High school student knowledge of diet choices as modifiable cardiac risk factors

Eric J. Hamilton

Medical University of Ohio

Follow this and additional works at: http://utdr.utoledo.edu/graduate-projects
High School Student Knowledge of Diet Choices as Modifiable Cardiac Risk Factors

Submitted by

Eric Hamilton

In partial fulfillment of the requirements for the degree of
Master of Science in Biomedical Sciences

Date of Presentation:

December 15, 2005

Academic Advisory Committee

Major Advisor
Michael Guerra, M.S., PA-C

Department Chairperson
Patricia Hogue, M.S., PA-C

Dean, College of Health Sciences
Christopher E. Bork, Ph.D., P.T.

Dean, College of Graduate Studies
Keith K. Schlender, Ph.D.
High school student knowledge of diet choices as modifiable cardiac risk factors

Eric J. Hamilton, MS, PA-S
Medical University of Ohio at Toledo
2005
Advisor: Michael Guerra, PA-C, MS
Table of Contents

I. Introduction ............................................................................................................. 1
   a. Problem statement............................................................................................. 1
   b. Background........................................................................................................ 1
   c. Purpose ............................................................................................................. 3
   d. Research question............................................................................................ 3

II. Literature Review .................................................................................................. 4

III. Methods ................................................................................................................. 19
   a. Design................................................................................................................ 19
   b. Permission/ Authorization................................................................................. 19
   c. Survey instrument.............................................................................................. 19
   d. Participants and Procedure.............................................................................. 20

IV. Results .................................................................................................................... 21

V. Discussion ............................................................................................................... 25

VI. Conclusion ............................................................................................................. 32

VII. References ............................................................................................................ 35

VIII. Appendices ......................................................................................................... 41
   a. Letters............................................................................................................... 41
   b. Survey............................................................................................................... 44
   c. Tables and Figures............................................................................................. 46

IX. Abstract.................................................................................................................. 49
Introduction

Problem statement

Poor diet choices have been strongly associated with heart disease throughout the lifespan. These diet choices have been proven to contribute to heart disease both directly and indirectly beginning at an early age. High school students may not know enough about nutrition or cardiac disease to make basic heart healthy choices in their dietary decisions. If appropriate dietary choices are made beginning in adolescence and carrying on throughout adulthood, the risk of future heart disease may be dramatically decreased.

Background

Heart disease is the leading cause of death in the United States, killing over 930,000 Americans each year. In addition, coronary artery disease is a leading cause of morbidity and premature and permanent disability among the United States population that is of working age (U.S. Department, 2004). Almost ¼ of the total population in America (about 63 million Americans) have some form of cardiovascular disease, resulting in nearly 6 million hospital admissions per year, and a cost of 238.6 billion dollars for healthcare and 142 billion dollars for lost revenue and productivity in 2004 (Preventing heart disease, 2004). Furthermore, Ohioans die of heart disease at a rate of 572 (versus the national average of 536) per 100,000 deaths (Heart disease, 2004). In the year 2000, the CDC reported the death rate due to heart disease in Lucas county (the county in which the study was performed) to be 627 per 100,000 deaths. This rate
is one of the 15 highest of all counties in Ohio and the highest of all counties in northern, western and central Ohio (Lucas, Ohio 2004). There is no question that heart disease has an incredible impact on society in the United States and a disproportionately high impact in Ohio, particularly in Lucas county. Although there are many avenues by which one may endeavor to make a positive impact on this problem, one of the best seems to be to ensure that steps are taken at as early of an age as is possible and efficacious to educate people to make better choices concerning heart health.

High school students are in the midst of a period in their lives in which they are faced with daily choices that have the potential to have lasting, sometimes permanent repercussions on their lives. Adolescence is a period of rapid growth and development on many levels, including physiologic, psychologic and social levels. These changes have the potential to influence not only a teenager’s daily dietary needs but also their ability to make the best choices to supply those needs.

Evidence of early heart disease, particularly atherosclerotic plaques has been identified in the arteries of patients as young as 2 to 18 years of age (Berenson, Srinivasan, Bao, et al., 1998). The high school years are a primary, perhaps even ideal time to equip young people between the ages of 13 and 19 to make appropriate dietary choices that may very well spare them the severe ramifications associated with heart disease morbidity and mortality later on in life. It has been estimated that one-third of all cardiovascular disease mortality can be attributed to diet choices (Lytle, 2002). Poor dietary choices, themselves a secondary heart disease risk factor, contribute to many other cardiac risk factors, including: major modifiable CAD risk factors such as
hypertension ad low HDL; cardiac equivalents such as diabetes mellitus; secondary coronary artery disease risk factors such as metabolic syndrome and obesity; and hyperlipidemia.

The first step in making more positive dietary changes begins with knowledge. It was in the pursuit of investigating a perceived deficit in knowledge of dietary choices as modifiable cardiac risk factors that this study began. It is imperative that high school students graduate and begin the rest of their lives with a basic knowledge of health and nutrition, particularly those nutritional choices that relate to the number one cause of mortality in the United States, Ohio, and Lucas county. Are high school students being adequately taught basic principles pertaining to heart healthy diet choices? Do high school students retain what they are taught in their schools (are they even being taught these basic principles)? This study undertook to answer such questions.

**Purpose**

The purpose of this study was to evaluate the knowledge that a typical adolescent (age 13-19) has concerning the effects of diet choices on heart health.

**Research Question**

What do high school students in the Sylvania public school district currently know and understand about diet choices as they relate to heart disease?
High school student nutritional knowledge

Little research has been done on the topic of current adolescent nutritional knowledge. Thakur and D’Amico (1999) found that there was no significant difference in nutritional knowledge between obese and non-obese students in any area tested except for the ability to identify high fiber foods (obese students were actually better able to identify foods that were high in fiber than non-obese students). The study involved the analysis of 289 surveys returned by high school students in grades 9-12 from 3 schools. The survey in the study included questions concerning high-fat foods, high-fiber foods, and fruits and vegetables.

In a study of 780 adolescents age 14-19 years of age (Backman, Haddad, Lee, et al., 2002), adolescents indicated that eating more servings of fruits and vegetables and limiting caloric intake had a stronger association with their intention to eat a healthy diet than consuming fewer calories from fat.

Another study addressing the issue of adolescent knowledge of healthy dietary choices was done by Croll, Neumark-Sztainer, and Story (2001). The authors investigated what the words “healthy” and “unhealthy” meant to 203 adolescent male and female students in grades 7-12 in the St. Paul, Minnesota public school district. They found that adolescents generally had a good understanding of healthy eating recommendations. They consistently named fruits, vegetables, and lean meats (especially baked chicken and turkey) as healthy eating choices. The adolescents studied also demonstrated an understanding of which foods might be considered...
unhealthy (foods that they mentioned included: chips, candy, carbonated beverages, fast food, pizza, pies, cakes, ice cream, steak, beef, ribs, and chicken with the skin). They also demonstrated knowledge of healthy dietary behaviors. Interestingly, only a few participants described long-term health benefits as being associated with healthy eating. Furthermore, the majority of students indicated that healthy eating was not important to them at this age (implying a lack of understanding of the link between diet choices and heart disease later on in life). This study is important due to the disparity between health knowledge and behavioral choices. Although students demonstrated a good understanding of what healthy foods and healthy dietary choices include, this understanding did not consistently influence their concern for what they ate or their decisions regarding dietary choices.

Adolescent heart disease and cardiac equivalents

In a study published in 1996, Mahoney, Burns, Stanford, et al. used electron beam computed tomography to detect coronary artery calcification in subjects (197 males and 187 females) during childhood and subsequently in adulthood in order to examine the relationship between coronary artery calcification and coronary risk factors during childhood and adulthood. They found numerous correlations. Mean childhood measures of weight, BMI, and triceps skinfold thickness were significantly higher in adult males with coronary artery disease than those without CAD. Elevations in childhood body mass index, weight and triglyceride levels were found to be significantly related to coronary artery calcification in young adulthood 15 to 20 years later.
Findings from the Bogalusa Heart study have had a profound impact on our understanding of cardiovascular disease in childhood and adolescence. In the Bogalusa Heart Study (Berenson, Wattingney, and Tracy, 1992; Newman, Freedman, and Voors, 1986), postmortem identification of coronary artery fatty streaks in patients between the ages of 6 and 30 was significantly associated with elevations in serum triglyceride, VLDL, systolic and diastolic blood pressures, and the ponderal index (a measure of obesity: the cube root of body weight times 100 divided by height in cm).

In a study by Li, Chen, Srinivasan, et al. (2003) that also had its roots in the Bogalusa Heart Study, investigators examined carotid artery intima-media thickness (IMT) in a population of 486 adults age 25 to 37. A prerequisite of the study was that each adult had to have at least 3 traditional cardiac disease risk factors identified since childhood. Investigators gathered information regarding childhood cardiac risk factors from surveys of children involved in the Bogalusa Heart Study. Carotid IMT was subsequently measured using ultrasound. This technique has been found to be a reliable and noninvasive technique to assess the presence and extent of coronary atherosclerosis. Investigators found childhood measures of LDL-C and BMI were reliable predictors for being in the top vs lower 3 quartiles of carotid IMT in young adulthood. In addition, cumulative burdens of LDL-C, and low HDL-C measured serially since childhood were found to be independent risk factors for having increased carotid IMT during adulthood.

Another study that involved performing autopsies on a group of younger subjects was published by Berenson, Srinivasan, Bao, et al. in 1998. In this study, autopsies were performed on 204 subjects between the ages of 2 and 39 who had died from
various causes (mostly accidents and homicide) in an effort to correlate cardiac risk factors with the severity of atherosclerosis in coronary arteries and the aorta. The results were not surprising. Fifty percent of subjects age 2 to 15 were found to have fatty streaks in their coronary arteries and 100% were found to have fatty streaks in their aorta. A positive, significant correlation was found to exist between atherosclerotic lesions and BMI, systolic and diastolic blood pressures, serum total cholesterol concentrations, serum LDL-C concentrations, and serum triglyceride concentrations. In addition, as the number of cardiac risk factors rose, so did the percentage of intimal surface area involved with fatty streaks in both the aorta and the coronary arteries. In addition, investigators found that fatty streak lesions in the coronary arteries of subjects were positively correlated with cigarette smoking.

In the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study (Strong, et al., 1999), investigators examined the bodies of 2,876 subjects between the ages of 15 and 34. The subjects included males and females, Caucasians and African-Americans - all of whom died of external causes and subsequently underwent autopsy between 1987 and 1994. Among subjects between the ages of 15-19, pathologists found intimal lesions in all of the aortas and more than half of the right coronary arteries. They also discovered that fatty streaks were more prevalent in African-American subjects than Caucasians. Raised lesions (fibrous plaques), however, did not differ significantly between the ethnic groups. In addition, although males and females had similar numbers of raised lesions in their aortas, male subjects tended to have more raised lesions in their right coronary arteries than their female counterparts. Overall, the prevalence of total lesions was lower in subjects’ right coronary arteries when compared
to their aortas. However, the proportion of raised lesions among these total lesions was higher in the right coronary arteries than in the aortas. The investigators also found that VLDL cholesterol and HbA1C were positively associated with both fatty streaks and fibrous plaques, while hypertension was positively associated only with extensive fibrous plaques. In addition, a direct relationship between BMI and the extent of fibrous plaques in the right coronary artery was found. HDL was negatively associated with both fatty streaks and fibrous plaques. This study added confirmation to the increasing amount of data supporting the hypothesis that cardiovascular disease has its roots in childhood and adolescence.

Diabetes mellitus has always been a concern among children and adolescents. This age group has traditionally suffered from DM type 1. Recently, however, an alarming number of cases of DM type 2 have been identified in this age cohort - and these numbers appear to be on the increase. Diabetes mellitus type 2 now accounts for up to 45% of new cases of diabetes in children and adolescents in the United States. Children with DM type 2 are almost always overweight or obese. In addition, the increase in prevalence of DM type 2 among children and adolescents temporally coincides with the increase in prevalence of childhood overweight and obesity (Botero & Wolfsdorf, 2005).

Adolescent overweight and obesity

In the United States, an estimated 4.7 million youth between the ages of 6-17 are overweight or obese ("Position of the American Dietetic Association, Society for Nutrition Education, and American School Food Service Association," 2003).
Prevalence of overweight adolescents in the United States nearly doubled over a 20 year period (Wang, Monteiro, and Popin, 2002). Prevalence of overweight increased from 15.4% of U.S. adolescents between 1971-1974 to 25.6% between 1988-1994. Between 1980 and 1994, the prevalence of obesity among children in the United States doubled. It is estimated that 24% of children are above the 85th percentile and 11% are above the 95th percentile for body mass index (Ludwig, Peterson, & Gortmaker, 2001).

Nicklas, Yang, Baranowski, Zakeri, and Berenson (2003) found that eating patterns that have been positively associated with adolescent overweight status include: consumption of sweetened beverages, sweets (defined as deserts, candy and sweetened beverages), meat, total gram consumption of low-quality foods (defined as salty snacks, candy, desserts, fats/oils, and sweetened beverages), and total gram amount of foods and beverages consumed. The authors examined data from the Bogalusa Heart Study (a long term study that began in 1973 designed to examine the natural history of heart disease in an African-American and European-American population).

Whitaker, Write, Pepe, Seidel, and Dietz (1997) discovered that a background of childhood obesity significantly increases the risk of adult obesity. In their study, height and weight from the records of 854 subjects born in Washington state were documented. In addition, parental medical records were reviewed. Several interesting findings were made. First, children under three years of age who did not have obese parents were found to be at low risk of obesity during adulthood. Second, childhood obesity in children over age three was found to be an increasingly (with age) important predictor of adult obesity regardless of parental obesity status. Finally, parental obesity
was found to more than double the risk of adult obesity among all children under ten years of age, regardless of the child’s BMI. No significant difference between genders was discovered.

There is a great deal of evidence linking adolescent obesity with cardiovascular disease and other CVD risk factors. Laur and Clarke (1984) demonstrated through prospective data that obese boys and girls (BMI > 90th percentile) were 9-10 times more likely to develop hypertension as young adults compared to non-obese children. Data from the Bogalusa Heart Study also indicated that overweight adolescents (BMI > 75th percentile) were 8.5 times more likely to have hypertension as adults compared to adolescents with a BMI < 75th percentile (Srinivasan, Bao, Wattigney, & Berenson, 1996). Data from this same study also indicate that overweight during adolescence was associated with a 2.4 fold increase in prevalence of total cholesterol > 240mg/dL, a 3-fold increase in LDL > 160 mg/dL, and an 8 fold increase in HDL levels < 35 mg/dL in adults. Adolescent obesity, especially among males has been associated with increases in total cholesterol and LDL- cholesterol in adulthood (Laur, Lee, & Clark, 1988).

Must, Jacques, Dallal, Bajema, and Dietz (1992) examined growth records from the Third Harvard Growth Study (of 1922-1934). They found that BMI > 75th percentile in adolescents between 13-17 years of age was associated with an increased CHD mortality rate (2.3 relative risk) when compared with adolescent males with a BMI < 75th percentile. They also found that risk of morbidity related to heart disease and atherosclerosis was increased among males and females with a BMI > 75th percentile during adolescence.
A fundamental issue that must be addressed in this discussion is whether people who are obese as adolescents will remain obese as adults. Gordon-Larsen, Adair, Nelson, and Popkin (2004) examined data obtained on over 20,000 adolescents over a 5 year study period through National Longitudinal Study of Adolescent Health (a school-based study of U.S. adolescents in grades 7-12). They discovered that of the 12.7% of the population that was obese at the beginning of the 5 year study, 9.4% of the population remained obese after 5 years. These findings further strengthen the argument that diet choices during adolescence have health implications (particularly cardiovascular) for many years to come.

Adolescent carbohydrate consumption

In 2003, French, Lin, and Guthrie examined three previous studies (the 1977/78 Nationwide Food Consumption Survey, the 1994/96 Continuing Survey of Food Intakes by Individuals, and the 1998 Supplemental Children’s Survey) to discover if there were any trends in soft drink consumption among children and adolescents age 6 to 17 years of age. The results were striking. They noted that the mean intake of soft drinks had more than doubled (from 5 fluid ounces to 12 fluid ounces per day) between the 1977/78 survey and the surveys done in the 1990s; in addition, the percentage of children consuming soft drinks on any given day increased by 48% (from 37% in 1977/78 to 56% in 1994/96) during the same time period. Interestingly, the greatest increases were found in the 14-17 year old age group (versus the 11-13 year old age group and the 6-10 year old age group). Ludwig, Peterson, and Gortmaker (2001) studied 548 school children with ethnically diverse backgrounds from various public
schools in Massachusetts. Their study demonstrated that 1 serving of soft drinks per
day apparently increased the risk of becoming overweight by 60% during the course of
one year. In addition, soft drink consumption was associated with a higher energy intake
in general in participants. Each additional serving of sugar-sweetened beverage
consumption was associated with an increase in obesity and BMI. This may place these
children at greater risk of becoming overweight or obese. Soft drinks were found to be
the leading source of added sugars in the adolescent diet (accounting for an average of
36.2 grams daily for adolescent females and 57.7 grams daily for males).

Forshee and Storey (2001) analyzed the data from the USDA 1994-1996
Continuing Survey of Food Intakes by Individuals for statistical (and practical)
significance of adolescent sugar intake on diet and nutritional choices. They found that
additional grams of added sugars were associated with increases in grain, lean meat,
vitamin C, iron and folate consumption. On the other hand, added sugars were
associated with decreased consumption of vegetables, fruit and dairy products. The
authors caution that, though their findings are of statistical significance, they are of very
little practical significance. For example, the authors note that a participant would have
to consume 476 additional grams of sugar (or approximately 12 carbonated beverages)
to reduce the predicted number of fruit servings by one.

Adolescent sodium consumption and Hypertension

Data from the Bogalusa Heart Study (Srinivasan, Bao, Wattigney, and Berenson
1996) demonstrated that hypertensive children who maintained this status as adults
were at increased risk of having greater waist to hip circumferences and greater body
weight, BMI, and skinfold thickness. In 2004, Geleijnse, Kok and Grobbee performed meta-analyses and quantitative reviews of 253 previous blood pressure studies in Western populations in order to identify the factors that these studies found contributed most to hypertension. Their research identified being overweight as the largest contributor to hypertension. Sodium intake was a close second. Low potassium intake and low magnesium intake also had an impact, albeit a lesser one, on hypertension.

He, et al. (2002) published a study examining the relationship between blood pressure and body fat distribution in a pediatric sample of patients. They sought to investigate this relationship because of the association between central (truncal) body fat and increased cardiovascular risk factors as compared to the cardiovascular risk factor patterns associated with peripherally deposited fat. They measured blood pressure and fat distribution (through skinfold thickness and dual-energy x-ray absorptiometry testing) in 920 healthy children and adolescents between the ages of 5 and 18. Investigators found that males (regardless of race or pubertal stage) demonstrated significant direct relationships between increased systolic and diastolic blood pressures and increased trunk fat as measured by both DEXA and skinfold tests.

Adolescent saturated fat consumption and Lipid levels

Kwiterovich, Vining, Pyzik, Skolasky, and Freeman (2003) found a direct relationship between a high fat ketogenic diet and increased mean plasma levels of total cholesterol, LDL-C, VLDL, triglycerides, apolipoproteins, and non-HDL cholesterol in children and adolescents. This diet was also associated with significant decreases in
HDL cholesterol. The diet examined in this study was a high-fat ketogenic diet (3:1 ratio of fat to carbohydrate plus sufficient protein for growth) employed in the treatment of seizures in children and adolescents that are refractory to traditional medical management. The study was a prospective study of 141 children and adolescents between the ages of 4 months and 20 years. The authors examined the effects of the diet on plasma lipoproteins in children being treated with this diet. Guidelines concerning cholesterol as set forth by the National Cholesterol Education Program were utilized. The elevations of total cholesterol and LDL cholesterol remained significant at the 12 and 24 month follow-ups. Although this diet represents an extreme in consumption of fatty foods, it is important to the present study for two reasons: it is one of few studies examining the link between fatty diets and cholesterol in this age cohort and it demonstrates a direct relationship between the two.

In a study published in 2002, Srinivasan, Myers, and Berenson investigated the distribution of non-HDL cholesterol levels in 2,843 children age 5 to 17 years old who had participated previously in the Bogalusa Heart Study. Not surprisingly, non-HDL cholesterol was found to have an inverse relationship to HDL cholesterol. In addition, it was found that age was directly related to both non-HDL cholesterol and LDL cholesterol levels. Finally, BMI and waist circumference were both positively associated to non-HDL cholesterol levels. No differences in non-HDL levels were found between Caucasian and African-American children.

McGill, McMahan, Malcom, Oalman, and Strong (1997) examined data obtained from autopsies of 1,079 men and 364 women age 15 to 34 years of age in an effort to evaluate the relationship between serum lipoproteins and atherosclerosis in young men
and women. They determined that VLDL and LDL-C concentrations were positively associated with fatty streaks and raised lesions in both the abdominal aorta and right coronary artery. In addition, they established that HDL-C levels were inversely associated with lesions of both types in the abdominal aorta and right coronary artery. These findings were noted in all age and racial groups.

Gender, Ethnic, and Parental education influences

Xie, Gilliland, Li, and Rockett (2003) investigated the effects of numerous variables on adolescent dietary intake. A 131 item questionnaire was distributed among 3,201 participants (ranging in age from 11-20) in the Children’s Health Study. They found that males had significantly higher intakes of total fat, saturated fat, monounsaturated fat, protein, cholesterol and calcium and had lower intakes of carbohydrates, fiber, vitamin C and vitamin A than their female counterparts. Females were more likely to meet RDA requirements for fruit and vegetables. They also found that intakes of total fat, saturated fat, monounsaturated fat, and polyunsaturated fat were lowest in Asians and highest in African-Americans (except for saturated fat intake which was highest in Non-Hispanic Whites). Hispanics and Asians were found to have significantly higher cholesterol intake than African-Americans and Non-Hispanic Whites. Hispanic Whites were found to have a lower intake of vegetables than African-Americans, Asians, and Non-Hispanic Whites. African-Americans had the highest sugar intakes while Asians had the lowest sugar intakes. It was also discovered that intakes of total fat, saturated fat, monounsaturated fat and cholesterol tended to decrease as parental education levels increased. Higher parental education levels (except for
participants whose parents did not complete high school) also appeared to correlate with higher intake of carbohydrates, protein, fiber, folate, fruits, and vegetables.

**Interventional programs**

Various research studies have looked at the impact of health education programs on adolescents’ knowledge of nutrition. Reinhardt and Brevard (2002) examined the effects of an intense health and physical education curriculum on high school student nutrition knowledge. Participants were given a pre- and post-intervention test containing 34 questions regarding nutritional knowledge and 30 questions relating to physical activity knowledge. Students demonstrated a 17% increase in total points possible on the nutritional knowledge questions (mean pre-intervention score = 20/34; mean post-intervention score = 27/34).

An important issue must be addressed here. Certainly interventional programs may have a positive affect on knowledge, but does that knowledge correlate with behavioral choices as well? There is some evidence to support the idea that adequate nutritional instruction may, in turn, produce behavioral changes. Research conducted by the Centers for Disease Control and Prevention in 1996 demonstrated a positive correlation between behavioral change and the amount of nutrition instruction received. In 1997, Probart, Mcdonnell, Achterberg, and Anger found that participants who received an intense school-based health education program (including intense lessons, increased time of instruction, and parental involvement) demonstrated significant improvements in students’ health knowledge and improved behavioral choices concerning diet and physical activity.
Fardy, et al. (1996) randomly assigned 346 students from a New York City public school to either a coeducational health curriculum or the control group (which received standard physical education classes). The coeducation health curriculum consisted of 20-25 minutes of circuit training exercises and approximately 5-10 minutes of health-behavior lectures and discussions five times per week for eleven weeks. Students were tested before and after the intervention. The authors discovered a significant increase in cardiovascular health knowledge for males and females in the treatment group compared to the control group. Mean scores for females in the treatment group increased from 51 to 56 out of a possible 100 points (control group demonstrated a decline in mean scores from 53 to 48). Mean scores for males in the treatment group increased scores from 44 to 50 out of 100 possible points (compared to control group decrease from 47 to 40). Females in the treatment group reported improvement in their choice of food (decreased intake of saturated fat, cholesterol, salt and sugar). In addition, females in the treatment group demonstrated a significant improvement in their cardiovascular fitness (as measured by VO2 max improvement). Males also demonstrated some improvement in these areas but the difference was not significant when compared to the control group.

In another study published in 1996 (Edmundson, et al.) 6,000 students (3rd-5th graders) from 96 schools across California, Louisiana, Minnesota, and Texas were randomized to two interventional groups and a control group. The first interventional group received the study education curricula, a physical education program, a campus no-smoking policy, and a school based food service intervention program. The second interventional group included all of the first group’s interventions with the addition of a
home-based intervention. The control group received the schools’ standard health education curriculum. A health behavior questionnaire (which measured food consumption, dietary knowledge, physical activity and several other constructs) was administered before and after intervention. The findings of the study demonstrated a significant improvement in health knowledge and healthy food choices in both intervention groups.

These studies suggest that interventional programs do in fact have a positive influence not only on adolescent health knowledge but, perhaps more importantly, on their behavioral choices as well. A few studies have revealed that increased knowledge of nutrition does not necessarily prompt behavioral changes in eating patterns. (Nestle, et al., 1998 and Merron and Lock, 1998). However, it is likely that behavioral changes may tend to occur slowly and require a greater time span than changes in knowledge. Such behavioral changes may necessitate frequent reinforcement.
Method

Design

Descriptive: Survey-based study assessing Sylvania public high school students’ knowledge and understanding of diet choices as they relate to heart disease.

Permission/ Authorization

The assistant superintendent of Sylvania School District was contacted to discuss the possibility of conducting survey research with the high school students in their school district. Upon review of the preliminary survey tool, permission was granted by the superintendent and assistant superintendent of Sylvania School District to conduct survey research. Written notification of permission was obtained from the superintendent of Sylvania School district. An expedited research form was submitted to the Institutional Review Board (IRB) at the Medical College of Ohio. The IRB at MCO subsequently approved the data collection method and all procedures.

Survey Instrument

Data were gathered using an anonymous questionnaire that elicited demographic information and tested students’ general knowledge of heart disease, basic knowledge of dietary choices, and understanding of how these dietary choices influence cardiac health. Fourteen demographic questions were designed to gather information concerning student age, ethnic background, grade in school, prior health education, weight, height, general nutrition choices, smoking history, and general parental
background (e.g. education, health status). Nutrition knowledge relating to cardiac health was measured by administering 3 true/ false and 12 multiple-choice questions. The questions were selected from a broad range of issues related directly to the role of diet in preventing and/ or causing heart disease. The concepts tested included dietary fats (saturated, unsaturated, monounsaturated, omega-3 fatty acids), salt intake, sugar intake, diabetes, cholesterol, calories, fiber (soluble), and general heart disease knowledge (see survey questions in Appendix for further detail). The survey was presented on one page, front and back.

Participants and Procedure

The high school students that were targeted for the study included those students enrolled in the two senior high schools in the Sylvania School District (Northview High and Southview High). One thousand three hundred (1,300) surveys were distributed to the principal of Northview high school and one thousand three hundred (1,300) surveys were distributed to the principal of the Southview high school. The surveys were subsequently dispersed to the homeroom teachers in the each high school to be further distributed to students during their homeroom period over the course of two weeks in May 2005. Upon completion, the surveys were gathered and returned to the principles of the high schools at which point they were collected for analysis. Anonymity was ensured throughout the process. Of the surveys returned, 1,081 surveys were usable for study purposes.
Results

A total of 2,600 surveys were distributed to high school students in the Sylvania school district of Sylvania, Ohio. Of these, a total of 1,081 surveys were returned in usable condition. Respondents were first asked numerous demographic questions (age, gender, grade level, height and weight, race, cigarette use, enrollment in health education classes, weekly exercise, weekly fish and fast food consumption, daily vegetable consumption, preventative healthcare screening, highest level of parental education, and family history of heart disease risk factors). The results of these questions are summarized in Tables and figures in the Appendix.

Are high school students aware of the link between diet choices during adolescence and heart disease in the future?

When asked to identify the link between eating bad foods between the ages of 12 and 20 and heart health and cholesterol levels in the future, 76.5% of respondents identified the correct answer. Overall, the vast majority of respondents indicated that eating bad foods between the ages of 12 and 20 may contribute to heart disease and high cholesterol 20 years from now.

Are high school students able to differentiate between "good" and "bad" fats?

Two questions (multiple choice questions 1 and 5) were asked in order to assess the ability of the adolescent population to differentiate between “good” and “bad” fats. True/false question number 1 asked students to decide whether or not they believed
that monounsaturated fats were “good” for them. Overall, 48.6% of all respondents correctly identified “true” as the appropriate response. The second question in this category was multiple choice question number 5. When asked about the health benefits of omega-3 fatty acids, 39.2% of the adolescents who responded indicated that omega-3 fatty acids may help to keep the heart healthy.

Are high school students able to identify foods that contain nutrients that are linked to heart disease?

Two questions were designed to evaluate respondents’ ability to identify foods that contain nutrients that are linked to heart disease. The first of these was multiple choice question number 6. This question asked respondents to choose the food group that contained the highest levels of saturated fats. Overall, 16.5% of respondents correctly chose “dairy products and meat” as the food group highest in saturated fats. In contrast, 67.4% of respondents incorrectly indicated that “candy, sugar, and carbonated beverages” was the food group containing the highest levels of saturated fats. Multiple choice question number 7 asked respondents to identify the consequences of a diet high in salt. Overall, 58.2% of respondents correctly identified that a diet high in salt can lead to increased risk of hypertension, increase fluid retention, and increased risk of heart disease.

Are high school students able to identify foods that contain nutrients that may prevent heart disease?
Four questions were designed to evaluate respondents’ ability to identify foods that contain nutrients that may prevent heart disease. These questions were multiple choice questions 2, 8, 9, and 11. Multiple choice question number 2 asked respondents to identify the food choice containing omega-3 fatty acids. Overall, 41.5% of respondents correctly selected fish as the right answer. Multiple choice question number 8 asked respondents to choose the food that may help to lower blood cholesterol. Overall, 33.5% of respondents correctly identified soluble fiber as the appropriate response. In contrast, 32.3% of respondents incorrectly chose protein as the food that might help to lower cholesterol levels. Multiple choice question number 9 asked respondents to select the food choice known to contain the healthiest fats. The correct response (fish) was identified by 54.5% of respondents. Multiple choice question number 11 asked respondents to identify the food containing the least saturated fat. Olive oil (the correct answer) was selected by 47.3% of respondents.

*Are high school students able to identify behavioral choices that are linked to elevated cholesterol levels?*

When asked to identify the behavioral choices that may help to control cholesterol levels, 73% of respondents correctly chose “all of the above.” This response indicated belief that avoiding cigarette smoking, consuming alcohol in moderation, regularly exercising, and consuming a healthy diet were behaviors that may help to control cholesterol levels.
Are high school students able to identify heart disease as the leading cause of death in the U.S.?

Overall, 48.4% of respondents correctly chose heart disease as the leading cause of death in the United States.

Are high school students able to identify common risk factors for heart disease?

Three questions (true/false numbers 2 and 3 and multiple choice number 10) were intended to assess respondents' ability to identify common risk factors for heart disease. True/false question number 2 asked respondents if they believed that smokers have a “much greater risk of developing heat disease than non-smokers”. Overall, 89.3% of respondents correctly selected true as the appropriate response. True/false question number 3 asked respondents if diabetes may lead to heart disease. The correct response (true) was identified by 79.8% of respondents. Multiple choice question number 10 asked respondents to select the items associated with an increase in risk of heart disease. “All of the above” (poor diet, genetics, high blood pressure, and cigarette smoking) was correctly chosen by 72.4% of respondents.
Discussion

The purpose of this study was to evaluate the knowledge that a typical adolescent (age 13-19) has concerning the effects of diet choices on heart health. Data was collected via a survey distributed to the two senior high schools in the Sylvania School District. The survey was designed to gather information regarding respondent demographics and knowledge of various diet issues pertaining to cardiac health. Respondents were asked to choose the one best answer for all true/false and multiple choice questions.

When asked to identify the link between eating bad foods between the ages of 12 and 20 and heart health and cholesterol levels in the future, it was encouraging that 76.5% of respondents believe that eating bad foods during adolescence may indeed contribute to heart disease and high cholesterol 20 years from now. This is in apparent contrast to a study by Croll, Neumark-Sztainer, and Story (2001) in which only a few of the 203 participants between 7-12 grade described long-term health benefits as being associated with healthy eating. This is a critical foundational concept for adolescents to grasp as it is difficult to encourage a person to take a more proactive role in their eating patterns if they do not believe that there are long term consequences for the choices they make regarding their diet.

True/false question 1 and multiple choice question 5 were designed to assess the ability of the adolescent population to differentiate between “good” and “bad” fats. The results were somewhat discouraging. When asked to decide whether or not monounsaturated fats were “good for you,” 48.6% of the respondents correctly identified
“true” as the appropriate response. This distribution of responses suggests that respondents were, in effect, guessing the correct response. If respondents were guessing, one would expect a 50/50 distribution similar to the results one would expect to find in head/tail distribution of numerous flips of a coin. Furthermore, the fact that the near 50/50 distribution favored the incorrect response demonstrates a poor understanding of the value of monounsaturated fats in the heart-healthy diet. Respondents’ answers regarding omega-3 fatty acids were somewhat more encouraging. Results indicated that 39.16% of respondents believe that omega-3 fatty acids may help to “keep your heart healthy.” There is still room for improvement in this category as 27.19% of respondents still thought that the best answer to the question was that omega-3 fatty acids cause high blood pressure while 21.01% chose “cause you to gain weight” as the appropriate response. It is important here to concede the point that a diet high in omega-3 fats, just as a diet high in any fat, may indeed contribute to weight gain and subsequently high blood pressure. However, the one best answer in this instance is still that omega-3 fatty acids help to keep your heart healthy.

Multiple choice questions 7 and 8 were included in order to evaluate high school students’ ability to identify foods that contain nutrients that are linked to heart disease. Students were first asked to identify the food grouping that contained high levels of saturated fats. Although some confusion between two of the food groupings in particular was expected prior to the study (namely “candy, sugar & carbonated beverages” and “dairy products and meat”), it came as some surprise that 67.44% of the respondents chose “candy, sugar, and carbonated beverages” as the food grouping containing high levels of saturated fat, while only 16.47% chose the correct response (“dairy products
and meat”). It seems reasonable to conclude that perhaps some of the confusion stems from the traditional teaching that “sweets are bad for you.” Although excessive intake of candy, sugar and carbonated beverages is certainly detrimental to one’s cardiac health, it is the food group’s high sugar content (rather than high saturated fat content) that can contribute to heart disease. This may be accomplished via induction of a hyperglycemic state and possibly subsequent insulin resistance and diabetes. The food grouping that is typically higher in saturated fats is undoubtedly the “dairy products and meat” food grouping. It is certainly worthy of note that a great deal of progress has been made toward decreasing the saturated fat content of milk, cheese, and red meat in particular. However, it is important to recognize the potential for these foods to play a role in heart disease when they are not eaten in moderation and/or not eaten in their reduced fat form. Their link to heart disease is through their high saturated fat content and, more specifically, through their possible contribution to elevated LDL-C levels.

Results of the other multiple choice questions designed to evaluate high school students’ ability to identify foods that contain nutrients that are linked to heart disease was more promising. Respondents were asked to identify the response most closely correlated with the consequences of consuming a diet high in salt. Nearly 60% (58.16%) of respondents believe that a high-salt diet can contribute to an increased chance of hypertension, increased fluid retention and increased chance of heart disease. Perhaps the apparent discrepancy between adolescent knowledge of the effects of salt consumption and knowledge of the effects of omega-3 fatty acids (previously discussed) is due to the fact that the negative effects of salt consumption have been known and
taught for many years now, while the effects of omega-3 fatty acids are a relatively newer area of investigation.

Multiple choice questions 2, 8, 9, and 11 were intended to assess adolescents’ ability to identify foods that contain nutrients that may prevent heart disease. Respondents were first asked to identify which food (or food grouping) contained omega-3 fatty acids. Responses were variable with 41.5% of respondents choosing fish as the appropriate response. Interestingly, many respondents (30.58%) chose chicken as the food most known to contain omega-3 fats. Although it was encouraging that respondents chose the correct answer more frequently than any of the other options presented, fish was by no means the overwhelming choice. This indicates some confusion among respondents regarding which food contains omega-3 fats. In addition, results of the survey demonstrated confusion over which food has been shown to help lower blood cholesterol. More respondents chose soluble fiber as the nutrient known to help lower cholesterol levels. However, this frequency (33.55%) was not an overwhelming majority. Apparently, nearly the same percentage of respondents (32.33%) thought that protein was the more likely nutrient to help lower blood cholesterol. This was quite unexpected. It seemed more likely that respondents would be confused over which form of fiber (soluble vs insoluble) has been shown to help lower blood cholesterol.

To further evaluate adolescents’ ability to identify foods that contain nutrients that may prevent heart disease, respondents were asked to identify the food containing the least amount of saturated fat. Results indicated that the majority of adolescents surveyed (54.46%) believe that fish (the correct answer) rather than skinless chicken,
extra lean pork, and extra lean beef contain the least amount of saturated fat. This result is not unexpected in light of the fact that fish is often touted as being “healthy” and it has long been taught that saturated fats are “unhealthy.” Knowing just this little bit of information should lead most people to be able to choose the appropriate response to the question. Finally, respondents were asked to choose the product (olive oil, corn oil, margarine, or butter) that “contains the healthiest fats.” Of the respondents, 47.25% correctly believe that olive oil is the product that contains the healthiest fats (monounsaturated). This result is somewhat surprising in view of the apparent lack of understanding by respondents of the value of monounsaturated fats (discussed above regarding true/false question 1). The results of this study seem to indicate that, although many respondents believe that olive oil contains healthy fats, they do not know which fat may decrease the risk of heart disease (or in other words, which fat is a “healthy” fat) is contained in the olive oil.

When asked to identify the behavioral choices that may help to control cholesterol levels, it was encouraging that an overwhelming majority (73.01%) chose “avoiding cigarette smoking”, “consuming alcohol only in moderation” and “regular exercise and healthy diet” all as helping to control cholesterol levels. It appears that most high school students surveyed have a good understanding of some of the larger, overarching principles of health and wellness.

Unfortunately, less than half (48.4%) of respondents were able to identify heart disease as the leading cause of death in the United States. Although this response (heart disease) was chosen more than any other response, 51.6% of respondents were thought that accidents, cancer, or AIDS were the greater causes of death in the United States. This result is somewhat surprising in view of the apparent lack of understanding by respondents of the value of monounsaturated fats (discussed above regarding true/false question 1). The results of this study seem to indicate that, although many respondents believe that olive oil contains healthy fats, they do not know which fat may decrease the risk of heart disease (or in other words, which fat is a “healthy” fat) is contained in the olive oil.
States. It appears that the message of heart disease is not being fully understood by population surveyed. This is, perhaps, understandable in view of the fear (and often associated media coverage) surrounding cancer and AIDS.

True/false questions 2 and 3 and multiple choice question number 10 was intended to gauge respondents’ ability to identify common risk factors for heart disease. Respondents had no trouble identifying the statement “smokers have a much greater risk of developing heart disease than nonsmokers” as being true. An overwhelming majority (89.32%) of respondents seem to have an adequate understanding of the negative effects of smoking on the heart. In addition, it was encouraging to note that nearly 80% (79.77%) of respondents know that diabetes may lead to heart disease. To further evaluate high school students’ ability to identify common risk factors for heart disease, respondents were asked to choose which multiple choice answer was most linked to an increased risk of heart disease. A majority of respondents (72.36%) correctly believe that “all of the above” (poor diet, genetics, high blood pressure, and cigarette smoking) increase one’s risk of heart disease. Overall, respondents demonstrated a surprising knowledge of the big players in regards to risk factors for heart disease. It is encouraging to know that the majority of respondents apparently know that diabetes mellitus, cigarette smoking, hypertension, poor diet choices, and genetics are all risk factors for heart disease.

The study is strengthened by the number of respondents (1,081 or approximately 42%) and the breadth of knowledge assessed by the survey tool. Other strengths of the study include the diversity of the age, gender, and grade levels of the participants.
Various limitations should be pointed out regarding the study. Numerous questions included in the demographics portion of the survey (i.e. grade, race, age, BMI, food intake, exercise frequency, etc.) were self-reported by the students and therefore subject to false-reporting and/or inability of participants to accurately describe their dietary patterns and other demographic characteristics. In addition, students’ answers to some questions may reflect a lack of comprehension of the question or a poorly written question as opposed to an incorrect response. Biases may be created by those who chose not to respond to the survey. Due to the nature of the study (cross-sectional), cause-effect relationships must be interpreted with caution. In addition, it may be inappropriate to generalize the findings to any population of adolescents outside of Sylvania, Ohio secondary to the limited scope of the study. Another drawback to the study was the limited ethnic diversity of the population surveyed.
Conclusion

Overall, participants appear to have a fairly good understanding of: factors that contribute to an increased risk of heart disease and elevated cholesterol levels, meats with low levels of saturated fat, the effects of a high-salt diet, the contribution of diabetes mellitus and smoking to heart disease, and the link between eating a poor diet during adolescence and future heart disease. In contrast, participants demonstrated a lack of understanding of: the role of monounsaturated fats and soluble fiber in the heart-healthy diet and, foods that contain high levels of saturated fat, and heart disease as the leading cause of death in the United States. It seemed unclear whether or not participants had a good understanding of omega-fatty acids.

Previous studies (Thakur and D'Amico, 1999; Backman, Haddad, Lee, et al., 2002) seem to indicate that high school students demonstrate an understanding of the importance of eating fruits and vegetables and decreasing caloric intake. However, many of these studies report findings that imply that adolescents may not understand (or at least underestimate) the importance of low-fat eating in a healthy diet. The results of this study combined with the findings of the aforementioned studies, point towards a general need for more education regarding the role of saturated fats, omega-3 fatty acids, monounsaturated fats, and soluble fiber in the heart-healthy diet.

There is some disagreement over the efficacy of nutritional knowledge on instituting behavioral change. Fardy, et al (1996) and Edmundson, et al. (1996) demonstrated that an intense health education curriculum may in fact have a positive influence on behavioral choices. In contrast, some studies (Croll, Neumark-Sztainer,
and Story, 2001; Nestle, et al., 1998; Merron and Lock, 1998) that have investigated
knowledge vs behavioral choices demonstrate that, although participants may have an
adequate knowledge base, this knowledge does not necessarily equate to proper
behavioral choices regarding nutrition. This suggests that nutritional choices among
high school students are not so much reflective of knowledge of the subject matter but
rather some other variable such as comprehension of the concepts or willingness to
implement behavioral changes consistent with knowledge previously attained. Although
this study has found that respondents possess knowledge regarding several key
general nutrition concepts as they relate to cardiac health, more work needs to be done
to investigate whether or not this knowledge reflects comprehension or rote
memorization and if the knowledge subsequently elicits positive diet choices.

In spite of the knowledge that most participants in this study have concerning
numerous topics regarding dietary choices as modifiable cardiac risk factors, numbers
of adolescents diagnosed with overweight/obesity, hypertension, and diabetes mellitus
in Ohio (particularly in northwest Ohio) continue to rise. In addition, Northwest Ohio
continues to rank above the national average in terms of heart disease morbidity. This
seems to indicate a disparity between adolescent knowledge and actual dietary
behavioral decisions. There seems to be another factor at work that is not accounted for
by knowledge.

Perhaps health and nutrition educators may be more successful in bridging the
gap between knowledge and action by including adolescents in the preparation (and
perhaps even the delivery) of their nutrition and heart disease messages. If adolescents
will not allow the messages of their teachers and doctors to sway their decisions,
perhaps their peers may be more successful. The impact of peer education has not been adequately studied. The message must somehow be clarified and possibly reframed to appeal to the adolescent population in order that it might induce change.
References


Fardy, P.S., White, R.E.C., Haltiwanger-Schmitz, K., Magel, J.R., McDemott, K.J.,
modification in minority adolescents: the PATH program. Society for Adolescent
Medicine, 18, 247-253.

Forshee, R.A., & Storey, M.L. (2001). The role of added sugars in the diet quality of

among children and adolescents age 6 to 17 years: prevalence, amounts, and
sources, 1977/78 to 1994/96. Journal of the American Dietetic Association, 103,
1326-1331.

on the prevalence of hypertension in western populations. European Journal of
Public Health, 14, 235-239.

incidence in the transition period between adolescence and adulthood: the
national longitudinal study of adolescent health. American Journal of Clinical
Nutrition, 80, 569-575.

Harrell, J.S., Gansky, S.A. McMurray, R.G., Bangdiwala, S.I., Frauman, A.C., & Bradley,


Letters

Office of the Assistant Superintendent
Dallas R. Jackson, Assistant Superintendent

December 1, 2004

Mr. Eric Hamilton
3317 Arlington Ave. Apt. 75
Toledo, OH  43614

RE: Permission to Conduct Survey

Dear Eric:

This is to inform you that your request to conduct a survey with high school students at Northview and Southview High Schools in the Sylvania School district to help determine their knowledge of diet choices as modifiable cardiac risk factors has been approved.

The distribution of these surveys to students will occur during their home room period on a mutually acceptable date during the second semester of the 2004-2005 school-year. The surveys will be distributed and collected by the home room teachers and returned to the building principal at each building. Students that are absent from school or otherwise not present during home room on the predetermined day of the survey distribution will not participate in the survey.

Please deliver to me approximately 1300 surveys for each high school. I will deliver the surveys to the respective building principals for distribution to their teaching staffs. We reserve the right to not require any student to participate in the survey, but it is our anticipation that most students will do so on a voluntary basis. The anonymity of the students taking the survey must be protected at all times.

Sincerely,

Dallas R. Jackson
Assistant Superintendent

Cc:  B. Rieger, Superintendent
     C. McElfresh, Treasurer
     K. Gorman, Principal N.V. High School
     J. Kurtz, Principal S.V. High School
To Whom It May Concern:

The purpose of this letter is to notify you of some important information regarding my research project entitled: **High school student knowledge of diet choices as modifiable cardiac risk factors.**

Many sources have documented the fact that heart disease leads to more deaths in the United States than any other cause of death. In addition, heart disease is a considerable cause of morbidity and associated medical expenses. Heart disease is not just a disease of the elderly. Habits, particularly diet habits, that are linked to heart disease often begin during a person’s childhood and adolescent years. In fact, atherosclerotic plaques, indicators of the beginning stages of heart disease, have been discovered in patients younger than 12 years old. It is imperative that education regarding heart disease and associated diet choices begin at an early age.

The purpose of this study is to evaluate the knowledge that adolescents (age 13-19) have regarding the effects of diet choices on cardiac health. Based on the findings, recommendations can be made to health care providers and high school educators on how to better educate high school students about diet choices and cardiac health.

Data will be collected using an anonymous survey that will be distributed to approximately 2,600 students attending Northview High School and Southview High school in Sylvania School district. Anonymity will be assured at all times during the process. No identifying data will be elicited at any point during the process. To further secure each participant's anonymity, each student will fold his or her completed survey, seal it, and place it in a blank envelope. The participant will subsequently seal their envelope. Once the surveys are collected, only the student investigator and his faculty research advisor will have access to the sealed contents of the surveys.

Participation in this survey is completely voluntary. Any student can choose at any point to not fill out a survey. In addition a student can choose to not answer any question that they are uncomfortable with answering (although it is not anticipated that any question will elicit information that could make a participant feel uncomfortable). Return of the survey will imply consent to participate.

Homeroom teachers will read aloud details regarding anonymity and instructions on filling out and securing the survey to their students prior to handing out the surveys.

Please feel free to contact me or my faculty research advisor with any questions or comments that you may have regarding the survey or research project in general. The surveys and envelopes are attached. I look forward to speaking with you further in the near future.

Sincerely,

Eric Hamilton
PA-S II
Survey Instructions:

**Teachers**: Please read the following survey instructions aloud to your students before passing out the surveys.

You are encouraged to take part in completing a survey for a research study entitled “High school student knowledge of diet choices as modifiable cardiac risk factors.” The researcher, a physician assistant student at the Medical college of Ohio would greatly appreciate your participation in this study.

The purpose of this survey is to gather information pertaining to what high school students know about daily diet choices and how those choices affect their heart. The survey will be anonymous and great effort will be made to maintain confidentiality. Please do not put your name or any other personal information on the survey. The survey should take approximately 10 minutes to complete. Although your participation is encouraged and appreciated, it is important for you to know that your participation is completely voluntary. You may choose not to participate.

If you do not feel comfortable answering a question, please skip the question and leave it blank. Please make sure to complete both the front and back sides of the survey. When you finish filling out the survey, please fold the survey and seal it in the blank envelope provided. If you have any questions, please ask them now…Thank you.
Survey: Please answer the questions on both sides of this survey. Thank you for your help!

**Demographic Characteristics:**

1. What is your age?
   - 13
   - 14
   - 15
   - 16
   - 17
   - 18
   - 19

2. What is your gender?
   - Male
   - Female

3. What grade are you currently in?
   - 9th grade
   - 10th grade
   - 11th grade
   - 12th grade

4. What is your approximate?
   a. Height _____ feet _____ inches
   b. Weight _____ pounds

5. How would you describe your racial makeup?
   - African American/ Black
   - Hispanic/ Latino
   - Asian/ Oriental
   - Native American/ American Indian
   - Caucasian/ White
   - Other

6. Do you smoke cigarettes?
   - Yes
   - No

7. Have you taken a high school health education class?
   - Yes
   - No

8. On average, how many times each week do you exercise?
   - I hardly ever exercise
   - 1 time
   - 2 times
   - 3 times
   - 4 times
   - 5 or more

9. Approximately how many times each week do you eat fish?
   - 0 times
   - 1 time
   - 2 times
   - 3 time's
   - 4 or more times

10. On average, how many times each week do you eat at a fast food restaurant (e.g. McDonald’s, Burger King, Taco Bell, etc.)?
    - I rarely ever eat at fast food restaurants
    - 1-2 times each week
    - 3-4 times each week
    - 5-6 times each week
    - More than 6 times each week

11. Approximately how many servings of vegetables do you eat each day?
    - 0 servings
    - 1 servings
    - 2 servings
    - 3 servings
    - 4 or more servings

12. Have you ever been tested/checked for (check all that applies to you):
    - Cholesterol levels
    - High blood pressure
    - Diabetes/ blood sugar levels

13. What is the highest level of education that either of your parents has completed?
    - Less than 8th grade
    - Completed 8th grade
    - Completed high school
    - Some College
    - Completed College
    - Graduate work

14. Do either of your biologic parents (check all that apply to one or both of your parents):
    - Smoke cigarettes
    - Have high cholesterol
    - Have heart problems
    - Have diabetes
    - Have high blood pressure
    - Don't know
    - None of the above
Please circle the **one** best answer to each question or statement below.

### True/ False:

1. Monounsaturated fats are good for you.  
   a. True   
   b. False

2. Smokers have a much greater risk of developing **heart disease** than non-smokers.  
   a. True   
   b. False

3. Diabetes may lead to heart disease.  
   a. True   
   b. False

### Multiple Choice:

1. Eating bad foods between the ages of 12 and 20  
   a. Has little effect on heart health and cholesterol 20 years from now  
   b. May contribute to heart disease and high cholesterol 20 years from now  
   c. Will not affect heart health and cholesterol levels 20 years from now as long as you exercise  
   d. Will only affect your heart if you eat a lot of fatty foods

2. Which of these foods contains omega-3 fats?  
   a. Fruits and vegetables  
   b. Chicken  
   c. Wholegrain cereals and breads  
   d. Fish

3. The leading cause of death in the United States is:  
   a. AIDS  
   b. Heart disease  
   c. Accidents  
   d. Cancer

4. Which of the following contains the most calories?  
   a. Alcohol  
   b. Protein  
   c. Carbohydrates  
   d. Fat

5. It is thought that omega-3 fats  
   a. Cause high blood pressure  
   b. Help keep your heart healthy  
   c. Cause you to gain weight  
   d. Fight cancer

6. Which group of foods contains high levels of saturated (bad) fats?  
   a. Candy, sugar, and carbonated beverages  
   b. Rice, bread, and pasta  
   c. Dairy products and meat  
   d. Vegetables and fruit

7. A diet high in salt can lead to:  
   a. Increased chance of getting high blood pressure  
   b. Increased body fluid/water  
   c. Increased chance of heart disease  
   d. All of the above

8. Which of the following can help to lower blood cholesterol?  
   a. Insoluble fiber  
   b. Protein  
   c. Complex carbohydrates  
   d. Soluble fiber

9. Which of the following products contains the healthiest fats?  
   a. Olive oil  
   b. Corn oil  
   c. Margarine  
   d. Butter

10. Which of the following increases your risk of heart disease?  
    a. Poor/bad diet  
    b. Heredity/genetics  
    c. High blood pressure  
    d. Cigarette smoking  
    e. All of the above

11. Which of the following has the least saturated (bad) fat?  
    a. Extra lean beef  
    b. Extra lean pork  
    c. Skinless chicken  
    d. Fish

12. Which of the following will help you to control your cholesterol levels?  
    a. Avoid smoking cigarettes  
    b. Consume alcohol only in moderation  
    c. Regular exercise and healthy diet  
    d. All of the above

IRB# 104895
### Name of High school

<table>
<thead>
<tr>
<th>School</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southview</td>
<td>427</td>
<td>39.5</td>
</tr>
<tr>
<td>Northview</td>
<td>654</td>
<td>60.5</td>
</tr>
<tr>
<td>Total</td>
<td>1081</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Respondent's BMI

<table>
<thead>
<tr>
<th>BMI</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>.2</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>.4</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>1.5</td>
</tr>
<tr>
<td>17</td>
<td>30</td>
<td>2.8</td>
</tr>
<tr>
<td>18</td>
<td>56</td>
<td>5.2</td>
</tr>
<tr>
<td>19</td>
<td>113</td>
<td>10.5</td>
</tr>
<tr>
<td>20</td>
<td>156</td>
<td>14.4</td>
</tr>
<tr>
<td>21</td>
<td>131</td>
<td>12.1</td>
</tr>
<tr>
<td>22</td>
<td>103</td>
<td>9.5</td>
</tr>
<tr>
<td>23</td>
<td>111</td>
<td>10.3</td>
</tr>
<tr>
<td>24</td>
<td>72</td>
<td>6.7</td>
</tr>
<tr>
<td>25</td>
<td>40</td>
<td>3.7</td>
</tr>
<tr>
<td>26</td>
<td>61</td>
<td>5.6</td>
</tr>
<tr>
<td>27</td>
<td>29</td>
<td>2.7</td>
</tr>
<tr>
<td>28</td>
<td>15</td>
<td>1.4</td>
</tr>
<tr>
<td>29</td>
<td>14</td>
<td>1.3</td>
</tr>
<tr>
<td>30</td>
<td>11</td>
<td>1.0</td>
</tr>
<tr>
<td>31</td>
<td>12</td>
<td>1.1</td>
</tr>
<tr>
<td>32</td>
<td>7</td>
<td>.6</td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>11</td>
<td>1.0</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>11</td>
<td>1.0</td>
</tr>
<tr>
<td>37</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>38</td>
<td>2</td>
<td>.2</td>
</tr>
<tr>
<td>40</td>
<td>4</td>
<td>.4</td>
</tr>
<tr>
<td>44</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>48</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>50</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>55</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>Total</td>
<td>1019</td>
<td>94.3</td>
</tr>
</tbody>
</table>

### Age of respondent

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>2</td>
<td>.2</td>
</tr>
<tr>
<td>14</td>
<td>85</td>
<td>7.9</td>
</tr>
<tr>
<td>15</td>
<td>240</td>
<td>22.2</td>
</tr>
<tr>
<td>16</td>
<td>286</td>
<td>26.5</td>
</tr>
<tr>
<td>17</td>
<td>302</td>
<td>27.9</td>
</tr>
<tr>
<td>18</td>
<td>152</td>
<td>14.1</td>
</tr>
<tr>
<td>19</td>
<td>14</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>1081</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Gender of respondent

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>547</td>
<td>50.6</td>
</tr>
<tr>
<td>Female</td>
<td>532</td>
<td>49.2</td>
</tr>
<tr>
<td>Total</td>
<td>1079</td>
<td>99.8</td>
</tr>
</tbody>
</table>

### Grade level of respondent

<table>
<thead>
<tr>
<th>Grade</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>265</td>
<td>24.5</td>
</tr>
<tr>
<td>10</td>
<td>253</td>
<td>23.4</td>
</tr>
<tr>
<td>11</td>
<td>331</td>
<td>30.6</td>
</tr>
<tr>
<td>12</td>
<td>229</td>
<td>21.2</td>
</tr>
<tr>
<td>Total</td>
<td>1078</td>
<td>99.7</td>
</tr>
</tbody>
</table>
### Respondent’s race

<table>
<thead>
<tr>
<th>Respondent’s race</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>37</td>
<td>3.4</td>
</tr>
<tr>
<td>Hispanic</td>
<td>34</td>
<td>3.1</td>
</tr>
<tr>
<td>Asian</td>
<td>40</td>
<td>3.7</td>
</tr>
<tr>
<td>Native American</td>
<td>6</td>
<td>0.6</td>
</tr>
<tr>
<td>Caucasian</td>
<td>875</td>
<td>80.9</td>
</tr>
<tr>
<td>Other</td>
<td>82</td>
<td>7.6</td>
</tr>
<tr>
<td>Total</td>
<td>1075</td>
<td>99.4</td>
</tr>
</tbody>
</table>

### How often do you eat fish each week

<table>
<thead>
<tr>
<th># times weekly</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 times</td>
<td>676</td>
<td>62.5</td>
</tr>
<tr>
<td>1 time</td>
<td>298</td>
<td>27.6</td>
</tr>
<tr>
<td>2 times</td>
<td>65</td>
<td>6.0</td>
</tr>
<tr>
<td>3 times</td>
<td>21</td>
<td>1.9</td>
</tr>
<tr>
<td>4 or more times weekly</td>
<td>19</td>
<td>1.8</td>
</tr>
<tr>
<td>Total</td>
<td>1079</td>
<td>99.8</td>
</tr>
</tbody>
</table>

### Does respondent smoke

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>85</td>
<td>7.9</td>
</tr>
<tr>
<td>no</td>
<td>994</td>
<td>92.0</td>
</tr>
<tr>
<td>Total</td>
<td>1079</td>
<td>99.8</td>
</tr>
</tbody>
</table>

### Have you taken health ed class

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>1038</td>
<td>96.0</td>
</tr>
<tr>
<td>no</td>
<td>41</td>
<td>3.8</td>
</tr>
<tr>
<td>Total</td>
<td>1079</td>
<td>99.8</td>
</tr>
</tbody>
</table>

### How frequently does respondent exercise weekly

<table>
<thead>
<tr>
<th># times weekly</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>hardly ever</td>
<td>159</td>
<td>14.7</td>
</tr>
<tr>
<td>1 time</td>
<td>67</td>
<td>6.2</td>
</tr>
<tr>
<td>2 times</td>
<td>129</td>
<td>11.9</td>
</tr>
<tr>
<td>3 times</td>
<td>205</td>
<td>19.0</td>
</tr>
<tr>
<td>4 times</td>
<td>144</td>
<td>13.3</td>
</tr>
<tr>
<td>5 or more</td>
<td>374</td>
<td>34.6</td>
</tr>
<tr>
<td>Total</td>
<td>1078</td>
<td>99.7</td>
</tr>
</tbody>
</table>

### How many times each week do you eat fast food

<table>
<thead>
<tr>
<th># times weekly</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>rarely ever eat at fast food restaurants</td>
<td>380</td>
<td>35.2</td>
</tr>
<tr>
<td>1-2 times each week</td>
<td>460</td>
<td>42.6</td>
</tr>
<tr>
<td>3-4 times each week</td>
<td>171</td>
<td>15.8</td>
</tr>
<tr>
<td>5-6 times each week</td>
<td>37</td>
<td>3.4</td>
</tr>
<tr>
<td>&gt; 6 times weekly</td>
<td>31</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>1080</td>
<td>99.9</td>
</tr>
</tbody>
</table>

### How many daily servings of vegetables

<table>
<thead>
<tr>
<th># daily servings</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 servings</td>
<td>91</td>
<td>8.4</td>
</tr>
<tr>
<td>1 servings</td>
<td>380</td>
<td>35.2</td>
</tr>
<tr>
<td>2 servings</td>
<td>366</td>
<td>33.9</td>
</tr>
<tr>
<td>3 servings</td>
<td>165</td>
<td>15.3</td>
</tr>
<tr>
<td>4 or more servings daily</td>
<td>72</td>
<td>6.7</td>
</tr>
<tr>
<td>Total</td>
<td>1075</td>
<td>99.4</td>
</tr>
</tbody>
</table>

### Which tests have had done

<table>
<thead>
<tr>
<th>Test</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>593</td>
<td>54.9</td>
</tr>
<tr>
<td>cholesterol levels</td>
<td>25</td>
<td>2.3</td>
</tr>
<tr>
<td>high blood pressure</td>
<td>165</td>
<td>15.3</td>
</tr>
<tr>
<td>diabetes/ blood sugar</td>
<td>47</td>
<td>4.3</td>
</tr>
<tr>
<td>Total</td>
<td>830</td>
<td>76.8</td>
</tr>
<tr>
<td>Parents' grade level</td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>&lt; 8th grade</td>
<td>12</td>
<td>1.1</td>
</tr>
<tr>
<td>completed 8th grade</td>
<td>31</td>
<td>2.9</td>
</tr>
<tr>
<td>completed high school</td>
<td>148</td>
<td>13.7</td>
</tr>
<tr>
<td>some college</td>
<td>156</td>
<td>14.4</td>
</tr>
<tr>
<td>completed college</td>
<td>378</td>
<td>35.0</td>
</tr>
<tr>
<td>graduate work</td>
<td>343</td>
<td>31.7</td>
</tr>
<tr>
<td>Total</td>
<td>1068</td>
<td>98.8</td>
</tr>
</tbody>
</table>
Abstract

Context: Heart disease is the leading cause of death in the United States. As rates of adolescent overweight, obesity and diabetes mellitus continue to increase, one must wonder if adolescents are receiving adequate education regarding diet choices as modifiable cardiac risk factors.

Objective: The objective of this study was to evaluate the knowledge that a typical adolescent has concerning the effects of diet choices on cardiac health.

Methods: 2,600 surveys with 14 demographics questions and 15 nutrition and heart disease questions were distributed to two high schools in Sylvania, Ohio.

Results/ Conclusions: Respondents demonstrated poor understanding of nutritional knowledge regarding: the role of monounsaturated fats and soluble fiber in a heart-healthy diet, identifying foods high in saturated fat, identifying heart disease as the leading cause of death in the United States. More research needs to be done in which the relationship between knowledge of heart-healthy diet choices and subsequent behavioral choices is examined.