

1-1-2009

Differences in Food Intake, Nutrition Knowledge, and Fitness Assessment Measurements in High School Students Who Have Completed the Nutricise 4 Life Program and Students Who Have Not

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Differences in Food Intake, Nutrition Knowledge, and Fitness Assessment Measurements in
High School Students Who Have Completed the Nutricise 4 Life Program and Students Who
Have Not

by

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Thesis

Submitted to the School of Health Sciences
Dietetics and Human Nutrition Program

Eastern Michigan University

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Human Nutrition with a concentration in Prevention

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ABSTRACT

The Nutricise 4 Life Program (N4L) is a school-based physical activity and nutrition education program for adolescents. It was hypothesized that dietary intake, nutrition knowledge, fitness assessment measurements and motivation/confidence to make healthier lifestyle choices would be improved in students participating in the N4L group compared to a control group. Twenty-eight students in 10th to 12th grade from 2 high schools in Pennsylvania participated. This quasi-experimental trial collected data over 19 weeks to assess program impact on dietary intake, nutrition knowledge, fitness assessment measurements, and motivation/confidence levels. The N4L group saw no improvements in dietary intake. Students in the intervention group demonstrated significant increases in nutrition knowledge. Likewise, body fat percentage was decreased in the intervention group. Participants perceived a positive program impact on their physical activity and eating patterns.

The N4L program was favorably received by students and indicated a feasible approach to educate students to make healthier decisions regarding nutrition and physical activity.

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Chapter 1: Introduction and Background

Introduction

The incidence of childhood obesity is rapidly rising throughout the world. The obesity epidemic is especially evident in industrialized nations where many people live sedentary lives and eat more convenience foods, which are typically high in calories and low in nutritional value. Data from NHANES surveys (1976–1980 and 2003–2006) show that the prevalence of obesity—defined as a Body Mass Index (BMI) at or above the 95th percentile on gender-specific BMI-for-age growth charts (CDC, 2007) has increased: for children aged 2–5 years, prevalence increased from 5.0% to 12.4%; for those aged 6–11 years, prevalence increased from 6.5% to 17.0%; and for those aged 12–19 years, prevalence increased from 5.0% to 17.6%. Thus in 2003–2006, more than one third of U.S. children aged 6–11 and more than one in three adolescents aged 12–19 were overweight or at risk of becoming overweight (Ogden et al., 2006). In total, about 25 million U.S. children and adolescents are overweight or nearly overweight (CDC, 2007).

The development and reinforcement of healthy diets, physical activity, and other healthy behaviors that prevent or decrease the incidence of obesity are paramount during the childhood and adolescent years. Promotion of these behaviors has become an important public health initiative as the number of children who are overweight and obese continues to increase. Schools are a critical part of the social environment that shape children's eating habits.

Causes of childhood obesity. Body weight is regulated by numerous physiological mechanisms that maintain balance between energy intake and energy expenditure. Any factor that raises energy intake or decreases energy expenditure will cause weight gain. These factors that may play a role in raising energy intake and decreasing energy expenditure whether directly or

indirectly include endocrinological or neurological syndromes, genetics, maternal nutrition status, feeding practices during infancy and childhood, diet, exercise, socioeconomic status, education level, race/ethnicity, and the breakdown of the family unit. Most health professionals would agree, however, that the incidence of childhood obesity is multifactorial, with both genetic and lifestyle factors contributing to its development.

Although certain endocrinological or neurological syndromes, including Prader Willi, Klinefelter's, Frohlich's, Lawrence Mood Biedl, Klein-Levin, and Mauriac syndromes, can lead to overweight, these syndromes are often tested for in children who are obese. Less than 5 percent of obesity cases result from these "endogenous" factors (Anderson & Butcher, 2006). In recent years genetic mutations have been found that have been linked to human obesity, all of which are present in childhood (Ebbeling, Pawlak, & Ludwig, 2002). Identical twins raised apart, for example, have been found to have a correlation in BMI of about 0.7, only slightly lower than that of twins raised together (Stunkard, Harris, Pedersen, & McClearn, 1990). It does appear that certain people may have higher genetic susceptibility to weight gain than others.

Other causes of childhood obesity may stem from maternal nutritional status. It seems that both undernutrition and overnutrition during important stages of fetal development can induce permanent physiological changes such as appetite, neuroendocrine functioning, and energy metabolism that results in obesity (Levin & Govek, 1998). Not being breastfed as an infant is another repeatedly analyzed characteristic found in childhood obesity. Many cross-sectional studies have found that older children are more likely to be lean if they were breast-fed (Anderson & Butcher, 2006). The mechanism is not certain but one possibility is an endocrine

response to breast milk. Another is that mothers have greater discretion over how much they feed when they bottle-feed. Breast-feeding may even affect future food preferences.

Infants and very young children seem capable of adjusting their intake to match their outflow, but as children grow up they seem to lose this apparently innate ability. Their food intake, rather than being based on energy needs, is influenced by external cues such as the amount of food present (Satter, 2000). Much research on childhood obesity focuses on the role of energy intake. The dietary patterns of children and adolescent teenagers have been found to be inadequate to meet the recommendations for good health, as they contain a large amount of snack food products that are high in sugar or fat and a low amount of disease-preventing food, such as fruits and vegetables. It is noted that life-long dietary preferences are formed based on the eating patterns that are established in youth (Satter, 2000). Diet is also one of the most potent tools for the prevention of certain types of cancer (US Department of Health and Human Services, 2005; Willett, 2001) and reversing non-communicable diseases, such as diabetes, and improving cancer survival (National Institute of Health, 2005). Certain sources of energy have been studied that show possible associations between their intake and obesity including fast food, sweetened beverages, and high-calorie snacks (National Institute of Health, 2005).

Furthermore, on the other end of the energy balance equation, children are not expending enough energy. However, studies performed on obesity and physical activity have had mixed results. One reason for this is because BMI may not be an accurate measure of one's adiposity in the presences of lean muscle mass. Regardless, children today are extremely sedentary. According to the American Academy of Pediatrics (2001), children spend an average

of 4 hours watching television daily. Less active children are more likely to be overweight and to have high blood pressure, higher insulin and cholesterol concentrations, and more abnormal lipid profiles (Freedman, Dietz, Srinivasan, & Berenson, 1999).

Although most of the research on causes of childhood obesity focus on factors that are expected to affect either the child's energy intake or energy expenditure, there are other characteristics that are correlated with overweight but do not fit into the energy balance equation. Children from certain demographic groups are more likely to be overweight than other children. African American and Hispanic lower-income children have a higher incidence of obesity than children overall (CDC, 2007). There is also a negative relationship between income and rates of overweight among Whites (CDC, 2007).

Overall, research on obesity does not single out one critical cause for the recent surge in childhood obesity. It seems many factors can upset the crucial energy balance by simultaneously increasing children's energy intake and decreasing energy expenditure.

Consequences of childhood obesity. As the prevalence and severity of childhood obesity increase, concern about adverse health outcomes in childhood and adolescence is rising. Childhood obesity is a multisystem disease with potentially life-threatening consequences. Overweight children are at higher risk for developing type 2 diabetes, hypertension, dyslipidemia, chronic inflammation, metabolic syndrome, insulin resistance, asthma, sleep apnea and depression/eating disorders (Ebbeling, Pawlak, & Ludwig, 2002).

Until recently, most medical concerns about children's hearts involved birth defects. But as advances in testing have made it possible to evaluate children's hearts and blood vessels, health professionals have discovered that some disease processes, such as hardening of the

arteries, once thought to be predominantly adult health concerns can in fact begin in childhood. One of the most significant risk factors for developing cardiovascular disease is hardening of the arteries, or atherosclerosis. In children, recent studies have shown that adiposity (fat) was significantly related to the presence of atherosclerotic lesions (Daniels, 2006). Furthermore, cholesterol abnormalities that involve abnormal changes in cholesterol and triglycerides in the blood appear to accelerate atherosclerosis in obese children and adults (NCEP Adult Treatment Panel III, 2002). A major risk factor for heart attack and stroke in adults is hypertension, or high blood pressure, and obesity is an important contributor to developing high blood pressure not only in adults, but also in children and adolescents (Daniels, 2006). The odds of elevated blood pressure are significantly higher for children whose body mass index (BMI) is at or above the 90th percentile than for those with a BMI at or below the 10th percentile. The risk of elevated blood pressure ranges from 2.5 to 3.7 times higher for the overweight children, depending on their race and gender (Rosner, Prineas, Daniels, & Loggie, 2000).

Many metabolic disorders—among them insulin resistance, the metabolic syndrome, and type 2 diabetes—have also been linked with obesity in childhood and adolescents. Insulin resistance, the process in which the action of insulin is blocked, often occurs in the context of obesity and results in increased insulin secretion by the pancreas and increased circulating levels of insulin. Increased circulating insulin may in turn raise blood pressure and cholesterol levels (Daniels, 2006). The metabolic syndrome, which is a cluster of risk factors that include a high BMI (males $>29 \text{ kg/m}^2$, females $>25 \text{ kg/m}^2$), high glucose ($>110 \text{ mg/dL}$), high triglycerides ($>150 \text{ mg/dL}$), low high density lipoprotein cholesterol (males $<40 \text{ mg/dL}$, females $<50 \text{ mg/dL}$), and hypertension (blood pressure $>130/85 \text{ mmHg}$), is likely associated with

increased risk of cardiovascular disease and diabetes in young people (Sothorn, Gordon, & von Almen, 2006). Type 2 diabetes, once virtually unrecognized in adolescents, now accounts for as many as half of all new diagnoses of diabetes in some populations (Sothorn et al., 2006). This condition is almost entirely attributable to the childhood obesity epidemic. It is so recent that long-term follow-up studies are not available to determine outcome, but most experts are fearful that complications of this epidemic will be formidable (Sothorn et al., 2006). The increased prevalence of type 2 diabetes also raises concern about cardiovascular disease risk. The National Cholesterol Education Program has identified diabetes as a coronary artery disease risk equivalent, meaning that patients with diabetes face a similar risk for a future adverse cardiovascular event as patients who have already had a heart attack or stroke (NCEP Adult Treatment Panel III, 2002).

The prevalence and severity of childhood asthma have increased in the past two decades, again in parallel with the increased prevalence and severity of childhood obesity (Daniels, 2006). Studies have demonstrated a link between overweight and asthma in children due to a number a possible factors including increased inflammation, corticosteroid treatment, and the physical effect of excess adiposity on lung function (Stenius-Arniala et al., 2000). Obstructive sleep apnea, or the abnormal collapse of the airway during sleep, is clearly related to obesity in both adults and children. Sleep apnea can lead to excessive sleepiness, poor school performance, learning disabilities, and memory defects, along with possible long-term cardiovascular consequences (Daniels, 2006). Sleep disordered breathing may be one of the most important but also under-recognized medical complications in overweight children and adolescents.

The psychosocial consequences of childhood obesity are also alarming. Obese children are typically characterized as unhealthy, academically unsuccessful, socially inept, and lazy (Hill & Silver, 1995). Overweight children are at higher risk for exhibiting signs of low self-esteem, behavior and learning problems, and depression. Depression is probably one of the best studied psychological problems linked to obesity. Recent studies have documented that obese adolescents seeking treatment for their obesity have more depressive symptoms than community-based obese or non-obese control groups (Britz et al., 2000). Children often tease or bully their overweight peers, who suffer a loss of self-esteem and an increased risk of depression as a result. Overweight children tend to have more anxiety and poorer social skills than normal-weight children have (Britz et al., 2000). At one extreme, these problems may lead to acting out and disrupting the classroom. At the other, they may cause social withdrawal. School-related anxiety can create a vicious cycle in which ever-growing worry fuels ever-declining academic performance. Social isolation and low self-esteem create overwhelming feelings of hopelessness in some overweight children.

Of all the consequences related to obesity, perhaps the most important is the cost of the associated health problems discussed above. In a study that looked at cost and treatment of obesity among children covered by Medicaid compared to those covered by private health insurance, substantial disparities associated with different insurance coverage and health status were found (Thomson Medstat, 2005). Children covered by Medicaid are nearly six times more likely to be treated for a diagnosis of obesity than children covered by private insurance. Other findings showed children treated for obesity are roughly three times more expensive for the health system than the average insured child. Researchers found that the national cost of

childhood obesity is estimated at approximately \$11 billion for children with private insurance and \$3 billion for those with Medicaid. This increase in Medicaid will lead to further demands on public health care spending.

Statement of the Problem

With all of the negative consequences that are related to childhood obesity, it is clear that preventing obesity or dealing with obesity in the early stages of life is crucial. Adult obesity frequently originates during childhood (Dietz, 1994). Dietz has suggested that there are three critical periods for the development of overweight children. These include a) intrauterine environment or early infancy, b) 5 to 7 years of age (adiposity rebound), and c) adolescence. Approximately one third of overweight preschool children, one half of overweight school-age children, and three quarters of overweight teenagers grow up to be obese adults (Serdula et al., 1993). By adolescence, the future health for overweight children becomes dismal; a recent review indicated that the probability of adult obesity increases from 60% in overweight children 9 years of age to almost 80% in overweight 17-year-olds, highlighting the impact that intervention for obesity prevention in adolescents can have in preventing chronic disease in adulthood (Flynn et al., 2006).

Given the increased number of children who are overweight and the consequences associated with the long-term tracking of adiposity, it is critical to identify the most promising intervention strategies for preventing and treating childhood obesity. However, addressing childhood obesity is complex, and once obesity is established in a child it is difficult to treat. Although treatment approaches may be effective in the short-term, long-term studies indicate high rates of relapse after treatment. Until now, most approaches have focused on changing the

behavior of adult individuals on diet and exercise, and it seems that these strategies have little impact of the growing increase of the obesity epidemic. The National Institute of Health's (NIH) consensus statement indicated that adults who remain in conventional weight loss programs can realistically expect a maximum weight loss of only 10%. About half of this modest weight loss is regained within a year, and virtually all is regained in 5 years (Anon, 1993). Moreover, as more and more children are becoming obese, treatment needs are already outstripping treatment resources. Health insurance seldom covers the cost of counseling for obesity, particularly the extended treatment of a year or more, which is suggested to facilitate long-term weight loss (McTigue et al., 2003). Notwithstanding the compassionate need to treat established obesity in children and adolescents, few would argue that the only feasible and ultimately cost-effective approach for dealing with the problem is to prevent it from happening in the first place. Almost all public health researchers and clinicians agree that prevention could be the key strategy for controlling the current obesity epidemic. Prevention may include the primary prevention of overweight or obesity itself, secondary prevention or avoidance of weight regain following weight loss, and prevention of further weight increase in obese individuals unable to lose weight.

Although the rationale for targeting children and adolescents through primary prevention is now compelling, effective obesity prevention remains elusive, and there is no consensus about the optimal age to intervene at a population and what preventative measure need to be enacted (Livingstone, McCaffrey, & Rennie, 2006). This is probably due to the numerous factors that determine obesity including social, cultural, and economic factors.

Overall, there is only a limited body of consistent, high-quality evidence that can be drawn about the best practices for the prevention of childhood obesity (Livingstone et al., 2006).

The relative intellectual and psychological immaturity of children compared with adults and their susceptibility to peer pressure present additional practical obstacles to the successful treatment of childhood obesity. There is a strong prejudice against overweight people, and children as young as 4 years of age are aware of the social stigma that comes with being overweight (Flynn et al., 2006). Programs must be careful not to promote unhealthy slimming practices. Since adequate nutrition is essential during the younger years of life, it is important not to restrict overweight children in hopes of them consuming fewer calories to produce a weight loss. Close follow-up and monitoring should be used when this method is applied. Prolonged weight maintenance as opposed to weight loss is recommended for mildly overweight children (Flynn et al., 2006).

Public health strategies have often focused on the individual when promoting healthy food choices and physical activity. However, the problem of rising obesity does not appear to be owing to the lack of interest by the individuals in the population. In the US, research shows the majority of the population is actively trying to control their weight (Flynn et al., 2006). The environment in which these individuals make food choices on food consumption and engagement in physical activity is necessary to understand and tackle the problem. New concepts such as addressing chronic diseases along with weight management have been introduced. Programs involving four main healthy living strategies (physical activity, healthy eating, mental health, environmental change) have the potential to address obesity along with

chronic diseases such as cardiovascular disease, Type 2 diabetes, and cancer. This approach may be helpful due to scarce resources and enhanced access to marginalized populations.

Purpose of the Study

Due to the sudden increase in childhood/adolescent obesity, the Nutricise 4 Life (N4L) program was developed. This program was created five years ago but has still not been evaluated to determine its effectiveness on adolescent's food intake, fitness assessments measurements, and nutrition knowledge. This program was created when Southwestern School District in Hanover, Pennsylvania, saw a need for a more intensive and combined physical and nutrition education class intended for overweight/obese and "at-risk" students. Today, the N4L program is executed through collaborations between Hanover Hospital, the Hanover Medical Fitness Center, Southwestern School District, Hanover Public School District, and the Hanover Area YMCA in Hanover, Pennsylvania. The program is structured as a school-based physical education elective targeted towards overweight/obese or "at-risk" students in place of their traditional physical education class that is held off-site at various collaborating partner facilities. The coordinators of the programs were interested in determining if the education the students were receiving in the N4L program was increasing their knowledge on nutrition and/or leading them to make better food choices and/or improving their fitness assessment measurements.

Significance of the Study

Schools are a logical setting for implementing interventions aimed at preventing and controlling childhood and adolescent obesity. Children spend many hours in school; approximately 6 hours a day are spent in the school environment, 1-2 meals are consumed there, and resources such as school nurses and physical education programs are already in place. The

vast majority of schools nationwide participate in the National School Lunch Program and more than three quarters of these also offer the School Breakfast Program (Crepinsek & Fox, 2004). In recent years, policymakers have recognized the important role schools play in the effort to control and prevent childhood obesity by fostering healthy-lifestyles. In 2004, the federal legislation that reauthorized the National School Lunch Program and National School Breakfast Program required that all participating school districts establish a local wellness policy by the beginning of the 2006-2007 academic year. These wellness policies must include the following:

- 1) Goals for nutrition education, physical activity, and other school based-activities that are designed to promote student wellness;
- 2) Nutrition guidelines for all food available on each school campus during the school day;
- 3) Nutrition guidelines for reimbursable school meals;
- 4) A plan for measuring implementation of the local wellness policy, including designation of one or more persons with the responsibility that each school fulfills the policy; and
- 5) Community involvement in the wellness policy from parents, students, school board, school administrators, and school food authority (Child Nutrition, 2004).

The need for these policies makes it clear that schools will continue to be a preferred setting for interventions for preventing and treating childhood obesity. According to Dietz and Gortmaker (2001), “Coordinated school health programming provides a strong basis for implementing a range of effective school-based activities and environments to improve diet and increase physical activity.” Veugelers and Fitzgerald (2005) examined the effectiveness of school programs in preventing childhood obesity and concluded that “school-based healthy eating and physical activity programs provide a great opportunity to enhance the future health and well-being of children because they can reach almost all children and may (1) enhance learning and provide social benefits, (2) improve

health during critical periods of growth and maturation, (3) lower the risk for chronic diseases in adulthood, and (4) help to establish healthy behaviors at an early age that will lead to lifelong healthy habits.”

The success of nutrition and physical activity programs, interventions, and practices relies greatly on the methodological approaches and theoretical underpinnings that are utilized when implementing interventions aimed at preventing childhood obesity. Schools and school districts are diverse and pose unique challenges when adopting the “right” method of improving dietary habits, increasing physical activity, and enhancing overall healthy lifestyle behaviors. Comprehensive interventions necessitate evaluation models that measure appropriate outcomes. The CDC Guide to Community Preventative Services Task Force reviewed the evidence for the efficacy of school-based interventions in preventing and controlling obesity (Truman, Smith-Akin, & Hinman, 2000). The Task Force utilized comprehensive and explicit measures to increase the reliability and validity of literature reviews as a foundation for recommending models for implementation and recognizing those that require further research (Katz et al., 2005).

Physical education classes are an important channel through which important behavior change can be addressed. School-based interventions also have the potential for establishing healthy dietary and exercise patterns that may persist in adulthood and reduce risk of chronic disease. Schools are increasingly observing children with multiple obesity-related co morbidities including hypertension, type 2 diabetes mellitus, movement disorders, and asthma; these are likely to increase if changes are not made (Wabitsch, 2000). With obesity recently classified as a chronic disease and schools responsible for the well-being of chronically ill children, the

motivation for obesity prevention and treatment interventions is urgently needed. It is clear that schools are and will continue to be a logical site for interventions aimed at controlling and preventing childhood obesity.

What is not clear, however, is how these interventions should be structured and implemented to achieve maximum effect. Recent reviews indicate that the existing body of research on the effectiveness of school-based interventions to prevent or reduce obesity is surprisingly small and provides limited evidence on which to base recommendations (Flynn et al, 2006). However, the Institute of Medicine (IOM) Committee on Prevention of Obesity in Children and Youth (2004) concluded that the problem of childhood obesity is so severe that immediate actions are warranted, “based on the best available evidence—as opposed to waiting for the best possible evidence.” Most obesity intervention trials have focused on younger school-aged children. Because of the lack of evidence, a recent systematic review of what works for obesity treatment and prevention concluded that treatment and prevention studies with adolescents are urgently needed (Budd & Volpe, 2006).

There are many reasons why adolescent obesity prevention is warranted. First, overweight status in adolescence tracks closely with adult overweight and with obesity associated morbidity (Isganaitis & Levitsky, 2008). In addition, adolescents have greater cognitive abilities than younger children, which may increase the likelihood that nutrition education will actually change their behavior. Classroom programming must provide behavior modification strategies, such as goal-setting, self-monitoring, and stimulus control to help students and their families learn how to reduce the amount of fast food, sugar drinks, and high-fat food in addition to increasing fruit and vegetable consumption. Along with those components, obesity prevention

interventions must be tailored to the age of the student. The CDC Guide to Community Preventative Services Task Force and the American Dietetic Association concluded that school-based interventions should be multi-component in nature and address nutrition, physical activity, and sedentary behavior (Committee on Prevention of Obesity in Children and Youth, 2004). The task force also states, “When planning future school-based interventions it is important to realize that schools are faced with multiple curriculum mandates and limited financial and staff resources.” Developing and implementing a program that takes into account the above considerations is more likely to be successful in seeing behavior changes in eating and physical habits in children and adolescents.

Chapter 2: Review of Related Literature

The accessible literature included electronic resources. The criteria for inclusion for these studies was a) publication between 1999 and 2008; b) publication in the English language; c) program involved children aged 13 to 18 years in secondary school (middle school or high school); d) school-based curriculum programs for obesity prevention; and e) manipulation of at least dietary habits or both dietary habits and physical activity, healthy lifestyle education, and/or parental involvement.

All of the studies were found through online computer searches utilizing the Eastern Michigan University Library Database System and included databases from PUBMED, CINAHL, and Health and Wellness Resources Center. The following key words were used: childhood, adolescents, obesity, schools, interventions, nutrition, physical activity, programs, and education. In all, ten research studies on school-based interventions for adolescents were found that meet the criteria for inclusion and will be discussed within the remainder of this chapter.

Food on the Run (FOR) is a multi-component, high school-based intervention program to promote healthful eating and physical activity among adolescents. FOR is organized by California Project LEAN (Leaders Encouraging Activity and Nutrition), a program of the California Department of Health Institute. FOR's mission is to increase healthful eating and physical activity among teens as a way to improve health and reduce the risk of chronic disease (Agron, Takada, & Purcell, 2002). Each FOR site recruited students to participate in the FOR program. There were 220 student advocates from 20 high schools who participated in the FOR program during the 1999 project year. The average age of the student was 16 years old and average grade level was tenth grade. Of the students studied, 30% were boys and 70% were girls;

37% were White, 10% were African American, 31% were Hispanic American, 13% were Asian American, 2% were Native American, and 5% were categorized as “other.”

The FOR program began with training for the student advocates, and during the training students learned the basics of nutrition and physical activity, as well as the steps necessary to create environmental and policy changes using materials provided to all school sites. Students were then asked to conduct 5-7 school-based activities to create awareness, educate others, and institute policy changes. Student advocates were given a survey before and after the program.

Overall the FOR program demonstrated success in its school-based nutrition and physical activity program. There was a significant increase in knowledge about positive attitudes towards physical activity ($P < .01$) and nutrition ($P < .05$). There was no significant change in physical activity behavior, but there was a significant change in healthful eating behavior ($P < .001$). Another observation was the correlation between nutrition and physical activity scores and the environment evaluation; there was also significant improvement in healthful food options offered to students at schools.

During the Health Promotion/Transtheoretical Model intervention, sixth, seventh and eighth grade low-income, culturally-diverse students from an urban middle school received four classroom interventions with the use of combined Health Promotion/Transtheoretical Model to control fat in the diet and increase physical activity (Freen et al., 2003). A control group of 57 students did not receive the education. For the total sample, female students composed 52% of the sample and male students 47% (1% missing demographic data). Fifty percent were African American, 20% Caucasian, 14% Hispanic, and 15% belonged to other races.

All classroom interventions took place during Family and Consumer Education (FACE) class. Students in both the control and intervention group completed the following instruments: demographic information, temptation scale to measure efficacy regarding dietary fat, decisional balance questionnaire to measure pros and cons regarding dietary fat consumption, low-fat diet stage of change instrument, access to low-fat food, Food Habits questionnaire, and Child and Adolescent Activity Log (CAAL). Data were collected by giving a paper-and-pencil test at the beginning and end of the study period. The primary strategy for the 45-minute classroom interventions was consciousness raising and self-reevaluation, because the majority of the students were in the pre-contemplation or contemplation stage of change. Classroom intervention incorporated multiple instructional methods, content to increase knowledge, and peer modeling of skills related to decreasing fat content and increasing physical activity. Separate, smaller group sessions were held for students in the preparation, action, and maintenance stages of change.

There were no significant differences ($P < .05$) in any of the demographic variables or on the percentage fat in diet or duration of physical activity between the control group and intervention groups. Higher stage of change was inversely related to a diet higher in fat in the intervention group. Higher temptation (low self-efficacy) was positively related to consumption of high fat foods. The average percentage of fat in food ranged from 30.7% to 32.8%, with the intervention group increasing percentage of fat to a lesser extent than the control group. Duration of exercise was significantly higher for the intervention group than the control group after the intervention.

In summary, the authors concluded that when the Health Promotion/Transtheoretical Model interventions were used in the four classroom sessions, students had a significantly ($P < .05$) reduced trend toward choosing a diet higher in fat and increased duration of physical activity, as compared with the control group. These data were cross-sectional, so causality cannot be implied. Longitudinal studies are needed to determine whether further sessions might reduce the percentage of fat in this population to the 30% of calories recommended by the US Dietary Guideline for Americans.

A similar study to the one discussed above was conducted with 63 in the control group and 67 students in the intervention group at two urban, low-income middle schools (Freen, Malin, & Bansal, 2003). Those included in all the analyses were 58 African Americans, 47 Whites, 4 Hispanics, 9 Asians and 4 Native Americans. Participants ranged in age from 13 to 15; 90 students were in seventh grade, 33 in eighth grade; 56 students were boys and 68 girls.

A four session (Internet and video) intervention with healthy snacks and gym labs (gym lab in one school only) was tested during the 2000-2001 academic year. The purpose of the study was to examine improvement related to Healthy People 2010 objectives for a low-fat diet, and moderate and vigorous activity. Independent variables included stage of change, decisional balance, and access. Dependent variables included the Food Habits Questionnaire and the Child and Adolescent Activity Log (CAAL). Pre- and post-test data collection each lasted approximately 45 minutes. The intervention was conducted in four Internet sessions plus a health snack session and a gym class for approximately 50 minutes (six total sessions). Interventions were delivered in the classroom computer lab. Videos and Internet sessions

included topics on fat content in foods, the Food Guide Pyramid, parental involvement, physical activity, dining out, grocery shopping, and television viewing.

Results showed that differences in percentage fat intake between the intervention and control groups were not significant. Mean percentage fat intake was 32% for the control group and 31% for the intervention on both pre- and post-test. Both the control and intervention groups decreased their amount of moderate and vigorous activity, but the level of decrease in moderate and vigorous activity was less among the intervention group. The girls intervention group decreased their dietary fat in comparison with the control group ($P=.018$) for African Americans, White, Hispanics, and Native Americans. There was also an interaction effect for access to low fat foods among race, gender and group ($P = .036$). White, Hispanic, and Asian girls in the intervention group were shown to have greater access to low fat foods, but there was no difference in percent fat intake in these groups compared to those with less access.

Overall, the significant interactions demonstrated that the effect of the interventions varied from race to race and from boys to girls. Although the Healthy People 2010 target of less than 30% of calories from fat was not met in students who received the four Internet sessions and videos, additional sessions may prove beneficial.

The aim of the West-Belgium Middle School intervention was to evaluate the effects of a healthy food intervention in middle school students, combining changes in the school environment with nutrition education through interactive computer-tailored feedback (Haerens et al., 2006). This study was a randomized control trial that included 15 middle schools. The schools were randomly assigned to the intervention or control conditions: intervention with

parental support, intervention alone, and a control condition. The sample size was 2840 boys and girls ages 13-15 years within 15 schools.

Measurements were assessed at the beginning and end of the school year for the 2003-2004 academic year. Fat intake was measured with a self-administered questionnaire. A validated food-frequency questionnaire was used to assess fruit intake and a separate food-frequency questionnaire was used to assess consumption of water and soft drinks. Demographic factors were assessed using another questionnaire.

The healthy food intervention was designed for implementation by the school staff. A working group was composed of a principal, physical education teacher, and other involved teachers. The working group received background information and guidelines on how to address the intervention topic. The food intervention focused on three behavioral changes that were supported by environmental changes: 1) increasing fruit consumption to at least 2 pieces a day; 2) reducing soft drink consumption and increasing water consumption; 3) reducing fat intake. During classes, children received the computer-tailored interventions for fat intake and fruit intake. Teachers were also encouraged to organize activities like healthy breakfast and educational games.

Result showed at baseline, 69% of the children exceeded the fat intake recommendations, and, on average, 85% did not meet the fruit intake recommendations. Children reported to drink on average 3 glasses of soft drinks each day. The intervention was not effective in increasing self-reported fruit intake and water consumption, and no positive intervention effects of soft drinks consumption were found. Gender did have an effect on fat intake and percentage of energy from fat; the intervention was effective only in girls and not in

boys. The authors concluded that a combination of personalized interventions with environmental changes and parental support is essential to access positive intervention effects.

The PATH program sought to assess the effects of a school-based intervention program on cardiovascular disease risk factors in urban girls (Bayne-Smith, Fardy, Azzollini, Magel, Schmitz, & Agin, 2004). The program compared heart health knowledge, health behaviors, cardiovascular risk factors, and physical fitness among a group of 442 multiethnic teenage girls (310 experimental participants vs. 132 control participants) 14 to 19 years of age. The PATH program was established in 3 New York City high schools representative of the demographic and racial/ethnic composition of Queens County. The race ethnicity of the study participants was 10% White, 46% African American, 29% Hispanic, and 15% Asian Americans.

In year one of the study, individual girls were assigned to experimental classes (PATH) or traditional physical education classes (PED) consisting of volleyball, basketball, and other sport activities. The PATH curriculum was taught as a personal wellness course that integrated vigorous exercise with lectures and discussions on diet, exercise, stress, and smoking. The PATH program consisted of 30-minute classes conducted 5 days per week for 12 weeks. Selected physical and physiological data, including height, weight, body mass index (BMI), percentage body fat, resting systolic and diastolic blood pressure, total serum cholesterol, and estimated maximum oxygen uptake, were recorded at the beginning and end of the study for each participant. Self-administered anonymous questionnaires were completed by participants before and after the intervention. Questionnaires obtained information on age, ethnicity, heart-health knowledge, self-perception of health, non-school related physical activity, dietary habits,

breakfast eating habits, socioeconomic status, and family history of cardiovascular disease and risk factors.

Compared with the control participants, PATH participants had slightly higher self-perception of health ($P < .05$) and slightly lower socioeconomic status. Mean changes in PATH versus PED physiological measures were significant for percentage of body fat, systolic blood pressure, and diastolic blood pressure. Mean difference in BMI, total serum cholesterol, and estimated maximum oxygen uptake were not significant. Significant differences in heart-health knowledge and eating breakfast were observed between PATH and PED participants. Analysis of other lifestyle measure revealed no significant differences between mean change scores for self-perception of health, out-of-school physical activity, and dietary habits. A positive outcome of PATH is that students appeared to enjoy the nontraditional approach to wellness reflected by personal observation from the instructors. The authors suggest that school-based programs of health promotion and personal wellness significantly improve heart health knowledge, eating habits, percentage body fat, and blood pressure in multiethnic teenage girls.

The El Camino Diabetes Prevention project reported the results of a school-based intervention in a predominantly Dominican middle school in New York City (Rosenbaum et al, 2007). Seventy-three students completed the study, and demographics of those students were not significantly different from those of the class as a whole. All subjects represented the first or second generation of their family in the United States and identified themselves as having origins in the Dominican Republic. One class of 24 students was randomly selected as the control group and did not receive the intervention. Family and medical histories were obtained and testing was performed at school once in December and again in early April. Height, weight, and percent

body fat were measured. Blood was drawn for concentrations of insulin, glucose, CRP, IL-6, TNF- α , ACRP30, cholesterol, triglycerides, and cholesterol subfractions.

The classroom intervention was integrated into the regular science programs and was taught by investigators. Classroom sessions were 45 minutes in duration and offered once per week. Session topics on nutrition education included lowering fat, decreasing consumption of sweetened sodas and juices, fast food consumption, and encouragement to share information with parents. The exercise program used in this study was designed by investigators and physical education teachers. All exercise sessions were supervised and consisted of dance/noncontact kickboxing that was offered three times per week.

The investigators demonstrated that after the intervention, body fat, body mass index, and C-reactive protein decreased, and insulin sensitivity increased in experimental compared with control subjects and in experimental subjects compared with themselves before the intervention. BMI and body fat percentage were significantly higher in the group of students who participated in both the classroom and exercise instruction. No statistically significant differences between groups were noted in the effects of the intervention on T2DM risk factors, and attendance was not a significant covariate of the overall participation in the intervention. Of interest, there was no statistically significant difference between students who participated in the exercise sessions and those who participated in the classroom alone, although improvements in all measures were generally greater in the former group. These data suggest the beneficial and additive effects of the lifestyle and exercise intervention on diabetes risk.

The New Moves program studied the feasibility of an innovative school-based program for obesity prevention among adolescent girls (Neumark-Sztainer, Story, Hannan, Stat, & Rex,

2003). The overall aims of New Moves were to bring about positive changes in physical activity and eating behaviors for weight loss/maintenance, to help girls avoid unhealthy weight control behaviors, and to help girls function in a thin-oriented society and feel good about themselves. In order to achieve these aims, New Moves integrated concepts and teaching strategies from both the obesity and eating disorder prevention fields.

New Moves was implemented as a multi-component, girls-only, high-school physical education class. Six schools were equally randomized into intervention and control conditions. Data were collected at baseline, post-intervention (16 weeks), and 8-month follow-up to assess program impact on physical activity, eating patterns, self-perceptions, and body mass index (BMI) among 89 girls in the intervention and 112 girls in the control conditions. Overweight and normal weight girls “at risk” for becoming overweight were included. The majority of the girls were in 9th and 10th grade. Participants came from diverse ethnic backgrounds although there were a higher percentage of White girls in the intervention group and a higher percentage of Asian-Americans in the control group.

New Moves was offered as a girls-only physical education program alternative that girls took for credit. The main component of the program included physical activity four times per week and nutrition and social support classes that were offered every other week on alternating weeks throughout a 16-week semester. Program evaluation also included interviews with school staff, parent surveys, participant interviews, and process evaluation surveys.

For the majority of the outcome variables, differences between intervention and control schools were not statistically significant. There was no difference in BMI between the control and intervention participants at either post-intervention or follow-up. There were differences in

the progression of stage of change for physical activity. At post-intervention in the control schools, 20% of the 106 girls progressed in their stage of physical activity, and 24% regressed in their stage of physical activity. In contrast, at post-intervention in the New Moves schools, 31% of the 84 girls progressed and 19% of the girls regressed. Results showed that the feasibility of implementing New Moves was high, as indicated by strong satisfaction among participants, parents, and school staff, and by program sustainability. Participants perceived a positive program impact on their physical activity, eating patterns, and self-image. Girls in the intervention significantly progressed in their stage of behavioral change for physical activity from baseline to follow-up. However, for the majority of outcome variables, differences between intervention and control schools at post-intervention and follow-up were not statistically significant. The authors concluded that an expanded intervention and evaluation is needed to enhance and assess long-term program effectiveness.

Research by Reinhardt and Brevard (2002) implemented an integrated approach to increase physical activity and improve dietary intake among adolescents in a mid-Atlantic rural middle school. All students were required to enroll in a combined health and physical education curriculum. Nutrition knowledge, dietary intake, and physical activity behaviors were measured at baseline. A nutrition knowledge and physical activity knowledge questionnaire was developed and given at pre-test and post-test. Dietary intake was measured by a 24-hour recall and was analyzed using ESHA Food Processor, a diet analysis program. Physical activity behaviors were measured using Youth Risk Behavior Surveillance System; height weight, body mass index (BMI) and percent body fat were also measured. The curriculum of the intervention program was developed to integrate practical life skills concerning nutrition and physical activity habits using

the Food Guide Pyramid and Physical Activity Pyramid. Curriculum aspects focused on four aspects of each of the corresponding pyramid groups: identification, frequency, quantification, and relationship. Results from the study showed a statistically significant increase in nutrition and physical activity knowledge. Additional data did suggest that some minimal behavior change did occur. However, since the intervention lasted only five weeks in length, behavior change was not expected in this short duration.

The Zuni Diabetes Prevention Program was another school-based intervention that was conducted among the Zuni Pueblo (Ritenbaugh et al., 2003). Type 2 diabetes prevalence is increasing with the Native American population, and this intervention studied the impact of a school-based intervention on plasma glucose and insulin levels (markers of type 2 diabetes risk). The study was developed and implemented from 1991 to 1997 at the Zuni Public School District. This study used a multiple cross-sectional design to evaluate outcome measures of Zuni high school juniors and seniors at 0, 1.5, and 3 years against an Anglo comparison group.

The Zuni high school diabetes prevention program included an educational component targeting decreased consumption of sugared beverages, knowledge of diabetes risk factors, and a youth-oriented fitness center. The principal target for dietary intervention was beverage consumption. The project provided palatable water in coolers in several school locations and eliminated all soft drink vending machines. Only healthful snacks and non-sugared beverages were permitted in the school and fitness center. The project worked with food service to increase fruits and vegetables and decrease fat in school lunches. Diabetes prevention knowledge and attitudes were addressed in several curriculum components. Physical activity events were

sponsored at the fitness center, and activities outside the fitness center included aerobics, hiking, basketball, mountain biking, and dances.

Main outcome measures were plasma glucose and insulin measured fasting and 30 min after a 75-g glucose challenge. Family history of diabetes was obtained at the time of the oral glucose tolerance test (OGTT) through a series of questions. Body composition was also measured.

Results showed that plasma glucose levels were normal at baseline for Zuni and Anglo youth and did not significantly change throughout the study. At baseline, fasting and 30-min plasma insulin levels were significantly elevated for Zuni youth; they showed significant steady declines for both males and females throughout the study. By year 3, values for Zuni males equaled Anglo comparison values, while Zuni female values had declined but were still higher than Anglo comparison values. Among at-risk youth, the Zuni study concluded that an environmentally-based lifestyle intervention may significantly suppress markers of type 2 diabetes risk.

Last, Planet Health, a school-based health behavior intervention for obesity among boys and girls in grades 6 to 8, sought to evaluate the impact the program had among ethnically diverse adolescents in Massachusetts (Gortmaker et al., 1999). The study was a randomized, controlled field trial with 5 intervention and 5 control schools. The median household income of zip code areas where the schools were located averaged \$36,020 among intervention schools and \$34,200 among control schools. Student intervention status was assigned based on school enrollment. Outcomes were assessed using pre-intervention (fall 1995) and follow-up measures (spring 1997), including prevalence, incidence, and remission of obesity.

Students involved in the intervention participated in a school-based interdisciplinary intervention over 2 school years. Each intervention school received the Planet Health program of teacher training workshops, classroom lessons, PE materials, wellness sessions, and fitness funds. Planet Health materials incorporated standards outlined in the Massachusetts Curriculum Framework so that skills and competencies that are required learning in middle school are used as vehicles for conveying Planet Health messages. Planet Health sessions were included within existing curricula using classroom teachers in 4 major subjects and physical education. Sessions focused on decreasing television viewing, decreasing consumption of high-fat foods, increasing fruit and vegetable intake, and increasing moderate and vigorous physical activity. Physical education material focused on activity and inactivity themes and included self-assessments of activity and inactivity levels and goal setting and evaluations for reducing inactivity and replacing it with moderate to vigorous activity. Lessons were organized into 30 5-minute micro-units.

Outcomes measurements for obesity were defined as a composite indicator based on both a body mass index and a triceps skin-fold value greater than or equal to age- and gender-specific 85th percentiles. The results showed that the prevalence of obesity among girls in intervention schools was reduced compared with controls, with no differences found among boys. There was greater remission of obesity among intervention girls vs. control girls. The intervention reduced television hours among both girls and boys, increased fruit and vegetable consumption, and resulted in a smaller increment in total energy intake among girls. Reductions in television viewing predicted obesity change and mediated the intervention effect. These results led to the conclusion that Planet Health curriculum decreased obesity among female students, indicating a promising school-based approach to reducing obesity among youth.

The N4L program has similar qualities to many of the interventions discussed. The combination of promoting both good nutrition and increasing physical activity within the school setting seems to be a trend that is producing positive results.

Chapter 3: Research Methodology

Research Design

Program recruitment for the Nutricise 4 Life (N4L) program is typically presented to students by the program coordinator during their 9th grade year. The recruitment process consisted of mailings to parents/guardians of all 9th grade students, hosting a recruitment booth by the program coordinator, assembly-wide presentations and presentations conducted during physical education classes. The class is advertised as a healthy eating and physical activity program rather than a “weight loss” program so the social stigma of attending a “weight loss” class is avoided. Interested students submitted an application that is reviewed by school representatives along with the program coordinator to select a maximum of 25 students per semester in order to give students individualized attention.

The study was conducted during the fall semester of the 2008-2009 school year, which ran from August 2008-Januray 2009. This study was a partially-controlled or quasi-experimental design that compared two groups of students. The control group was recruited by each school district’s athletic coordinator or physical education teacher. Students were screened by these individuals to find another group of overweight/obese or “at-risk” students in similar numbers from these high schools to be assigned to the control group. The intervention group consisted of students interested in taking the Nutricise 4 Life program as an elective class in place of standard physical education instruction. These students filled out an application form (Appendix A: Application Form), and this application was reviewed by the investigators. The application asks students questions regarding their background including hobbies and extracurricular

interest, along with a short essay on why they would like to participate in the N4L program. All students who applied for the N4L program during the recruitment process were accepted.

The N4L program curriculum was developed and taught by the program investigators. A registered dietitian conducted the nutrition education part of the program, and the physical activity portion of the program was taught by a health educator, an exercise physiologist, a physical education teacher, and certified fitness instructors from the local YMCA.

Participants

A total of 29 individuals from Southwestern High School and Hanover High School in Hanover, Pennsylvania, were recruited. Eighteen of those individuals were students interested in taking the N4L program during the fall 2008 semester. Those students were considered the intervention group. One informed consent waiver was not obtained and therefore that information was not used in this analysis, but the student still participated in the program. The remaining 11 students did not participate in the N4L program during that semester. Of the total participants we had 24 females and 4 males. Self-reported ethnic background of the individuals included White/Caucasian (n=25) and Hispanic/Latino (n=3) adolescents.

Hypothesis/Research Aims

The aim of the present study was to evaluate the effects of the N4L program on nutrition and fitness assessment parameters. It was hypothesized that dietary intake, nutrition knowledge, and fitness assessment measurements would be improved in the group that received instruction using the N4L program compared to the control group after one semester (19 weeks) of intervention.

To answer the proposed hypothesis, the investigators set out to answer four major questions about the program's effectiveness: 1) Do students who take an elective high school physical education class combined with nutrition education have dietary intakes that follow the MyPyramid food guidance system better than students who do not receive this instruction? 2) Do students who take an elective high school physical education class combined with nutrition education have a greater knowledge base of basic nutrition principles than students who do not receive this instruction? 3) Do students who take an elective high school physical education class combined with nutrition education have more improved fitness assessment measurements than students who do not receive this instruction? 4) Do students who take an elective high school physical education class combined with nutrition education increase their motivation/confidence to make healthier lifestyle choices with regard to increasing physical activity and choosing healthier foods?

Materials

To answer the research questions mentioned above, the investigators used the following tools/ measurements to determine the program's effectiveness. To assess the student's nutritional intake, each student filled out a three-day food log that included their total food intake for one weekend day and two weekdays. Students completed these logs at the beginning and end of the semester. Students were instructed on how to properly fill out the food logs, and incomplete logs were reviewed with the students by a Registered Dietitian to properly assess the correct food and amount consumed. The worksheet used was adapted from the USDA's MyPyramid Food Tracking Worksheet (See Appendix B: Food Tracking Worksheet). This worksheet was then put into the ESHA Food Processor Database (ESHA Research, 2007) and

analyzed the student's average intake over three days and compared it with their recommended intake from MyPyramid (MyPyramid Food Guidance System, 2005). Each student's height, weight, age, and activity level was put into the database, which generated a recommendations page utilizing MyPyramid food groups. Height and weight measurements were taken from the Fitness Assessment Worksheet, and activity level was generated from the Program Assessment Questionnaire, which will be discussed shortly. The MyPyramid reports showed the average amount of food consumed (in cup equivalents) from each food group over the three-day time frame. These food groups included grains, fruits, vegetables, milk, and meat and beans.

To test nutrition knowledge at baseline and post-program, each student in the intervention and control group took a self-administered nutrition questionnaire. The questionnaire was 20 questions long, multiple-choice, and included questions regarding basic nutrition knowledge. Please refer to Appendix C: Nutrition Questionnaire to review the questions.

In terms of fitness assessment measurements, anthropometric data were obtained from all students and included measurements of height, weight, BMI, and body fat composition (Hanover school only) and performed by the program coordinator. Fitness assessment measurements were performed by the program coordinator as well, at the beginning and end of the fall semester using the Fitnessgram® software (Human Kinetics, 2006) and copied onto the Fitness Assessment Form (see Appendix D). Fitnessgram® is a comprehensive fitness assessment testing tool that is already being utilized at Southwestern School District and Hanover Public School District. The software indicates if the child is in the healthy fitness zone and provides suggestions on how to reach the healthy fitness zone through physical activity. It

includes a variety of health-related physical fitness tests designed to assess cardiovascular fitness, muscle strength, muscular endurance, flexibility, and body composition. The PACER (Progressive Aerobic Cardiovascular Endurance Run) is the default aerobic capacity test in Fitnessgram®. The PACER is a multistage fitness test adapted from the 20 meter shuttle run. The test is progressive in intensity; it is easy at the beginning and gets harder at the end. The progressive nature of the test provides a built-in warm-up and helps children pace themselves effectively. The CD has either music or beeps to instruct students. The CD has cadences for pushups and curl up tests; each will give a 5-second countdown and tell students when to start. Measurements to assess physical fitness used within this study within the Fitnessgram® software included flexibility (sit and reach test), muscle endurance (push-ups and sit-ups), and cardiovascular endurance (PACER). To test body fat composition, a skin fold measurement was conducted. Skin fold estimates have lower prediction error and provide a more direct estimate of body fatness and are the recommended approach in Fitnessgram®. The skin fold procedure uses two sites that are easy to measure and whose measurements are not very invasive (triceps & calf). Skin fold calipers through Human Kinetics are used for the testing. All of the tests were also performed at baseline and at the end of the semester and conducted by the program coordinator.

To evaluate motivation/confidence and determine activity levels in students, the N4L Program Assessment Questionnaire was given to students at baseline and at the end of the semester. The first part of the questionnaire was focused on determining how confident and motivated students felt about being more physically active and making healthier food choices. The second part of the questionnaire determined what stage of change the student was currently

in regarding physical activity. This assessment also determined the student's current activity level: sedentary, lightly active, and moderately active (see Appendix E: Program Assessment Questionnaire).

Physical education classes consisted of non-traditional activities such as kickboxing, yoga, kayaking, spinning class, aerobic boot camp, swimming, disc golf, weight training, and strength training. During some classes, students were taken to the local YMCA where they were allowed to use the exercise equipment freely and to their own comfort level. The curriculum also included video games in classroom. Games that incorporated physical activity such as Dance Dance Revolution and Wii Sports on the Nintendo Wii were played. This exposure to different forms of physical activity was intended to help students find an activity that they would be able to continue with once the program was completed.

The nutrition curriculum used lessons from the California CANFIT Super Manual (CANFIT Super Manual, 2006). Nutrition topics were discussed each week and included meeting your nutrition requirements, MyPyramid, reading food labels, grocery shopping, whole grains, sugar, fat, fast food, snacking, nutrition and media, and taste testing. After a few topics, students were quizzed on their knowledge. In all, there were 4 quizzes and one final exam given throughout the semester. These quizzes were different from the Nutrition Questionnaire previously discussed. Testing was necessary as this program counted as a physical education credit, and students received a grade at the end of the semester. Students also were given homework assignments throughout the semester that coincided with a particular nutrition topic.

Procedure

The study protocol was approved by The College of Health and Human Services' Human Subjects Committee at Eastern Michigan University (see Appendix F). Informed consent was obtained from all students 18 years and older before any measurements were taken, and informed assent and parental written informed consent from students 16-18 years of age. During the fall 2008-2009 semester, students in the Nutricise 4 Life program met two to three times per week in place of their physical education class (please refer to Appendix G to view the N4L schedule from the fall 2008 semester). Each session was devoted to some form of physical activity or nutrition education. At the beginning of the semester, each student in the intervention and control group took the nutrition questionnaire and program assessment questionnaire, and completed the three-day food logs and fitness assessments measurements. Throughout the semester, the intervention group completed lessons, quizzes, homework assignments, and various other activities related to physical activity and nutrition. Parental involvement was also included. An information session was held at the beginning of semester for parents to come and meet the instructors and ask questions about the program. All through the semester, weekly e-mails were sent to the family with tips and ideas on living a healthier lifestyle. For a more hands-on approach, monthly educational sessions on nutrition and physical activity were also offered to students' families at Hanover Hospital's Wellness Center. Team building activities were also included throughout the curriculum and conducted by a psychologist, along with lessons discussing self-esteem and body image. Students were encouraged to talk about their issues, if any, with their weight. At the end of the semester, the same measurements as pre-program were completed.

Statistics and Calculations

Data were analyzed using SPSS 17.0 GradPack (SPSS Inc., 2009). Initial analysis consisted of descriptive statistics of sample characteristics. Paired two-sample t- tests for means were used to compare within group differences. Two-way repeated measures ANOVA assuming unequal variances was used to evaluate control and intervention group differences for all the secondary outcomes comparing baseline and post program data. A p-value of <0.05 was considered statistically significant.

Chapter 4: Results

The control group (n=11) completed all required measurements throughout the semester. All students in the intervention group (n=17) completed the N4L program. Demographic data on all participants can be found in Table 1. At baseline, the average BMI of all students participating was categorized as Obesity-Grade 1 (M= 31.1, SD=7.01) according to the CDC BMI Tables (CDC, 2007). Average BMI for the intervention group (M=30.6, SD=7.8) and the control group at baseline (M=31.9, SD=5.9) were similar. No significant differences were found at baseline between groups for weight, BMI, body fat composition, fitness assessment measures, nutrition knowledge, and food intake.

Table 1

Demographic Data on all Participants

	Control (n=11)	Intervention (n=17)
Gender (n)		
Female	8	15
Male	3	2
Ethnicity (n)		
White	9	16
Hispanic	2	1

Note. Demographic data on all participants. n=number of participants.

To analyze participants' food intake to determine how well their intakes followed MyPyramid, their three-day intake for fruits, vegetables, and milk were collected and the

amounts translated into cup equivalents using the ESHA Food Processor Database MyPyramid Reports. Their average intake at baseline and post-program was compared (Table 2). Students in the control group were not meeting the average recommendation for fruits, vegetables, and milk at baseline and post-program. Students taking the N4L program were also not meeting the average recommendation for fruits, vegetables, and milk at baseline and post-program. Changes in intake among these food groups from baseline to post-program were not statistically significant in the N4L group.

Table 2

Control Group and N4L Group Average Daily Food Group Intake

Food Group	Baseline	Post-Program	Δ	p
Control				
Fruit	0.22±0.32	0.76±0.58	+0.54*	0.04
Vegetable	1.01±0.72	0.85±0.45	-0.16	0.34
Milk	1.51±0.62	1.44±0.82	-0.07	0.81
N4L Group				
Fruit	0.62±0.54	0.53±0.53	-0.09	0.58
Vegetable	1.18±1.08	1.05±0.62	-0.13	0.54
Milk	1.74±0.82	1.73±0.86	-0.01	0.95

Note. Mean change in fruit, vegetable, and milk intake in cup equivalents from baseline to post-program in the control group (n=11) and N4L group (n=17). Δ= change in intake. *p <0.05.

There was a significant increase in fruit intake from baseline to post-program within the control group ($p < .05$); however, the N4L group's overall (average of both baseline and post-program consumption) mean fruit ($M=0.58$, $SD=0.32$), vegetable ($M=1.10$, $SD=0.19$), and milk ($M=1.72$, $SD=0.14$) intake was slightly higher than the control group, though not statistically significant (Figure 1).

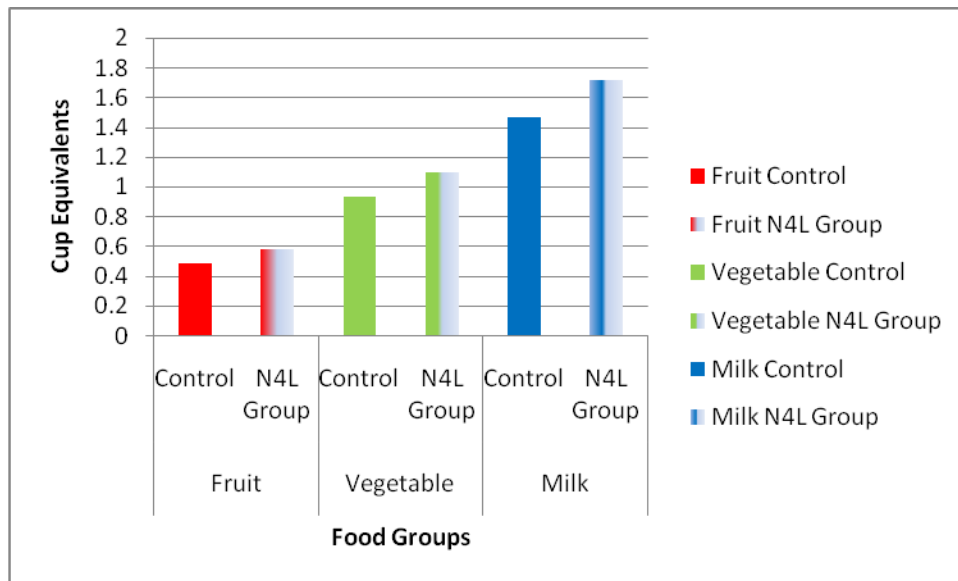


Figure 1. Mean Intake of Food Groups from the N4L Group and the Control Group
Note. Mean intake in cup equivalents for fruit, vegetable, and milk intake throughout the study.

A 2(Group) x 2(Fruit, Vegetable, Milk) mixed-model ANOVA revealed that the main effect for Group (intervention vs. control) was not significant ($p > .05$). Thus, there were no overall differences in food group intake of the N4L group compared to the control group (Table 3).

Table 3

Analysis of Variance (ANOVA) for Group Effects on Food Group Intake

Source	Df	F	η^2	p
Between Subjects				
Fruits	1	0.371	0.14	0.50
Vegetables	1	0.459	0.017	0.50
Milk	1	0.948	0.035	0.34

Note. ANOVA results for the effects of group placement (intervention vs. control) on fruit, vegetable, and milk intake. Df= degrees of freedom; F=F-values; η^2 =Eta squared.

Nutrition knowledge scores showed significant changes in the intervention group from baseline to post-program ($p < 0.05$) and are shown in Table 4. When comparing group differences between the control and intervention group, the main effect of Group was also significant. Thus, there was an overall difference in nutrition knowledge in the N4L group compared to the control group (Table 5 & Figure 2).

Table 4

Nutrition Questionnaire Scores at Baseline and Post-Program

	Baseline	Post-Program	Δ	p
Nutrition Questionnaire- Control	13 \pm 2.1	12.5 \pm 2.8	-0.45	0.38
Nutrition Questionnaire- N4L Group	12.72 \pm 2.7	17.0 \pm 2.4	+1.36**	0.00

Note. Mean nutrition questionnaire scores out of 20 possible points for the control vs. N4L group. Δ =change in score. ** $p < 0.01$.

Table 5

Analysis of Variance (ANOVA) for Group Effects on Nutrition Questionnaire Scores

Source	Df	F	η^2	p
Between Subjects				
Nutrition Questionnaire	1	5.233*	0.162	0.03

Note. ANOVA results for the effects of group placement (intervention vs. control) on nutrition knowledge. Df= degrees of freedom; F=F-values; η^2 =Eta squared. *p<0.05.

As discussed previously, students in the N4L group were given quizzes throughout the semester that coincided with nutrition topics discussed. These quizzes were separate from the Nutrition Questionnaire (Appendix C) given for both the N4L group and control group at baseline and post-program. Mean quiz scores for the N4L group during the semester (M=82.9 SD=10.2) were out of a total of 90 points, while the Nutrition Questionnaire given to both groups was out of 20 points.

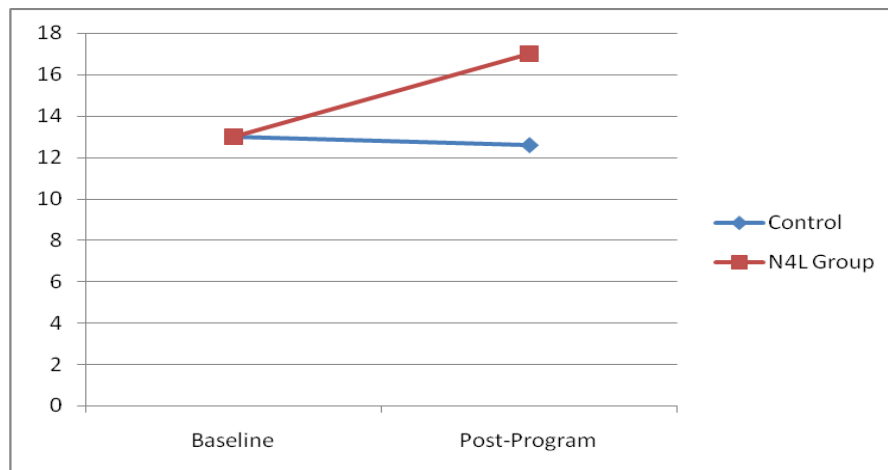


Figure 2. Mean Nutrition Questionnaire Scores for the N4L Group and Control Group
Note. Average point score (out of 20) of nutrition questionnaire pre-program and post-program.

Participants who did not participate in the N4L program experienced no statistically significant changes in fitness assessments throughout the semester (Table 6). Fitness assessment differences in the N4L group from baseline to post-program found statistically significant changes ($p < .05$) in percent body fat, flexibility: sit and reach right/left, and muscle endurance: sit-ups/push-ups (Table 7). Body fat composition was only measured in participants at

Table 6

Control Group Fitness Assessment Changes

Students (n=11)				
Source	Baseline	Post-Program	Δ	p
Weight (lbs)	187.91±30.0	200.0±47.6	+12.12	0.20
Body Mass Index	31.9±5.9	33.2±8.3	+1.3	0.44
Body Fat (%)	35.53±7.0	36.7±6.3	+1.17	0.07
Sit & Reach Left (inches)	12.09±1.8	11.32±3.8	-0.77	0.47
Sit & Reach Right (inches)	12.45±2.1	12.18±4.5	-0.27	0.79
Sit-Ups^a	55.55±25.9	42.45±24.3	-13.09	0.18
Push-Ups^b	8.82±3.8	6.27±4.5	-2.55	0.07
Pacer Laps^c	20.45±9.0	21±11.0	+0.55	0.71
Pedometer Steps^d	-	-	-	-

Note. Mean fitness assessment measurements and changes from baseline to post-program in the Control Group. Δ=change in measurement. ^a number completed in 4:06 minutes. ^b number completed in 4:08 minutes. ^c number of laps completed in 22:30 minutes. ^d Pedometer steps were not measured in the control group.

Hanover High School (n=7) but there was a significant decrease in their percent body fat. Although changes in weight, BMI, aerobic endurance, and pedometer steps were found to be statistically insignificant, on average, increases were seen in aerobic endurance ($\Delta = 2.1$ laps) and pedometer steps ($\Delta = 2,733$ steps). Weight ($\Delta = -1.8$ pounds) and BMI ($\Delta = -1.1$) decreased throughout the semester.

Table 7

N4L Group Fitness Assessment Changes

Students (n=17)				
Source	Baseline	Post-Program	Δ	p
Weight (lbs)	186.6 \pm 50.3	184.8 \pm 48.0	-1.8	0.23
Body Mass Index	30.6 \pm 7.8	29.5 \pm 6.8	-1.1	0.21
Body Fat (%)^a	30.1 \pm 8.4	26.0 \pm 7.2	-4.1*	0.05
Sit & Reach Left (inches)	10.6 \pm 3.3	12.1 \pm 3.5	+1.6**	0.00
Sit & Reach Right (inches)	9.6 \pm 4.5	12.0 \pm 3.9	+2.3*	0.02
Sit-Ups^b	45 \pm 30.3	62.3 \pm 21.9	+17.1**	0.01
Push-Ups^c	6.5 \pm 6.9	10.2 \pm 9.2	+3.8 **	0.00
Pacer Laps^d	19.4 \pm 13.2	21.5 \pm 12.6	+2.1	0.19
Pedometer Steps(weekly)	43,672 \pm	48,936 \pm	+2,733.0	0.47
	15017.67	15715.62		

Note. Mean fitness assessment measurements and changes from baseline to post-program in the N4L Group. Δ =change in measurement. ^an=7. ^b number completed in 4:06 minutes. ^c number completed in 4:08 minutes. ^d number of laps completed in 22:30 minutes. *p < .05 **p < .01.

When the main group effects were analyzed (intervention vs. control), a 2 (Group) x 2 (Measure) ANOVA revealed that the main effect for Group was only significant for body fat percentage, $F(18) = 4.91, p = .04$. Thus, overall there was a difference in body fat percentage in the intervention group compared to the control. With all other measures, group placement was found to have no significance (Table 8).

Table 8

Analysis of Variance (ANOVA) for Group Effects on Fitness Assessment

Source	Df	F	η^2	p
Between Subjects				
Weight	1	0.228	0.008	0.64
BMI	1	0.662	0.024	0.42
%Body Fat	1	4.913*	0.235	0.04
Sit & Reach Left	1	0.094	0.004	0.76
Sit & Reach Right	1	0.609	0.024	0.44
Sit-Ups	1	0.308	0.012	0.31
Push-Ups	1	0.079	0.003	0.78
Pacer Laps	1	0.001	0.000	0.97

Note. ANOVA results for the effects of group placement (intervention vs. control) on fitness assessment measures. Df= degrees of freedom; F=F-values; η^2 =Eta squared. * $p < 0.05$.

Although group placement was not found to have a statistically significant effect on fitness assessment measurements (except % body fat), the N4L group, on average, saw decreases in weight and BMI (see Figure 3), while the control group experienced increases in these areas.

The intervention group also, on average, saw positive changes in flexibility, muscle endurance, and aerobic endurance (PACER), while the control group, on average, saw negative changes in all these aspects but aerobic endurance.

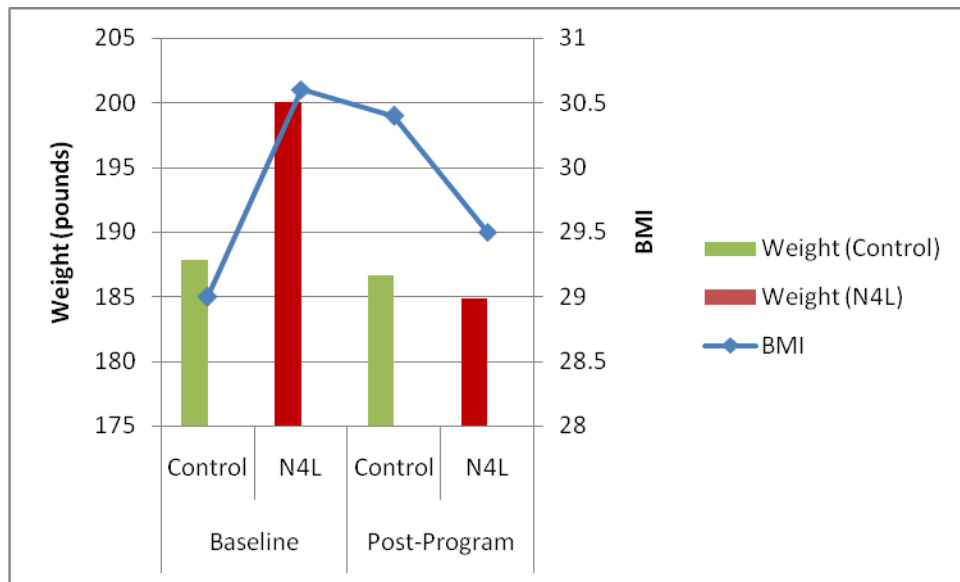


Figure 3. Mean Weight & BMI Changes for the N4L Group and Control Group
Note. Average change in weight (pounds) and BMI from baseline to post-program for both groups.

Using the N4L Program Assessment Questionnaire (see Appendix E), we found that on average the N4L program was beneficial in the minds of the students. There were improvements from baseline to post-assessment on all 3 measures of motivation/confidence. Students moved one scale point in a general approach to healthy habits and felt they would incorporate physical activity into their daily schedule. Some reported improvement in feeling they will exercise at least 5 days per week (see Figure 4).

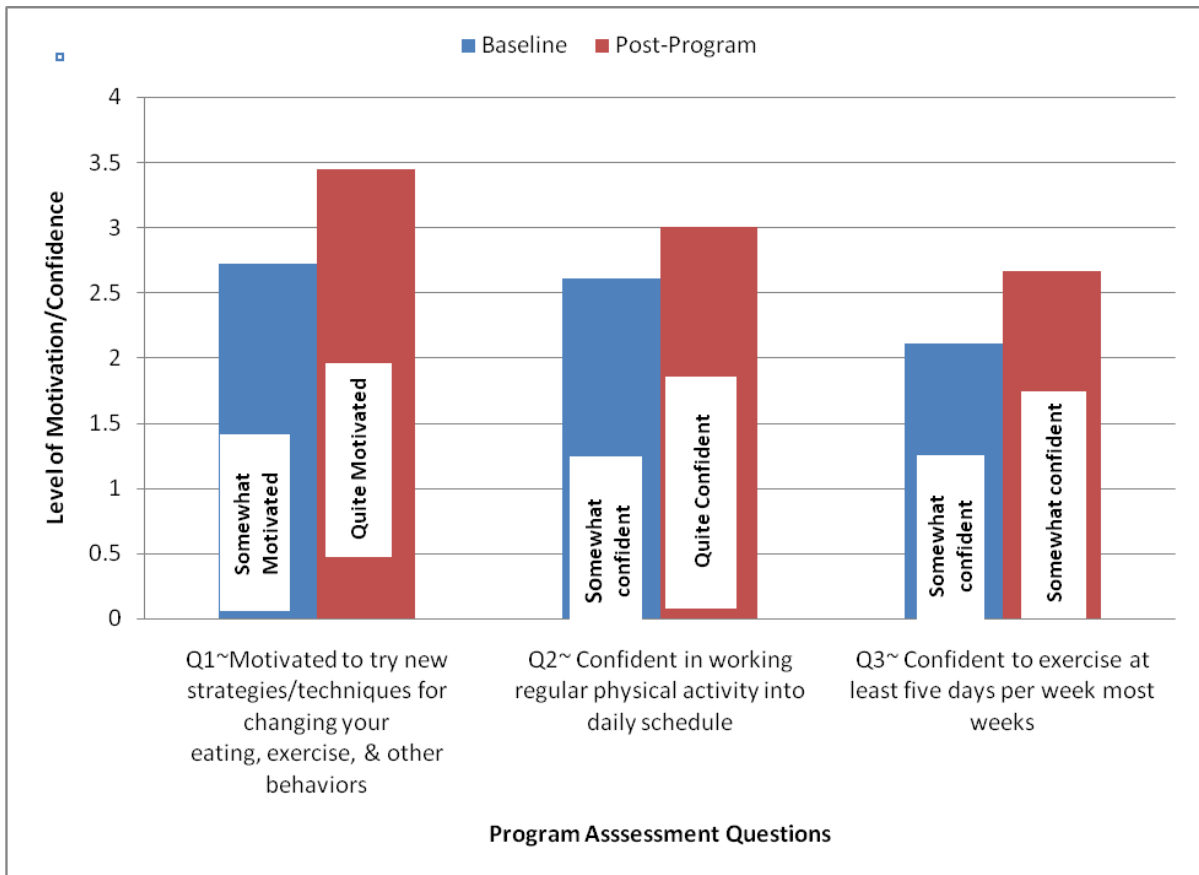


Figure 4. Mean Findings from Program Assessment Questionnaire (PAQ) on N4L Students Confidence/Motivation Levels

Note. Confidence/motivation levels regarding making healthy lifestyle changes, i.e. choosing healthier foods, increasing physical activity. Changes show baseline vs. post-program. PAQ consisted of three questions listed on the x-axis.

Post-program evaluations gave instructors insight on what students liked/disliked about the program. When students were asked what they liked most about the program, 33% reported trying new types of foods. Other responses included yoga, kayaking, Zumba (Latin-style dancing), exercising at the YMCA, hiking, disc golf, and getting to know the classmates (see Figure 5).

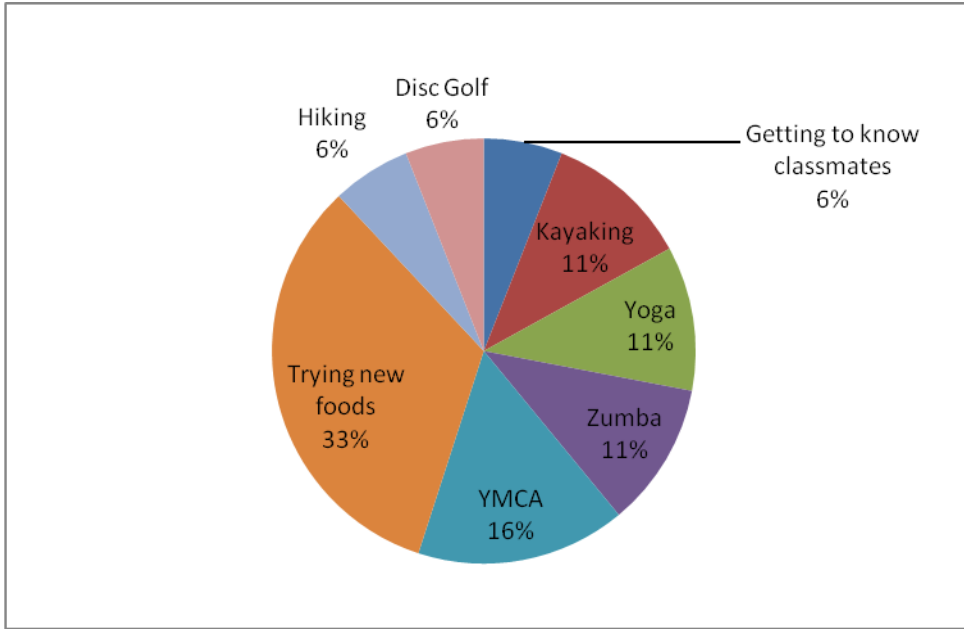


Figure 5. Post-Program Evaluations-What Did You Like Most About N4L
Note. Results of post-program evaluation on what N4L students enjoyed the most during the program. Evaluation taken at the end of the semester (January 2009).

Chapter 5: Discussion, Recommendations for Further Research and Conclusions

Discussion

The Nutricise 4 Life program utilizes an innovative approach combining nutrition education and physical activity to reach adolescent students who are either overweight or at risk for becoming overweight due to poor dietary habits and low levels of physical activity. Through the utilization of physical education classes within these school districts, N4L was able to reach students on a daily basis with a more intensive program than would be possible via programs run from health clinics, community centers, or after-school programs. Furthermore, the program reaches students who might not be motivated or able to attend programs outside school hours. The N4L program has been an ongoing intervention for the past 5 years but its efficacy has never been evaluated. The main aim of this study was to evaluate the program's effectiveness.

Overall, the Nutricise 4 Life program produced favorable results and provided students with tools to make changes toward a healthy lifestyle. Our hypothesis of this study was that students participating in the Nutricise 4 Life program would have improved dietary intakes and greater nutrition knowledge and fitness assessment measurements than students who did not participate in the program. To answer this hypothesis, we looked at four specific questions: 1) Do students who take an elective high school physical education class combined with nutrition education have intakes that follow the MyPyramid food guidance system better than students who do not receive this instruction? 2) Do students who take an elective high school physical education class combined with nutrition education have a greater knowledge base of basic nutrition principles than students who do not receive this instruction? 3) Do students who take

an elective high school physical education class combined with nutrition education have more improved fitness assessment measurements than students who do not receive this instruction?

4) Do students who take an elective high school physical education class combined with nutrition education increase their motivation/confidence to make healthier lifestyle choices with regard to increasing physical activity and choosing healthier foods?

From the analysis described in the previous chapter it was concluded that students participating in the N4L program did not have food intakes that followed the MyPyramid food guidance system (in terms of fruit, vegetable, and milk) better than students who did not participate in the program. There were no significant differences in dietary intake in the N4L group. When participants' daily food intakes were analyzed, participants were way below average when comparing their fruit, vegetable, and milk intake with recommendations given by MyPyramid. There were no increases in intake post-program with these three food groups, nor were there any differences in intake between the N4L group and the control group. The control group showed a significant increase in fruit consumption throughout the study. Mean intake for fruits, vegetables, and milk was higher overall in the N4L compared to the control group, but this was not found to be statistically significant.

Nutrition knowledge was increased in individuals who took part in the N4L program. Students who participated in the N4L program had higher test scores post-program than the control group. The nutrition education imparted to students was effective in increasing their nutrition knowledge. However, although students in the intervention group had improved knowledge regarding nutrition (as reflected by test scores), it did not necessarily translate into behavioral changes by altering habitual food intake.

Measurements from baseline to the end of the semester show that the N4L program made a positive impact on fitness assessment measurements. Though some of these measures were not considered significant, the overall trends for fitness assessment measurements were in the positive direction. However, when comparing fitness assessments scores to the control group, there were no significant differences other than a change in body fat percentage. Body fat percentage was significantly decreased in intervention group compared to the control. Therefore, students in the N4L program did have a decrease in body fat percentage, but no other differences were found with fitness assessment measurements after program instruction compared to students who did not participate in the program.

Motivation and confidence levels of students participating in the program showed, on average, one scale point increase. Most students increased their stage of change one step closer to the action stage. Participants reported that they were more confident in being physically active on a daily basis and felt motivated to try new strategies/techniques for changing their eating and exercise behaviors. Participants also enjoyed trying new foods and being exposed to different forms of physical activity.

Outcomes from similar school-based interventions also show mixed results. Whether school-based interventions produce favorable changes in dietary behavior is unclear. Many successful programs were not able to see a significant change in eating behaviors among students. Fruit, dietary fat, and sweetened beverage intake were the major components evaluated to determine changes in intake in previous studies. Many studies revealed that a positive change in eating behavior was dependent upon gender, primarily females. For the majority of school-based interventions that evaluated nutrition and/or physical activity knowledge, statistically

significant changes were seen between the intervention and control group. Thus, similar programs were effective in increasing knowledge with participants. Changes in physical fitness parameters seem to depend upon what was being measured. Most interventions that looked at duration of physical activity saw mixed results within the intervention group. TV viewing time decreased in interventions where this was evaluated. Anthropometric changes such as weight and BMI within the intervention groups were highly variable from study to study. Last, changes in self-perception and stage of change improvements have been seen in numerous other school-based studies similar to the results from the N4L study. Most students seem to report a positive impact from these school-based interventions. Increasing one's motivation and confidence towards increasing physical activity and making healthy food choices may lead to significant changes in these areas after program completion.

The N4L program has a number of strengths. A major strength of N4L is its accessibility to students, since it is offered during the school day. The comprehensive approach that includes physical activity, nutrition education, and social support within one integrated framework is also needed when addressing complex health issues such as obesity prevention. The variety of hands-on activities and sites visited was also a positive aspect of the program. The students visited local fitness centers, grocery stores, health education centers, and even state parks to help them experience real-life situations in making changes toward a healthy lifestyle. The parent-involvement component is essential in any obesity-prevention program geared towards school-aged children. Parents were invited to attend an "open-house" during the beginning of the semester to learn about the program and why it is essential for them to be involved. Weekly mailings were sent home to parents with tips on physical activity and healthy eating. Educational

classes were also held in the evening for both the student and parent, which were devoted to ways to increase physical activity and choose healthier foods as a family. Parents and primary caregivers shape children's dietary practices and their physical activity patterns in many ways. They are, in effect, policymakers in their own home. Parents make decisions about food availability in the home and also impact children's opportunities for recreation and physical activity. They may also control access to money that can be used to purchase foods outside the home.

Last, the partnerships developed from the N4L program will help enhance schools' efforts in preventing and controlling childhood obesity. The N4L program was provided to these schools through Hanover Hospital, which allowed qualified health-care professionals to promote healthy eating and physical activity. More specific health conditions could also be identified by these professionals who could then address the situation to their primary health professional. The National Institute of Health has called for the development and evaluation of comprehensive "trans-site" interventions to achieve sustained prevention and control of childhood obesity. Trans-site interventions can connect different organizations that care for children and their families, potentially providing "continuity, reinforcement and synergy" in promoting health behavior changes (Resnikow & Vaughn, 2006). Both Hanover and Southwestern school district connected with organizations in the community who serve the same student population and whose missions are compatible with nutrition and physical activity programs such as Hanover YMCA. The less-structured setting of these programs may allow more for in-depth and flexible adult-child relationships. Students who completed the N4L

program received a free one-year family pass from the Hanover YMCA to facilitate behavior change after program completion.

Although results from this intervention are encouraging, this study has several limitations. The lack of impact on fitness assessment scores and dietary intake suggests a need for more intensive and longer interventions. Limitations of the current study's evaluation design include its limited statistical power to detect changes due to the small number of students. Having a sample size of only twenty-eight students makes the power of this study less than ideal. The small study sample size limits generalizability to other schools and may have limited our ability to detect differences in some outcomes. Results were likely skewed with large changes from just one participant.

A lack of measures sensitive to changes in body composition and use of self-reported measures to assess variables such as physical activity and dietary intake were other major limitations. Although body fat composition was measured, it was not measured with all participants; this left an even smaller sample size of body fat percentage changes. Students in both groups may have reported improvements in behaviors in order to provide socially desirable responses. Reports on daily food intake were highly variable and may not have been an accurate reflection of actual intake. Although food records were reviewed with students by a Registered Dietitian, some students may not have accurately recalled what and how much they ate in a three- day time frame.

Non-randomization was another concern. Since the N4L program examined only students who were interested in participating in a nutrition/exercise program, they were probably more motivated to make changes in their eating and physical activity habits than if they

were randomly selected participants. Furthermore, because both control and intervention students were at the same schools, it is possible that cross-contamination occurred in which the students in the control group were indirectly influenced by communicating with students from the intervention group. This would have led to underestimation of differences between the intervention and control groups, which may have been greater than detected here.

Last, the intervention lasted only one semester (19 weeks). Ideally, the N4L program would be incorporated into the regular school schedule and offered throughout the entire year so key principles could be reinforced. There was also no follow-up period, which did not allow for the detection or the prevention of weight gain over time. A longer-term study and follow-up would better gauge the effectiveness and long-term effects of the program.

Recommendations for Further Research

The N4L program has been sustained at both intervention schools following study completion. Schools have continued to offer the N4L program as a physical education credit that combines un-conventional physical activity, nutrition education, and social support. After completing this study, recommendations are warranted to help develop future research about the program's effectiveness.

Further studies should attempt to recruit a larger sample size to help strengthen the statistical power of the study. However, this may prove difficult with scheduling students and staffing issues. Trying to manage the schedules of the various health professionals involved limits the times and dates the program can be run. This could be dealt with by collecting more physical education teachers who are interested in running the program at their school. Training could then be set up so the physical education teacher would be able to conduct the N4L

program throughout the semester. In addition, randomization of students into the control and intervention conditions should follow baseline assessments, to increase the likelihood of having similar baseline characteristics.

Following up with students is another recommendation for future studies. Currently students are able to retake the N4L program, but many of the same principles are covered again. There is a one-day summit for past N4L students to get together and talk about their success/hardships, but attendance for this event is typically very low. Possibly providing continuing support, incentives, education, and events will help students continue to make healthy lifestyle choices with regard to physical activity and healthy eating.

Often in examining the effectiveness of interventions aimed at modifying deeply entrenched attitudes and behaviors and hard-to-change physical outcomes such as BMI, results are disappointing. Perhaps measures are inadequate in that they do not assess the beginning of change. It may also be that expectations for short-term interventions are too great. Longer or more intensive interventions may be needed to achieve substantial changes in outcome variables such as eating behaviors, physical activity, and BMI. Offering the program over a longer period of time would also be advisable. Instead of one semester, the N4L program would be a year-long class. This would allow more exposure to different kinds of physical activity and allow for more nutrition topics to be discussed.

Although weight and BMI are relatively easy to measure, they are not the best measure in change in body composition. Measures that are more sensitive to small changes in body composition are needed to assess programs like N4L. It is possible that some students from the intervention had decreases in body fat and increases in lean body mass as a result of their

participation in physical activity. Although we did measure percent body fat in some students, this should be a standard measure for all students in the intervention groups.

Overall, further program evaluation should consider a larger sample size, randomization of participants, longer intervention time, the use of more sensitive measures for body composition and dietary intake, and a longer follow-up period to capture change over time.

Conclusion

Obesity is a major public health concern that needs to be addressed using interventions that are accessible to children and adolescents along with focusing on the various factors that are involved such as environment and parents/guardians. Schools are a logical setting to provide education related to obesity prevention. The N4L program was developed to offer a comprehensive nutrition and physical activity program tailored to adolescent students in place of their regular physical education class. The positive reception and favorable outcomes related to healthy eating and physical activity from the N4L program within the schools indicates the approach is feasible and should be expanded upon.

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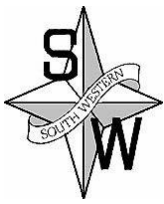
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APPENDICES



Appendix A: Application Form



Nutricise 4 Life Program Application

Selection criteria:

There are a limited number of spaces available for the Nutricise 4 Life Program. Your participation in the program will be determined by your responses to the questions in this application form. South Western School District and Hanover Hospital will review the applications and we will notify you of your admission status. All information must be filled out completely. Please print or type.

Application Deadline:

Your application must be returned to the guidance counselor by April 3, 2009.

PLEASE TYPE OR PRINT ALL INFORMATION CLEARLY.

Student Last Name

Student First Name

E-mail address

Primary Residence/Address (number and street)

City

State

Zip

Date of Birth

Grade

Telephone Number

Emergency Contact Name

Emergency Contact Telephone Number

Parent/Guardian Name _____

Parent/Guardian Signature _____

Please complete the reverse side of this document.

Nutricise 4 Life Program Application

Please use the space below to briefly tell us about yourself. We are particularly interested in your extracurricular interests and hobbies, your future plans, and any other information you think that we should know.

Please use the space below to discuss your reasons for wanting to participate in the *Nutricise 4 Life* Program.

Student Signature

Date



MyPyramid Worksheet

Check how you did today and set a goal to aim for tomorrow

	Write in Your Choices for Today	Food Group	Tip	List each food choice in its food group*	Estimate Your Total	
Breakfast:	_____	GRAINS 	Make at least half your grains whole grains	_____	_____	
	_____			_____	_____	ounce equivalents
	_____			_____	_____	
Snack:	_____	VEGETABLES 	Try to have vegetables from several subgroups each day	_____	_____	
	_____			_____	_____	cups
	_____			_____	_____	
Lunch:	_____	FRUITS 	Make most choices fruit, not juice	_____	_____	
	_____			_____	_____	cups
	_____			_____	_____	
Snack:	_____	MILK 	Choose fat-free or low fat most often	_____	_____	
	_____			_____	_____	cups
	_____			_____	_____	
Dinner:	_____	MEAT & BEANS 	Choose lean meat and poultry. Vary your choices—more fish, beans, peas, nuts, and seeds	_____	_____	
	_____			_____	_____	ounce equivalents
	_____			_____	_____	
Snack:	_____	PHYSICAL ACTIVITY 	Build more physical activity into your daily routine at home and work.	_____	_____	
	_____			_____	_____	*Some foods don't fit into any group. These "extras" may be mainly fat or sugar—limit your intake of these.
	_____			_____	_____	minutes

How did you do today? Great So-So Not so Great

My food goal for tomorrow is: _____

My activity goal for tomorrow is: _____

Nutricise 4 Life Nutrition Questionnaire

Name _____ **Date** _____

Please check the box to the **one** best answer to each question.

1. According to My Pyramid discretionary calories include foods such as:

- Breads, cereals, and pasta
- Fish, chicken and beans
- Soda, candy, and dressings
- None of the above

2. Which of the following beverages contains the least amount of sugar?

- 1 cup orange juice
- 1 cup chocolate milk
- 1 cup low-fat milk
- 1 cup soda

3. The following are all examples of lower-fat cooking methods EXCEPT:

- Baking
- Frying
- Grilling
- Broiling

4. Which of the following would be the healthiest snack option?

- Potato chips
- Popcorn (plain)
- Candy bar
- Ice cream

5. You should not eat starches at meals because

- They are too high in fat
- Even eating small amounts can cause weight gain
- They cause disease
- None of the above

6. The definition of a serving size is:

- A standard amount of food
- The amount of food a person serves themselves
- Both answers are correct
- Neither answer is correct

7. Examples of whole grains include the following:

- Whole Grain Oats
- Whole Wheat
- Brown Rice
- All of the above

8. High sodium foods include the following EXCEPT:

- Deli Meats and Cheeses
- Frozen Dinners
- Fruits
- Canned Soups

9. A food is considered low-fat if it has:

- < 10 grams of fat per serving
- > 5 grams of sugar per serving
- < 3 grams of fat per serving
- None of the above

10. A 3 –ounce portion of meat best resembles:

- A ping-pong ball
- A deck of cards
- 4 dice
- None of the above

11. The three main components of food are

- Sugars, fat, salt
- Carbohydrates, protein, fat
- Glucose, fructose, lactose
- None of the above

12. Foods that contain natural sugar include the following EXCEPT

- Milk
- Whole fruits
- Soda
- None of the above

13. The following items are shown on a food label EXCEPT

- Calories
- Sugar
- Serving size
- None of the above

14. Which of these food groups IS included in the Food Guide Pyramid?

- Fruits
- Grains
- Milk
- All of the above

15. The following foods must not be eaten when trying to lose weight

- Bread and rice
- Meat and fish
- Fruit
- None of the above

16. Which of the following food choices is lowest in fat?

- Fish, chicken without skin, and lean meat
- Beef, sausage, bacon
- Fried fish, fried chicken
- All of the above

17. How much fruit does the average person need per day according to the Food Guide Pyramid?

- 1 cup
- Half a cup
- 2 cups
- 3 cups

18. Which foods contain a lot of fiber?

- White bread and rolls
- Oats, apples, beans
- Milk, yogurt, cheese
- All of the above

19. Which foods contain the most calcium?

- Chicken and eggs
- Milk, yogurt, cheese
- Breads and cereals
- Vegetables

20. What is a serving of cooked vegetables?

- 1 Tablespoon
- Half a cup
- 1 cup
- ¼ cup



When performance counts.

Nutricise 4 Life – Fitness Assessment

Name _____

Male Female Age _____ Date of Birth _____

	PRE	POST	RESULTS (+/-)
Height	_____ inches	_____ inches	_____ inches
Weight	_____ lbs	_____ lbs	_____ lbs
BMI	_____ Kg/m ²	_____ Kg/m ²	_____ Kg/m ²
Body Fat Composition	_____ %	_____ %	_____ %
Flexibility			
Sit & Reach	_____ inches	_____ inches	_____ inches
Shoulder	_____ inches	_____ inches	_____ inches
Trunk Lift	_____ inches	_____ inches	_____ inches
Muscle Endurance/Functional Strength			
Sit Ups	_____ reps	_____ reps	_____ reps
Push Ups	_____ reps	_____ reps	_____ reps
Pacer			
Heart Rate	_____ bpm	_____ bpm	_____ bpm

Appendix E: Program Assessment Questionnaire

Nutricise 4 Life Program Assessment

Answer the questions below to see how well your attitudes and current behaviors are. For each question, circle the number that best describes your attitude, then write the number on the line before each question number.

1. How motivated are you to try new strategies/techniques for changing your eating, exercise, and other behaviors

- 0 Not at all motivated
- 1 Slightly motivated
- 2 Somewhat motivated
- 3 Quite motivated
- 4 Extremely motivated

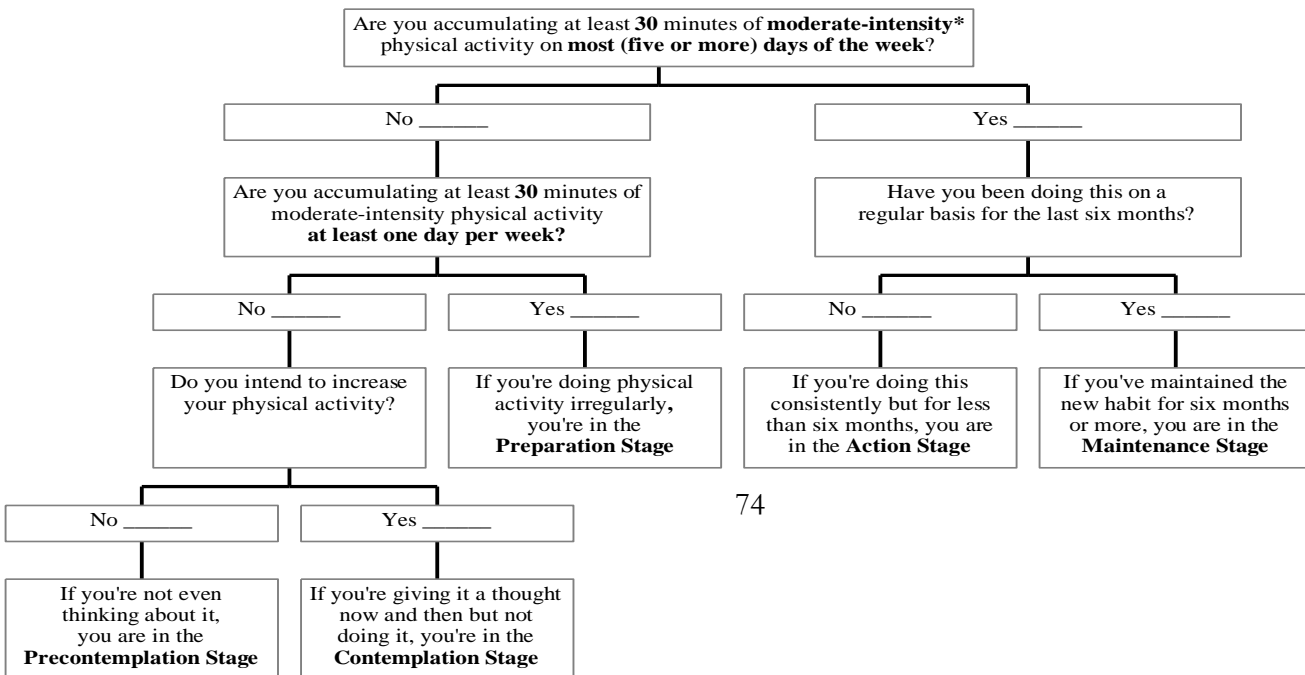
2. How confident are you that you will be able to work regular physical activity into your daily schedule?

- 0 Not at all confident
- 1 Slightly confident
- 2 Somewhat confident
- 3 Quite confident
- 4 Extremely confident

3. How confident are you that you will be able to exercise at least five days per week, most weeks?

- 0 Not at all confident
- 1 Slightly confident
- 2 Somewhat confident
- 3 Quite confident
- 4 Extremely confident

Physical Activity Readiness ~ Read each question and check each answer along with providing a description of the type of activity and how often you are currently doing it. (Example for question #1 ~ No X, I walk once a week for 15 minutes. A few examples of moderate-intensity physical activity include brisk walking, light jogging, mopping, activities where you break a sweat but can still talk)



Appendix F: Human Subjects Approval Letter



EASTERN MICHIGAN UNIVERSITY

September 12, 2008

Malorie Lander
c/o Anahita M. Mistry, Ph.D.
Eastern Michigan University
School of Health Sciences
Ypsilanti, MI 48197

Dear Malorie,

The CHHS Human Subjects Review Committee has reviewed the revisions to your proposal entitled: "Differences in Food Intake, Nutrition Knowledge, and Physical Activity levels in High School Students who Have Completed the Nutrition 4 Life program and Students Who Have Not" (CHHS 08-076).

The committee reviewed your proposal and its revisions and concluded that the risk to participants is minimal. Your study is approved by the committee.

Good luck in your research endeavors.

Sincerely,

Gretchen Dahl Reeves, Ph.D.
Interim Chair, CHHS Human Subjects Review Committee

Appendix G: 2008 N4L Schedule
Nutricise 4 Life
 South Western High School Schedule

WEEK 1		
Tuesday 9-02-08	WC- Janice	Orientation of Program & Walk (shield) <ul style="list-style-type: none"> • Ice breaker, Pre & Post Assessment • Pedometer Step Program • Height, Weight?
Thursday 9-04-08	WC- Janice	Pre- Fitness Assessment <ul style="list-style-type: none"> • Height, Weight, BMI • Muscle Endurance & Flexibility ~ push/curl up
WEEK 2		
Monday 9-8-08	YMCA- Janice	Pre- Fitness Assessment <ul style="list-style-type: none"> • Pacer • YMCA Orientation & use
Wednesday 9-10-08	YMCA	Pool~ Water Aerobics
Friday 9-12-08	WC- Malorie	Nutritional Requirements <ul style="list-style-type: none"> • Diet Assessment • Develop nutrition goals
WEEK 3		
Tuesday 9-16-08	YMCA	Pool <ul style="list-style-type: none"> • Basic Water Class Instruction • Prepare for kayak class
Thursday 9-18-08	Codorus: Sailboat Cove	Kayaking & lunch (Step Logs Due) <ul style="list-style-type: none"> • Learn safety precautions • Learn basic technique
WEEK 4		
Monday 9-22-08	Moul Field- Janice/Cathy	<i>Moul Field Team Building</i> <ul style="list-style-type: none"> • Various Activities
Wednesday 9-24-08	WC- Malorie	Nutrition Requirements Cont.
Friday 9-26-08	Codorus	Disc Golf & lunch
WEEK 5		
Tuesday 09-30-08	YMCA -Janice	Cardio & Weight Room Use
Thursday 10-02-08	MFC- Staff	Personal Fitness Plan with Goals <ul style="list-style-type: none"> • Facility Orientation

WEEK 6		
Monday 10-06-08	MFC- Staff	Circuit Training
Wednesday 10-08-08	WC- Malorie	Reading Food Labels <ul style="list-style-type: none"> • Serving Size • Read labels
Friday 10-10-08	MFC- Staff	Stability Ball <ul style="list-style-type: none"> • Core Stability
WEEK 7		
Tuesday 10-14-08	NO CLASS	NO CLASS
Thursday 10-16-08	WC-Malorie	Reading Food Labels Cont. <ul style="list-style-type: none"> • Healthier Snacks
WEEK 8		
Monday 10-20-08	MFC- Staff	Trouble Spot Toning
Wednesday 10-22-08	WC- Malorie	The Low-Down on Sugar <ul style="list-style-type: none"> • Healthier Drink Options
Friday 10-24-08	SWSD-Library	Eating Under Stress <ul style="list-style-type: none"> • Responses to stress, emotional eating and self-care
WEEK 9		
Tuesday 10-28-08	MFC- Staff	Personalized Workouts
Thursday 10-30-08	WC- Malorie	Low-Down on Fat <ul style="list-style-type: none"> • Different types of fat
WEEK 10		
Monday 11-03-08	MFC- Staff	Agility Training
Wednesday 11-05-08	YMCA2- Janice	Cardio Equipment Orientation <ul style="list-style-type: none"> • Receive Orientation on Weight Equipment • Discuss Personal Goals
Friday 11-07-08	WC- Malorie	Eating on the Run <ul style="list-style-type: none"> • Fast Food Choices
WEEK 11		
Tuesday 11-11-08	YMCA2- Janice	Cardio Equipment Orientation (Cont.) <ul style="list-style-type: none"> • Receive Orientation on Weight Equipment • Discuss Personal Goals
Thursday 11-13-08 short class	SWSD- Janice	Goal Check & Computer

WEEK 12		
Tuesday 11-18-08	YMCA2	Boot Camp <ul style="list-style-type: none"> • Increase agility, stamina & strength
Thursday 11-20-08	WC-Malorie	My Snack Options <ul style="list-style-type: none"> • Healthy Snacks
WEEK 13		
Monday 11-24-08	YMCA2	Body Flow <ul style="list-style-type: none"> • Proper Body Alignment • Yoga, Tai Chi & Pilates
Wednesday 11-26-08	NO CLASS	Thanksgiving Break, No Class
WEEK 14		
Tuesday 12-02-08	YMCA2	Cycling <ul style="list-style-type: none"> • Review Bike Set Up & Bring water & towel • Increase cardiovascular
Thursday 12-04-08	WC- Malorie	My Snack Options <ul style="list-style-type: none"> • Healthy Snacks
WEEK 15		
Monday 12-08-08	SWSD-Library	Environmental Influences & Overcoming Barriers
Wednesday 12-10-08	WC-Janice	Strength Training Made Easy <ul style="list-style-type: none"> • Teach full workout strength training routine using resistance bands
Friday 12-12-08	WC- Malorie	What Are You Really Paying For (Log Steps) <ul style="list-style-type: none"> • Food Companies Strategies
WEEK 16		
Tuesday 12-16-08	WC-AR Leigh	Kickboxing <ul style="list-style-type: none"> • Learn basic technique
Thursday 12-18-08	WC- Malorie	What Are You Really Paying For <ul style="list-style-type: none"> • Food Companies Strategies
WEEK 17		
Monday 12-22-08	WC-Janice	Nintendo Wii~
12-24-8 thru 02-09	NO CLASS	CHRISTMAS BREAK~ SCHOOL CLOSED
WEEK 18		
Monday 1-05-09	WC- Malorie	Taste Test <ul style="list-style-type: none"> • New Food Exposure

Wednesday 1-07-09	WC- Janice & AH	Post- Fitness Assessment & Environment Influence <ul style="list-style-type: none"> • Height, Weight, BMI • Muscle Endurance & Flexibility ~ push/curl up
Friday 1-09-09	YMCA- Janice	Post- Fitness Assessment (Step Logs Due) <ul style="list-style-type: none"> • Pacer • YMCA use
WEEK 19		
Tuesday 1-13-09	Grocery Store Tour~ Eisenhower	Grocery Store Tour <ul style="list-style-type: none"> • Read food labels to identify healthy items
Thursday 1-15-09	WC- Janice	Assessment Make Up & Goal Check <ul style="list-style-type: none"> • Post Program Assessment • Wii

Appendix H: Abbreviations List

ANOVA-Analysis of Variance

BMI-Body Mass Index

CDC-Center for Disease Control

CIHAHL-Cumulative Index to Nursing and Allied Health Literature

CAAL-Child Adolescent Activity Log

CRP- C-Reactive Protein

FACE-Family and Consumer Education

FOR-Food on the Run

IL-6-Interleukin 6

IOM-Institute of Medicine

LEAN-Leaders Encouraging Activity and Nutrition

N4L-Nutricise 4 Life

NCEP-National Cholesterol Education Program

NHANES-Nations Health and Nutrition Examination Survey

NIH-National Institute of Health

OGTT-Oral Glucose Tolerance Test

PACER-Progressive Aerobic Cardiovascular Endurance Run

PAQ-Program Assessment Questionnaire

PED-Physical Education Class

PUBMED-Publications Medical

T2DM-Type 2 Diabetes Mellitus

TNF-Tumor Necrosis Factor

USDA-United States Department of Agriculture

YMCA- Young Men's Christian Association