13	☺	☺	☺
Participant 14		☺	☺
Participant 15		☺	☺
Participant 16		☺	☺
Participant 17		☺	☺
Participant 18		☺	☺

APPENDIX D

Overall Schedule for Intervention at Vienna Grade School (Sample of One Intervention)

10:30am = Registration/update contact info, do child assent, check food allergies.

Check height, BMI and BLOOD PRESSURE.
Make buttons for color-coded name tags (video/photo).
Give t-shirts/pedometers to wear during intervention.

Parent info area: Food Cost of Healthy Snacks, Display books and other resources, plus "prizes"

10:45 = Graffiti Wall…
Ice Breaker game…
Spinner P.A. game…

11:00=11:15am = Parents stay for "skit" and "What is Diabetes?"

11:15-1:00pm = Rotate through all stations. (*Family Meals & Healthy Snacks*)

10 min. Portion Distortion station
10 min. Forms ----page 1-2. (11:25-11:35am)

10 min. Soy foods taste-testing.-----
10 min. Forms ---page 3-4. (11:45-11:55am)

10 min. Label Reading station---11:55-12:05)
10 min. Forms ---page 5-6. (12:05-12:15pm)

15 min. Food: TWO GROUPS make either
***Rainbow Veggie Salad* OR**
Fruit & Yogurt parfaits… (12:15-12:30pm)
15 min. ***Build-your-own-wraps*** ... (12:30-12:45pm)
15 min. Eat and turn in tickets for a prize… (12:45-1:00pm)

1:00-2:00 pm=move to resource room for "Stress Management" session (Unique U) with Dr. Les Lloyd (Mind/Body expert) + do Goal Setting Worksheet.

2:00-3:00pm = (*Physical Activities)* Group game
then free play activities such as Wii Fit/ Wii sports, dance mats, Monster basketball, Hamster Balls, Inflatable Twister…

3:00pm = Evaluations, give out medals, return pedometers, parents arrive: taste-food items we prepared!
(take workbooks, t-shirts, and their 'prize').

APPENDIX E

Participant Questionnaire

WELCOME to "R. U. A. Healthy Kid?"

Participant's Name:_____

These forms are for the participating student to fill out.

1. **During a typical day**, how much time do you spend **sitting and watching shows or movies on TV**?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

2. **During a typical day**, how much time do you spend **on the computer (not related to homework**)?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

3. **During a typical day,** how much time do you spend **sitting and playing non-active video games**?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

4. **During a typical day**, how much time do you spend **sitting and talking on the phone and/or texting**?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

5. **During a typical school day**, how much time do you spend **doing physical activities during recess?**

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

6. **During a typical day**, how much time do you spend doing **after-school sports practice or games**?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

7. During a <u>typical day</u>, how much time do you spend in any **<u>activity-based lessons</u>** (such as batting practice, dance, gymnastics, martial arts, etc)?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

8. During a <u>typical day</u>, how much time do you spend **<u>Fitness Walking, Bicycling or Jogging</u>** during free time?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

9. During a <u>typical day</u>, how much time do you **<u>Skate, Skateboard or Rollerblade</u>** during your free time?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

10. During a <u>typical day</u>, how much time do you spend **<u>Lifting weights</u>** during your free time?

None	15 - 30 minutes.	31 minutes to 1 hour.	Between 1 - 2 hours.	Between 2 - 3 hours.	More than 3 hours.

11. During the past <u>7-day week</u>, how many **<u>DAYS</u>** do you think you did <u>any combination of physical activities</u> for a **<u>TOTAL of one hour or more per day</u>**?

0 days	1 day	2 days	3 days	4 days	5 days	6 days	7days

12. Do any of the following reasons <u>prevent</u> you from doing physical activities more often?

☐Cost of membership fees ☐Embarrassment/Lack of confidence

☐I don't like to exercise

☐Lack of motivation/interest ☐Part-time job or chores at home

☐Lack of transportation

☐Lack of safe places to exercise ☐Heavy homework load/lack of time

☐Discouragement from others

☐No friends who exercise ☐Bad weather ☐Any other reasons?

13. **Which of the following BEST describes you right now? (Please choose <u>only one</u>)**

☐ I **<u>do not plan to decrease</u>** my "screen time" (playing non-active computer games and/or video games and/or watching TV) <u>anytime in the future</u>.

☐ <u>Sometime in the next 6 months</u>, **<u>I am thinking about decreasing</u>** my "screen time" (playing non-active computer and/or video games and/or watching TV).

☐ <u>Sometime in the next 30 days</u>**, <u>I am seriously planning to decrease</u>** my "screen time" (playing non-active computer and/or video games and/or watching TV).

☐ *I* am **<u>currently working on</u>** decreasing my "screen time" (the total time I spend playing non-active computer games and/or video games and/or watching TV).

☐ *I* **<u>have already decreased</u>** my "screen time" (playing non-active computer games and/or video games and/or watching TV) and I <u>have been doing so for over 6 months</u>.

14. Which of the following are your **<u>top three most important factors</u>** when choosing a snack to eat?

(**A "<u>Snack"</u> is any food eaten separately from a "Meal.")** (**Please rank them #1, #2, and #3)**

□Cost of the snack. □Nutrition content. □Taste of the snack. □Convenience/Easy to prepare

□The mood I'm in. □Friends are having it. □ I'm craving it.

□Size of package/portion size. □ How hungry I am. □Appearance of snack. □Because it's available. □Other? _____

15. How often do you buy a snack from a **<u>vending machine or a convenience store (like Huck's or Casey's)</u>**?

□ Every day □ 2-4 times/week □ Once a week □ 2-3 times/month □ Rarely/Never

16. When choosing a packaged snack, how often do you **<u>look at the "Nutrition Facts" section</u>** on food labels?

□ Never □ Rarely □ Sometimes □ Almost Always □ Every time

17. When choosing a packaged snack, how often do you **<u>choose "sugar-free" or "fat-free" or "diet" snacks</u>** on purpose?

□ Never □ Rarely □ Sometimes □ Almost Always □ Every time

18. How often do you think about **portion size** when deciding the amount of snack to eat?
□ Never □ Rarely □ Sometimes □ Almost Always □ Every time

19. How many snacks do you have during a typical school day?
Circle one: **0 1 2 3 4 5 6 7+**

20. **During a typical school day**, how many **½ cup servings of FRUIT** do you eat including canned fruit, 100% fruit juice, and fresh fruit? (Please see examples of serving sizes)

Circle one: **0 1 2 3 4 5 6 7+**

21. How many of these fruit servings are eaten as a "snack"?

Circle one: **0 1 2 3 4 5 6 7+**
Reminder: A "Snack" is any food eaten separately from a "Meal."

22. **During a typical school day**, how many **½ cup servings of VEGETABLES** do you eat including canned, cooked and raw leafy vegetables? (See examples of serving sizes)

Circle one: **0 1 2 3 4 5 6 7+**

23. How many of these vegetable servings are eaten as a "snack"?

Circle one: **0 1 2 3 4 5 6 7+**
Reminder: A "Snack" is any food eaten separately from a "Meal."

24. During a typical 5-day school week, how often do you **eat the school lunch**?
□ O days □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days

25. During a typical 5-day school week, how often do you **bring your lunch** from home to eat at school?
□ O days □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days

26. During a typical 5-day school week, how many days do you **Buy lunch at a fast food restaurant**?
□ O days □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days

Your name: "R. U. A. Healthy Kid?"

During a <u>TYPICAL 7-day WEEK</u>, please put an "X" next to <u>HOW OFTEN</u> you eat of each of the following foods:

	<u>DAILY/ OFTEN</u> (3-7 times per WEEK)	**<u>SOMETIMES</u>** (1-2 times per WEEK)	**<u>RARELY</u>** (1-3 times per MONTH)	**<u>NEVER</u>**
27. POTATO CHIPS				
28. TORTILLA CHIPS (ex: Doritos)				
29. FRESH VEGGIES				
30. FRESH FRUIT				
SNACK CAKES or PIES				
32. DONUTS or SWEET ROLLS				
33. CAKE				
34. YOGURT CUP (any flavor)				
35. FRUIT CUP (any type)				
36. FRENCH FRIES				
37. LOWER-FAT POPCORN				
38. NUTS (PEANUTS, ALMONDS, etc)				
39. CEREAL BAR/ PROTEIN BAR				
40. TRAIL MIX				
41. CHOCOLATE CANDY				
42. HARD or CHEWY CANDY				
43. COOKIES				
44. ICE CREAM				
45. CHEESE STICK or CUBES				
46. SOY MILK (any flavor)				
47. SOY NUTS (any flavor)				
48. REGULAR SODA POP				
49. DIET SODA POP				
50. WATER				
51. COFFEE (Black)				
52. CAPPUCCINO, etc.				
53. VITAMIN D WHOLE MILK				
54. 2% (LOW-FAT) MILK				
55. FAT-FREE (skim) or 1% MILK				
56. 100% FRUIT JUICE (any type)				
57. FRUIT DRINKS (ex: Kool-Aid)				
58.ENERGY DRINKS				

59. During a typical 7-day week, which of these is the most common reason you *decide to eat something*?

☐Because it's available. ☐Because I feel hungry. ☐Because it is time to eat. ☐Because my friends are.

60. During a typical 7-day week, which of these is the most common reason you *decide to stop eating*?

☐ I finished my food. ☐ I feel "full" or satisfied. ☐ My friends stopped. ☐ I ran out of time.

61. During a typical 7-day week, how many days do you **Eat Breakfast** (either at home or at school)?

□ O days □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days □ 6 days □ 7 days

62. During a typical 7-day week, how often do you **Eat supper at a fast-food restaurant with all or most of your family**?

□ O days □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days □ 6 days □ 7 days

63. During a typical 7-day week, how often do you **Eat supper at home with all or most of your family**?

□ O days (=skip to Q#66) □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days □ 6 days □ 7 days

64. During a typical 7-day week, how often do **YOU help prepare these "family meals" at home**?

□ O days □ 1 day □ 2 days □ 3 days □ 4 days □ 5 days □ 6 days □ 7 days

65. How often is the **Television on** during these "family meals" at home?

☐ Never ☐ Sometimes ☐ Almost Always

66. How often do you **enjoy eating meals together** as a family?

☐ Never ☐ Sometimes ☐ Almost Always

67. How often do **scheduling problems keep you from eating together** as a family?

☐ Never ☐ Sometimes ☐ Almost Always

68. How often do you **wish that your family could eat more meals together**?

☐ Never ☐ Sometimes ☐ Almost Always

69. **Which one of the following statements BEST describes your family right now (Please choose only ONE):**

☐ *We* **do not plan to eat more** meals together as a family anytime in the future.

☐ Sometime in the next 6 months, we are **thinking about eating more** meals together as a family.

☐ Sometime in the next 30 days, we are **seriously planning to eat more** meals together as a family.

☐ *We are* **currently working on** eating more meals together as a family.

☐ *We* **already eat most meals together** as a family and have been doing so for over6 months.

"Healthy snacks" are foods that are lower in fat, salt, and added sugars and contains one or more important nutrients, such as vitamins, minerals or fiber. Examples are: fruits, vegetables, nuts, lower-fat popcorn, cheese sticks, etc.
"Junk Food" snacks are high in calories, fat, and/or sugar and do not contain key nutrients. Examples are: potato chips, cheese puffs, Doritos, soda pop, cookies, hard candy, chocolate, and snack cakes…

70. Do any of the following **prevent you from eating "healthy snacks"** more often? (Check all that apply)

□ We usually don't have any "healthy snacks" at home.
□ It's easy for me to get "junk food" snacks at home.
□ I don't like the taste of "healthy snacks."
□ I don't like the appearance or texture of "healthy snacks."
□ I don't care about choosing "healthy snacks."
□ I prefer "junk foods" as snacks.
□ My family members don't like "healthy snacks" (they prefer "junk foods" as snacks).
□ My friends don't like "healthy snacks" (they prefer "junk foods" as snacks).
□ I don't know how to find "healthy snacks" at grocery stores or convenience stores or gas stations.
□ TV ads make "junk foods" seem cool and the ads make me want to eat "junk foods."

71. Which one of the following describes you BEST right now? (Please choose only ONE)

☐ I **do not plan to increase** my intake of "healthy snacks" anytime in the future.

☐ Sometime in the next 6 months, I am **thinking about increasing** my intake of "healthy snacks."

☐ Sometime in the next 30 days, I am **seriously planning to increase** my intake of "healthy snacks."

☐ *I am* **currently working on increasing** my intake of "healthy snacks."

☐ *I* **have already increased** my intake of "healthy snacks" and have been doing so for over 6 months.

72. Do you have any concerns about your eating habits or exercise patterns? ☐Yes ☐No

73. Are you currently trying to lose weight? …….. ☐Yes ☐No
(if no, skip to Q#75)

74. If yes, are you trying to avoid certain foods? …….. ☐Yes ☐No

75. How often do you weigh yourself on a scale?

☐Never ☐Once a year ☐Once a month ☐Once a week ☐Every other day
☐Every day

76. Which of these statements best describes you:

☐"I like what I weigh now." ☐"I would like to weigh more." ☐"I would like to weigh less."

77. During the past month, how often did **someone tell you that you need to lose weight**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely/Never (=skip to Q#79

78. If so, **WHO** told you that you need to lose weight? ☐ Doctor ☐ Classmate/friend

☐Parent ☐Brother/sister ☐Other relative ☐ Other person?

79. During the past month, how often did you **feel good about the way you look**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

80. During the past month, how often did **someone tease you about the way you look**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

81. During the past month, how often were you encouraged by an adult to **eat everything on your plate**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

82. During the past month, how often did you **wait until you felt hungry before you ate**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

83. During the past month, how often did you **eat a lot more than usual when you didn't feel hungry**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

84. During the past month, how often did you **eat until you felt uncomfortably full**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

85. During the past month, how often did you **feel like you were not aware of how much you were eating**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

86. During the past month, how often did you **try to hide while eating or hide food wrappers after eating**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

87. During the past month, how often did you **feel disgusted, depressed, and/or guilty after eating**?

☐ Every day ☐ 2-4 times/week ☐ Once a week ☐ 1-3 times/month

☐ Rarely / Never

88. **Which one of the following statements BEST describes you right now (please choose only ONE):**

☐*I* **do not plan to work on improving** how I feel about myself or my body anytime in the future.

☐Sometime in the next 6 months, I am **thinking about improving** how I feel about myself and my body.

☐Sometime in the next 30 days, I am **seriously planning *to* improve** how I feel about myself and my body.

☐*I* **am currently working *on* improving** how I feel about myself (self-esteem) and my body (body image).

☐I **have already improved** how I feel about myself and my body and have been doing so for over 6 months.

89. I want to be the best at everything I do. ☐ Never ☐ Sometimes ☐ Almost Always

90. I get mad at myself when I make a mistake. ☐ Never ☐ Sometimes ☐ Almost Always

91. People expect me to be great at everything. ☐ Never ☐ Sometimes ☐ Almost Always

92. I always try for the top score on a test. ☐ Never ☐ Sometimes ☐ Almost Always

93. My family expects me to be perfect. ☐ Never ☐ Sometimes ☐ Almost Always

94. My coach expects me to be perfect. ☐ Never ☐ Sometimes ☐ Almost Always

95. I feel people ask too much of me. ☐ Never ☐ Sometimes ☐ Almost Always

96. When I do something, it has to be perfect. ☐ Never ☐ Sometimes ☐ Almost Always

97. My teachers expect my work to be perfect. ☐ Never ☐ Sometimes ☐ Almost Always

98. I try to keep my faults to myself. ☐ Never ☐ Sometimes ☐ Almost Always

99. It is important that I appear to be perfect. ☐ Never ☐ Sometimes ☐ Almost Always

100. Please rate your current stress level from 1 to 5 where

1= "I have no stress at all"
2= "I have some stress, but it doesn't affect me at school or home"
3= "I have stress that causes me to think about my problems all the time"
4= "I have so much stress that it wakes me up at night or I have trouble sleeping"
5= "I have so much stress I can't stand it"

Your current stress level= ____

101. **When you feel stressed**, which of the following areas do you typically get stressed about?

☐Friends ☐School ☐Lack of time ☐Boyfriend/Girlfriend ☐My eating habits ☐Money issues

☐Work issues ☐Family issues ☐My weight/body issues ☐Other reasons? _____

102. When you feel stressed, how do you "deal with" your stress? (Please check all that apply):

□Text, talk or IM with a friend □Text, talk or IM with an adult □Go to sleep
□Listen to music □Do some exercise □Scream/yell
□Pray or meditate □Eat more than usual □Watch TV/movies
□Withdraw and just go through the motions □Ask for a hug
□Joke about it or use humor □Read something □Play video or computer games
□Write in a journal or diary □Play with my pet □Try to eat better so I will feel better
□Get irritable and take it out on others □Take time to relax, breathe and unwind
□Ignore my problem and hope it goes away □Worry about my problem
□Try to focus on things I can control and accept things I can't control
□Other? _____

"Emotional Eating" is when we use food to *comfort* ourselves, *numb* ourselves or *distract* ourselves from how we are really feeling. It is whenever we eat something even though we don't really feel hungry…

103. **In the past month, how often did you do some "Emotional Eating"?**

☐Every day ☐2-4 times/week ☐Once a week ☐1-3 times/month
☐Rarely / Never

104. What is the most important thing you learned about yourself by completing these forms?

APPENDIX F

Snacking Score

Participant	"Unhealthy"	"Healthy"	Total
Participant 1	-16.0	25.0	9.0
Participant 2	-27.0	27.0	0.0
Participant 3	-32.0	20.0	-12.0
Participant 4	-18.0	19.0	1.0
Participant 5	-11.0	11.0	0.0
Participant 6	-19.0	23.0	4.0
Participant 7	-18.0	28.0	10.0
Participant 8	-12.0	22.0	10.0
Participant 9	-23.0	16.0	-7.0
Participant 10	-34.0	10.0	-24.0
Participant 11	-21.0	23.0	2.0
Participant 12	-15.0	25.0	10.0
Participant 13	-15.0	23.0	8.0
Participant 14	-14.0	32.0	18.0
Participant 15	-21.0	23.0	2.0
Participant 16	-16.0	25.0	9.0

VITA

Graduate School
Southern Illinois University

Cassidy M. Scoggins Date of Birth: June 9, 1985

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Southern Illinois University Carbondale
Bachelor of Science, Food and Nutrition, May 2007

Thesis Title:
The Effects of a Community-Based Lifestyle Intervention on Snacking Patterns, Screen Time Patterns, and Physical Activity Levels Among Adolescents Who Are At - Risk for Type 2 Diabetes Mellitus

Major Professor: Dr. Sharon Peterson