

1-1-2007

Student Perceptions of the Shift from Soft Drink Vending Machines to Milk Vending Machines in Schools

Jillian B. Trapini

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Student Perceptions of the Shift from Soft Drink Vending Machines to Milk Vending
Machines in Schools

by

Jillian B. Trapini

Thesis

Submitted to the School of Health Science

Eastern Michigan University

In partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

in

Human Nutrition

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February 26, 2007

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Acknowledgements

I would like to show gratitude to all those who helped me through this process and who are responsible for making it all possible.

I am indebted to my committee for their hard work and dedication in helping me through all of the stages of this project. They have read and edited my revisions numerous times and helped me to develop a great final draft. Thank you to Alice Jo Rainville PhD, RD, my thesis chair, who was a wonderful mentor through this process, and I appreciate her support. Thank you to George Liepa, PhD, a committee member and professor of my thesis courses, who has also been a wonderful mentor and has been extremely supportive of me through this process. Dr. Liepa also inspired me to develop the idea and expand upon this project. His enthusiasm will not be forgotten. Thank you to Lydia Kret, MS, RD, a committee member, for your help and support during this process. Thank you to AbouEl-Makarim Aboueissa, PhD, a committee member, who spent endless hours helping me sort through the survey results, to complete chi-square tests, and most important, understand statistics!

Also, I am grateful for the support I received from Kyunghee Choi, MS, RD. Her expert help with perfecting my project in APA format is very much appreciated and has saved me from many hours of frustration.

I wish to thank my family, who has stood by me every step of the way, through life and through this project.

Finally, special thanks go to Brandon Huff, my fiancé, whose love, support, and, especially, patience, has truly meant the world to me.

Abstract

Soft drink vending machines are available in many schools across the nation. Some schools have recently removed soft drink vending machines and replaced them with milk vending machines. The purpose of this study was to investigate high school students' (n = 84) perceptions of the shift from soft drink vending machines to milk vending machines in schools.

Students in this survey had an understanding of the importance of drinking milk, and students generally felt that purchasing milk from the lunch line was more convenient than from the vending machine. Students felt that the vending machine might contain warm, out of date, and/or generic milk. The majority of students felt indifferent toward the removal of the soft drink vending machine and did not often purchase soft drinks from vending machines.

Purchases from the milk vending machine may increase with more visible sell-by dates, promotional posters, and additional nutrition education.

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Chapter 1: Introduction

A revolution is taking place in our schools. For many years, soft drink vending machines have been available for students in cafeterias, outside gymnasiums and auditoriums, and in other accessible areas. In some states, due to concern for children's nutrition, schools have taken out soft drink vending machines and replaced them with milk vending machines. This is an important change because soft drinks are a source of empty calories and "constitute a significant part of the problem of poor child nutrition" (De La Rosa, 2002, p. 2). Despite this shift in thinking, many schools still have soft drink vending machines available, and according to a study by Wechsler, Brener, Kuester, and Miller (2001), these machines are still available in 98% of U.S. high schools. Many school districts in the U.S. are bringing milk machines into schools and are finding that they are popular.

According to the NHANES 1999-2002 report, overweight among adolescents has increased 5%, moving from 11% in 1988-1994 to 16% in 1999-2002. If one goes back further (1971-1974), the increase is even more dramatic (12%) (Centers for Disease Control and Prevention [CDC], n.d.). While soft drink consumption is not the only contributing factor to this increase in the number of overweight and obese students, it is an important issue to consider when determining which foods and beverages are appropriate and which are inappropriate for children in school.

According to a recent article in ("Moove' Over Soda," 2005), two-thirds of Wisconsin high schools have milk machines, and there are more than 7,000 machines dispensing milk in schools nationwide. The Los Angeles Unified School

District (LAUSD) was one of the early leaders of this revolution. In August of 2002, LAUSD voted unanimously to ban soft drink sales in all LAUSD schools; the ban began in 2004 (De La Rosa, 2002). LAUSD is the second largest school district in the United States, and thus, this radical decision achieved substantial news coverage and provoked other school districts to follow their lead. Other school districts that have banned soft drinks include Chicago Public Schools (“Chicago latest,” 2004), New York City Public Schools (“Dairy Sales,” 2003), and Philadelphia Public Schools (“Philadelphia Public Schools,” 2004).

In 2005 The Soft Drink Association voluntarily announced restrictions on soft drink sales, which would mainly apply to elementary and middle schools (American Beverage Association, 2005). Unfortunately, these restrictions were not set for high schools. Soft drink bans in U.S. schools are becoming more prevalent because schools have been used as a marketing tool to “establish brand loyalty as early in a consumer’s life as possible, explicitly targeting school-aged children” (De La Rosa, 2004, p. 3). While some schools may lose some monetary donations by rejecting future contracts with soft drink companies, it is important to put the nutritional needs of children first and establish good nutrition habits early in life rather than help soft drink companies establish brand loyalty.

Removing soft drink vending machines from schools is an important step in the movement toward healthier choices for children in schools. Soft drink consumption contributes to the intake of empty calories and may contribute to excess energy intake (Harnack, Stang, & Story, 1999). A standard 12-ounce soft drink can contain as many as, or in excess of, 150 calories (Pennington, 1994).

Many soft drink vending machines contain 20-ounce bottles that can have as many as 250 calories. According to a recent study, soft drink consumption increased 48% in children ages 6 to 17 years old between 1977/1978 and 1994/1998, and consumption of soft drinks from vending machines also increased by 48% (French, Lin, & Guthrie, 2003). A similar study found that nearly one fourth of adolescents consumed soft drinks in excess of 26 ounces per day (Harnack et al., 1999).

With soft drink consumption on the rise, many studies have been conducted to better understand the relationship between soft drink and milk consumption. These studies have shown that soft drinks may be replacing healthier choices, such as milk (Harnack et al., 1999; French et al., 2003), and that children are consuming less milk and more soft drinks than 25 years ago (U.S. Department of Agriculture [USDA], 2004; Frazão, 2005). Decreased intake of milk can lead to decreased intake of calcium (Harnack et al., 1999; Harkness & Bonny, 2005) and other important nutrients, such as vitamin D. Dairy products are the largest source of calcium in the American diet, and low calcium intake may increase the risk of osteoporosis later in life (French et al., 2003; De La Rosa, 2002; Harkness & Bonny, 2005).

Research has revealed that there are possible negative health effects that occur when there is an increase in soft drink consumption and a decrease in milk consumption. These effects include but are not limited to poor calcium intake, reduced bone accrual, and weight gain (De La Rosa, 2002; Greer, 2005; Lin & Ralston, 2003; Whiting et al., 2001). These types of health changes could be motivators for school and government officials to do away with soft drink vending in

schools and to offer healthier alternatives, such as milk. Data from parents and school administrators indicate that they support the change from soft drink to milk vending in schools (Barratt, Cross, Mattfeldt-Beman, & Katz, 2004; Hendel-Paterson, French, & Story, 2004; Weilert, 2005); however, little research has been done to solicit the opinions of students who are affected by this conversion. The purpose of the present study was to evaluate the attitudes and feelings of high school students who are involved in the process of integrating milk vending machines into schools.

Chapter 2: Literature Review

Student perceptions

Student perceptions of school nutrition programs can provide school foodservice personnel with important information for improvement of foodservice operations (Meyer, 2005). Student polls have been used in the past to study various topics affecting students, including health and nutrition. James, Rienzo, and Frazee (1996) conducted a study designed to understand how students felt about school meal choices. Students were interviewed in focus groups and were asked to share opinions related to meal programs and to make suggestions for improving these programs. The researchers hoped to provide information to educators about improving both nutrition education materials and student participation in school lunch programs.

Conklin, Cranage, and Lambert (2005) researched the effects of posting nutrition information at the point of food selection for students from 9th through 12th grades and found a slight to moderate shift toward foods with fewer calories and fat grams, however, not necessarily toward healthier foods. A pilot study by Loughridge and Barratt (2005) explored possible outcomes associated with health promotion in the cafeterias of secondary schools and found that the promotion of water consumption led to an increase in consumption. The researchers used three schools, and each school was assigned to one of three groups; implementation of free, cool, filtered water with promotion of water drinking; free, cool, filtered water only; and the control group. This study used focus groups to gather information about students' thoughts and opinions. In another study, school-aged children were

surveyed and it was shown that they preferred plastic bottles rather than paper cartons ("Prevailing Plastic," 2005). The use of student opinions may influence the sale of particular items, as well as encourage participation in school nutrition programs. Although it is important to satisfy the desires of students, it is also important to provide them with healthier options. While some state that physical health is a personal responsibility, Weilert (2005) has argued that teenagers require additional support when it comes to making health-related decisions, and schools can aid in this process by restricting the choices of foods that are high in sugar and fat.

School Nutrition Policies

The Centers for Disease Control and Prevention (CDC, 1996) have developed *Guidelines for School Health Programs to Promote Lifelong Healthy Eating*, which includes recommendations for school-based programs to encourage healthier eating. Some school districts have been changing and expanding school nutrition policies to be more consistent with the CDC guidelines. A statewide survey of foodservice directors from 117 public school districts in North Carolina (Barratt et al., 2004) was used to determine the prevalence of policies that encourage healthy eating within school districts. They found that only 24.5% of districts stated that they had coordinated nutrition policies and that none had policies that fulfilled all six CDC guidelines. It was also revealed that the districts with coordinated nutrition policies were more apt to have policies regarding the placement of vending machines in the schools. Many of these respondents reported barriers to having coordinated nutrition policies that included but were not limited to lack of administrative and

financial support. Additionally, some respondents stated that the district did not have a registered dietitian or a trained professional who could implement such policies.

In addition to the CDC recommendations, the USDA (2000) created a *Changing the Scene Improving the School Nutrition Environment Kit* as a means for promoting a healthy school nutrition environment (HSNE). The kit was to be used for the development of a program that would help schools provide clear and consistent messages to students and aid in the development of healthy lifestyles. Rainville, Choi, and Brown (2005) surveyed a random, nationwide sample of K-12 school foodservice personnel and other school employees and found that many of the 1,222 respondents felt that they already had an HSNE. However, responses to other questions in the survey regarding the availability of foods of minimal nutritional value (soft drinks, candy, cakes, etc.) in vending machines and during fundraising events indicated that there were opportunities for improvement. In addition, 71% of the respondents reported having vending machines available to students, which often included vending machines with soft drinks.

Statistics from the NHANES 1999-2002 survey (CDC, n.d.) revealed that the prevalence of overweight adolescents (12-19 years old) had more than tripled since the 1976-1980 survey. Overweight adolescents are inclined to become overweight adults who are in turn at risk for subsequent obesity-associated health conditions (Hedley et al., 2004). The National School Lunch Program has regulations that bar the availability of “foods of minimal nutritional values”, such as soft drinks, in the food-service area during mealtimes (USDA, 2001, p. 8); however, competitive foods

(foods that compete with school meals) are still available in vending machines, in school stores, and in off-campus locations.

Milk Consumption

Children, particularly adolescent girls, are consuming less milk and more soft drinks, resulting in a decreased intake of dietary calcium (Lin & Ralston, 2003). Studies have shown a possible inverse relationship between calcium intake and obesity. Skinner, Bounds, Carruth, and Ziegler (2003) studied the relationship between calcium intake and body fat in 8-year-old children. These children were part of a group of 52 mother-child pairs who agreed to (a) participate in providing dual-energy x-ray absorptiometry (DEXA) measurements to assess body fat, and (b) provide in-home interviews about dietary intake. The study showed that children could reduce their body fat by 0.4% by consuming an additional 8-oz. glass of skim milk or yogurt per day and that there was a significant negative correlation between their dietary calcium intake and body fat. The researchers also acknowledged the importance of physical activity in controlling obesity in children.

Likewise, Heaney (2003) reexamined observational studies and clinical trials, all of which initially set out to investigate relationships between dietary calcium intake and bone density and/or blood pressure and found that young women with calcium intakes equal to the Recommended Daily Allowance (RDA) were significantly less overweight or obese than women consuming only 25% of the RDA. Schragger (2005) recently corroborated these findings with a review of data from various studies and reported that “calcium is not a magic bullet in the battle against obesity, although it may play a small, but significant, role” (p. 210).

Regardless of the effect of calcium on overweight and obesity, it is clear that some changes have occurred in the diets and lifestyles of Americans in recent years to influence the prevalence of obesity. Several research initiatives have attempted to gain a greater understanding of this phenomenon. Some researchers have proposed that the increasing consumption of soft drinks, along with the declining intake of dairy appears to parallel growing obesity rates in this country.

Bowman (2002) evaluated beverage choices of girls ages 12-19 years old by comparing four USDA Nationwide Food Consumption Surveys and reported that over the past three decades there has been a continuous drop in the proportion of girls who drink milk, whereas intake of other beverages, such as soft drinks, increased markedly during the same period. Bowman also found that the significant decline of milk, fruit-ade, and fruit punch consumption was accompanied by increased soft drink and tea consumption in adolescent girls aged 13 years old. Eighteen-year-olds showed decreased consumption of fruit juices, sweetened fruit drinks, and teas; however, soft drink (regular and diet) consumption remained high. In addition, intake of added sugar by the soft drink consumers greatly exceeded the Food Guide Pyramid recommendations (Bowman, 2002; USDA, 2004), and soft drink intake had a harmful impact on milk intake and the consumption of many crucial micronutrients (Bowman, 2002). Similarly, Harnack et al. (1999) stated that decreased consumption of milk and fruit juices among children and adolescents was a cause for concern because it was associated with a suboptimal intake of certain important nutrients.

Subar, Krebs-Smith, Cook, and Kahle (1998) reported that dairy products were the main source of dietary calcium of children in the United States, supplying more than 50% of the daily calcium intake. This conclusion was arrived at by studying dietary records of 4008 children (2-18 years old) who participated in the U.S. Department of Agriculture's Continuing Survey of Food Intakes by Individuals. This study showed that milk accounted for 51.5% of the total intake of calcium in the diet. This is important because of the growing evidence that American adolescents are in danger of suffering from poor calcium and vitamin D intake. Harkness and Bonny (2005) discussed the importance of calcium and vitamin D for the developing skeleton and other cellular processes. Adequate intake of calcium and vitamin D is particularly important to adolescents because a great deal of bone mass is attained during this period of life.

Soft Drink Consumption

The increase of soft drink consumption in the United States has been related to several factors. Grimm, Harnack, and Story (2004) published a survey in a children's magazine (*Dragonfly*) that was circulated throughout the country to children (8-13 years old) in elementary and middle schools and that yielded a response from 560 children. The researchers found that soft drink consumption was related to the availability of soft drinks in the home as well as the existence of soft drink vending machines in schools. This same research revealed that those who watched television were more likely to drink more soft drinks and speculated that this could be related to the exposure to advertisements.

French, Lin, and Guthrie (2003) compared data from three national surveys (Nationwide Food Consumption Survey 1977/1978; the combined Continuing Survey of Food Intakes by Individuals 1994/1996; and the Supplemental Children's Survey 1998) in order to determine patterns of soft drink consumption in children and adolescents. Soft drink consumption was measured and found to be greatest at home; however, children were also obtaining an escalating number of soft drinks from quick-service restaurants and other restaurants, as well as from vending machines.

A significant percentage of the soft drinks that children consume are from vending machines (Weicha, Finklestein, Troped, Fragala, & Peterson, 2006; French et al., 2003), perhaps due to increased advertising and accessibility. Weicha et al. (2006) researched the association between the intake of sugar-sweetened beverages and the use of vending machines and fast-food restaurants. This study was a cross-sectional observational study involving 1,474 students from 10 middle schools in Massachusetts, all of which had vending machines and sold soft drinks and/or other sugar-sweetened beverages. This research found that 71% of students purchased sugar-sweetened beverages, and the average intake of these beverages was 1.2 servings per day. These authors stated that removing vending machines that contain soft drinks and sugar-sweetened beverages could aid in reducing the average intake of these beverages and therefore aid in reducing the intake of excess sugar in the diet of adolescents.

Lin, Guthrie, and Frazão (1999) discussed the importance of forming good eating habits in childhood and adolescence, since such habits are likely to continue

throughout life. The authors also expressed concern with the current trends in eating patterns and the steady decline in the consumption of healthy, nutrient-dense foods and increases in intake of less healthful foods. In addition, Harnack et al. (1999) reported that soft drink consumption may lead to excess energy intake.

National and community-based interventions may be used to reach parents, who serve as role models; however, schools are beginning to take a closer look at how healthy eating habits can be formed and reinforced in schools. School districts throughout the United States have begun banning soft drinks from vending machines altogether regardless of where the vending machine is located or the times that it is accessible. A recent report in the Washington Post (Bahrampour, 2005) stated that public high schools in Arlington, Virginia, were banning soft drinks and sports drinks from vending machines. The author reported that many parents approved of the new rule; however, it was also stated that the one board member who voted against this new rule said that he believed “healthful eating should be encouraged but not regulated” (para. 12). The Los Angeles Unified School District (LAUSD), the nation’s second largest school district (De La Rosa, 2002), also recently implemented a soft drink ban because of the emergent public concern that the consumption of high-sugar and highly caffeinated soft drinks can contribute to several adverse health issues, including a negative impact on learning.

The rising popularity of soft drink bans in schools has received significant attention, and soft drink companies are taking notice. In 2005 The American Beverage Association announced a new policy regarding the use of vending machines in schools. This policy was aimed at providing students with more

nutritious beverages while decreasing the availability of soft drinks (American Beverage Association, 2005). However, these restrictions only applied to elementary and middle schools, high schools had no restrictions at all. In addition, this new policy only applies to new contracts; schools with existing contracts will implement the policy when their current contracts expire. This new policy may be a small step in the right direction, but much larger steps are still needed.

Some believe that soft drink bans are important in slowing the rates of childhood obesity; however, Forshee, Storey, and Ginevan (2005) found that the presence of vending machines containing soft drinks in schools did not have a significant effect on the amount of regular carbonated soft drinks (RCSD) consumed by adolescents. This conclusion was obtained by using a four-step risk-assessment process in which three data sets were used (Continuing Survey of Food Intake by Individuals 1994–1996, 1998 [CSFII], National Health and Nutrition Examination Survey 1999–2000 [NHANES], and the National Family Opinion [NFO] World Group Share of Intake Panel [SIP] study). These data sets were analyzed and showed that there was not a significant relationship between intake of regular carbonated soft drinks (RCSD) and BMI. Alternatively, Jacobson (2005) stated that soft drinks are the largest source of calories in the American diet, and adolescents get a significant percent of calories from both carbonated and noncarbonated soft drinks, adding that the increased consumption of soft drinks is partly caused by the intense promotion and marketing of these beverages by soft drink companies. Regardless of caloric content or relationship to BMI, soft drink consumption has been related to decreased

intake of more nutritive beverages, such as milk and 100% fruit juice (Bowman, 2002; Harnack et al., 1999).

Importance of Calcium

Whiting et al. (2001) studied the relationship between low-nutrient-density beverages and bone mineral accretion and found that when beverages of low-nutrient-density, such as carbonated beverages, replaced milk, adolescent girls had decreased bone mineral accrual. These authors also reported that other factors can contribute to total bone mineralization, such as level of physical activity. Similarly, Zhu et al. (2005) found that “milk supplementation was associated with a greater increase in both periosteal and endocortical apposition” (p. 1171) when studying 10-year-old Chinese females and the effect of supplementation with calcium-fortified and calcium- and-vitamin-D-fortified milk. In a related study, Baker et al. (1999) used several approaches to determine calcium requirements for children, including measurement of calcium levels in subjects with a variety of calcium intakes; measurement of the children’s bone mineral both before and after calcium supplementation; and epidemiologic studies to determine bone mass or fracture risk in adults in correlation to their childhood calcium intake levels. Additionally, calcium balance was determined by measuring the effect of calcium intake on retention of the mineral on the body. This research found that adequate calcium intake during childhood could prevent osteoporosis later in life and that both exercise and calcium intake are important in helping people attain “maximal peak bone mass” (p. 1152). These authors also affirmed that “it is reasonable to conclude that low calcium intakes may be an important risk factor for fractures in adolescents. This risk may be

an issue that adolescents can more readily relate to than long-term risk of osteoporosis” (p. 1152).

Alternatively, some research has shown that peak bone mass may not be reliant on calcium intake, particularly from dairy products. Lanou, Berkow, and Barnard (2005) reviewed a variety of previous research articles which were aimed at studying the relationship between calcium intake and/or dairy intake and bone mineralization or fracture risk in humans. Lanou et. al (2005) limited their investigation to those studies that looked at children, young adults, and adolescents (ages 1-25 years). The comparison of these studies was aimed at determining the effects of dairy products and total calcium intake on bone integrity. It was found that physical activity appeared to have more of an influence than calcium on increased bone growth and development for adolescents. They stated that dietary calcium intake was also likely to play a role in bone development under some conditions.

Along with the probable effects of soft drink consumption on decreased dietary calcium intake, soft drink consumption may also have an adverse effect on dental health. According to Peterson (2005), soft drinks are very acidic and can cause decay of the teeth. The normal pH of the mouth is between 6.2 and 7, while the pH of soft drinks ranges from 2.47 to 3.35. The acidic nature of soft drinks has been shown to dissolve the enamel of teeth. Research suggests that soft drink consumption is positively associated with tooth decay (Moazzez, Smith, & Bartlett., 2000; Johansson et al. 1996). Dental experts, along with health and nutrition experts, have expressed concern about the increased consumption of soft drinks in

the United States and recommend decreasing the amount of soft drink consumption to help prevent tooth decay and erosion (Jacobson, 2005).

Milk Vending

Although conflicting evidence exists between soft drink consumption and various adverse health affects, the fact remains that soft drink consumption is on the rise, and most vending machines in schools contain soft drinks. Perhaps in an attempt to curb childhood and adolescent obesity or out of concern that soft drink consumption will have other long-term health effects, many districts and states throughout the United States are eliminating soft drink vending machines from schools, some in favor of milk vending machines. Milk vending has become popular in many schools, according to a recent article in *Dairy Field Magazine* ("Prevailing Plastic," 2005). Increased consumption of milk may be due, in part, to the state-of-the-art vending machines that are being placed in schools ("Dairy Sales," 2003), which feature sports characters drinking milk ("Schools: Vending," 2001).

Chapter 3: Methods

The present study was designed to determine whether high school students from South Portland, Maine, were satisfied with the shift from soft drink vending machines to milk vending machines that has occurred in their school over the past two years.

Subjects

One hundred male and female high schools students who attended South Portland High School (SPHS) in South Portland, Maine, were recruited to participate in the study. SPHS is a racially mixed school, and therefore, participants of all racial groups were included in the study. Participants were between 16 and 19 years old and were either high school juniors or seniors.

Study Design

This study focused on survey data that was collected from students in Math, English, and Science classes. The study design was approved by the Human Subjects Review Committee at Eastern Michigan University (see Appendix A). The researcher met with the SPHS principal prior to the dispensing of the surveys in order to gain approval from the principal and school board. Surveys were given to students by teachers at the start of *home base* (a class that meets once a week for one half hour prior to the start of first period) and returned to the same teachers at the end of the period. Surveys were randomly distributed to the teachers by the school secretary, who then collected them for the researcher. The reliability, validity, and structure of the survey instrument were established prior to administration.

Survey

The survey included 29 questions and was designed to evaluate student opinions of the shift from soft drink to milk vending machines at the high school. The survey contained both open-ended and multiple-choice questions aimed at deriving information regarding milk and soft drink consumption, student demographics, and purchasing practices. The survey is shown in Appendix B.

Data Entry and Statistical Analysis

Demographic data obtained included gender, age, race, and class standing. A Chi-square test was used to analyze and compare the revealed data, with significance determined at the 0.05 level. Chi-square tests were used to determine the statistical significance between demographic information and the data collected regarding student opinions of milk vending machines; use of outside facilities to purchase milk, soft drinks, or other beverages; and use of school venues to purchase milk, soft drinks, or other beverages. All survey responses were entered into Microsoft® Excel XP 2002 (Microsoft® Corporation), and valid percentages were calculated for each question. The Statistical Package for Social Sciences (SPSS) version 12.0, software program was used to perform statistical analyses on the data. Responses to the open-ended questions were recorded according to question number in a separate document.

Chapter 4: Results

Demographics

Surveys were completed by 84 of 100 students. Only complete surveys were used in this study; however, of the 84 completed surveys, some answers were omitted because multiple answers were given and could not be properly tabulated. The majority of respondents (n = 71, 85%) were Caucasian, and the rest were Black/African American (n = 2, 2.4%), Latino/Hispanic (n = 2, 2.4%), Pacific Islander (n = 2, 2.4%), Native American (n = 1, 1.2%), or “other” (n = 6, 7.1%). Respondents were seniors (58%) and juniors (42%), of which 55% were male and 45% were female, and their ages ranged from 16 to 19 years of age (16 years = 22%, 17 years = 55%, 18 years = 22%, and 19 years = 1.2%).

Student Opinions Regarding Milk and Vending Machines

Sixty-eight percent (n = 57) of students responded that they purchase milk at school. Fifty-six percent (n = 47) of students responded that milk vending machines were available to them at school, 20% (n = 17) said that they were not, and 24% (n = 20) were unsure of the availability of milk vending machine. The majority of students (71%; n = 61) had never purchased milk from a milk vending machine, 25% (n = 21) said that they had purchased milk from a vending machine 1-2 times for every 10 milk purchases, and 3.6% (n = 3) said that they had purchased milk from a vending machine 3-5 times for every 10 milk purchases. No students had purchased milk from a vending machine 6 or more times per every 10 purchases.

More than half of the students (63%, n = 53) felt that drinking milk was important to them, 17% (n = 14) did not believe that it was important, and 20% (n =

17) were unsure of its importance. Many students (44%, n = 37) did not feel that having a milk vending machine encouraged them to drink milk, 38% (n = 32) were unsure, and only 18% (n = 15) felt that the vending machine encouraged milk consumption. A strong relationship was found ($p = 0.001$) between the *importance of drinking milk* and the *effect of the availability of a milk vending machine on milk consumption* (see Table 1).

Table 1
Comparison of Student Opinion on the Importance of Drinking Milk to the Availability of the Milk Vending Machine and Encouraging Students to Drink Milk

Importance of drinking milk	Vending machine availability encourages milk consumption					
	Yes		No		Unsure	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Yes	12	14.3	28	33.3	16	19
No	1	1.2	8	9.5	1	1.2
Do not know	1	1.2	1	1.2	16	19

Students who did not feel that the milk vending machine encouraged milk consumption were more likely than their peers to believe that drinking milk was important. However, a weak relationship ($p = 0.09$) was found between students' *opinion about having a milk vending machine at school* and the likelihood of *purchasing milk at school*. Those students who purchased milk at school were slightly more likely than peers to find the milk vending machine important. No relationship was found between the *importance of the milk vending machine* and *age, gender, or class standing*.

Student Opinions Regarding Soft Drinks and Vending Machines

Students had varying opinions about not having a soft drink vending machine available to them at school. Forty-three percent (n = 36) felt that this was *neither*

good nor bad, 30% (n = 25) felt that it was *good*, and 27% (n = 23) felt that it was *bad*. A significant relationship ($p = 0.025$) was shown to exist between *class standing* and the opinion about *not having a soft drink vending machine*. Most seniors answered that it was *neither good nor bad* or that it was *good*, and more juniors believed that it was *bad* than any other category. The average between juniors and seniors for each response is shown below, (see Figure 1), and the majority of students felt that not having soft drinks available to purchase at school was neither good nor bad.



Figure 1. Opinions of junior and senior high school students (n = 84) regarding availability of soft drink vending machines.

A nonsignificant relationship ($p = 0.384$) was shown to exist between *level of physical activity* and *opinion of not having a soft drink vending machine*. In addition, no relationship ($p = 0.840$) was found between the *opinion of not having a soft drink vending machine available at school* and *the amount of milk that students drank during each school week*.

Students who purchased soft drinks often did not purchase them from a vending machine. Fifty-five percent (n = 46) said that for every 10 times they purchased a soft drink, no soft drinks were purchased from a vending machine; no students purchased soft drinks from vending machines 7 or more times per 10 purchases; 1 student (1.2%) purchased from vending machines 5-6 times out of 10 times; 8.3% (n = 7) answered 3-4 times; and 36% (n = 30) said that they purchased soft drinks from vending machines only 1-2 times for every 10 purchases.

Physical Activity and Milk Consumption

Thirty-three percent (n = 27) of the students surveyed were involved in high school athletics, 14% (n = 12) said that they exercised 5-7 days per week, 19% (n = 16) exercised 3-4 days per week, 20% (n = 17) exercised 1-2 days per week, and 14% (n = 12) did not exercise at all.

A strong relationship between *milk consumption* and *physical activity* ($p = 0.004$) was found. Students who exercised the most (3 or more days per week) consumed more milk than those who exercised the least (2 or fewer days). Interestingly, a weak relationship ($p = 0.06$) existed between the level of physical activity (number of days exercising) and *type of milk* consumed. However, Figure 2 shows that those who exercised the most were most likely to drink skim, 1% low-fat milk, or 2% reduced-fat milk, and those who were the least physically active were more likely to drink whole milk and chocolate milk. Those who responded *other* wrote in strawberry milk (n = 3), coffee milk (n = 1), 1 ½% milk (n = 2), ½% milk (n = 2) and soy milk (n = 2).

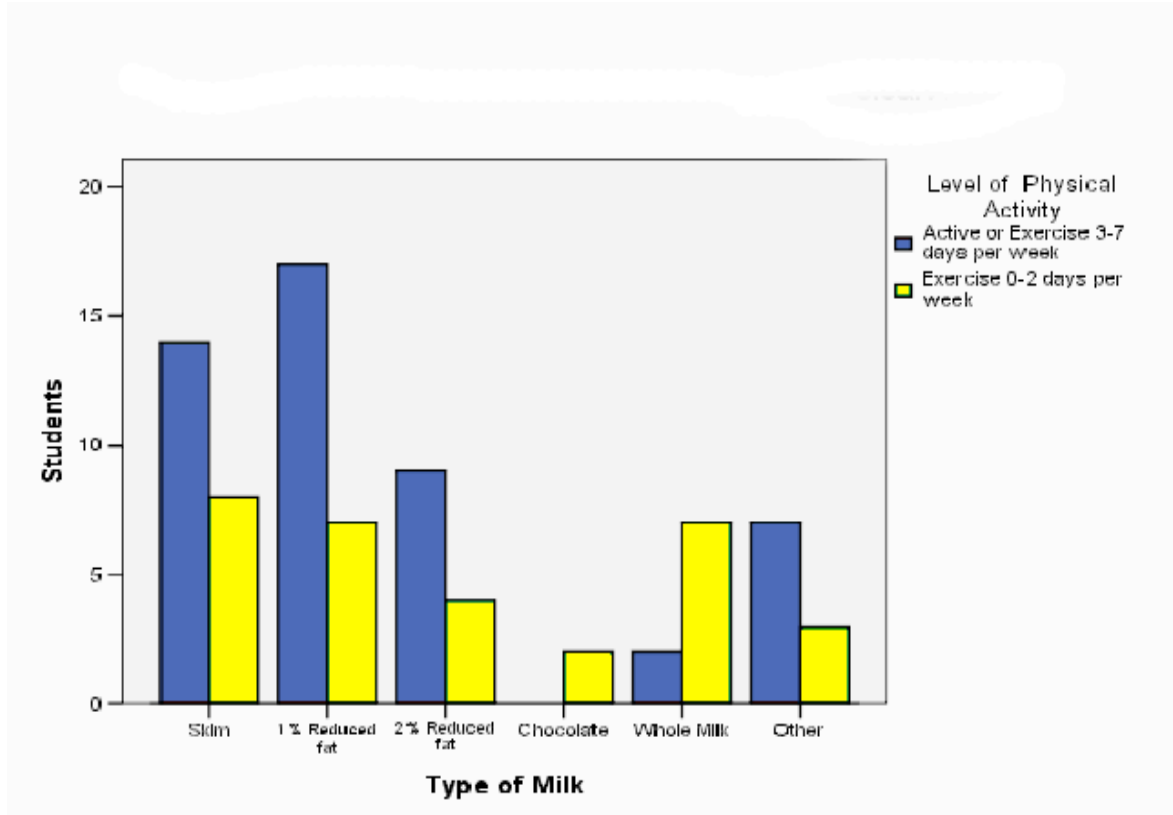


Figure 2. Relationship between level of physical activity and type of milk consumed by junior and senior high school students (n = 84).

Frequency counts regarding soft drink consumption and level of physical activity revealed a strong relationship ($p = 0.001$) between the number of times of drinking soft drinks during the school week and level of physical activity (see Table 2). Students who were physically active at least three days per week were the least likely to drink soft drink beverages during the school week.

Table 2

Frequency Counts for the Number of Times Students Drank Soft Drinks During the School Week in Comparison to the Number of Days Students Were Physically Active

Times of drinking soft drinks at school/ school week	Level of physical activity (in days)				
	Active in sports	Between 5 and 7	Between 3 and 4	Between 1 and 2	Never
None	6	5	8	7	3
Between 1-2	13	1	4	0	5
Between 3-5	3	4	4	3	2
Between 6-10	2	1	0	7	0
More than 10	3	1	0	0	2

Age and Type of Milk Consumption

A significant ($p = 0.003$) relationship was shown to exist between *age* and the *number of times drinking milk per week*. Seventeen-year-olds in this survey were the most likely to consume milk nine or more times per week (see Figure 3).

Students drank milk from glasses, cartons, or jugs; therefore, the exact amount (in ounces) was not specified. Sixteen-year-olds were most likely to drink the least amount of milk (between 0 and 2 times per week) and least likely to drink milk nine or more times per week, whereas 18-year-olds claimed to drink milk equally across each of the three specified amounts (0-2, 3-8, and 9 or more times).

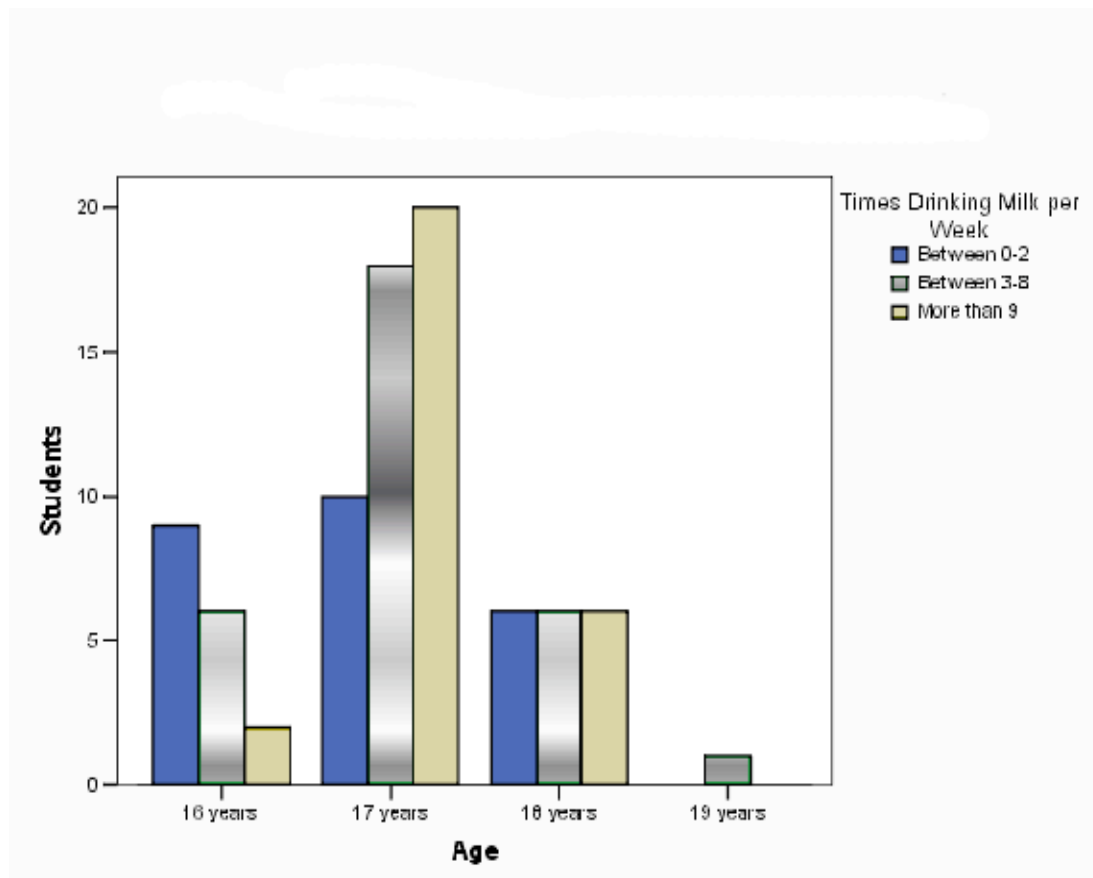


Figure 3. The relationship between high school students' age and level of milk intake.

Gender and Milk Consumption

No relationship ($p = 0.886$) was found between gender and the number of times students drank milk per school week. There was also no relationship ($p = 0.212$) between gender and opinions regarding milk vending machines.

School Lunch and Beverage Choices

Twenty-seven percent ($n = 23$) of students purchased lunch at school five days per week, and 26% ($n = 22$) never purchased lunch at school. There was also a strong relationship ($p = 0.035$) between those who purchased a school lunch and those who purchased a drink at school (see Table 3). Thirty-nine percent ($n = 28$) of

students who said that they purchased lunch also purchased milk, and the next most popular choice was water, at 18% (n = 13).

Table 3

Frequency Counts for the Types of Beverages that Students Purchased in Comparison to the Number of Days Students Purchased School Lunch

Type of beverage	Number of times purchasing lunch at school per week	
	0 to 2	3 to 5
None	6	0
Soda	2	0
Water	9	5
Milk	11	16
Juice	5	3
Other	4	6
Not Applicable	4	0

A significant relationship (< 0.001) between those who brought a *lunch from home and purchased a drink at school* and the *type of drink purchased* was determined, as shown in Figure 4. Of those students who purchased a drink at school when bringing a lunch from home (36.9%, n = 31), 32.3% (n = 10) chose milk, and the rest chose juice (25.8%, n = 8), water (25.8%, n = 8), or *other* (16%, n = 5)

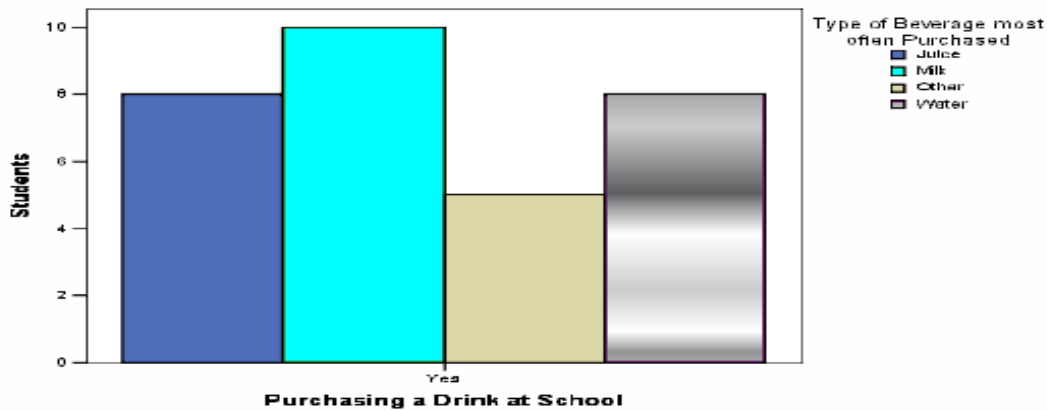


Figure 4. Frequency counts for the types of beverages that students purchased when students purchased a drink at school when bringing a lunch from home.

Sixty-three percent (n = 53) of students responded that drinking milk was important, 17% (n = 14) said that it was not important, and 20% (n = 11) were unsure. Students who purchased lunch at school purchased milk (39%, n = 28) more often than other beverages.

The amount of milk that students reported drinking during the school week ranged from 0 (9.52%, n = 8) to more than 10 times per week (17.9%, n = 15). Seventeen students (20.2%) drank milk only 1-2 times, 19 students (22.6%) drank milk 3-5 times, and 13 students (15.5%) drank milk 6-8 times. Most students drank 2%, 1%, or skim milk (17%, 28%, and 27%, respectively), whereas only 10% claimed to drink whole milk, 5.1% drank chocolate, and 13% answered *other* (strawberry milk, 1 ½ %, and soy milk). Sixty-eight percent (n = 57) of students claimed to purchase milk while at school.

Soft Drink Purchases

Sixty-five percent (n = 55) of students who drank soft drinks answered that they most often drank regular soft drinks, whereas only 20% (n = 17) drank diet soft drinks. The remainder responded that the question was *not applicable*. Thirty percent (n = 22) of students who purchased lunch at a location other than the school cafeteria purchased soft drinks, whereas only 5.4% (n = 4) purchased milk. The remaining students purchased no drink (8.1%), water (23%), juice (11%), or *other* (5.4%); 18% (n = 13) said that this did not apply.

Chapter 5: Discussion

Student Opinions Regarding Milk and Vending Machines

The majority of students who completed this survey purchased milk at school. Students who felt that the milk vending machine encouraged milk consumption commonly responded, “It’s way better than soda,” “I can get it during the school day,” and “It’s available when the café is closed.” Some responses from students who did not feel that the milk vending machine encouraged milk consumption were “I don’t know where it is,” “I drink milk at home,” “I don’t know if the milk [from the vending machine] is any good,” and “I don’t drink generic brand [milk products].”

Many students commented that purchasing milk in the lunch line was more convenient than purchasing from the milk vending machine; other students reported not knowing a milk vending machine existed at the school. Those who reported purchasing milk while in the lunch line also reported that the lunch-line milk was more likely to be fresh, cold, and of a well-known brand name. According to a recent article printed in *Dairy Foods Magazine* (“MilkPEP’s capturing,” 2004), dairy products sold in schools should be branded because students are more comfortable purchasing products that they recognize from the grocery store and other retail locations.

Some students felt that the milk was *generic* and were uncomfortable with the concept of milk vending because the “milk might be warm” or “out of date.” Students may benefit from visuals such as temperature gauges and more visual *sell-by* dates. Additionally, updating the bottles to be more visually appealing to students may aid in increasing sales and interest. It is important to ensure that the milk in the vending

machines is always cold, as warm milk can be a turn-off (“MilkPEP’s capturing,” 2004).

The location of the milk vending machine was an important issue. More than three-quarters of students reported not ever purchasing milk from the milk vending machine and commented that the milk vending machine was in a very inconvenient location and not accessible during breaks or during class changes. Perhaps moving the milk vending machine from the cafeteria, where it is far away from the majority of classrooms, to an area where students can access it during breaks and class changes would increase purchases from the vending machine. A recent article in *Dairy Foods* magazine declared that in order to maximize milk purchases, milk vending machines should be placed in convenient and high-traffic areas to allow students to purchase milk throughout the day (“MilkPEP’s capturing,” 2004).

Although many students reported that they felt that drinking milk was important, the number of times many students reported consuming milk each week was below the recommended daily intake of four dairy servings (Greer and Krebs, 2006) for this age group. However, data were not collected on cheese and yogurt; therefore, it is possible that students were getting their calcium through other sources. Although it appears that many students in this survey understood the importance as well the health benefits of milk, it does not appear that their consumption patterns match their knowledge. It is important for children develop healthy eating habits that continue through adolescence and adulthood (Lin et al., 1999), whereas habits formed during childhood can last a lifetime.

Encouraging healthful eating practices, which includes encouraging adequate consumption of dairy products, is particularly important for this age group. Currently, the milk vending machine at South Portland High School contains snack foods, some possibly of minimal nutritional value, in addition to a variety of dairy products. This may send a wrong message to students, either that the snack foods carry the same nutritional impact as dairy or that milk is a snack or junk food. Marie, Hunt, Gerald, and Murimi (2004) reported that vending machines have low-nutrient dense foods that may “encourage eating habits that are not consistent with nutrition recommendations” (Introduction, para. 1).

Student Opinions Regarding Soft Drinks and Vending Machines

Many students felt that not having a soft drink vending machine was *good*; however, nearly half of the students felt that it was *neither good nor bad*. The majority of students in this survey who purchased soft drinks from vending machines did so fewer than five times per 10 purchases. More research in this area would be helpful in determining whether soft drink purchases from vending machines declined significantly after the removal of the vending machines from the school. Despite the removal of soft drink vending machines from the school, such vending machines were available within close proximity to the school at local gas stations, the recreation center, and quick-service restaurants.

Physical Activity and Milk Consumption

The vast majority of students reported exercising at least 1-2 days per week, and one-third of students reported being involved in high school athletics. Those who exercised most (at least 3 days per week) were more likely than their peers

(who exercised 2 or fewer days per week) to consume milk products. Additionally, those who were most physically active were more likely to consume skim and lower fat milks than their peers.

Student responses both for and against drinking milk indicate that many students have a clear idea of the benefits milk has to offer regardless of their opinions. Students appeared to understand that milk contains calcium and that calcium is a key nutrient in building strong bones, which suggests that current nutrition education is helpful. Further nutrition education regarding dairy consumption may help improve the overall intake for students in this age group.

Students who were more physically active were also less likely to consume soft drinks during the school week than their peers who were less physically active. In a related study, Klonaridou, Papadopoulou, Fahantidou, and Hassapidou (2006) studied snack consumption and physical activity, using a questionnaire completed by 338 children in the sixth grade. These researchers found that students who were more physically active were less likely than their peers to consume soft drinks.

Students in this survey who were more likely to consume milk and were physically active three or more days per week were also less likely to consume soft drinks, perhaps due to a greater level of focus on nutrition education in the lives of this group. Klonaridou et al. (2006) also reported that students who were more physically active were more likely to prefer healthier foods than their peers who were less physically active.

Age and Milk Consumption

Seventeen-year-olds in this survey were the most likely to consume milk; however, they also represented more than half of the population of students who took this survey. Sixteen-year-olds drank the least amount of milk, and 18-year-olds drank milk equally across all three categories (0-2, 3-8, and 9 or more times). In a recent study of 560 male adolescents (13-18 years old) from the Antelope Valley Union High School District in North Los Angeles County, California, results showed that 94.8% of students drank milk and that the majority (46.1%) drank 2% milk (Kassem and Lee, 2005). The investigators used a 66-item questionnaire to identify factors that influence students to consume reduced-fat milk. Kassem and Lee (2005) also found that 16.5% of participants drank three or more glasses of milk per day, and nearly half (46.6%) drank 2-6 or fewer glasses of milk per week. This is in concurrence with this study, which found that 17.9% of students drank milk more than 10 times during the school week and that the majority of students drank milk between 1 and 10 times during the school week.

Gender and Milk Consumption

No relationships were found between gender and the number of times students drank milk per week or the opinions about having a milk vending machine. Lin et al. (1999) researched the nutrient content of foods eaten at and away from home and found that most children aged 12 to 18 were consuming less than the 1997 benchmark intake for calcium (530 mg per 1000 calories), whereas only 31% of boys and 13% of girls in this age group were meeting this benchmark. They found that foods eaten both at home and at school had the highest calcium densities,

especially when compared to foods eaten away from home, such as in restaurants and fast-food establishments. This same research revealed that girls chose foods with a lower calcium density as they reached the teen years, which is an important finding because teenagers require more calcium (1300 mg/day) than adults (Institute of Medicine, 1997) and are consuming less. This is consistent with the findings in this study, which may indicate that adolescents may require more education and encouragement to consume adequate amounts of milk and calcium.

School Lunch and Beverage Choices

Nearly one-quarter of students in this survey did not purchase lunch at school. However, students who purchased lunch at school were also likely to purchase drinks at school, and milk was the most popular choice among those who purchased drinks at school. Additionally, Lin et al. (2003) reported that school lunch had the highest level of calcium and met the benchmark for calcium content per 1000 calories for school-aged children.

School lunch purchases yielded a much higher number of milk purchases than did off-campus meal purchases. Those who purchased lunch off campus most frequently purchased a soft drink, whereas only 5.4% purchased milk. The remaining students purchased juice, water, or nothing. This is an area where broad messages such as a *Crash Course on Calcium*, a program that uses spotlighted female athletes to promote milk consumption, may be beneficial in improving calcium intake in adolescent girls (Lin et al., 1999).

Soft Drink Purchases

Nearly one third of students said that they never drank soft drinks during the school week, and less than 10% said that they drank soft drinks more than 10 times during the school week. Additionally, more than half of the students reported never having purchased a soft drink from a vending machine during the school week, and no students purchased soft drinks more than 6 times for every 10 purchases during the school week. This could be due to the fact that there were no soft drink vending machines available at the high school; however, to the knowledge of this researcher, no comparison to students at a high school that has a soft drink vending machine is available.

An alarming number of students reported drinking *regular* soft drinks as opposed to *diet* soft drinks. This is in concurrence with a similar survey that revealed that 85% of respondents aged 8 to 13 years old from 23 states reported drinking nondiet or regular soft drinks (Grimm et al., 2004). Regular soft drinks contain excess calories and could contribute to weight gain (Harnack et al., 1999). Additionally, such beverages contain a great deal of sugar. The United States Department of Health and Human Services and the USDA's *Dietary Guidelines for Americans* (2005) recommended limiting foods with added sugars, excluding foods with naturally occurring sugars, such as milk and fruit.

When asked about purchasing lunch outside of the school, students often reported that the cafeteria was too expensive or that the food was of poor quality. Encouraging students to purchase lunch at school or bring lunch from home may aid in curbing soft drink purchases outside of the school. Additionally, nutrition education

regarding the possible health effects (poor bone health, poor weight management, harm to teeth, poor nutrient density) may also aid in discouraging soft drink purchases. Nutrition education on this topic, however, may be most beneficial if implemented in elementary school and carried on throughout high school.

Students had varying opinions about not having a soft drink vending machine available to them at school. Forty-three percent felt that this was *neither good nor bad*, 30% felt that it was *good*, and 27% felt that it was *bad*. Students who answered *good* often responded that “soft drinks are not good for students”; “it causes obesity”; and “soda is unhealthy.” Students who answered *bad* most often said, “It should be up to the student”; “people will drink it either way”; “I’ll drink soda when I get home”; and “students need it so they don’t fall asleep in class.”

Many healthcare professionals have suggested that soft drinks should be removed from schools (Greene, 2004). Greene also stated that most school-aged children drink at least one soft drink per day, and most of the time these soft drinks are sweetened, which constitutes the largest source of excess sugar in the diets of U.S. children. According to national statistics, one-third of teenage boys consume at least three cans of soft drinks per day, and soft drinks account for more than one-quarter of all drinks consumed in the United States (Squires, 2001).

Limitations of This Study

1. The results of this study cannot be generalized to other school districts.
2. Question number 13, “*How do you feel about **not** having soda available to you to purchase while you are in school?*” yielded conflicting responses. It

is evident that this question was poorly worded and may have confused some students.

3. Repeating this survey at another school before and after the removal of soft drink vending machines to make a comparison to this survey may give better insight into the thoughts and opinions of students and the areas in which more education is needed.
4. The survey was long and may have been confusing to some students. Some surveys were discarded because they were incomplete, especially at the end of the survey. Also, giving students a better explanation of this survey prior to handing out the survey may have given students a better insight into the purposes of the survey.

Summary

Obesity among America's youth is on the rise, and soft drink consumption among teens runs parallel to this epidemic (French et al., 2003; Bowman, 2003). Additionally, soft drinks are replacing more nutritive beverages, such as milk and fruit juices (Bowman, 2003; Frazão, 2005). It is important to consider avenues for changing this ever worsening issue. In order to develop effective strategies to educate children, adolescents, and parents on the topics of obesity, excessive energy consumption, and intake of important nutrients, one must consider the thoughts and opinions of the adolescents who would be part of such processes. Calcium intake is especially important during the teen years, as this is when peak bone mass occurs (Baker et al., 1999). Although dairy is not the only source of calcium in the American diet, it is one of the richest (Subar et al., 1998; French et al.,

2003; Harkness & Bonny, 2005). Milk vending machines are being placed in schools where soft drink vending machines once were. Even though this may not be the only solution to curbing obesity, it is an important step toward the overall improvement of the health of teens. Investigating the thoughts and opinions of teens, as well as their eating patterns, may be helpful in pinpointing key issues and areas where education is necessary and may improve intake patterns and opinions of students.

References

- American Beverage Association. (2005, August 16). *Beverage industry announces new school vending policy: Plan calls for lower calories and/or nutritious beverages in schools and new limits on soft drinks*. Retrieved December 6, 2006, from http://www.ameribev.org/pressroom/2005_vending.asp
- Bahrampour, T. (2005, September 24). Arlington banishes sodas, some snacks, schools will soon sell water, juice, and more nutritious vending-machine fare. *The Washington Post*. Retrieved November 23, 2005, from <http://www.washingtonpost.com/wp-dyn/content/article/2005/09/23/AR2005092301766.html>
- Baker, S. S., Cochran, M. J., Flores, C. A., Georgieff, M. K., Jacobson, M. S., Jaksic, T., et al. (1999). Calcium requirements of infants, children, and adolescents. *Pediatrics*, *104*(5), 1152-1157.
- Barratt, D. R., Cross, N. A., Mattfeldt-Beman, M. K., & Katz, B. M. (2004). School policies that promote healthy eating: A survey of foodservice directors in North Carolina public schools. *The Journal of Child Nutrition & Management*, *28*. Retrieved October 4, 2005, from <http://docs.schoolnutrition.org/newsroom/jcnm/04spring/barratt/>
- Bowman, S. A. (2002). Beverage choices of young females changes and impact on nutrient intakes. *Journal of the American Dietetic Association* *102*(9), 1234-1239.
- Centers for Disease Control and Prevention (CDC). (1996). *Guidelines for school health programs to promote lifelong healthy eating*. Retrieved September 23, 2005, from <http://www.cdc.gov/mmwr/preview/mmwrhtml/00042446.htm>
- Centers for Disease Control and Prevention, National Center for Health Statistics. (n.d.). *Prevalence of overweight among children and adolescents: United States, 1999-2002*. Retrieved September 23, 2005, <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overwght99.htm>
- Chicago latest to ban soda, candy in schools: Policy slated to go into effect next fall. (2004). *Food Management*, *39*(5), 18-19.
- Conklin, M. T., Cranage, D. A., & Lambert, C. U. (2005). Nutrition information at point of selection affects food chosen by high school students. *The Journal of Child Nutrition & Management*, *29*. Retrieved November 2, 2005, from <http://docs.schoolnutrition.org/newsroom/jcnm/05spring/conklin/index.asp>

- Dairy sales gain in vend test: Cheese, milk, yogurt among top sellers at middle, high schools. (2003). *Food Management*, 38(13), 10.
- De La Rosa, F. (2002, September). *Challenging the soda companies: The Los Angeles Unified School District soda ban*. Retrieved September 13, 2005, from the Occidental College, Urban & Environmental Policy Institute Website: http://departments.oxy.edu/uepi/cfj/publications/Challenging_the_Soda_Companies.pdf
- Forshee, R., Storey, M., & Ginevan, M. (2005). A risk analysis model of the relationship between beverage consumption from school vending machines and risk of adolescent overweight. *Risk Analysis*, 25(5), 1121-1135.
- Frazão, E. (2005). Nutrition and health characteristics of low-income populations: Meal patterns, milk and soft drink consumption, and supplement use. *Agriculture Information Bulletin*, 796, 4.
- French, S. A., Lin, B. H., & Guthrie, J. F. (2003). National trends in soft drink consumption among children and adolescents age 6 to 17 years: Prevalence, amounts, and sources, 1997/1978 to 1994/1998. *Journal of the American Dietetic Association*, 103(10), 1326-1331.
- Greene, A. (2004). Soft drinks in schools. *Daily dose of Dr. Greene*, January 07, 2004. Retrieved December 6, 2005, from http://www.drgreene.com/21_1731.html
- Greer, F. R. (2005). Bone health: It's more than calcium intake. *Pediatrics*, 115, 792-794.
- Greer, F. R., & Krebs, N. F. (2006) Optimizing bone health and calcium intakes of infants, children, and adolescents. *Pediatrics*, 117(2), 578-585.
- Grimm, G. C., Harnack, L., & Story, M. (2004) Factors associated with soft drink consumption in school-aged children. *Journal of the American Dietetic Association*, 104(9), 1244-1249.
- Harkness, L. S., & Bonny, A. E. (2005). Calcium and vitamin D status in the adolescent: Key roles for bone, body weight, glucose tolerance, and estrogen biosynthesis. *Journal of Pediatric and Adolescent Gynecology*, 18(5), 305-311.
- Harnack, L., Stang, J., & Story, M. (1999). Soft drink consumption among U.S. children and adolescents: Nutritional consequences. *Journal of the American Dietetic Association*, 99(4), 436-441.

- Heaney, R. (2003). Normalizing calcium intake: Projected population effects for body weight. *Journal of Nutrition*, 133, 268S-70S.
- Hedley, A. A., Ogden, C. L., Johnson, C. L., Carroll, M. D., Curtin, L. R., & Flegal, K. M. (2004). Overweight and obesity among U.S. children, adolescents, and adults, 1999-2002. *Journal of the American Medical Association*, 291, 2847-50.
- Hendel-Paterson, M., French, S. A., & Story, M. (2004). Parental attitudes towards soft drink vending machines in high schools. *Journal of the American Dietetic Association*, 104, 1597-1600.
- Institute of Medicine, Food and Nutrition Board. (1997). *Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride*. Washington, DC: National Academy Press.
- Jacobson, M. F. (2005). *Liquid candy: How soft drinks are harming America's health*. Retrieved from the Center for Science in the Public Interest Website November 20, 2005, from http://www.cspinet.org/new/pdf/liquid_candy_final_w_new_supplement.pdf
- James, D. C. S., Rienzo, B. A., & Frazee, C. (1996). Using focus group interviews to understand school meal choices. *The Journal of School Health*, 66(4), 128-131.
- Johansson, A. K., Johansson, A., Birkhed, D., Omar, R., Baghdadi, S., & Carlsson, G. E. (1996). Dental erosion, soft-drink intake, and oral health in young Saudi men, and the development of a system for assessing erosive anterior tooth wear. *Acta Odontologica Scandinavica*, 54, 369-78.
- Kassem, N. O., & Lee, J. W. (2005). Understanding reduced-fat milk consumption among male adolescents using theory of planned behavior. *American Journal of Health Education*, 36, 16-24.
- Klonaridou, V., Papadopoulou, S. K., Fahantidou, A., & Hassapidou, M. (2006). Physical activity effect on snacks choice of children. *Nutrition & Food Science*, 36, 400-406.
- Lanou, A. J., Berkow, S. E., & Barnard, N. D. (2005). Calcium, dairy products, and bone health in children and young adults: A reevaluation of the evidence. *Pediatrics*, 115(3), 736-743.
- Lin, B. H., Guthrie, J., & Frazão, E. (1999). Quality of children's diets at and away from home: 1994-1996. *Food Review*, 22, 2-10.

- Lin, B. H., & Ralston, K. (2003). Competitive foods: Soft drinks vs. milk. *Food Assistance and Nutrition Research Report*, 34(7), 1-3.
- Loughridge, J. L., & Barratt, J. (2005). Water in secondary school cafeterias. *Journal of Human Nutrition and Dietetics*, 18(4), 281. Retrieved November 14, 2005, from www.annieappleseedproject.org/watinsecscho.html
- Marie, S., Hunt, A., Gerald, B., & Murimi, M. (2004). Vending machine practices in Louisiana high schools. *The Journal of Child Nutrition and Management*, 28(1). Retrieved January 3, 2007, from <http://docs.schoolnutrition.org/newsroom/jcnm/04spring/marie/>
- Meyer, M. K. (2005). Upper-elementary students' perception of school meals. *The Journal of Child Nutrition & Management*, 29(1). Retrieved September 29, 2005, from <http://docs.schoolnutrition.org/newsroom/jcnm/05spring/meyer/index.asp>
- MilkPEP's capturing the school milk opportunity in 2005. (2004, December). *Dairy Foods*. Retrieved November 8, 2006, from http://www.findarticles.com/p/articles/mi_m3301/is_12_105/ai_n8585728
- Moazzez, R., Smith, B. G., & Bartlett, D. W. (2000). Oral pH and drinking habit during ingestion of a carbonated drink in a group of adolescents with dental erosion. *Journal of Dentistry* 28, 395-7.
- 'Moove' over soda: Milk expands its reach. (2005, January). *Dairy Field*. Retrieved October 14, 2006, from <http://www.dairyfield.com/content.php?s=DF/2005/01&p=5>
- Pennington, J. A. T. (1994). *Bowes and Church's food values of portions commonly used*, (16th ed). Philadelphia: J.B. Lippincott Co.
- Peterson, D. (2005). *Pop and cavities in a can*. Retrieved January 3, 2006, from http://www.dentalgentlecare.com/diet_soda.htm#Pop
- Philadelphia public schools ban soda from cafeterias, vending machines. (2004, February 16). *Nations Restaurant News*, 26, 1. Retrieved October 1, 2005, from http://www.findarticles.com/p/articles/mi_m3190/is_7_38/ai_113682691
- Prevailing plastic. (2005, October). *Dairy Field*. Retrieved October 26, 2006, from http://www.findarticles.com/p/articles/mi_qa3846/is_200510/ai_n15744382

- Rainville, A. J., Choi, K., & Brown, D. M. (2005). Healthy school nutrition environment: Views of school food service personnel compared to other school personnel. *Journal of Child Nutrition and Management*, 2(1). Retrieved September 24, 2007, from <http://docs.schoolnutrition.org/newsroom/jcnm/05fall/rainville/index.asp>
- Schools: Vending milk opens door to extra venues. (2001). *Food Service Director*, 17, 7.
- Schrager, S. (2005). Dietary calcium intake and obesity. *Journal of the American Board of Family Practice*, 18(3), 205-210.
- Skinner, J., Bounds, W., Carruth, B. R., & Ziegler, P. (2003). Longitudinal calcium intake is negatively related to children's body fat indexes. *Journal of the American Dietetic Association*, 103, 1626-31.
- Squires, S. (2001, February 27). The amazing statistics and dangers of soda pop. *Washington Post*. Retrieved September 23, 2005, from http://www.mercola.com/2001/mar/10/soda_pop_dangers.htm
- Subar, A. F., Krebs-Smith, S. M., Cook, A., & Kahle, L. L. (1998). Dietary sources of Nutrients among U.S. children 1989-1991. *Pediatrics*, 102(4), 913-923.
- United States Department of Agriculture, Economic Research Service. (2004). *Food consumption: Food supply and use*. Retrieved January 22, 2006, from www.ers.usda.gov/Briefing/Consumption/Supply.htm
- United States Department of Agriculture, Food and Nutrition Service. (2000). *Changing the scene--Improving the school nutrition environment*. Retrieved September 5, 2005, from <http://www.fns.usda.gov/tn/Healthy/changing.html>
- United States Department of Agriculture, Food and Nutrition Service. (2001). *Foods sold in competition with USDA school meal programs*. Retrieved December 6, 2006, from <http://www.cspinet.org/nutritionpolicy/Foods Sold in Competition with USDA School Meal Programs.pdf>
- United States Department of Health and Human Services, United States Department of Agriculture. (2005). *Dietary guidelines for Americans*. Washington, DC: U.S. Government Printing Office. Retrieved October 26, 2006, from <http://www.health.gov/dietaryguidelines/dga2005/document/pdf/DGA2005.pdf>
- Wechsler, H., Brener, N. D., Kuester, S., & Miller, C. (2001). Foodservice and foods and beverages available at school: Results from the school health policies and programs study 2000. *Journal of School Health*, 71, 313-342.

- Weicha, J. L., Finklestein, D., Troped, P. J., Fragala, M., & Peterson, K. E. (2006). School vending machine use and fast-food restaurant use are associated with sugar-sweetened beverage intake in youth. *Journal of the American Dietetic Association*, 106, 1624-1630.
- Weilert, M. (2005). Editorial: Push towards nutrition helpful. *Opinion*, 33(9),1. Retrieved November 3, 2005, from <http://www.usd258.net/cubtracks/opinion/opinion09/Opinion9>
- Whiting, S. J., Healey, A., Psiuk, S., Kowalski, K., Mirwald, R., & Bailey, D. A. (2001). Relationship between carbonated and other low nutrient dense beverages and bone mineral content of adolescents. *Nutrition Research*, 21(8), 1107-1115.
- Zhu, K., Du, X., Cowell, C. T., Greenfield, H., Blades, B., Dobbins, T. A., et al. (2005). Effects of school milk intervention on cortical bone accretion and indicators relevant to bone metabolism in Chinese girls aged 10-12 y in Beijing. *American Journal of Clinical Nutrition* 81(5), 1168-1175.

Appendices

Appendix A: Human Subjects Approval Letter

Appendix B: Survey Form

Please choose the answer which best describes you

1.) What is your level of physical activity: **Total: n = 84**

- a. I am active in high school athletics n = 27; 32%
- b. I exercise 5-7 days per week n = 12; 14%
- c. I exercise 3-4 days per week n = 16; 19%
- d. I exercise 1-2 days per week n = 17; 20%
- e. I never exercise n = 12; 14%

2.) Approximately how many times during the school week (Monday through Friday) do you drink a bottle/can of soda? **Total: n = 84**

- a. Never n = 27; 32%
- b. 1-2 times n = 25; 30%
- c. 3-5 times n = 16; 19%
- d. 6-10 times n = 10; 12%
- e. More than 10 times n = 6; 7.1%

3.) For every 10 times that you purchase soda, how many times do you purchase soda from a vending machine? **Total: n = 84**

- a. 0 n = 46; 55%
- b. 1-2 n = 30; 36%
- c. 3-4 n = 7; 8.3%
- d. 5-6 n = 1; 1.2%
- e. 7-8 n = 0; 0%
- f. 9-10 n = 0; 0%

4.) Do you generally purchase regular or diet soda? **Total: n = 84**

- a. Regular n = 55; 65%
- b. Diet n = 17; 20%
- c. not applicable n = 12; 14%

5.) On average, how many cartons/jugs/glasses of milk do you drink during the school week? **Total: n = 84**

- a. 0 n = 8; 9.52%
- b. 1-2 n = 17, 20.2%
- c. 3-5 n = 19, 22.6%
- d. 6-8 n = 13, 15.5%
- e. 9-10 n = 12, 14.3%
- f. More than 10 n = 15, 17.9%

6.) What type of milk do you typically drink? **Total n = 78**

- a. Skim n = 21; 27%
- b. 1% n = 22; 28%
- c. 2% n = 13, 17%
- d. Whole Milk n = 8, 10%
- e. Chocolate n = 4; 5.1%
- f. Other: _____ n = 10; 13%

7.) Do you ever purchase milk at school? **Total: n = 84**

- a. Yes n = 57; 68%
- b. No n = 27; 32%

8.) Is the milk vending machine accessible to you during school? **Total: n = 84**

- a. Yes n = 47; 56%
- b. No n = 17; 20 %
- c. I don't know n = 20; 24%

9.) For every 10 times that you drink milk, how many times do you purchase it from a vending machine? **Total: n = 84**

- a. Never n = 60; 71%
- b. 1-2 times n = 21; 25%
- c. 3-5 times n = 3; 3.6%
- d. 6-8 times n = 0
- e. 9-10 times n = 0

10.) Is drinking milk important to you? Please describe your answer after your selection.

Total: n = 84

- a. Yes- why? n = 53; 63%
- b. No- why? n = 14; 17%
- c. I don't know n = 17; 20%

11.) In your opinion, does having a milk vending machine encourage you to drink milk?

Please explain your answer in the space provided. **Total: n = 84**

- a. Yes- why? n = 15; 18%
- b. No- why? n = 37; 44%
- c. Unsure n = 32; 38%

12.) How do you feel about having a milk vending machine at your school? Please explain your answer in the space provided. **Total: n = 84**

a. It's good- why? n = 40; 48%

b. Neither good or bad- why? n = 38; 45%

c. It's bad- why? n = 6; 7.1%

13.) How do you feel about not having soda available to you to purchase while you are in school? **Total: n = 84**

a. It's good. Why? n = 25; 30%

b. Neither good or bad. Why? n = 36; 43%

c. It's bad. Why? n = 23; 27%

14.) Do you have any comments about milk, soda, or vending machines at your school that you would like to share with the researcher? If so, please write your comments in the section below.

15.) Do you leave the school for lunch? **Total: n = 84**

a. Yes n = 25; 30%

b. No n = 59; 70%

16.) If so, why? **Total n = 81**

- a. I purchase lunch elsewhere n = 19; 23%
- b. I go home for lunch n = 9; 11%
- c. Not applicable n = 53; 65%

17.) Please explain your answer to question 15:

18.) If you purchase your lunch at a location other than school, where do you purchase your lunch? **Total n = 81**

- a. Amatos n = 9; 11%
- b. A convenience store (Blue Canoe, Campbell's, etc) n = 3; 3.7%
- c. A fast food establishment: McDonalds, Burger King, or Wendy's n = 6; 7.4%
- d. Dunkin Donuts n = 2; 2.5%
- e. Subway n = 5; 6.2%
- f. Other: please write in your answer n = 10; 12%
- g. Not applicable n = 46; 57%

19.) How often do you purchase lunch elsewhere? **Total: n = 84**

- a. Never n = 38; 45%
- b. 1 day per week n = 21; 25%
- c. 2 days per week n = 13; 15%
- d. 3 days per week n = 7; 8.3%
- e. 4 days per week n = 1; 1.2%
- f. 5 days per week n = 4; 4.8%

20.) How often to you purchase lunch at school? **Total: n = 84**

- a. Never n = 22; 26%
- b. 1 day per week n = 12; 14%
- c. 2 days per week n = 10; 12%
- d. 3 days per week n = 11; 13%
- e. 4 days per week n = 6; 7.1%
- f. 5 days per week n = 23; 27%

21.) When and if you purchase your lunch elsewhere, what beverages do you typically purchase to go along with your lunch? **Total n = 74**

- a. None n = 6; 8.1%
- b. Soda n = 22; 30%
- c. Water n = 17; 23%
- d. Milk n = 4; 5.4%
- e. Juice n = 8; 11%
- f. Other (please write in your response) n = 4, 5.4% _____
- g. Not applicable n = 13; 18%

22.) When and if you purchase your lunch at school, what beverages do you typically purchase to go along with your lunch? **Total n = 71**

- a. None n = 6; 8.5%
- b. Soda n = 2; 2.8%
- c. Water n = 13; 18%
- d. Milk n = 28; 39%
- e. Juice n = 8; 11%
- f. Other (please write in your response) n = 10; 14%
- g. Not applicable n = 4; 5.4%

23.) Do you ever pack a lunch from home to eat at school? **Total: n = 84**

- a. Yes n = 40; 48%
- b. No n = 44; 52%

24.) If so, do you purchase a drink at school? **Total: n = 84**

- a. Yes n = 31; 37%
- b. No n = 33; 39%
- c. Not applicable n = 20; 24%

25.) If your answer to #24 was yes, which beverage do you most often purchase?

Total: n = 84

- a. Milk n = 16; 19%
- b. Juice n = 8; 9.5%
- c. Water n = 14; 17%
- d. Other (please write your answer in the space provided) n = 6; 7.1%
- e. Not applicable n = 40; 48%

26.) What is your gender? Male n = 46; 55% Female n = 38; 45%

27.) How old are you? 16 n = 18; 22% / 17 n = 46; 55% / 18 n = 18; 22% / 19 n = 1; 1.2%

28.) I am a (choose one) Junior n = 35; 42% Senior n = 49; 58%

29.) What is your ethnicity? **Total: n = 84**

- a. Asian n = 0
- b. Black/African descent n = 2; 2.4%
- c. East Indian n = 0
- d. Latino/Hispanic n = 2; 2.4%
- e. Middle Eastern n = 0
- f. Native American n = 1; 1.2%
- g. Pacific Islander n = 2; 2.4%
- h. White/Caucasian n = 71; 85%
- i. Other n = 6; 7.1%

* Note: return of this survey signifies that the participant gives consent for the use of this survey in preparation of a research paper regarding student opinions of nutrition based changes at school over the past two years.

Appendix C: Summary of Chi-Square Tests

Variables	P-value	Comments
Gender vs. times drinking milk per week	0.886	There is no association
Opinion of not having a soft drink vending machine vs. level of physical activity	0.384	There is no association
Opinion of not having a soft drink vending machine vs. number of times drinking milk per week	0.993	There is no association
Opinion about the milk vending machine vs. purchasing milk at school	0.090	There is no association
Types of beverages purchased during the week vs. number of times purchasing lunch at school per week	0.035	There in an association
Opinion about having a milk vending machine at school vs. gender	0.212	There is no association
Opinion about having a milk vending machine at school vs. class standing	0.642	There is no association
Opinion about not having a soft drink vending machine at school vs. class standing	0.025	There in an association
Type of soft drink purchased vs. level of physical activity	0.778	There is no association
Opinion about the accessibility of the milk vending machine vs. number of times purchasing from the milk vending machine	0.717	There is no association
Times drinking milk per week vs. level of physical activity	0.004	There in an association
Type of milk vs. level of physical activity	0.060	No association/ weak association
Gender vs. number of times drinking milk per school week	0.886	There is no association
Number of times drinking soft drinks during the school week vs. level of physical activity	0.002	There in an association
Opinion on the importance of drinking milk vs. number of times drinking milk during the school week	0.000	There in an association
Opinion on the importance of drinking milk vs. opinion on the milk vending machine encouraging milk consumption	0.000	There is an association
Purchasing a drink at school vs. most frequent drink purchased	0.000	There is an association
Packing a lunch from home vs. purchasing a drink at school	0.101	There is no association
Age vs. amount of milk consumed during the school week	0.003	There is an association
Age vs. number of cartons/jugs/glasses of milk do you drink during the school week	0.230	There is no association
Age vs. opinion of the milk vending machine	0.464	There is no association
Age vs. opinion of the importance of drinking milk	0.338	There is no association

