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Factors Influencing Milk Consumption in an Elementary School Lunch Program

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FACTORS INFLUENCING MILK CONSUMPTION IN AN ELEMENTARY NATIONAL SCHOOL LUNCH PROGRAM

by

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Elementary School Lunch Program

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This study investigated milk consumption in an elementary school and whether it could be affected by milk temperature and/or nutrition education. This study was of interest because of the increasing amount of nutritionally related diseases, and the effect that calcium intake could have in diminishing some of those diseases. It was also of interest because the younger generation is drinking less milk and more soda, therefore setting themselves up for nutritionally related diseases later in life.

The study was conducted at an elementary school containing grades K-5. The study was conducted Monday through Friday for a seven week time period. The school had an old milk cooler that was not keeping milk very cold. Temperatures and consumption were measured with the old cooler for two weeks. The old cooler was then replaced with a new milk cooler; temperatures and consumption were measured once again for two weeks, during weeks three and four of the study. On week five nutrition education was implemented for one week. The education consisted of nutrition activities, classroom discussions, and explaining the functions and advantages of the new cooler.

Temperatures and consumption were measured again after nutrition education during weeks six and seven of the study. The data was then evaluated in three categories: old cooler, new cooler before nutrition education, and new cooler after nutrition education.

Data showed that the temperature of the new cooler was colder than that of the old cooler. With the old cooler, 85 percent of students eating lunch were taking milk; when the new cooler was introduced, 95 percent of students eating lunch took milk. Although consumption was not significantly different, there was a 10 percent increase in the number of students taking milk. However, after the nutrition education, students taking milk increased from 95 percent to 96 percent, and consumption increased significantly. After nutrition education, ounces consumed per child increased from 6.8 ounces to 7.1 ounces. Therefore, the study showed that milk consumption did increase with colder milk and nutrition education.

(53 pages)

INTRODUCTION

Nutrition related diseases continue to increase in the United States, and the age at which these diseases are affecting the population is getting younger. Preventative measures are possible with every nutritional related issue. No one can change their genetic predisposition, age, gender, or family history, but with the proper education and motivation they can change their lifestyle.

Milk and dairy food consumption is not a high priority among Americans, and calcium related diseases are becoming more prevalent in our society. The biggest issue is that once the problem is discovered it is often too late to do anything about it. In this instance prevention is essential, and in order for that to occur proper nutrient intake must begin at a young age.

It is the position of the American Dietetic Association (ADA) that comprehensive school based nutritional programs and services be provided to all the nation's elementary and secondary students. These programs and services include effective education in foods and nutrition; a school environment that provides opportunity and reinforcement for healthful eating and physical activity; involvement of parents and the community; and screening, counseling, and referral for nutrition problems as part of school health services (1,2).

ADA also makes the following point, "appropriate nutrition education to recipients of child and adolescent food and nutrition programs is recognized as a key factor in health promotion/chronic disease prevention. As part of any comprehensive health program, nutrition should be integrated across the curriculum, in all subject areas. Delivery of nutrition education should include experiences that use integrated education

resources such as the cafeteria dining area, health and physical education classes, and math and writing skills designed to enhance the critical thinking processes" (1,2).

It is important that nutrition education and disease prevention begin as young as possible. School meals must be consistently healthy, nutritious, and appealing, and school nutrition education must be significant and dominant. The ADA also states the following about the impact of school meals on children's diets, "more than 26 million children, 66% of children aged 6 to 10 years, participate in the National School Lunch Program daily. For some 10-year-olds, approximately 50% to 60% of their total daily intake of energy, protein, cholesterol, carbohydrate, and sodium comes from school meals" (3).

The National School Lunch Program will be discussed in detail later, but in order for these programs to receive funding there are certain requirements that must be met. The lunch program must meet 1/3 of the daily RDA for calories, iron, calcium, vitamin A, and vitamin C, and with less than 30% of calories coming from fat and less than 10% from saturated fat. The breakfast program must meet 1/4 of the daily RDA for the same nutrients with the same fat restrictions. The contribution of school meals to total daily intake of vitamins and minerals ranges from 45% for iron to 77% for calcium. School lunch provides 22% of energy intake, with 30% of the energy coming from fat and 10% of energy from saturated fat. One third of the total sodium intake and 8% of total sucrose intake comes from school lunch (3, 4).

For many children, school lunch is their healthiest meal of the day. Therefore, it is crucial that their nutritional needs are met. Since it is impossible to force children to eat, they must have the proper education to make healthy choices. In other words, they have to want to drink their milk and eat their vegetables. This is possible with the proper

food presentation and education. Children must also be taught to start the day off right with breakfast. Breakfast is an easy way to get at least one serving of dairy products, since most breakfast foods consist of milk or milk products.

Breakfast is an important meal for growing children. Studies have documented a significant positive relationship between eating breakfast and school performance and overall nutritional well being of children. Children who skip breakfast (approximately 14%) have total nutrient intakes that are lower than children who consume breakfast at school or at home (5).

Beginning with the 1996-1997 school year, schools participating in the USDA's national school meals programs were required to serve meals that complied with the Dietary Guidelines for Americans. Requiring schools to follow the Dietary Guidelines has enhanced the coordination of school foodservice with classroom nutrition education. The Dietary Guidelines for Americans required years of research and were developed to benefit the health of society. Using them in schools reinforces messages about healthful eating by emphasizing the total diet and not any single food or nutrient. It also gives students opportunities to practice healthful eating skills at school, and hopefully they will take what they learned and apply it at home as well. Across the country, school meals are becoming more healthful in an effort to improve the nutritional status of children (2,3,4).

Purpose

The purpose of this study was to provide information, investigate the influence of milk temperatures and nutrition education on milk consumption in one elementary school with grades K-5. This study was conducted to prove that increasing the consumption of

milk in elementary students could be done by changing and implementing a few simple procedures. The purpose of the literature review in conjunction with the study, is to prove that increased consumption and nutrition education are needed for disease prevention and overall a healthy society.

LITERATURE REVIEW

The Role of Calcium in the Body

Calcium is the most abundant mineral in the body. It makes up about 1.5% to 2% of the body weight and 39% of the total body minerals (6). Ninety-nine percent of the calcium is in the bones and teeth. The remaining 1% is in the blood and extracellular fluids and within the cells of soft tissues, where it regulates many important metabolic functions (6,7).

When the body is not receiving the proper amount of calcium needed to maintain metabolic functions, calcium is drawn from the bones. Prolonged inadequate intake of calcium can result in a deficient bone structure (6). Bone is constantly being synthesized and resorbed. Bone mass results from complex interactions between osteoclastic (reabsorbing) cells and osteoblastic (forming) cells. According to some estimates, more than 100 osteoblasts are required to reverse the resorption caused by one single osteoclast (8). Osteoblastic activity is crucial in proper bone development and requires calcium for proper formation. Osteoblasts and osteoclasts are controlled by a multitude of hormones and growth regulatory factors (6,7).

Although 99% of the body calcium is found in the skeleton, the remaining 1% is critical to a great variety of indispensable life processes. Levels of calcium in extracellular fluids are regulated by complex mechanisms that balance calcium intake and excretion with bodily needs. When calcium intake is inadequate, homeostasis is maintained by drawing on mineral from the bone to keep the serum calcium ion concentration at normal levels. Depending on the amount required this can be accomplished by drawing from readily mobilizable calcium salts in the bone fluids or through the process of remodeling from the bone itself (6,9).

Calcium is absorbed mainly in the part of the duodenum where acidity is prevalent. Consequently, absorption is greatly reduced in the lower part of the intestinal tract where alkaline contents prevail. Usually only 20 to 30% of ingested calcium is absorbed (6). In general, the greater the need and the smaller the dietary supply, the more efficient the absorption will be. Increased needs experienced during growth enhance calcium absorption (6). The kidneys excrete most of the absorbed calcium, but the mineral is also lost in the saliva, sweat, bile and intestinal secretions. The kidneys process calcium using glomerular filtration and tubular reabsorption. Parathyroid hormone stimulates calcium reabsorption in the organ's distal tubule, while vitamin D may stimulate proximal tubular reabsorption (8).

There are many factors that can increase or decrease calcium absorption, as shown in the following table. Many of them have already previously been discussed, and it should be noted that some of them can be controlled by individual behavior, but some of them cannot.

Table 1: Factors Affecting Calcium Absorption

Factors Increasing Absorption	Factors Decreasing Absorption
Dietary Lactose	Excessive Caffeine
Dietary Glucose	Excessive Sweating
Vitamin D	Vitamin D Deficiency
Equal Dietary Calcium and Phosphorous	Excess Magnesium and Phosphorus
Estrogen Hormone	Large Amounts of Dietary Fiber
Moderate Exercise	Phytate, Oxalic Acid, and Unabsorbed Fatty Acids
Parathyroid Hormone	Menopause
Normal Intestinal pH	Increased Intestinal pH

This table was adapted from: Maher TJ. Osteoporosis and Calcium: Continuing Education Module. *Nutr Sci News* 12/01/2000.

Lack of or insufficient amounts of vitamin D in its active form can inhibit the absorption of calcium. Oxalic acid in rhubarb, spinach, chard, and beet greens forms insoluble calcium oxalate in the digestive tract. For example, only 5% of the calcium in spinach is absorbed due to oxalic acid (6). Cocoa is also high in oxalates however; the amount of cocoa in chocolate milk is not large enough to interfere with calcium absorption. Phytic acid, a phosphorus containing compound found principally in the outer husks of cereal grains, combines with calcium to form calcium phytate, which is also insoluble and cannot be absorbed. Large amounts of dietary fiber can also inhibit that amount of absorption that occurs. In an alkaline medium, calcium with phosphorus forms insoluble calcium phosphate. Large amounts of caffeine have also been linked to increased excretion of calcium and decreased absorption, although research suggests that this can be offset by consuming the allotted amount of calcium each day. Dermal losses occur in the form of sweat, so excessive exercise will increase sweating and increase loss

(6,8,10). There are many factors that affect the absorption of calcium, so it is crucial that the daily needs are met and the factors that decrease absorption are minimized.

Vitamin D is needed for calcium absorption and for deposition of calcium in the bones. Because this nutrient is also available from the action of sunlight on subcutaneous tissues, the amount required from dietary sources depends on the geographic location of the individual. All milk is fortified with vitamin D, and is the main source of this nutrient. However, other dairy products such as yogurt and cheese are not usually vitamin D fortified (6).

The calcium needs for each stage of human development are different. There are times when the body requires more calcium to adjust to a growing and developing body. The RDAs for calcium have changed several times over the years as research has continued to confirm its importance in proper bone formation. Research is always being conducted to see if the RDAs are meeting the needed requirements for each stage of life. Daily Recommended Intakes (DRIs) were developed in 1997-1998 to be used as the latest guidelines in nutrient needs. There is a lot of information available that is constantly changing, so it is important to keep updated with the latest changes to ensure that the proper amounts of calcium are being consumed on a regular basis.

The following table shows the necessary calcium intake for children and adolescents. It shows how the recommendations changed from the 1989 RDAs to the 1997-1998 DRIs. It also shows the recommended calcium that should be provided daily by the school lunch program, and what the Food and Drug Administration (FDA) use as labeling values. The school lunch program is required by law, for reimbursement purposes, to provide on average 1/3 of the current calcium recommendation for each age group. The

FDA is responsible for all labeling on food products and has used one figure to portray the needed amount of calcium for each person. It is the responsibility of the individual to know if their calcium requirements are higher.

Table 2: Recommended Daily Calcium Intake

Ages Male and Female	1989 RDA	1997-1998 DRI	School Lunch Requirements	FDA Labeling Values
4--8	800 mg	800 mg	286 mg	1000 mg
9--10	800 mg	1300 mg	286 mg	1000 mg
11--14	1200 mg	1300 mg	400 mg	1000 mg
15--18	1200 mg	1300 mg	400 mg	1000 mg

This table was adapted from the most current research available from USDA and FDA. It should also be noted that the current recommendation for adults is 1000 milligrams of calcium per day. Also note that grades K-5 range in ages 5-10.

Calcium in children is needed for adequate mineralization and maintenance of bone growth. Actual need depends on individual absorption rates and dietary factors, such as intake of protein, vitamin D, and phosphorus. Calcium retention in children between ages 2 and 8 is approximately 100 mg/day. Since calcium intake has very little influence on the degree of urinary calcium excreted during periods of rapid growth, children need two to four times as much calcium per kilogram body weight than do adults. Because milk and other dairy products are primary sources of calcium, children who consume none or limited amounts of these foods are at risk for calcium deficiency (6).

The American Academy of Pediatrics has stated that osteoporosis is a disease of the elderly, but its prevention begins in childhood by maximizing calcium retention and bone density in the growing years. Studies of adolescent girls suggest that, to reach maximum calcium balance, younger teenage girls may need to consume more than the

1989 RDA of 1200 mg/day (11). Even in prepubertal children, calcium supplementation, in addition to an average calcium dietary intake of 800-1000 mg, increased bone mineral density significantly (6). This evidence suggested that consideration be given to increasing the RDA, once again for calcium, for children and adolescents. The Daily Recommended Intake (DRIs) of 1997-1998 increased the calcium recommendation by 100 mg, from 1200 mg to 1300 mg each day, but research may find that these requirements should be even higher. Education is also needed to encourage young people to achieve an appropriate intake of calcium food sources (6,8,9,11).

Some of the latest research has shown that when it comes to health benefits, dairy products are working double duty. A new research review reinforces the critical role dairy foods play in good health. The review highlights numerous studies linking calcium and dairy intake to the reduced risk of heart disease, osteoporosis, colon cancer, kidney stones, and obesity. The researchers also noted that many Americans are falling short of meeting their calcium recommendations. If those daily needs can be met, disease prevention can begin (12).

Dietary Sources of Calcium

There are many ways to obtain calcium in the diet. The following table includes the best sources of calcium that are available naturally in foods. The best sources are from dairy products, but there are other foods that contain calcium as well.

Table 3: Dietary Sources of Calcium

FOOD	SERVING SIZE	MG OF CALCIUM
Low fat yogurt with fruit	1 cup	345
Skim milk	1 cup	302
2% milk	1 cup	297
Ice milk, soft serve	1 cup	274
Tofu, firm	1/2 cup	258
Mozzarella cheese	1 oz	207
Cheddar cheese	1 oz	204
Vanilla ice cream	1 cup	176
American cheese	1 oz	174
Salmon	3 oz	167
Ricotta cheese	1/4 cup	167
Cottage cheese 2% fat	1 cup	155
Spinach, frozen, cooked	1/2 cup	138
Molasses, blackstrap	1 tablespoon	137
Tofu, regular	1/2 cup	130
Broccoli, fresh	1 cup	126
Instant dry milk	2 tablespoons	104
Almonds	1/4 cup	92
Orange	1 medium	52
Halibut	3 oz	51
Whole wheat bread	1 slice	32
Oatmeal, cooked	1 cup	19
Chicken breast	3 oz	13
Apple	1 medium	10
Pasta, cooked	1 cup	10
Banana	1 medium	7

Table was adapted from Mahan KL, Stump SE. Food, Nutrition and Diet Therapy 9th Edition. Philadelphia: W.B. Saunders Company: 1996.

With the increasing need for calcium in the diet, many products on the market are now being fortified with calcium. Orange juice was one of the first products to try the fortification and has been very successful. One cup of calcium fortified orange juice is equivalent to one cup of milk; both provide 30% of the required daily value, which according to the labeling value put out by FDA it is 1000 mg. Some cereals are also fortified with calcium. Depending on the cereal, a serving can provide 10-50% of the

daily required value. Many other products are in process of fortification, such as butter, margarine, and salad dressings. Some have not been as successful as orange juice and cereal, but the population should know that there are alternative options.

There are many ways to receive calcium in the diet and there is also an easy way to keep track of how much calcium is consumed in one day. Assuming that 8 ounces of milk, 8 ounces of yogurt, and 1 ounce of cheese, provides approximately 300 mg of calcium per serving, and 2-3 servings are consumed in one day that equals 600-900 milligrams. It is also safe to assume that a balanced diet provides another 300 milligrams from various food sources. Knowing this information, the individual can keep track of their calcium intake and make sure that they are getting their recommended milligrams each day (13).

Calcium Supplements

Studies have shown that taking a calcium supplement with a meal or eating calcium rich foods with other foods will increase the amount of absorption (8). Vitamin D in its active form works simultaneously with calcium and is needed for optimal absorption, and vitamin D also stimulates intestinal absorption (6).

Calcium supplements are becoming very popular and are a good way to get the needed calcium if food is not meeting the body's needs. While diet is the preferred way to obtain the necessary amounts of calcium, many individuals cannot achieve optimal calcium intake with food alone. There are numerous calcium supplements available. Preparations available include the following salts of calcium (listed from highest to lowest percent by weight of elemental calcium): carbonate, phosphates, citrate, lactate,

gluconate and glubionate. Calcium carbonate and calcium citrate are the two most common types of supplements used. The carbonate salt contains the greatest elemental calcium: 40 percent by weight. Carbonate supplements require acid to dissolve and for efficient absorption. Although calcium carbonate absorption is pH-dependent, calcium citrate absorption is not, and therefore does not require acid for absorption. Calcium supplements should be taken between meals and divided throughout the day because the smaller the dose, the better the absorption. Researchers have done conducted studies to see when the best time to take a calcium supplement is, and some of their results have shown that taking a calcium carbonate supplement at dinner time and a calcium citrate supplement before bed will best enhance absorption and utilization (8,11,14).

There have been some reports of unacceptable tablet disintegration and dissolution rates with various products, but there is no reliable information available to accurately address this issue. If the calcium supplement being used does not meet the United States Pharmacopoeia standards (it will contain USP symbol on the label if it does), then the vinegar test is a way to test absorption. Put a supplement in a cup of vinegar and stir every five minutes. It should dissolve within thirty minutes. If it does not, the calcium tablet probably will not dissolve in the stomach either. Most chewable and liquid forms should dissolve, because they are already broken down (8). Some individuals should use products that also contain vitamin D if their intake of this vitamin is inadequate or if their exposure to sunlight is minimal. (8,11,14,15).

The following table includes calcium supplements listed from the highest amounts of calcium to the lowest.

Table 4: Calcium Supplements

Product	Percent Elemental	Elemental Calcium in Milligrams (mg)
Calcium Carbonate	**40%**	
Generics		500-600 mg
Caltrate		600 mg
OsCal-500		500 mg
Rolaids		220 mg
Tums		200-500 mg
Tums Ultratablets		1000 mg
Mylanta Gelcaps		550 mg
Calcium Citrate	**21%**	
Generics		200 mg
Citrical Tablets		200 mg
Citrical Caplets + D		315 mg + D3 (200 IU)
Citrical Liquitabs		500 mg
Dibasic Calcium Phosphate	**23%**	
Generics		115 mg
Calcium Lactate	**13%**	
Generics		84 mg
Calcium Gluconate	**9%**	
Generics		45-90 mg
Calcium Glubionate	**7%**	
Neo-calglucon syrup		115 mg (per 5 mL)

This table was adapted from Maher TJ. Osteoporosis and Calcium: Continuing Education Module. *Nutr Sci News* 12/01/2000 and Goebel and Willhite.

Osteoporosis

Osteoporosis has been defined as a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase

in bone fragility and susceptibility to fracture (8). The bone loss that begins in adult life and continues into old age is a normal process. Bone composition is unchanged, but mass and density decrease. Osteoporosis occurs when loss of bone density becomes so acute that the skeleton is unable to sustain ordinary stress, a condition that is marked by the occurrence of fractures (6).

It is estimated that the proportion of Americans over 65 years of age will double from 12% in 1988 to 24% in 2020 (6). Osteoporosis prevalence increases with age: 15 percent of 50 year olds, 30 percent of 70 year olds and 40 percent of 80 year olds are affected by the disease. The hip fracture rate for 65-year-old men and women is 0.9 and 1.6 per 1,000 people. That rate increases dramatically, reaching 26 and 35 per 1,000 people by age 95 (8). Because virtually all elderly are affected, the increasing longevity of this population emphasizes the need for prevention of osteoporosis early in life (6).

There are two types of osteoporosis: Type I, postmenopausal osteoporosis; and Type II, or age associated osteoporosis. Type I is seen in elderly women within 15-20 years of menopause, and it primarily involves trabecular bone. Fractures of the distal radius and painful, deforming "crush" fractures of the lumbar vertebrae are characteristics of Type I osteoporosis. Bone mass in the lumbar spine of women with Type I osteoporosis has been measured at levels 33% lower than in women who are in the same age bracket and are not suffering from osteoporosis. The pelvis and proximal end of the femur can also be affected in this type of osteoporosis (6,9,10,11).

Type II osteoporosis occurs around age 70 and beyond. It affects both sexes and may involve both cortical and trabecular bone. Fractures of both hip and vertebrae continue to rise with aging, with a dramatic increase in hip fractures occurring late in life.

Fractures of the thoracic vertebrae lead to back pain, loss of height, and spinal deformity. The spinal deformity is known as kyphosis or more commonly called the "dowager's hump." It is not unusual for patients to lose between 4 and 8 inches in height. The most common symptom is back pain, which may be mild or severe and may last for days or weeks before receding or recurring. Besides increasing the prevalence of fractures, osteoporosis also negatively impacts quality of life by leading to reduced lung capacity, chronic pain, and decreased height. A poor self image, plus the constant fear of falling are other psychological repercussions associated with the disease (6,8,11).

The following illustration is a good example of how the body changes as a result of osteoporosis.

Figure 1 Body Changes Caused By Osteoporosis

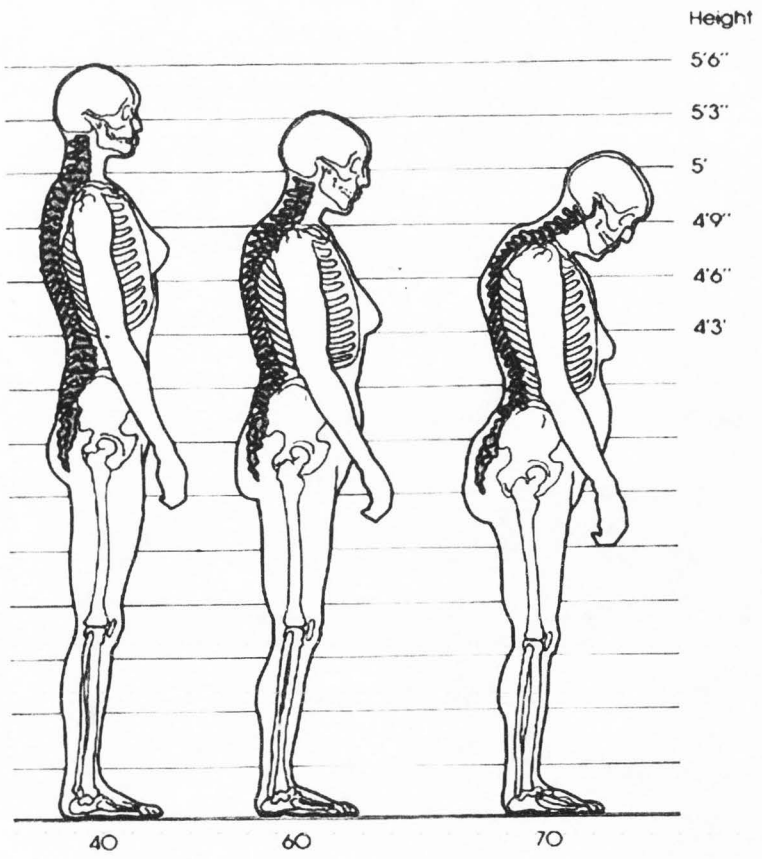


FIGURE 25 – 2. *Normal spine at age 40 and osteoporotic changes at ages 60 and 70. These changes can cause a loss of as much as 6 to 9 in. in height and result in the so-called dowager's hump* (far right) *in the upper thoracic vertebrae. (From Ignatavicius D and Bayne MV: Medical-Surgical Nursing: A Nursing Process Approach. Philadelphia, WB Saunders, 1991, p 739.)*

Peak Bone Mass

During growth periods of childhood and puberty, deposition outstrips the resorption of bone. According to current research, the estimated age when mineral acquisition ceases is between the ages of 28.3 and 29.5 (6,8). The long bones stop growing in length around age 20, but mass continues to accumulate for a few more years. If the proper amounts of calcium are not consumed regularly during early life, there can be a 5-10% difference in peak adult bone mass. Such a difference may seem small and irrelevant, but it is sufficient enough to account for 25-50% difference in hip fracture rates later in life (16).

Bone mass is an important determinant of bone strength (16). Peak bone mass is the greatest amount of bone mass and strength that an individual can genetically develop before a certain age. Achieving full genetic potential is ideal where the size and mass of the skeleton have not been restricted by an insufficient supply of nutrients and/or suboptimal mechanical loading (16,17). Once the peak bone mass is reached, the bone will no longer grow longer or harder. It is crucial that peak bone mass is developed and that mass is as deep and strong as possible, because the bone will soon start to break down. If there is enough bone mass to accommodate for normal break down, then osteoporosis will not occur (6,16,17).

Peak bone mass is greater in men than in women because of their larger frame size. Both bone mass and bone density are normally lower in women. One study demonstrated a 15% lower bone density and a 30% lower bone mass in women than in men after skeletal growth was complete (6). Bone density is also greater in the Black, and Hispanic cultures than in Caucasians and Asians. This factor may be related to a

genetically larger muscle mass and body frame. A strong hereditary component is also related to peak bone mass development. Pre-menopausal daughters of osteoporotic mothers have demonstrated reduced bone mass in the spine and femoral neck compared with daughters of normal mothers (6).

Peak bone mass is also related to dietary calcium intakes and the extent of weight bearing exercise during the growth and development period. Physical activity and dietary calcium appear to play a large role in supporting gains in bone mass in the third decade of life in women (6). Physical activity should consist of weight bearing activity. This means that the exercise is putting pressure on the bones. Walking, running, and weight lifting are all forms of weight bearing exercise; swimming and biking are not considered weight bearing. A combination of weight bearing exercise and a calcium rich diet should maximize peak bone mass (6,16).

Surveys in the United States reveal that adolescent girls are less likely to meet the current recommended dietary levels for calcium than are teenage boys, whose intakes are higher and come closer to achieving recommended values (16,17). It is alarming to note that roughly 90% of females from age 9-18 years fail to ingest even 77% of current DRI of 1300 milligrams. Adolescence is a critical and complex developmental period in which major biological, social, and psychological changes occur. These changes influence both the nutritional needs and nutritional status of teenagers. Psychological changes involving the adolescent's search for independence and identity, desire for acceptance by peers, and preoccupation with physical appearance can affect eating habits, food choices, nutrient intake, and ultimately nutritional status. An important consideration in this age range is developing eating patterns, which will be associated with a healthy diet later in life.

Parents should be encouraged to include adequate calcium sources in their children's diet in the weaning period and throughout childhood into adolescence (6,12,14,15,16,17).

During this crucial time of peak bone mass development, these issues must be addressed through nutrition education. In most instances, adolescents are unaware that their bones are at a crucial developmental stage. As osteoporosis becomes more prevalent, it is important that calcium intake, peak bone mass, and osteoporosis are addressed in nutrition education. Education will not change everyone's habits for the better, but it will make students more aware and conscious of the decisions they are making. It is important to note that not every aspect of peak bone mass development can be controlled, but those that may have a lifelong impact.

Current Milk Consumption in Children

Among young children, consumption of fluid milk has decreased by 16 percent since the late 1970's, while consumption of carbonated soft drinks has increased by 16 percent (18). A little more than half of teens drank milk in 1994, compared to about three-fourths in the 1970's. Intakes two years ago ranged from 12 ounces for preschoolers and school aged girls to around 16 ounces for school aged boys (19). That is only one cup and a half to two cups a day, and they should be receiving three to four cups per day, some of the girls are not even meeting one half of their requirement.

Among a large sample size of US children, only those with a source of milk in the noon-time meal met or exceeded 100% of the RDA for calcium. Thus, including three servings a day of milk or dairy products each day (3). According to USDA's Food and Nutrient Intakes by children, published in 1998, the information showed that males ages

6-11 were receiving on average 335 milligrams of calcium each day, and females ages 6-11 were receiving on average 283 milligrams of calcium each day (4). The current recommendation is 800-1000 milligrams each day.

Children are not being taught the importance of drinking milk (12). Calcium is needed for proper growth and development, and the body's needs only continue to increase for the next few years. They already have bad habits as they enter into the most crucial time of bone development, adolescence, where the calcium requirements can be as high as 1500 milligrams per day. Children must be taught and understand at a young age that drinking milk and consuming dairy products is essential to a healthy life. They must also understand the soft drinks do not provide the needed nutrients to make them grow healthy and strong.

Increased Soft Drink Consumption

Trends in beverage consumption among children and adolescents suggest that soft drinks may be replacing more nutritious beverages such as milk and fruit juices. The proportion of adolescent girls drinking fluid milk on any given day dropped from 72% in 1977-1979 to 57% in 1994 (20). Reduced consumption of milk and fruit juice among children and adolescents is cause for concern because intake of these beverages and some of the nutrients contained in them, such as calcium, is suboptimal for a substantial proportion of the US children. Data from national surveys indicate that calcium intakes of a notable proportion of children (teenagers in particular) are below the RDA (20,21).

For all age groups, those individuals who consume high amounts of soft drinks are more likely to consume less than eight ounces of fluid milk per day. For example,

adolescents consuming 26 ounces of soft drink or more per day were about 4 times more likely to consume less than eight ounces of milk per day compared with non-consumers of soft drinks. Similarly, for all age groups, those in the high soft drink consumption category were more likely to consume less than four ounces of fruit juice per day when compared with non-consumers of soft drinks (20). Soft drinks are replacing the nutritious beverages that are needed by children and adolescents for proper growth, good nutrition, and disease prevention (22).

A study conducted by the Journal of the American Dietetic Association showed that a sizeable portion of children and adolescents regularly consume soft drinks. The study was conducted in the United States, using in home interviews. Dietary intakes for two nonconsecutive days was collected; for children who were too young to report on their own, proxies were used. The proxy was the individual who prepared the child's meal. All beverage consumption was evaluated and scored. Regular and diet soft drinks were considered, as well as milk of all varieties, and juice of all varieties.

The results showed that 95% of the children assessed were not consumers of the diet soft drinks, and only 17% of children were only milk and juice consumers, therefore assuming that approximately 78% of the children assessed were soft drink consumers. The research did find that, 12% of preschool aged children drink an average of 9 ounces of soft drink or more per day. Among school aged children, more than one third consume 9 ounces of soft drink per day. Almost one fourth of adolescents drank more than 26 ounces of soft drink per day, with the average teen consuming 42 ounces of soft drink each day. Evidence from a similar study also showed that 37% of 3 to 5 years olds consume 10 ounces of soft drink or more per day (20,22,23).

Data suggests that soft drinks displace milk and fruit juice in the diets of children and adolescents, particularly at high levels of soft drink consumption. Soft drink consumption was, in general, inversely associated with consumption of milk, fruit juice, and the nutrients concentrated in these beverages. Intake of nutrients concentrated in milk (calcium, riboflavin, vitamin A, and phosphorus) and fruit juices (folate, and vitamin C) tended to be lower among youth that consumed large amounts of soft drinks (3).

Phosphorus and caffeine are also found in soft drinks and can also have detrimental effects on growing bones. Phosphorus is found in many foods, including soft drinks. Phosphorus interferes with the absorption of calcium into the bone. The phosphorus content of some of the leading soft drink sellers are:

Coke	41mg
Diet Coke	18mg
Pepsi	53mg
Diet Pepsi	41mg

Caffeine also has a negative effect on calcium. When caffeine is consumed, the loss of calcium increases. Drinking coffee, tea, or colas on a regular basis is a sign that more calcium needs to be added to the diet. Putting milk in coffee to increase daily calcium intake is one way to increase consumption. Research has found that if caffeine is consumed on a daily basis, an extra source of calcium or calcium supplement may be necessary each day (8).

The role of carbonated beverage companies in the promotion of soft drink consumption cannot be overlooked since nutrition education efforts by nutrition professionals must compete with the beverage companies' extensive promotional efforts.

In 1995, the three major US carbonated beverage companies spent more than 400 million dollars on advertising and promotional activities. Some of the marketing strategies have been primarily geared towards children and adolescents (20).

Nutrition education messages encouraging limited consumption of soft drinks are needed to counter the rising popularity of soft drink consumption, and must emphasize that soft drinks contain minimal nutritional value. Education messages should be targeted to the individuals that are most likely to consume moderate to high quantities of soft drinks (children and adolescents, particularly adolescent boys). Health professionals and parents should also advocate for policies in day care centers and schools that would limit the access of soft drinks to students. A 1996 study of 55 metropolitan high schools found that 11% of schools offered soft drinks in vending machines during school hours. It has been noted that this percentage has increased even more over that last few years (20,22,23).

There are people out there trying to make a difference. Kids are going to buy it if it is in front of them, so the goal must be to keep it from being in front of them. Senator Patrick Leahy has introduced a bill to require the USDA to rule within 18 months on banning or limiting the sale of soft drinks and junk food in schools before students have eaten lunch. "Schoolchildren are a captive market for soda vendors," Leahy said in a press release. "Our kids pay the price when we give soft drink companies free reign to market their products in schools" (24).

"The Better Nutrition for School Children Act of 2001" bill would also immediately amend the Child Nutrition Act of 1966 by mandating that soft drinks and

other foods of minimal nutritional value not be sold or donated to students of schools participating in the school lunch program anywhere on school property during either lunch or breakfast. Under current law, schools are prohibited from selling unhealthy snacks and soft drinks during lunch in the cafeteria. Schools and soft drink makers avoid this by donating free soft drinks or selling them in vending machines or concession stands outside of the cafeteria (24).

Unfortunately, everyone working to discourage the amount of soft drinks consumed by children and adolescents have their work cut out for them. Recently the Coca-Cola Company bought, for $150 million, sole worldwide marketing rights to the first Harry Potter film, they also signed on for the sequel to the movie (24). This will only continue to enhance the amount of soda being consumed by children. To target younger children, Coke has announced a global agreement with Disney to market "healthful" vitamin-enriched drinks using Disney characters. Most of these products are basically water, sugar, a couple tablespoons of juice, plus colorings and added vitamins. Coca-Cola plans to spend as much as $500 million more than originally planned this year on marketing (25).

Nutrition education cannot compete with soft drink companies, but it can be just as effective. If nutrition education is part of everyday curriculum, students will start making healthy choices on their own. Something must be done to decrease the consumption of soda. Unfortunately, the statistics are moving in the opposite direction. According to the United States Department of Agriculture (USDA), per capita soft drink consumption has increased by almost 500% over the past 50 years. From 1989-91 and 1994-95, soft drink intake rose from 195 to 275 milliliters in the general population, and

from 345 to 570 milliliters among adolescent boys. Half of all Americans and most adolescents, 65% girls and 74% boys, consume soft drinks daily, most of which are sugar sweetened. Currently, soft drinks constitute the leading source of added sugars in the diet (26). North America has been the major consumer of carbonated soft drinks, when compared with other countries, with sales figures doubling that of other areas in the world (27). Soft drink consumption is on the rise in every country, but the United States is already consuming more than several countries put together (27). The soft drink companies will never go out of business, but limiting their growth and product availability, may stop contributing so much to obesity, osteoporosis, and diabetes.

Child and Adolescent Obesity

The country's leading health researchers call obesity the top nutrition problem in the United States. Obesity is defined as anyone who is more than 20% over their ideal body weight. More than half of all adults are overweight and one third are obese, according to the year 2000 data published by National Institutes of Health, and as many as 20 percent of children are obese. The rising prevalence of obesity in children has been linked in part to the consumption of sugar sweetened drinks, mainly soft drinks. Excessive bodyweight now constitutes one of the most common pediatric medical problems in the United States. Although the cause of obesity is likely to be multifactorial, findings suggest that sugar sweetened drink consumption could be an important contributory factor. The odds of becoming obese among children increased 1-6 times for each additional can or glass of sugar sweetened beverage consumed each day (26).

Energy intake has been found to be positively associated with soft drink consumption. In particular, energy intake was higher for individuals categorized as high soft drink consumers. This finding raises concerns about the trend toward increased soft drink consumption among children and adolescents because the energy provided by soft drinks appears to contribute excessive energy intake and childhood obesity (3). By contrast, increased diet soda consumption was negatively associated with obesity incidence. Analysis has also indicated that both baseline sugar sweetened drink consumption and change in consumption independently predict change in body mass index (BMI) (26).

Researchers from Children's Hospital in Boston and the Harvard School of Public Health tracked lifestyle habits of 548 11 and 12 year olds attending public schools in Massachusetts from October 1995 to May 1997. All children drank soft drinks at the beginning of the study, and 57 percent increased their soft drink consumption over the next 19 months. For each additional soft drink consumed, researchers found, BMI odds of obesity went up significantly, regardless of television viewing, physical activity, and diet habits (28).

Soft drinks are the leading source of added sugars among the diets of adolescents. Soft drink consumption increased 500 percent over the past 50 years, and child obesity rates rose 100 percent in the United States between 1980 and 1994. It is not uncommon for teenagers to receive 500 to 1,000 calories per day from sugar sweetened drinks. These drinks are easy to over consume, because calories in a liquid form seem to be less satiating, or less filling, than calories in a solid form (26,27,29). Gortmaker, co-author of the study and director of the Prevention Research Center at the Harvard School of Public

Health stated, "children are drinking more sugar sweetened drinks like soft drinks and fruit punch, instead of milk or water, and this poses a real health risk. Families need to be aware of the access their children have to these products both at home and at school" (28).

The question has been raised as to why sugar sweetened drinks should promote obesity any more than other categories of food. In the short term, most individuals effectively compensate for excess energy consumption by eating less at subsequent meals. In the long term, changes in bodyweight elicit physiological adaptations, involving hunger and rate of metabolism, which tends to restore baseline bodyweight. Studies done over the last 25 years suggest that compensation at subsequent meals for energy consumed in the form of liquid could be less complete than for energy consumed in the form of solid food (26).

Research has proven that the more soft drinks consumed, the less calcium in the form of milk is consumed (21). So not only is soft drink consumption increasing obesity rates, it is also decreasing milk consumption. As mentioned previously, milk consumption during the childhood and adolescent years is crucial to bone mass development. Some current studies have also shown that children with higher dairy/calcium intakes had a lower body fat percentage than those children with lower dairy/calcium intakes. These results are supported by a growing body of research on adults showing a connection between dairy food consumption and weight loss (30).

Obesity is an epidemic that cannot be ignored. The adult population continues to become more overweight, and the logical solution seems to be to stop obesity in the younger population. At this point the efforts to do so are failing. Obesity is responsible

for millions of deaths each year (31). The causes are many, but encouraging our children to practice healthy eating patterns from a young age can greatly reduce their chances of becoming obese. Soft drink companies are only going to continue to encourage consumption, so society must be determined enough and care enough about the future populations to encourage nutrition education and decrease the cases of obesity in the United States.

Nutrition Education

The Child Nutrition Act defines nutrition education as a multidisciplinary program in which scientifically valid information about foods and nutrients is imparted in a manner that individuals receiving such information will understand the principles of nutrition and seek to maximize their well being through food consumption practices. Nutrition education programs shall include, but not be limited to:

1. Instructing students with regard to the nutritional value of foods and the relationship between food and human health
2. Training school food service personnel in the principles and practices of food service management
3. Instructing teachers in principles of nutrition education, so that they can pass it on to students
4. Developing and using classroom materials and curriculum to promote nutrition education
5. Provide information to parents and caregivers regarding the nutritional value of food and the relationship between food and health.

It is the position of the American Dietetic Association (ADA) that comprehensive school based nutritional programs and services be provided to all the nation's elementary

and secondary students. These programs and services include: effective education in foods and nutrition; a school environment that provides opportunity and reinforcement for healthful eating and physical activity; involvement of parents and the community; and screening, counseling, and referral for nutrition problems as part of school health services (1,2).

ADA also makes the following point. Appropriate nutrition education to recipients of child and adolescent food and nutrition programs is recognized as a key factor in health promotion/chronic disease prevention. As part of any comprehensive health program, nutrition should be integrated across the curriculum, in all subject areas. Delivery of nutrition education should include experiences that use integrated education resources such as the cafeteria dining area, health and physical education classes, and math and writing skills designed to enhance the critical thinking processes (1,2).

Recess Before Lunch

There are simple ways that can be easily changed or adopted that would increase the amount of milk and other nutrients being consumed by students at lunch time. One of those things is having recess before lunch instead of after. This could make an enormous difference and cost nothing to change. Other suggestions are adopting the National School Lunch Program into the school, and other federally funded programs. These things can enhance the nutrient intake of the students.

There has been a lot of research for years about whether or not recess before lunch made a difference in the amount of food and milk consumed. One study found that milk consumption did increase when recess was after lunch. The study began with the

students eating lunch before recess and milk consumption was measured, recess was then changed to before lunch and milk consumption was checked again. There was a significant increase in milk consumption when recess was changed to before lunch (32).

When recess is before lunch children are thirstier. They have been outside playing, running, working up a sweat, etc. and their bodies are in need of a drink, and therefore more milk is consumed. In most cases it is an unconscious effort made by the students, they just continue to drink because they are thirsty. (When recess is after lunch the students are too excited to get out and play that eating is not a priority). Plate waste studies have proven that waste is increased when recess is before lunch versus after (32). Students have actually made the comment that "they are hungry and the lunch is good, but they want to get outside to play." Teachers have also made the statement that children are easier to teach when they have come back from eating lunch versus come back to class directly from recess. So not only does recess before lunch increase milk consumption, it could also increase learning ability in the students. There is a simple, inexpensive way to increase the consumption of milk in elementary students. Have recess before lunch. Schedules would have to be rearranged, and it would take a little effort from school administrators, teachers, students, and parents. But in the long run children will be consuming more of the essential calcium needed for their growing bodies, a simple change is worth the end result.

National School Lunch Program

The National School Lunch Program (NSLP) has existed officially in the United States since 1946. Over time, the program has continued to grow and has served over 170

billion lunches since the program began. The NSLP is a nonprofit program and is currently operating in more than 96,000 public and private, nonprofit schools. The United States Department of Agriculture (USDA) administers the program at the Federal level. USDA is responsible for purchasing and distributing commodities to the program, and is also responsible for meal reimbursement to the individual school districts. At the state level, the NSLP is usually administered by state education agencies, which operate with the local school districts (4).

The school lunch program strives to feed every child, and offers free and reduced price lunches to students who fit into the income guidelines. To receive a free lunch the family's income must be 130% of the poverty level or less, and to receive a reduced price lunch the family's income must be 185% of the poverty level or less. In order for the school lunch program to receive reimbursement from USDA, it must meet specific nutrition guidelines. The menu must meet 1/3 of the 1989 Recommended Dietary Allowances (RDAs) for protein, vitamin A, vitamin C, iron, calcium, and calories and 30% or less of calories must come from fat and 10% or less from saturated fat (4).

One focus of the NSLP is teaching children the importance of good nutrition. If this concept can be taught at a young age, some of the nutrition related diseases discussed previously could be more likely to decrease in adulthood. Many programs are focusing on "5 A Day" and "Got Milk" marketing. Both of these programs could benefit children's health now and in the future. When the NSLP is teamed with good nutrition education the results can be very positive. If children are able to apply what they learn in the classroom into the lunchroom, then the reinforcement is automatic. Ideally, they will then take that information home, practice it, and make it part of their lifestyle.

By engaging in nutrition education, students will be able to gain the needed understanding of healthy eating practices at an early age. Participating in school lunch and the activities associated with it can promote healthy eating patterns, and allow students to practice healthy eating every day. Nutrition education and school lunch are programs that are worth donating time, effort and money. The success of these programs is essential to a healthy future.

PROCEDURES AND RESULTS FOR MILK CONSUMPTION STUDY

Purpose

The purpose of this study was to evaluate milk consumption intake of elementary school students. This study was conducted at Edith Bowen Lab School; this elementary school has students in kindergarten through fifth grade. At this elementary school it should be noted that, they have recess before lunch and their beverage choices are milk or water. They can choose from white or chocolate milk everyday. The juice drinks stopped being offered at Edith Bowen two years ago.

There were several different variables used in the study. The school had ordered and received a new milk cooler that would keep the milk colder. As part of the study the temperatures of the old cooler and new cooler were compared and evaluated to see if consumption was different. The study also included a nutrition education component. The purpose of the education was to see if consumption increased after students were educated on the importance of milk. The study was conducted as follows. Weeks 1-2

were considered the baseline where measuring temperatures and consumption with the old cooler was recorded, weeks 3-4 were measuring temperatures and consumption with the new cooler, week 5 was for nutrition education, and weeks 6-7 continued to measure temperatures and consumption. The activities of each time frame will be discussed further.

Methodology

The study was conducted for seven weeks at an elementary school. For the first two weeks of the study the temperatures of the old cooler were assessed on Mondays and Fridays of each week. This was accomplished by using a thermocouple, and checking milk temperatures at the beginning of the lunch period and then at 15 minute intervals until the end of the lunch period. There were a total of six temperatures taken every Monday and Friday for two weeks. The temperatures were recorded on a basic table developed at the beginning of the study. The individuals conducting the study were senior and graduate dietetics students. On the days where temperatures would be assessed two individuals were at the school to conduct the study. This way one person would be responsible for measuring and recording temperatures while the other was responsible for measuring and recording the milk waste. (See Appendix)

Assessing the milk consumption was done each day during the two week period. This information was obtained by comparing the amount of milk taken with the amount of milk consumed. This was accomplished by counting the milk before and after lunch and measuring the amount of milk that was not consumed. The individuals conducting

the survey that day were to arrive 15 minutes before lunch began to count the milk and fill out the necessary paper work for that day.

Every student who had lunch was responsible for disposing of their own garbage and tray, with the assistance of a teacher. The individual conducting the study that day would stand near the garbage can along with the teacher and help the students throw away the garbage on their tray. The students were used to this, so it was not unusual to have someone else there helping. There was a bus boy container setting on the tray disposable area, and any milk carton that contained any milk was placed in the bus boy. Once students had left the area the bus boy was emptied and each milk carton was dumped into a three gallon plastic bucket. This part was done completely behind the scenes. The students were not allowed to see the dumping take place; this would only encourage them to want to participate in the dumping.

Students never really questioned why their milk cartons were being collected. Many of them did not even notice, but the school does have a large compost and many of the students just assumed the milk was being used for that. If the students did ask, they were told that the college students were doing a project about milk. This once again was not unusual for them. This school is a lab school located on a university campus and college students are always conducting projects there.

The conditions of the day were also assessed each day, which included the weather, the menu, and any school function that may have been occurring that day, i.e. a field trip. This data was collected so it could be used if one day was extremely different from the rest. This way the menu could be assessed, whether there were some salty foods that increased milk consumption, or whether it was really hot outside so the students were

more thirsty, or vice versa. The study was conducted in early spring so there were days with snow and days with 70-degree weather.

At the end of the initial two week baseline, the new cooler was put in the cafeteria. Nothing was said to the students about the cooler, and business was conducted as usual. The same methods were used as with the old cooler for another consecutive two week period. Temperatures were taken six times on Mondays and Fridays for two weeks, and waste was assessed using the same manner as previously explained. The conditions of each day were also noted during the two week period (this was weeks 3 and 4).

At the end of the second two week period, nutrition education and milk related activities were initiated with the students. The activities started by asking the students to "name the cow." The school had two inflatable cows, a white one that says "Got Milk" and a brown one that says "Got Chocolate Milk." These cows were set up in the cafeteria periodically and were favorites of the students. To involve the students in the week's activities they were each able to write down a name for the white and chocolate cow. The school foodservice chef and staff, and two graduate dietetics students evaluated the names. The students who won were given blue ribbons and certificates, and were able to participate in the "Got Milk" mustache activity later in the week. The winning entries were "Milky Way" for the white cow and "Lady Cocoa" for the chocolate cow.

Nutrition education was taken into every classroom at the school. An activity showing the importance of milk for bone growth began the education. The students were then taught that they could get all of calcium that they needed each day by drinking three cups of milk. If they chose not to drink milk there were other ways for them to get calcium such as cheese, or broccoli, or liver, etc. The main goal of the nutrition education

was to teach the kids that the easiest way to receive the calcium they needed was to simply drink milk, and as an end result they could have strong bones. The students were very responsive to the education and participated well. Several of them had important questions about milk, calcium, and bone development.

As part of the nutrition education week, the principal of the school talked to the students about the new milk cooler. It had not been mentioned until this point. She explained that it kept the milk colder and that the temperature was always constant unlike the old cooler. She explained to the students how the cooler worked, that the panels were frozen every night and then placed in the cooler surrounding the milk to keep it cold. She told them they were very fortunate to have this innovative cooler, and that if they had not been drinking milk before they may want to try it again, since they may like the new temperature.

The last activity of the week was the "Got Milk" campaign. The teacher who helped the children empty their trays had been observing which students were good eaters and always drank all of their milk. The teacher had a good idea of who these students were, because they had been doing well all year long. On the day of the milk campaign, these students were rewarded. They were able to get their picture taken with a milk mustache. The "Got Milk" campaign had provided posters, banners, cardboard fixtures, bookmarks, etc. all with famous people or cartoons with milk mustaches. The cafeteria was covered with the decorations. The recipe for the milk shake that created the milk mustache was half milk and half vanilla ice cream. This was mixed up in a blender and poured into portion cups for the participating children. The principal was in the cafeteria explaining what was going on, and she also read the list of students who would be

participating. She explained to the students that the children who got to participate had been good eaters and milk drinkers all year long.

After the selected students had finished their lunch they were able to come over and get their picture taken. It was explained to them that they were to drink from the portion cup tilting their head back and tilting the cup, so the milk shake would coat the top of their lip. It was pretty easy for most kids, but some had to try several times. They would then stand by Spiderman, or a Cookie Monster poster to have their Polaroid picture taken. The pictures were hung up on a bulletin board that had "Got Milk" decorations. They would be displayed until the end of the school year, after which the students could take them home. The school principal, foodservice chef and staff, and a couple of teachers also participated in the activity. Every student was given a "Got Milk" bookmark as they left the cafeteria that day.

After the week of nutrition education the study resumed, proceeding the same as before. Temperatures were taken Mondays and Fridays and consumption was measured the same way each day. The conditions of each day were also noted. It should also be noted that every milk that was used for temperature taking was subtracted from the overall count that day, and therefore did not affect the consumption statistics. Another important note is the fact that the location of the milk in the cooler was also noted when the temperatures were taken. This was thought to be an important factor with both the old and the new cooler, seeing that the milk on the bottom could remain colder with the students reaching in and opening the cooler throughout the entire lunch period.

Limitations

There were a few limitations that may have affected the results of the study. The food choices on the menu each day could have affected the amount of milk consumed by the students each day. The weather is also something that could have limited or enhanced the amount of consumption. These two conditions were noted each day, so if the data seemed to be extremely skewed on one particular day there would possibly be a reason why. Another thing that limited the consumption on one or two days was field trips taken by some of the students. This did effect the data on a couple of days. There were significantly less students eating lunch on those days. There was also a day that the older students put on a play, and changed the schedule for the entire day. On this day the students also got out of school early. Their lunch was served an hour and one half earlier, so this consumption data was not taken, only temperatures.

One point that the students made, that may influence the data and may not, is that after the new cooler was introduced to the students many of them felt the milk was too cold. They were used to the milk being around 35-38 degrees Fahrenheit, and there were temperatures taken with the new cooler that were as low as 26 degrees Fahrenheit. The temperature of the cooler was later adjusted slightly, by placing the milk in the cooler differently and not freezing the panels as long. The problem was fixed quickly and the temperatures did start to range in the lower thirties, which did appeal more to the students.

Another limitation was milk delivery. Some days the milkman would deliver the milk close to lunch time. This did not give the milk a chance to be cooled in the new cooler. Milk should be delivered at a temperature below 40 degrees Fahrenheit, and

should be rejected if higher. When assessing some of the first milk temperatures, it was obvious that the delivery truck was not that cold. This was also apparent by noting that the temperatures at the beginning of lunch were higher than those at the end of lunch. On the days that the milkman did not deliver the milk the reverse happened, and the milk was colder at the beginning of lunch than it was at the end. Although, it is unknown if the milk temperature was checked upon delivery, it was apparent that some of the milk was at or above 40 degrees Fahrenheit upon delivery. On the days that this did occur, the temperature data was reevaluated and in some cases thrown out and reassessed on a different day.

Analysis of Data

At the end of the seven week period, all of the data was evaluated. The data was first divided into the appropriate weeks, data from the old cooler, data from the new cooler before nutrition education, and data from the new cooler after nutrition education. The first thing that was assessed was the temperature. The temperatures from the old and new cooler were compared and given an average. The consumption data was assessed for each day using the same categories, old cooler, new cooler before nutrition education, and new cooler after nutrition education, the amount of milk taken was subtracted from the amount of milk cartons left to measure the amount of milk taken each day. The number of cartons taken was then multiplied by eight, because there are eight ounces in every carton, the measured waste in ounces was then subtracted from this number to determine how many ounces of milk were consumed that day. This number was then

divided by eight to determine how many eight ounce servings were consumed on that day.

The number of students eating lunch each day was also taken into account and compared to the number of students taking milk. These figures were divided to determine what percent of students eating lunch were taking milk. The temperature, consumption, and percentage of students taking milk data was averaged for each of the two week periods and reported by category, old cooler, new cooler before nutrition education, and new cooler after nutrition education. All of this data was figured by hand calculations. It was later put into the SPSS data analysis program; the results were as follows.

Results

The results of the temperature comparison, old cooler versus new cooler, showed that the average temperature at each time frame and the overall average for both coolers were as follows:

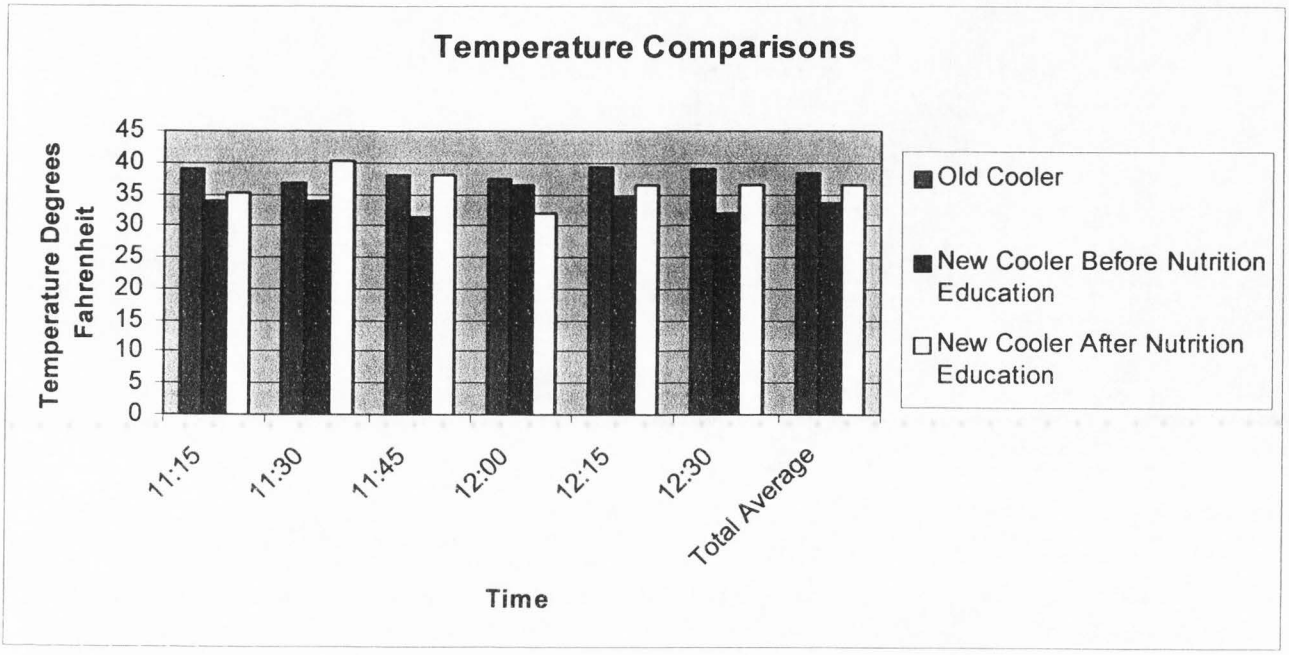
Table 5: Temperature Comparison of Old and New Milk Cooler

Time	Old Cooler	New Cooler Before Nutrition Education	New Cooler After Nutrition Education
11:15	39.1	33.8	35.1
11:30	36.7	33.9	40.2
11:45	37.9	31.3	38.1
12:00	37.5	36.5	32.1
12:15	39.4	34.5	36.3
12:30	38.9	32.1	36.6
Total Average	**38.3**	**33.6**	**36.4**

*Note that temperatures are listed in degrees Fahrenheit

The bar graph illustrates the temperatures of each of the three categories and with exception of one time period; the new cooler did report lower temperatures.

Figure 2: Temperature Comparison Bar Graph



The data demonstrated that the temperature of the milk in the new cooler was on average cooler than the milk temperature in the old cooler. There was one time period that the new milk cooler reported higher temperatures than then old milk cooler. It was assumed that the milk was delivered warmer than it should be and the older milk, which had been in the cooler, was used for the first assessment because it was on the top and the milk that was just delivered was used for the second assessment. The milk then had time to cool down in the cooler, which is why the remaining temperature averages are lower. It should be noted that cooler milk is preferred to prevent food borne illness and to provide a better taste to the milk. Often times milk that gets too warm can take on the flavor of the cardboard milk carton. The new cooler did and will continue to benefit the milk quality.

The following tables explain and illustrate the consumption data for each of the three time periods in the study.

Table 6: Milk Consumption Data with Old Cooler, New Cooler Before Nutrition Education, and New Cooler After Nutrition Education

	Average Outdoor Temp.	Average Number of Kids Eating Each Day	Percent of Kids Taking Milk	Average Number of Cartons Taken	Average Ounces Wasted Daily	Average Ounces Consumed Each Day	Average Number of 8 Ounce Servings Consumed Each Day
Old Cooler	46 Degrees Fahrenheit	246	85%	210	229 oz	1454 oz	182 cups
New Cooler Before Nutrition Education	39 Degrees Fahrenheit	245	95%	235	267 oz	1610 oz	201 cups
New Cooler After Nutrition Education	50 Degrees Fahrenheit	243	96%	234	191 oz	1686 oz	211 cups

The data indicates that consumption did increase with the new cooler and then increased even more with education. The average daily number of cartons taken was a little lower after the nutrition education, but this was close to the end of the school year and many classes were on field trips quite often. After the new cooler was introduced, a 10% increase occurred in the amount of milk that was taken, but consumption was only slightly greater. It was not significantly different. It was however significantly different after the nutrition education. After education the number of students taking milk increased another percent and overall consumption increased.

A least significant difference test (LSD) was run showing that there was a significant difference of .46 between the consumption with the old cooler and consumption with the new cooler after education. The LSD did not show astatistically

significant difference between the old cooler and the new cooler before education, but it is obvious that there is a trend developing.

This table is the result of the data after it was run through the SPSS data analysis program, it shows the mean, which is the average ounces consumed by each student, and the standard deviation.

Table 7: Milk Consumption Statistical Reports

	Number of Days Assessed	Mean (Average Ounces Consumed By Each Child)	Standard Deviation
Old Cooler	10	6.9	0.235
New Cooler Before Nutrition Education	7	6.8	0.379
New Cooler After Nutrition Education	7	7.1	0.156
Total	**24**	**7**	**0.294**

The mean was lower with the new cooler before nutrition education than it was with the old cooler. When referring back to the previous table it shows that the amount of milk taken was 10% greater with the new cooler before nutrition education than it was with the old cooler. This table also shows that the mean consumption per student was greater by not quite an ounce after the new cooler and nutrition education.

All of the results from the study demonstrate that milk consumption benefited from the new cooler and nutrition education. A lower milk temperature did increase intake, and nutrition education also increased intake. This was an inexpensive way to increase the consumption of milk in these students. It should also be noted at this school they do have recess before lunch, so it may have been that they were already consuming more milk than students at schools who have recess after lunch, yet a new cooler and nutrition education was still able to increase their intake. Imagine how beneficial recess

before lunch, a new cooler, and nutrition education could be to a school that does not have any of the three.

CONCLUSIONS AND DISCUSSION

This study has shown that by simply replacing an old milk cooler and implementing nutrition education, milk consumption in elementary school students will increase. Unhealthy practices are becoming more common in today's society, and the risk of nutrition related diseases continues to rise. By implementing these two simple factors, decreasing the risk of some of these diseases can occur. It is crucial that healthy or unhealthy eating patterns are developed at a young age. It is questionable whether a study similar to the one conducted would have been effective at a junior high or high school level. In many instances that is too late to change eating patterns. There are things that can be done to improve the declining intake of milk.

Recommendations

It is recommended at the elementary school level that recess occur before lunch. Parents and educators should advocate and lobby for that practice. Research has proven that this does increase milk consumption because the children are thirstier. That is a simple and inexpensive way to increase the consumption of calcium, which is crucial for proper development at that life stage. This may seem to be more of an inconvenience for some, which it may be at first, but the benefits definitely outweigh the minor inconvenience.

Nutrition education is another recommendation that can have lifelong benefits. Nutrition education is more effective if started at a young age and built upon for life. It is the same as any other subject or principle taught in school, and must be started at a young age and reinforced year after year. The consumption study proved that one week of nutrition education can make a difference; imagine the impact it could have if it was being taught every week and followed through with appropriate foods served in lunch and role models participating in the program.

Recommendations to change dietary intake at the junior high and high school levels are not as simple as those at the elementary level since the population is older and more determined to do things their way. Making simple changes are not easy, but there are factors that can make a difference. First, the amount of soda being sold in the schools should be decreased. If the machines have to be there, then they should be turned off during lunch. Once again, parents and faculty should advocate for this practice. There are also many schools that have stores that sell soda and other foods during lunch to raise money for the school, but it is also promoting unhealthy eating patterns to its students.

It would also be beneficial to promote the school nutrition programs. Marketing the school lunch program to the students can encourage them to participate in the program. It is easy to promote the program by making it sound fun, by promoting how inexpensive it is, and by making the cafeteria an environment students want to be in. This takes effort from several different groups, including students, parents, faculty, administrators and even health care professionals, but it proves to be beneficial for the students and the school in the short and long term.

Nutrition education is also important at junior high and high school stage. At this point the students should have learned enough about nutrition to want to make healthy choices. They should be taught the risks associated with poor eating habits. Someone who has osteoporosis can be a guest speaker in the health classes, advocating the role of adequate nutrition in the aging process. There are many adolescents who desire to be healthy, and are probably unaware that they are making detrimental choices. The education at this point should be more informative and very honest. It would also be beneficial for students to have the opportunity to speak with a health professional about their eating patterns or problems. During this life stage eating can be a very powerful and private issue with many people, which is why it is crucial that current and correct information is available at all times.

A simple recommendation would be to repeat the activities conducted in this study. The study proved to increase milk consumption. If the school has the resources, the combination of the new cooler and nutrition education would be the most effective, but if not nutrition education can make a difference. In the study conducted this has the bigger impact. Resources to implement nutrition education can easily be obtained from the Dairy Council, and most of the information is free of charge.

Health professionals seem to have their hands full in trying to promote healthy eating patterns, so in order for the message to reach everyone and make a difference a variety of people need to be involved. The biggest thing that parents and teachers can do is to be a positive example to their children and students. If parents and teachers are seen making healthy choices, then children learn by example.

It is also be beneficial to become involved in advocating to keep soft drinks out of schools as much as possible. Speaking out, writing letters to legislators, school boards, and anyone else who would help to decrease availability of competitive, inappropriate foods in school. Write letters to the industry such as the Coca-Cola Company discouraging the purchasing rights to Harry Potter, and any other company that is using advertising to children to increase sales.

Volunteers can be in charge of the "Got Milk" activities. This is a fun and easy way for students to spend time each day thinking about milk. The Dairy Council provides most of the information and decorations, but volunteers are needed to put it all together. This is a big success at any school or any age.

The U.S. population continues to become more obese and less healthy, but with some effort that can be reversed. If milk consumption continues to decline over the next ten years and soft drink consumption continues to increase, the likelihood of improved statistics is reduced. If nutrition education can reach the younger population and cause them to make healthier choices, the future could look brighter. More studies should and will be conducted on the risks of inadequate of milk consumption. Ideally, the public will be aware of these studies; it will become common knowledge. .

More studies should also be conducted on the role that soda consumption has in obesity. It should not only focus on children, but also adults. It is unlikely that the consumption of soda will decrease as the years go by, unless people become very aware of the detrimental effects it can have on a healthy lifestyle. The bottom line is, the future holds diminishing health for our population if nutrition education does not start to reach

every person, and the younger population is not taught healthy eating practices early in life.

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APPENDIX

DATA COLLECTION FORMS USED AT EDITH BOWEN

Milk Temperatures and Conditions of the Day

Evaluator: _____

Date: _____

Measuring Tool: _____

Weather: _____

Menu: _____

_____

Start taking milk temperatures at the beginning of the lunch period and then at 15 minute intervals until the lunch period is over.

Time	Temperature	Location of Milk in Cooler
11:15		
11:30		
11:45		
12:00		
12:15		
12:30		

Milk Count Before Lunch: _____

Milk Count After Lunch: _____

Total Milk Used That Day: _____

***Remember to subtract the six that are used to take temperatures**

Total Milk Waste in Ounces: _____

Comments:

Conditions of the Day

Date:_____

Evaluator:_____

Weather:_____

Menu:_____

_____

Comments:_____

_____

_____

Milk Count Before Lunch:_____ **Total Milk Used That Day:**_____

Milk Count After Lunch:_____ **Total Milk Waste in Ounces:**_____

Conditions of the Day

Date:_____

Evaluator:_____

Weather:_____

Menu:_____

_____

Comments:_____

_____

_____

Milk Count Before Lunch:_____ **Total Milk Used That Day:**_____

Milk Count After Lunch:_____ **Total Milk Waste in Ounces:**_____