EVALUATION OF INTERNET EDUCATION TO INCREASE DIETARY CALCIUM INTAKE IN YOUTH

A Thesis

by

VALERIE SUZANNE HENDERSON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2003

Major Subject: Nutrition

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ABSTRACT

Evaluation of Internet Education to Increase Dietary Calcium Intake in Youth. (August 2003)

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In recent years, dietary calcium intake among children and adolescents has fallen sharply. This trend is alarming because childhood and adolescence are the primary ages for building bone mass. Therefore, an interactive website, *Clueless in the Mall* (http://calcium.tamu.edu) was developed targeting youth to increase knowledge, improve attitudes, and equip them to incorporate calcium-rich foods into their diets. This website was created with the help of adolescents at every stage of development and has been pilot tested with adolescents at home and in school, showing improvements in knowledge and attitudes. However, the website has not been tested for effectiveness in changing behaviors, specifically for increasing calcium intake. The present study was conducted to measure the effectiveness of the website for changing knowledge, attitudes, and behaviors. The hypothesis of this investigation was that the website intervention would significantly improve attitudes and knowledge about calcium and increase dietary calcium intake among adolescents and pre-adolescents who took part in the study. After the group-administered Food Frequency Questionnaire (FFQ) was validated among a local church youth group, a total of 126 middle school and high school students were recruited from 12 local public school classes to participate. Each student took three questionnaires during class time to measure baseline knowledge, attitudes, and behaviors (including calcium intake using the FFQ). Then each student took one class period to view the calcium website. Four to six weeks later, the investigators returned to administer the same three tests to each student. Demographic information was collected, and data were analyzed using paired samples t-tests and analyses of variance (ANOVA). Results demonstrated that the website alone was sufficient to improve knowledge scores; however, it was not enough to change attitudes and behaviors significantly. In conclusion, the website should be used to promote and reinforce health behaviors, but should not be expected to stand alone as an intervention.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

As the population of the United States ages, osteoporosis gains momentum as a major public health problem. This crippling bone disease afflicts ten million Americans today, and an additional 34 million have low bone mass with increased risk for osteoporosis (1). In 2001, $47 million was spent daily (a total of $17 billion per year) on osteoporotic and related fractures, and the cost is rising. Osteoporosis has no early warning signs; in fact, people may be unaware that they have osteoporosis until a fall or even a minor bump or strain causes a vertebra to collapse or a bone to break. The damage is irreversible, and repair can necessitate major surgery and may cause permanent disability or even death (1). Thus, prevention becomes a central issue when discussing osteoporosis.

Twenty to twenty-five percent of peak bone mass (PBM) is determined by risk factors that are controllable such as a low calcium diet, anorexia nervosa, excessive alcohol use, an inactive lifestyle, and use of caffeine, tobacco, or steroids (2). Since calcium intake has a direct effect on PBM (3, 4) and bone mass is most rapidly acquired while the skeleton is still forming, the most important years for osteoporosis prevention are the childhood and adolescent years. In recent years, studies looking at dietary calcium intake in children and adolescents show that milk consumption and dietary calcium intake has fallen sharply (5, 6). Other studies document reasons for the decline, such as soft drinks replacing milk as beverage of choice, false perceptions about the nutritional content of dairy foods, gastrointestinal discomfort as a result of drinking milk, dislike of dairy products, and limited knowledge of high calcium foods and their nutritional value (7-13).

These barriers point to the need for interventions that address these specific problems in a way in which children and adolescents can identify. The Internet is one such tool that can be used with this population, mainly because they like the novelty and interactivity of computers and the Internet. Adolescents see the Internet as something different, exciting, and motivating (14). The web allows

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This thesis follows the style and format of the *Journal of the American Dietetic Association.*

interactivity through the use of graphic and audio interfaces so that the user is entertained while they are learning. Other reasons the Internet is an ideal medium include convenience (15), ease of use (15), and cost-effectiveness (16, 17).

While previous studies have documented the effectiveness of using computer related technology for other health related behavior interventions (17-28), none have documented the use of the Internet to teach children about calcium and osteoporosis or to show the effectiveness of such a website to enact changes in behavior. Thus, an interactive website, *Clueless in the Mall* (http://calcium.tamu.edu) was developed by nutrition and computer specialists at Texas Cooperative Extension, Texas A&M University System, targeting youth to increase knowledge, improve attitudes, and enable them to incorporate calcium-rich foods into their diets (29). The theme of the website is a scavenger hunt in a shopping mall, and youth answer questions about calcium to receive the next clue to continue the hunt. Along the way, youth discover facts about calcium, including osteoporosis and other health issues, the USDA Food Guide Pyramid (adapted for teens) showing calcium-rich foods, and information about how to read food labels to determine calcium content. For increased appeal to youth, the website features animation, music, video, and audio clips. While the website has been pilot-tested for attitude and knowledge changes, it has not been tested for its effectiveness in changing behavior.

Purpose

The purpose of this investigation was to evaluate the effectiveness of the *Clueless in the Mall* calcium website by comparing pretest and posttest data among adolescents and pre-adolescents to assess changes in: 1) Knowledge about calcium and osteoporosis; 2) Attitudes about high calcium foods and osteoporosis; and 3) Behaviors related to calcium and osteoporosis, including dietary calcium intake. Specifically, analyses included:

1) Demographic information on the subject pool.

2) Pretest and posttest dietary calcium intake.

3) A comparison of changes in knowledge, attitudes, and behaviors from pretest to posttest.

Statement of Hypothesis

The hypothesis of this investigation was that the website intervention would significantly improve attitudes and knowledge about calcium and increase dietary intake of calcium among adolescents and pre-adolescents who took part in the study.

CHAPTER II

REVIEW OF LITERATURE

Calcium

Calcium is an essential nutrient for many biological functions, including muscle contraction and regulation of the heartbeat, nerve conduction, stimulation of hormone secretions, blood coagulation, cell adhesiveness, mitosis, and structural support of the skeleton (1, 30). Calcium is essential, meaning the body cannot produce it, and it is lost daily through shed skin, hair, nails, and sweat in addition to losses through the urine and feces (1). Thus, adequate dietary calcium is important long after skeletal maturity is reached. When dietary calcium is inadequate, calcium is taken from the bones, which serve as a reservoir for calcium. The importance of adequate dietary calcium becomes obvious to prevent this constant withdrawal from the skeleton, which leads to osteoporosis.

Calcium from Foods

Calcium is a widely available nutrient in foods, especially today as a result of calcium being added to many foods through fortification. Government organizations, health and professional organizations, and leading nutrition and medical experts agree that foods, as opposed to calcium supplements, are the best sources of calcium.

A National Institutes of Health (NIH) consensus panel stated that optimal calcium intake is best accomplished through dietary sources of calcium, especially dairy products (31). The National Institute of Child Health and Human Development (NICHHD) asserts that low-fat milk and milk products are the best sources of calcium since they contain large amounts of calcium along with additional nutrients to help the body absorb calcium more effectively and because they also are already consumed by most Americans. Besides calcium, milk provides other essential nutrients, such as vitamin D, potassium, and magnesium, and all of these are essential for optimal bone health and human development (32). The National Institutes of Health also recognizes the importance of unfortified foods containing calcium as the major source of calcium, explaining that meeting calcium

needs through foods provides other beneficial nutrients and food components yet unidentified which may help the body utilize nutrients through nutrient interactions (33). The United States Department of Health and Human Services (USDHHS) also recognizes the importance of dietary sources of calcium, including milk and milk products, canned fish with bones such as salmon and sardines, dark leafy green vegetables such as kale, mustard and turnip greens, tofu that is made with calcium, and calcium fortified foods and beverages (34). The USDHHS' Healthy People 2010 states that "with current food selection practices, use of dairy products may constitute the difference between getting enough calcium in one's diet or not" (34).

Many health professional organizations, including the American Dietetic Association, Dietitians of Canada, the American Medical Association, the American Academy of Pediatrics Committee on Nutrition, the National Osteoporosis Foundation, and the Osteoporosis Society of Canada all agree that foods, as opposed to supplements, are the best way to meet calcium needs and that dairy products are among the most desirable foods to consume to meet calcium requirements (35-40). Leading nutrition and medical experts also agree that foods are the best source of calcium (41-46). In a recent review Robert Heaney, M.D, states, "While it is possible to arrange an adequate diet using available Western foods, it is usually difficult to do so without including dairy products. Few individuals succeed, and, in general, a diet low in dairy foods means a diet that is poor in several respects beyond insufficiency of calcium" (47).

Dairy Foods

Dairy foods are the major source of calcium in the American diet, providing over 70% of the calcium available in the United States food supply (48). According to one study in 1994, milk and milk products provided 83% of the calcium in children's diets, 77% of the calcium in teenage females' diets, and 65-72% of the calcium in adult diets (49). Another study of 800 high school students found that dairy foods provided 79% of their calcium intake (50).

Dairy foods are an excellent source of calcium for several reasons. One is that they contain approximately 300 milligrams (mg) of calcium per serving, which makes dairy foods the most calcium

dense foods available. Other foods (see **Table 1**) contain calcium (such as almonds, spinach, broccoli, and okra, but unless they are calcium-fortified foods, larger portions would need to be consumed to provide the same amount of calcium from dairy foods (51). Thus, it is difficult for Americans to meet calcium needs exclusively from nondairy foods containing calcium naturally.

Table 1
Dietary sources of calcium (52)

	Calcium Content (mg)
Dairy Foods	
Nonfat yogurt, 1 cup	488
Whole milk yogurt, 1 cup	296
Skim milk, 1 cup	301
Whole milk, 1 cup	290
Mozzarella cheese, made with part-skim milk, 1 oz	205
Ice cream, ½ cup	87
Mixed Foods Containing Dairy	
Lasagna	258
Cheese enchilada	324
Macaroni & cheese, 1 cup	362
Baked potato with cheese	350
Café latte (8 oz.)	309
Other Foods Naturally Containing Calcium	
Almonds (2 oz.)	148
Spinach (1/2 cup, fresh cooked)	122
Broccoli (1/2 cup, fresh cooked)	47
Okra (1/2 cup, frozen)	89
Calcium Fortified Foods	
Selected spaghetti, 2 oz. uncooked	300
Eggo© waffles, 2 oz	300
Nutri-Grain© cereal bar	200
Selected tofu, 4 oz.	434
Selected orange juice	240

Another reason that dairy foods are an excellent source of calcium is that calcium in dairy foods is bioavailable. One study found that calcium bioavailability ranges from 5% in spinach to greater than 50% in vegetables, such as bok choy and broccoli (53). The authors also concluded that a person would need to consume eight cups of spinach or over two cups of broccoli to absorb the same amount of calcium gained from one cup of milk (53). Although some foods may contain calcium that

is more bioavailable than the calcium in milk, the high absorbability cannot make up for a food's low calcium content (33). Some non-dairy foods also contain components such as phytates and oxalates which reduce the bioavailability of calcium (54, 55). Phytates are found in foods such as seeds, nuts, and most cereals; oxalates are found in spinach, rhubarb, sweet potatoes, and walnuts. Phytates and oxalates form insoluble complexes in the body, which decrease the bioavailablity of the calcium from these foods (54, 55). Calcium absorption is not affected by dietary fiber at levels common among the American public (5-15 grams per day) (31, 33, 53). Similarly, a normal intake of protein and phosphorus do not affect fractional calcium absorption (56).

Calcium-Fortified Foods

The availability of calcium-fortified foods in the US is on the rise (57, 58). A *Wall Street Journal* article reported that in 1999, as many as 234 new calcium-fortified foods were introduced, which is nearly four times more than in 1995. Among the new products are juice drinks, orange juice, pasta, rice, cereal, waffle and pancake mixes, energy bars, snack foods, margarine, soy beverages, chocolate and caramel chews, dairy products, and bottled water (58). This wide variety of calcium-fortified foods makes it easier than ever for people to consume adequate amounts of calcium, which may be especially important for people who avoid dairy foods and foods naturally high in calcium (55, 59). However, some experts advise exercising caution, saying that calcium-fortified foods and calcium supplements do not solve the underlying problem of dietary inadequacy, which accounts for the generally low calcium intake of the typical American diet (60). Another says, "It is important for individuals who choose to meet their calcium needs through calcium-fortified foods and/or supplements to ensure that their needs for other nutrients supplied by foods, such as dairy foods, are also met. Calcium-fortified foods and calcium supplements are a supplement to, not a substitute for, foods naturally containing calcium" (30). Although they do provide calcium, these calcium-fortified foods are not nutritionally equivalent to dairy foods (61, 62). People using these fortified foods as a replacement for dairy foods may miss out on other valuable nutrients, such as vitamin D, potassium,

and riboflavin that dairy foods provide. Thus, the use of calcium fortified foods may contribute to a false sense of security that their diets are nutritionally adequate (63).

Calcium Supplements

If calcium supplements are necessary, there are many factors to consider when choosing a supplement, such as elemental calcium content and purity, absorbability, and tolerance or side effects. Calcium exists in nature in the form of compounds, such as calcium carbonate, calcium phosphate, calcium malate, calcium gluconate, calcium magnesium carbonate (from dolamite), and calcium citrate (1, 64, 65). Elemental calcium in these salts ranges from 40% in calcium carbonate to as low as 9% in calcium gluconate (65). When choosing a calcium supplement, check the label for the USP (US Pharmacopeia) designation, which signifies that voluntary standards for purity and composition of the supplement have been met (35).

Absorption is another factor to consider when choosing a supplement. Absorption of calcium salts is similar to the absorption of calcium in milk (54). Some calcium supplements may contain vitamin D, which aids in calcium absorption. Such supplements are beneficial to people who lack exposure to sunlight, such as homebound and institutionalized older adults (65). The percentage of absorbed calcium also decreases in high dosages; therefore, experts recommend taking calcium supplements in small multiple doses of 500 mg or less. Some supplements, such as calcium carbonate are best absorbed when taken with meals (41). Other supplements, such as calcium citrate malate, are absorbed equally when taken with or without food because no stomach acid is necessary for absorption to occur (41, 64, 65).

Finally, tolerance to the supplement and possible side effects should be considered when choosing a calcium supplement. Sometimes calcium supplements may cause gas or constipation. If these side effects are not relieved by adequate hydration and fiber intake, another form of calcium may be necessary (1). Calcium supplements may interact with other minerals such as iron and zinc; however, evidence to date does not demonstrate that excess calcium contributes to deficiencies of iron or zinc (66-68). Calcium supplements can decrease the effects of certain medications, such as the

osteoporosis drug Fosamax and the antibiotic drug Tetracycline; therefore, calcium supplements should be taken separately from these medications (1, 64).

Although calcium supplements may help individuals meet recommended calcium levels, a study of over 420 adolescents found that a significant number had inadequate intakes of calcium, regardless of supplement use (69). Therefore, the authors of this study recommended that improving adolescents' calcium intake focus on encouraging calcium-rich foods, such as low-fat dairy foods.

Calcium in Prevention of Osteoporosis

Osteoporosis is the inevitable fate of an individual who lives long enough. Thus, as the population of the United States ages, osteoporosis gains momentum as a major public health problem. This crippling bone disease is defined as a reduction in bone mineral mass resulting in decreased bone strength and increased susceptibility to fracture. It afflicts 10 million individuals in the U.S. today (80 percent of whom are women) (1). In addition, 34 million more have low bone mass and increased risk for osteoporosis. The estimated national direct expenditures for hospitals and nursing homes for osteoporotic and related fractures were $17 billion in 2001. That's $47 million each day, and the cost is rising (1). By 2040, the estimate is $200 billion per year (70). One and a half million osteoporotic fractures occur every year, mostly among white, postmenopausal women (71). Almost always, a hip fracture will necessitate major surgery, and it may cause permanent disability or even death. In fact, about 24 percent of patients with a hip fracture over age 50 die within one year of their fracture. At six months after a hip fracture, only 15% of patients can walk across a room without help, and 25 percent of those who were ambulatory before their fracture require long term care, such as a nursing home, after their fracture. Spinal or vertebral fractures also have serious consequences, including loss of height, severe back pain, and deformity (1, 2).

Osteoporosis, or porous bone, is characterized by demineralized, disconnected trabecular bone and thinning of the outer surfaces of cortical bone (72). Osteoporosis is often called the "silent disease" because bone loss is asymptomatic. Thus, the first "symptom" of this irreversible bone degeneration often is a fracture or collapsed vertebrae. Over the age of 50, one in every two women

and one in every four men will have a fracture related to osteoporosis. Annually, 1.5 million fractures occur that are related to osteoporosis, including 300,000 hip fractures, 700,000 vertebral fractures, 250,000 wrist fractures, and 300,000 fractures in other areas. As much as Americans fear cancer, a woman's risk of hip fracture is equal to her combined risk of breast, uterine, and ovarian cancer. While women may be two to three times more likely to have a hip fracture than men, men are twice as likely as women to die within one year of a hip fracture (1).

Risk factors for osteoporosis that an individual has no control over include being female (especially Caucasian or Asian), increasing age, small bone structure or thin frame (less than 127 pounds), family history, estrogen deficiency as a result of menopause (especially early or surgically induced), low testosterone levels (in men), and taking certain medications (such as corticosteroids and anticonvulsants). About 75-80% of peak bone mass (defined as the highest level of bone mass achieved as a result of normal bone growth) is determined by these factors, and by 18 years of age, about 90% of peak bone mass has already been acquired (1, 73). However, the other 20-25% of peak bone mass is determined by factors that are controllable such as a low calcium diet, anorexia or bulimia nervosa, exercise to the point of amenorrhea in women, excessive alcohol use, an inactive lifestyle, and use of caffeine, tobacco, or steroids. These risk factors can be addressed by specific public health strategies for osteoporosis prevention (2).

Calcium in Prevention of Other Diseases

In addition to osteoporosis prevention, studies have shown that calcium may also be important for controlling obesity, controlling blood pressure, and preventing colon cancer. Several new studies show that a dietary intake of calcium that meets current recommendations may help regulate body weight and reduce the risk for obesity (74-77). The author of one study concluded that, "calcium and dairy products should not be removed from weight loss diets, but instead may enhance the effects of the diet" (76). Another study concluded that " calcium may play a substantial contributing role in reducing the incidence of obesity and prevalence of the insulin resistance syndrome" (76). In another study using data from NHANES III (Third National Health and Nutrition Examination Survey), the

researchers found an inverse association between calcium intake and body fat, especially in women (77).

A growing body of research also supports calcium-rich dairy foods or a calcium-rich diet to help regulate blood pressure (78-84). The landmark DASH (Dietary Approaches to Stop Hypertension) study has led health professionals to the consensus that adequate calcium intake is important for optimal blood pressure regulation (78, 79, 84).

Calcium may also play a beneficial role in preventing colon cancer (7, 75, 85-88). One study found that high intakes of dietary calcium and vitamin D may help prevent colon cancer by reducing the oncogenic properties of colon cancer cells (7, 75, 85). Another study found similar results, concluding that "high intakes of both dietary calcium and vitamin D are associated with reduced development of precancerous changes in colonic musosa" (7). In a study of over 61,000 Swedish women, researchers found that high dietary calcium intake was associated with a decreased risk of colorectal cancer, especially cancer of the distal colon. Women with calcium intakes between 816 and 1,300 mg of calcium per day reduced their risk of cancer in the distal colon by 67 percent and their risk of all colorectal cancers by 34 percent (75).

Calcium may also help prevent other ailments, such as strokes (89, 90), kidney stones (91, 92), and pre-menstrual syndrome (PMS) (93, 94). In the Nurses' Health Study of almost 86,000 women, calcium intake, particularly calcium from dairy foods, was inversely related to the incidence of strokes (89). Past recommendations to prevent kidney stones included restricting calcium from the diet, but new research shows that this recommendation could actually increase the risk for kidney stones (92). While calcium *supplements* may increase the risk for kidney stones, dietary calcium from dairy foods such as skim milk are protective against kidney stones (91).

Current Calcium Intakes Among Adolescents

According to the most recent dietary analyses of survey data representative of the United States, calcium intakes have been steadily declining over the last 35 years (95-97). In 1965, the average intake of calcium by 11-18 year-old youth was 1,100 mg; in 1977, the average slipped to 1,009

mg; and in 1989-90, the average intake fell to 974 mg. Data from the Continuing Survey of Food Intakes by Individuals (CFSII) 1994-96 showed that in 1994-96, intake reached an all-time low of 960 mg (5). These intake levels are well below the established Adequate Intake (AI) for calcium for ages 9-18 years, which is set at 1,300 mg (98). This means that in 1994-96, adolescents were averaging less than 75% of the recommended level. Only 12% of females ages 12 to 19 and 32% of boys ages 12 to 19 were meeting 100% of the AI for calcium (96). Another study measured calcium intakes of 1,117 ninth-grade students in public high schools using a 24-hour diet recall. Average intake for females was estimated at 536 ± 19 mg (41% of the AI), and males was estimated at 681 ± 28 mg (52% of the AI) (6). Levels of calcium intake for US youth are far below recommended levels. These findings are particularly alarming in light of an epidemiological study that shows that low calcium intake in early life may account for 5-10% decrease in adult peak bone mass and that this difference may translate into a 50% greater risk of hip fracture later in life (3, 4). Another study reported that about 90% of females' total body bone mineral content is formed by age 16.9 years, 95% by age 19.8 years, and 99% by age 26.2 years (99).

Barriers to Adequate Calcium Intake

Understanding the barriers to adequate calcium intake is the first step toward creating nutrition interventions and education programs to increase calcium intake (83). Barriers to adequate calcium intake include the substitution of soft drinks for milk, parental and peer influences, health concerns about milk, gastrointestinal discomfort associated with drinking milk, dislike of dairy products, lack of knowledge of non-dairy calcium sources, and lack of general knowledge about calcium and the prevention of disease. Research on adolescents in these areas is very limited; therefore, results from adult studies may be cautiously extrapolated to adolescents.

Lower fat milk is replacing whole milk in the American diet, but overall consumption of milk is decreasing. Unfortunately, the calcium that previously came from milk is not being replaced in the diet by other significant calcium sources (5). The drastic decline in calcium consumption in the United States may be blamed, at least partially, on the trend toward consuming more soft drinks and less milk

(5, 31, 34, 48, 100, 101). In 1945 Americans drank over four times more milk than carbonated beverages, but in 1998 Americans consumed two and one-third times more soda than milk (101). Since studies have shown that milk and other dairy products can make a significant contribution to overall calcium intake (49, 50, 102-105), the decrease in milk consumption is alarming. Substituting soft drinks for milk decreases calcium intake and may lead to adverse health effects (5, 105-109), and one study shows that the increase in soft drink consumption is highest among adolescents and young adults (48).

Parents, especially mothers, may influence children's milk intake. One study found that if mothers drank milk, then their daughters were also likely to be milk-drinkers (110). However, if parents do not consume milk, they may actually influence their children to be milk-avoiders (111). As children grow older, parents exert gradually less influence on their children's eating habits, and peer influences on food choices become the dominant force (83). The desire for independence and peer acceptance have increasing influences on food choices (83, 112, 113). Adolescents told researchers in a recent study of factors influencing adolescents' food choices that if you want them to do something, such as drink milk, it must be viewed as the "thing to do" or "cool" (114). Thus, healthful food choices must be presented to adolescents in a "context of appealing to the teen culture" (30).

A common misconception is that milk is fattening and should be avoided, especially if one is on a diet (9, 11, 12, 38, 50, 103, 111, 115, 116). Chapman and colleagues reported that up to one-third of adult participants reported avoiding dairy products because of concerns that milk is high in fat and cholesterol (9). This misconception pervades even at the elementary school level (10). A recent study of Hawaiian adolescent girls reported that girls were afraid drinking milk would make them fat (111). Thus, dietary interventions aimed at adolescents should remind them that low-fat dairy products have just as much calcium as whole milk (38).

Another barrier to adequate calcium intake is abdominal distress associated with drinking milk. According to Chapman and colleagues, 12.8% of participants reported gastrointestinal discomfort (9). Another study produced similar results with 16.1% of military recruits (n=5,187) self-reporting milk-related gastric distress (12). These recruits were 3.2 times less likely to drink milk than

those who did not report these side effects. Other studies also confirm these results (13, 115). Interestingly, studies have demonstrated that people who are lactose-intolerant can consume one to two servings of milk divided into small doses without experiencing symptoms (117-121). In fact, one study of African-American females who were lactose intolerant reported that they were able to consume 1,200 mg of calcium per day from dairy foods without developing lactose intolerancy symptoms (121).

Dislike for dairy products has also been reported as a barrier to adequate calcium intakes in several studies, (11, 115) with up to 38.2% of one study of African-Americans claiming dislike as a major reason for not consuming more dairy products (13). In fact, the primary factor influencing consumers' food choices is taste (50, 111, 114, 122-124). Flavor of milk is especially important for many elementary school children. In one study, the majority of children chose chocolate milk over regular milk (skim, 2%, and whole milk combined), and the children mentioned that flavor was more important than fat content (10). For people who have a taste aversion to dairy products, intakes of other foods high in calcium and calcium fortified or enriched product consumption should be increased. However, one study of low-income Vietnamese mothers found that most of the participants were not aware of non-dairy high calcium sources (115). These findings suggest that interventions should address non-dairy foods high in calcium and suggestions for improving the taste of dairy products, such as mixing them with other foods or flavors.

Finally, limited knowledge may lead to inadequate calcium intake during adolescence, and knowledge of personal calcium intake is one of the first steps toward increasing dietary calcium intakes (6, 9, 11, 38, 96, 109, 122, 125, 126). According to a study by Harel and colleagues, 92% of ninth graders knew that calcium is important for strong bones, and 51% even knew that calcium prevents osteoporosis. Sixty percent also knew that the peak period for building bone mass is during their teen years. However, only 19% knew the Recommended Dietary Allowance (RDA) for calcium, and only 10% knew the calcium content of various dairy products. In addition, only 45% could identify non-dairy sources of calcium. Interestingly, the study found that the adolescents who knew that calcium prevents osteoporosis had significantly higher calcium intakes (642 ± 23 mg) than those

who did not (556 ± 22 mg, p=0.009). Higher intakes were also associated with the knowledge of peak calcium accretion and RDA awareness, but these findings were short of statistical significance (6). Another study of women (n=351) found that 43% of women had calcium intakes below 60% of the RDA, yet 27% of them actually believed that their intake met the RDA (9). Similarly, in a study of African-American women, 20% of the subjects had adequate calcium intakes, defined as at least 75% of the RDA. Yet, 77.5% of them believed their intakes were sufficient (13). A study of Vietnamese mothers found that after the mothers were educated about osteoporosis and the osteoporosis-calcium link, they were motivated to try drinking more milk (115). These studies indicate that while the public understands that low calcium intake is related to osteoporosis, they do not have a clear picture of how much calcium they need and how much they actually are consuming every day.

Internet as a Possibility for an Intervention

These barriers create a need for interventions to successfully increase dietary intakes of calcium. Computers and the Internet hold exciting promise for intervention. Recently, several studies have been published documenting the possibilities and success for the use of interactive technology in health promotion activities, including the use of computer-generated phone calls (127, 128), interactive software and CD ROMs (18, 22-28), message-tailoring (20, 21), and the Internet (129-133). Evaluation of interactive technology has been explored in areas such as skin cancer prevention (23), diabetes education and weight loss (129, 131, 134), physical activity (132), and headache management (135).

Statistics About Internet Usage

In 1990, access to the Internet had reached approximately 1.1 million people. A 1999 Harris poll found an estimated 70-90 million Americans are Internet users and projected that this number would double within the following two to three years (136). Approximately 56% of American adults have Internet access, and 56% of Internet users go online every day (137, 138). New evidence

indicates that the Internet is becoming the preferred method of finding health information among working-aged adults (137, 139, 140).

The Internet is used for a wide variety of activities. According to the US Census Bureau's Current Population Survey, 62% of online adults check news, weather, or sports information online; 42% play games online; 39% shop online; 18% bank or pay bills online; and 17% access chat rooms or listservs (141). Over 55% of Internet users search for health information or support. During the next 24 hours, more than five million Americans will access health and medical information through the Internet (137). Other sources reported that more than 50% (142) and up to 80% (143, 144) of adults with Internet access use it to find health care information. Another study published that only about 40% of Internet users reported using the Internet to access health care information during the past year, suggesting that other studies over represented people who were enthusiastic about the Internet and who were more willing to participate in studies about it (145). Either way, it is clear that Internet use in the last decade has exploded at a rate faster than any other new technology, including the telephone, radio, TV, VCR, or the fax machine (136).

This unparalleled growth has been fueled by the adoption of personal computers and improvements in bandwidth (the carrying capacity of the wired and wireless "pipes" of the Internet) (136). In the last year (March 2002-March 2003), high-speed Internet adoption grew by 50%. Today, 16% of Americans, or 30 million people, log on at home with a broadband connection (146).

Individuals or families can access the Internet for less than $20 per month with standard connections, and for those families who don't have personal computers, almost all schools and public libraries are wired to the Internet (16). A recent study of 625 adolescents 10 to 17 years old found that 75% of those surveyed had home access to the Internet, and practically all had school access to the Internet (147). Another study of an ethnically and economically diverse sample of 412 students in 10th grade in New York found that 96% of the students used the Internet (148). Eighty-eight percent of adolescents had a computer at home, and 72% stated that home was the most frequent place they accessed the Internet. The next most frequent response was at school (17%), followed by 4% who said they most often accessed the Internet at a friend's house (148).

Advantages of the Internet

The success of computer-based intervention for health promotion depends on several factors. Those related to this investigation are discussed below and include appeal to children and adolescents, convenience and ease of use, cost-effectiveness, and ease of updating information.

The first and most important reason for Internet-based intervention is that children and adolescents like using the Internet, mainly for its novelty and interactivity. An Australian qualitative study was designed to assess how children and adolescents would respond to computer-based learning. Participants frequently commented that it was "fun" and "something different" or "it gets you involved." Students also expressed a sense of "magic" and amazement at what they could do with the computer program. In addition, this study reported that students found the ability to work at their own pace "motivating" (14). New technologies may attract interest because the novelty of receiving information from a new medium seems attractive. In addition, the web allows interactivity through the use of graphic and audio interfaces (15). Interactivity appeals to children because they learn best when they can manipulate their environment (149), and this interactivity facilitates learning while also entertaining them. Another aspect of interactivity is the computer's ability to store and respond to input from the user. This "message-tailoring" has been shown to increase the effectiveness of interventions (20, 21). Often, users can receive personalized information by entering data on specific concerns and receive individualized advice (148). The Internet also allows adolescents a private and non-threatening way to access information, which might otherwise be difficult or even embarrassing for adolescents to obtain (148). The target audience must be willing to participate if an intervention is to be successful; therefore, it is crucial that children and adolescents enjoy using computers for an Internet-based intervention to succeed.

Another factor that makes the Internet an ideal medium for a health promotion intervention is its convenience and ease of use. The user may access the web at any time (not constrained by normal working hours) and at any place (assuming Internet connections are available). No appointment is needed to see a health professional for information, and no traveling to a particular place for a group

discussion is necessary. Additionally, users can also move back and forth through a program, going back if they do not understand or quickly moving on by pointing and clicking if they feel they have mastered a concept. This allows users to receive information at a rate with which they are comfortable. Users can even drop out for a while if a more pressing matter arises (15). They have the flexibility of reading the material and using the information of their own choosing (150).

Cost-effectiveness of computer interventions also makes the Internet a feasible means of disseminating information. Before the Web became popular, traditional methods of health delivery such as lectures, discussion groups, pamphlets, and brochures reached a limited population base. Therefore, only large institutions could afford to reach a large population. Use of the Internet allows an almost unlimited number of people to receive the intervention (16, 151, 152). One evaluation of a multimedia educational software program concluded that computer-based education may be more cost-effective than traditional methods of asthma management (17). Similar programs could be used to promote higher calcium intakes for osteoporosis prevention.

One distinct advantage that an Internet-based intervention holds over all other interactive technology is the ease of updating the information. A CD-ROM or computer software program is developed and distributed, then updated and distributed again. This process of producing and reproducing can be expensive and may go on indefinitely. Multiple versions of the same program may be in existence, meaning that many users are not receiving the most updated information. The Internet, on the other hand, may be updated daily if desired, at little or no cost. Outdated versions are inaccessible unless a user has printed a copy of material from a website prior to the update.

Internet Avoiders

According to a Pew Internet & American Life 2003 report, about 42% of Americans say they don't use the Internet. Of these, 20% live with someone using the Internet from home. Some of these "net evaders" may have family members receive email or do online searches for them. Others "proudly reject the Internet and proclaim their independence from the online world" (153). Another 17% of Internet avoiders once were users but stopped using it because of technical problems with

computers or Internet service providers. Approximately 24% of Americans truly have no direct or indirect experience with the Internet (153).

The 42% of Americans who do not use the Internet tend to be black or Hispanic, have an annual income less than $50,000, have a lower educational attainment, be over the age of 50, live in a rural area, be unemployed, or be disabled. Thus, concerns have been raised about underprivileged populations having access to the Internet so that they may be a part of the "Information Revolution" (153). However, a study of adolescent girls in New York City showed that private school girls (99%) used the Internet frequently, but surprisingly, 83% of the ethnically diverse and underprivileged group also accessed the Internet frequently (154). Another study of adults found that 50% of Hispanic adults use the Internet and e-mail. The authors also noted increases in Internet access among women, minorities, those from homes with incomes from $30,000 to $50,000, and parents with children living at home (155). These studies may indicate that the high cost of computers and Internet services are not as big an issue as first thought to be.

Studies Related to Interactive Technology and the Internet

Several studies have been published which document the increased knowledge scores and success of interactive technology for health promotion (22-28), but very few studies were published prior to the start of this investigation which document successful health-related Internet programs (130, 133).

In 1994, a pilot study was published documenting a computer-based health education program for prevention of Coronary Heart Disease (24). The study was conducted with 90 children ages 8-11 years in the United Kingdom. The intervention was an interactive computer program designed for Macintosh LC computers that used animation, sound, music, color, and text output with both keyboard and mouse input options. A "journey" concept was used to teach children about risk factors for heart disease. A pretest and posttest were administered to detect changes in knowledge and to detect attitudes toward the program and ease of behavior change. Prior to the study, 38% of the children were able to identify one or more correctable risk factors; at the conclusion of the study, 66% could identify

two correctible risk factors. All of the children found the program easy to use. Also, 48% thought that making changes, especially to their diet, would be difficult. The authors concluded that the program was an "overwhelming success," and stated that future studies would be directed at changing the diet.

Another study from the United Kingdom was published in 1998. A computer program was developed for use in a hospital-based enuresis clinic and evaluated in 43 healthy children aged 8-10 years attending a local inner-city primary school. This program for children about nocturnal enuresis was designed to run on a personal computer with Windows 3.1 or Windows 95 and used sound, voice, cartoon drawings, and animation. A short multiple-choice questionnaire was used to assess knowledge, and scores showed significant changes (Wilcoxin matched pairs test, $p<0.001$), and these changes were sustained when re-tested after 6-10 months ($p<0.01$). The authors acknowledged that this study did not include a comparison of other simpler media, such as written information. Therefore, they could not conclude that this technology was better than other methods; however, they did conclude that the program was successful for holding a child's attention and informing them about nocturnal enuresis and demonstrated the potential value of multimedia to complement the information provided by health professionals" (22).

In a study by Hornhung et al, an interactive CD-ROM program was developed for skin cancer prevention and tested on 209 elementary school children in North Carolina using pre-and-post-intervention surveys measuring knowledge, attitudes, and self-reported behaviors. The subjects were randomly assigned to the computer intervention group, the standard teacher-led intervention group, or the control group. The results showed a significant increase in post-intervention knowledge and attitudes toward sun tanning. Behavioral scores also improved, but not significantly. Similar results were found in the follow-up study except that attitudes toward sun tanning were no longer significant (23).

Several studies have documented the use of the Internet for health promotion. A 1999 pilot study used an office-based Internet system for patient education (130). The researchers developed a web page directory for patient education sites on the Internet, and this directory was made available to patients during their office visit to a family practice medical clinic. For one month, a student medical

assistant assisted 50 patients with Internet use and collected data on web sites visited, levels of assistance required, amount of time spent surfing on-line versus amount of time reading on-line, the quality of the experience, perceived usefulness, and patients' satisfaction with the materials. Ninety-four percent of the subjects said the Internet information was helpful, and 77% said they would change a behavior as a result of information they read on-line. Ninety percent were more satisfied than usual with their office visit, and 92% said they would use the clinic Internet center again. This study demonstrated the possibility for the Internet for improving patient satisfaction with office visits and for changing health behaviors.

The Food Frequency Questionnaire

In some cases, multiple 24-hour recalls that are collected on non-consecutive days are considered the most effective measure of dietary intake; however, they must be conducted by highly trained interviewers and are labor intensive (156, 157). In large studies or in other studies, such as the present calcium website study, where time for dietary assessment is limited, it is not economically feasible to use this method of dietary assessment. Often, these types of studies rely on a Food Frequency Questionnaire (FFQ) (156, 158, 159). The FFQ is popular because it is low-cost and easy to administer relative to other dietary assessment methods (160, 161). The FFQ does not measure the actual diet; instead, it is designed to measure long-term diet and is based on the idea that information about dietary intake over a period of time is more important than the intake of an individual on a particular day (161).

However, the FFQ is not without limitations. Briefel et al. (162) labeled the FFQ a "shortcut method" that fails to obtain all of the information needed to calculate nutrient intake. Foods are grouped into broad categories. For example, question 82 of the FFQ used in the current study (see APPENDIX F) combines bread, rolls, pita, bagels, biscuits, English muffins, and cornbread all into one question. Respondents only answer how often they eat the broad category of foods. Evidence shows that some respondents may not understand these nutrient-related food groups because they do not correspond to actual food consumption patterns (163). Another problem is that for FFQs, survey

participants do not indicate portion sizes. Instead, food portion size estimates are generated from data derived from 24-hour recall data collected from similar aged and gender matched persons. Finally, the exact foods eaten are not recorded. FFQs may list only a few mixed dishes. For all other foods consumed, the survey respondent must separate the mixed food into all its individual components, which may present a barrier to accurate data collection because people may not know the exact contents of foods consumed (162). No method of dietary assessment is without flaws; in fact, dietary assessment is the subject of intense, on-going study in the field of nutrition. For the purposes of this study, the FFQ method of dietary assessment was most suitable.

CHAPTER III

MATERIALS AND METHODS

Preliminary Procedures

Prior to the study, the primary investigator was trained in administering the Food Frequency Questionnaire (FFQ) to individuals and groups of subjects by the major research advisor who was also a Registered Dietitian. The primary investigator and research advisor then trained a group of nine interviewers to aid with the administration of the FFQ. These secondary interviewers were graduate and undergraduate students enrolled in a directed studies nutrition class at Texas A&M University during the fall semester of 2001. This class was taught by the principle investigator and by the research advisor.

Questionnaires

The FFQ and the Calcium Osteoporosis Physical Activity (COPA) Questionnaire were previously developed and pilot-tested on a similar subject pool by researchers at the University of Texas School of Public Health (UTSPH). These questionnaires were used by UTSPH for a National Institutes of Health calcium intervention study in youth (164). A Food Descriptions List was provided by UTSPH to aid with consistency in completing the FFQ (APPENDIX B).

The FFQ is composed of 112 questions and is designed to detect overall dietary intake, with an emphasis on calcium intake. The COPA Questionnaire has 85 questions addressing knowledge, attitudes, and behaviors concerning calcium, osteoporosis, health, and physical activity. Certain sections of the COPA were omitted due to lack of relevance to this study. The FFQ and COPA questionnaires were in a scantron format and were scored by UTSPH investigators.

The Demographics Plus Questionnaire (DPQ) was a questionnaire (Titled “Calcium Pre-Test” and “Calcium Post-Test”) developed by the research advisor as an additional tool to gain demographic information on subjects and to aid in judging the effectiveness of the website. The DPQ was pilot-tested previously with youth (29). Composed of 12 questions in addition to the demographic

information, this questionnaire was in multiple-choice format and was hand-scored by the interviewers and primary investigator and rechecked by the primary investigator for accuracy. Questions on the DPQ were broken down into three categories: Knowledge (Questions 4-8, 10-12), Attitude (Questions 1and 2), and Behavior (Question 9).

The COPA Questionnaire was also broken down into three categories: Knowledge (Questions 1-12, 20-23, 27), Attitude (Questions 38, 40-42, 45-46, 48-49, 52, 56, 59-61, 63), and Behavior (Question 28,65-68, 70, 72, 74, 84-85). The DPQ and COPA were distributed to students for self-completion, but research staff was available for assistance. Copies of all three questionnaires can be found in APPENDICES E, F, and G.

Calcium Website Intervention

Since the childhood and adolescent periods are critical for bone mass accretion, dietary calcium intakes are especially important at this time of life. Therefore, a previously developed interactive website targeting youth, *Clueless in the Mall* (http://calcium.tamu.edu), was used as the intervention for the current study (29). Team members for the development of the website included two university nutrition faculty who are registered dietitians, an undergraduate student majoring in nutritional sciences, and a university Web master. The objectives of the website were to increase knowledge and improve attitudes about calcium and enable youth to increase dietary intake of calcium.

Educational Model

The website was modeled after the PRECEDE-PROCEED health education promotion planning model (165). Predisposing, Reinforcing, and Enabling factors that may impact people's decisions and actions were used to shape the intervention. A complete list of the factors is shown in **Figure 1** (29)

Predisposing factors are those that provide a rationale or motivation for behavior change, such as knowledge and attitudes about calcium. Research has demonstrated a lack of knowledge about calcium content of foods and daily calcium needs. Research has also shown that

adolescents with higher knowledge levels have higher calcium intake levels (6). These factors are addressed in the website. For example, a video clip featuring two teens of different ethnic backgrounds discussing the importance of calcium for teens and drinking milk versus soft drinks provides appeal, motivation for behavior change, and relevance to their stage of life. Teens are also given the opportunity to assess their own calcium intake and receive feedback from the program on a comparison to recommended levels.

Enabling factors, such as resources or skills, may support someone's ability to carry out the desired behavior change. Lack of enabling factors may hinder someone's ability to carry out the desired behavior. Studies show that teens are comfortable using computers (22) and that they actually prefer to receive information from computers as opposed to conventional styles (19, 139). Using the Internet as the information medium may allow teens to interactively learn about calcium in a novel way.

Reinforcing behaviors are factors that occur after the behavior that may either encourage or discourage continuation of the behavior. These factors include positive reinforcement from teachers, parents, or doctors and the discovery of high calcium foods that are appealing to the taste. For example, the website included a video clip from Dr. Nancy Dickey, former President of The American Medical Association, to provide positive reinforcement. Predisposing, Reinforcing, and Enabling factors were included in this intervention as often as possible to increase the likelihood that increased calcium consumption will occur as a result of using this program.

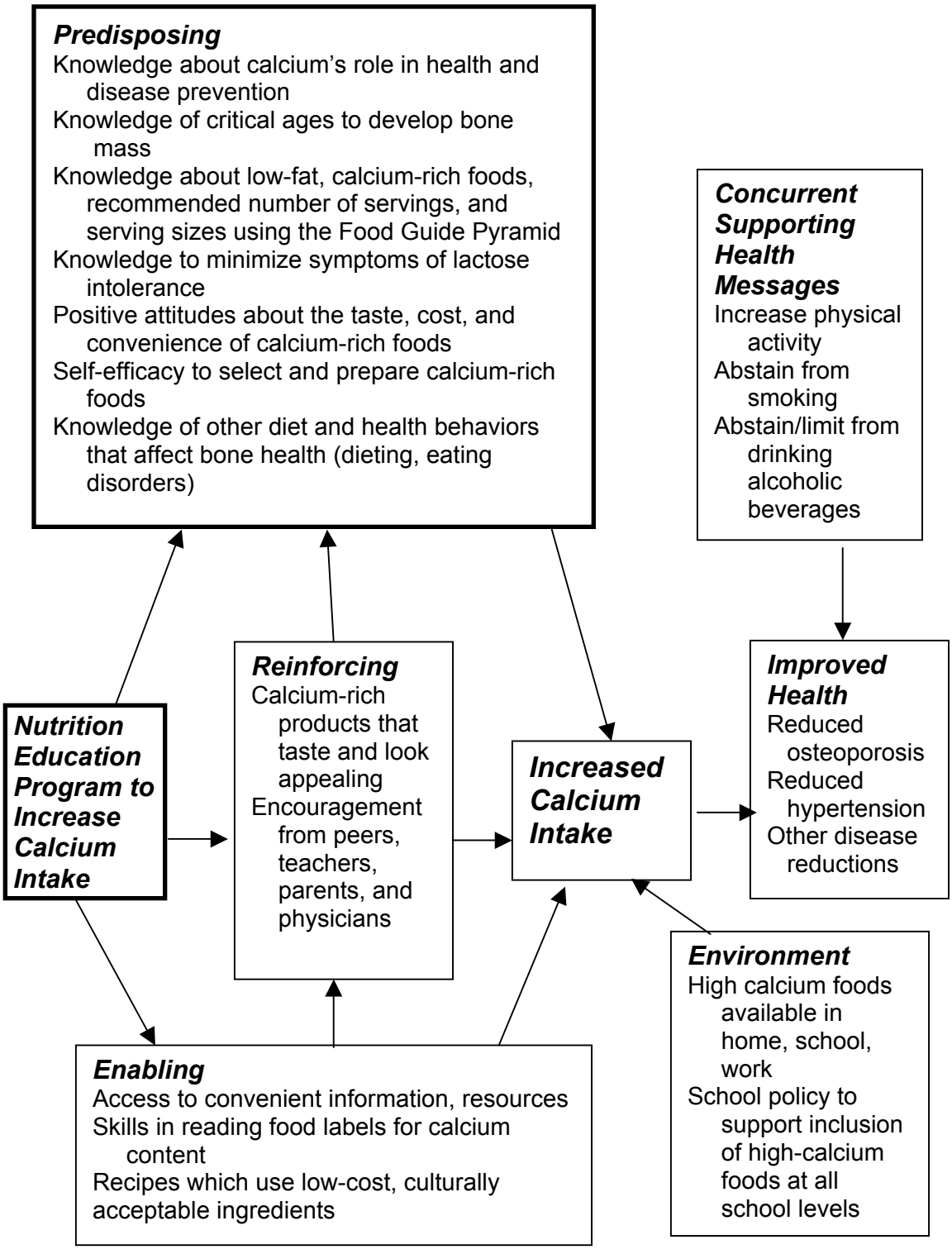

FIG 1. A model of nutrition education to increase dietary calcium in teens.

Website Features

Figure 2 presents the site map of *Clueless in the Mall*. The theme of the website is a scavenger hunt in the mall, and youth answer questions about calcium to receive the next clue to continue the hunt. Along the way, youth discover facts about calcium, including osteoporosis and other health issues, the USDA Food Guide Pyramid (adapted for teens with a separate pyramid for calcium-rich food sources), and information about how to read food labels to determine calcium content. Users select the food court, bookstore, sports store, and other stores to find clues and answer questions. At the completion of the scavenger hunt, the program also offers a host of other topics the user may click on for more information. For example, simple recipes and other ethnically sensitive suggestions for incorporating calcium into the diet are available. For increased appeal to youth, the website features animation, music, video, and audio clips. Youth were involved through all phases of development, and the website was tested with youth at home and at school (29). The website also allows for users with different technological capabilities to participate. Users select "low," "medium," or "high" technology. For lower technology users, audio clips are used in place of the video clips so that no information is missed. The *Clueless in the Mall* website received a "better than most" rating from Tufts Nutrition Navigator, a nutrition website evaluation program administered by Tufts University. It has also been announced on several professional listservs and can be accessed through several other national and international websites.

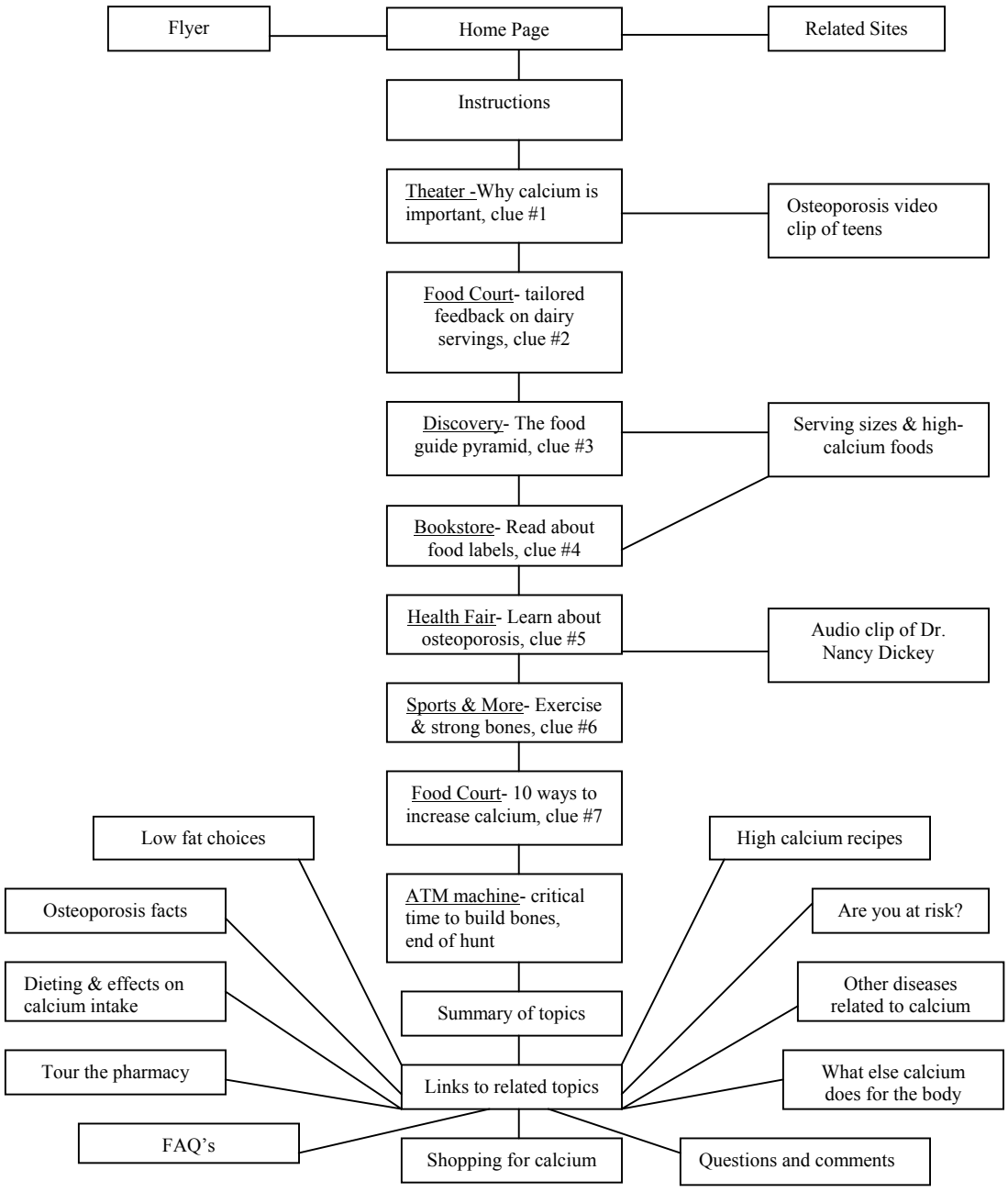

FIG 2. Site map of *Clueless in the Mall.*
This interactive website on calcium aimed at youth is designed as a scavenger hunt. At each location in the mall (underlined), youth receive information about calcium and related topics, answer a calcium-related question, and earn their next clue. At the end of the hunt, there are links relating to calcium and osteoporosis where youth can learn more about items of interest or email the program director.

Preliminary Website Testing

This website was developed and tested among children ages 11 to 15 years prior to this investigation (29). First, a pre-computerized version, or "storyboard" was developed and tested with 18 local middle and high school students for clarity, comprehension, and appeal. Then, 19 local students viewed the website and were asked before and after the viewing to rate their concern about calcium on a scale from 1 to 10 (with 10 being the most concerned). Before viewing the website, the mean response was 4.68, and after viewing the website, the mean was 8.26. Finally, the website was tested with 148 local high school students in a computer lab. On the first day, students completed a pretest. The next day, they viewed the website, and on the third day, they took the posttest. The questions on the pretest and posttest related to predisposing factors of knowledge and attitude in the model previously described. Scores increased significantly from pretest to posttest ($p<0.05$), indicating an increase in knowledge and positive attitudes about calcium as a result of the intervention. Because the pretest and posttest were timed so close together, change in calcium intake was not measured. Therefore, the present investigation aimed to test knowledge, attitude *and* behavior changes as a follow-up to the preliminary study.

Subjects

The subjects for this study were students from A&M Consolidated High School and College Station Middle School in College Station, Texas. Coaches and teachers of health, science, physical education, and family and consumer sciences were contacted by flyers, phone, email, and personal conversations to recruit classrooms interested in learning about calcium and osteoporosis prevention. Three teachers responded with a total of 12 classes of students in grades 6-12. One of these classrooms was designated as the control group and did not receive the intervention, meaning they did not view the website. One entire class was dropped from the study because of technical difficulties in the computer lab, which resulted in most students in this class viewing only half of the website's content.

Prior to data collection, students were informed of the nature of the study and the risks involved. They were then asked to sign student assent forms, and parental consent forms also were obtained from all students involved in the study. These student assent forms, parental consent forms, and the study protocol were approved by the Texas A&M Institutional Review Board for Human Subjects and the College Station Independent School District Research Review Committee. As a benefit to participating in the study, prizes were donated by local businesses to encourage participation. Prizes included coupons for free food, gift certificates, and donated merchandise.

To maintain confidentiality, all subjects were assigned a subject identification number, which was recorded on all questionnaires. If the subject recorded a name on any of the questionnaires, the names were either erased completely or covered with permanent black marker so that the names were not visible. The questionnaires were stored in a locked office.

Collection of Data

Data collection occurred in two phases. Phase I was the validation of the FFQ in a group format. Phase II involved collection of dietary calcium intake data before and after the website intervention.

Phase I – Validation of the Calcium-Focused Food Frequency Questionnaire (FFQ)

The FFQ, developed previously by Hoelscher et al. (164), has been tested on individual subjects, but this study evaluated its effectiveness for a group format. A group format rather than an individual interview with the researchers was preferable since it used less classroom time. To validate the group-administered FFQ, a group of 14 students from a local church youth group volunteered to help in exchange for a free pizza lunch during the summer of 2001. Permission was obtained from the church and parents. Parental Consent and Student Assent forms can be found in APPENDIX A. Half of these students filled out the questionnaire in a group format first with an interviewer directing the groups of three to four students. Then those same students filled out the questionnaire individually

with an interviewer. The other half of the students filled out the questionnaire one-on-one with an interviewer first and then in the group setting. This format was selected to help prevent possible bias due to the fact that students filling out the survey for the second time had more time to think and remember food they had eaten in the past week.

Phase II – The Research Study

Data collection for the study occurred in the fall of 2001. Permission was obtained from students and their parents. On day one, Parental Consent and Student Assent forms were passed out and sent home (consent/assent forms are found in APPENDIX A). During the same class period, the subjects saw a demonstration of how skinfold calipers would be used for a concurrent study using the same subject pool. This process took half of a class period. On Day 2, the pretest FFQ and DPQ were administered. On Day 3, anthropometrics were recorded for a concurrent study using the same data pool. On this day students also completed the COPA Questionnaire. During the fourth class day, the students viewed the website in classrooms equipped with multiple computers (computer labs) under the supervision of the interviewers. Students also printed a certificate of completion at the end of the website. After six weeks had lapsed, the investigators returned for Day 5 to administer the post-test FFQ, DPQ, and COPA.

Statistical Analysis

Statistical analyses were performed using SPSS for Windows (version 11.0, 2001, MacGraw Hill, Chicago, Ill). The control and experimental groups were compared in all analyses except Phase I of the FFQ, where this was not applicable. Means and frequencies were determined for demographic variables. Changes in attitudes, knowledge, and dietary intake of calcium were analyzed using Analyses of Variance (ANOVA) and t-tests with paired comparisons of the pretest and posttest data. Specifically, the FFQ (Phase I and II) was analyzed using paired t-tests and the nonparametric sign test for comparison. For both the DPQ and the COPA, new variables were computed to measure change. For example, subtracting the pretest knowledge total category value from the posttest knowledge total

category value created the variable “knowchan” on the COPA Questionnaire. These change variables were used in ANOVA to determine if the change between the experimental and control groups was statistically significant. Follow up t-tests were also performed on certain parts of the DPQ and COPA. Statistical significance was set at less than 0.05 ($p \leq 0.05$) for this study.

CHAPTER IV

RESULTS

The results section is divided into four parts: the Food Frequency Questionnaire (FFQ) Phase I, the FFQ Phase II, the Demographics Plus Questionnaire (DPQ), and the Calcium Osteoporosis Physical Activity (COPA) Questionnaire. The FFQ Phase I was a validation study to determine whether or not the individually administered FFQ could be administered to small groups of students. After results showed that a group administered FFQ was valid, 12 middle school and high school classes took three pretests (the group administered FFQ, DPQ, and the COPA Questionnaire), viewed the calcium website, and then took the same three posttests. One of the classes was designated as the control group. All data were analyzed using SPSS for Windows (version 11.0, 2001, MacGraw Hill, Chicago, Ill).

The FFQ Phase I—Validation of the Group FFQ

In this phase of the study, students were interviewed using the standard one-to-one protocol, and were also interviewed about their individual calcium intake in a group format. The group FFQ was compared to the one-to-one FFQ. Fourteen students took both the individual and group FFQ. For the group-administered FFQ, the 14 students were randomly assigned to groups of three to four students per group. To avoid bias due to having taken the test previously, half of the students took the group FFQ first while the other half of the students took the individual FFQ first. One subject was dropped from the data pool because his answers were inconsistent and because his calcium intake was exceptionally high. For example, in the group interview, he reported that he drank 2% milk or buttermilk zero times per day, but in the individual interview, he reported drinking 2% milk or buttermilk five times per day. It appears that the subject was trying to impress the interviewer in the individual interview.

With the 13 students who were left in the study, the mean calcium intake of the four groups ranged from 1,509 milligrams (mg) to 1,644 mg. These and other descriptive statistics are shown in

Table 2. See Tables D1-D4 in APPENDIX D for reported calcium intake frequencies. The reported calcium intake in the individual interviews ranged from 494 mg to 3,094 mg, while the reported calcium intake in the group interviews ranged from 281 mg to 3,068 mg. In the students' first interviews, calcium intakes ranged from 494 mg to 3,094 mg; in the students' second interviews, calcium intakes ranged from 281 mg to 2,642 mg.

The spread of the data is shown visually in histograms in FIGURE D1 of APPENDIX D. According to these histograms and the skewness values recorded in **Table 2**, the data appeared to be normally distributed; nonetheless, nonparametric sign tests in addition to t-tests were conducted for comparison.

Table 2
Descriptive statistics for the FFQ individual and group interviews, Phase I

	Calcium Intake, Individual Interview	**Calcium Intake, Group Interview**	**Calcium Intake, 1st Interview**	**Calcium Intake, 2nd Interview**
n	13	13	13	13
Mean ± (SD)*	1509.1 ±764.8	1644.3 ± 845.0	1634.3 ± 854.2	1519.1± 756.3
Median	1317.8	1766.0	1449.4	1580.5
Skewness	-0.108	0.484	-0.251	-0.010
Minimum	494.0	281.4	494.0	281.4
Maximum	3094.1	3067.6	3094.1	2642.0

*SD-Standard Deviation

The relationship between subjects' calcium intakes in the individual interview and the group interview is shown by the correlational results in **Table 3**. The correlation value of 0.703 (p=0.007) signified a high correlation between the two interviews. Similarly, comparing the students' first and second interviews, a correlation value of 0.701 (p=0.008) also signified a high correlation.

Table 3
Correlations of individual versus group FFQ interviews and FFQ 1st versus 2nd interviews (Phase I)

	Individual Interview & Group Interview (n=13)	**1st Interview & 2nd Interview (n=13)**
n	13	13
Correlation	0.703	0.701
Sig.	0.007	0.008

A paired samples t-test testing for differences between individual and group interviews yielded a p-value equal to 0.45. A paired samples t-test testing for differences between students' first and second interviews yielded a p-value of 0.52 (**Table 4**), which indicates that the means are not statistically significantly different. Table D5 in APPENDIX D displays the complete t-test output.

Table 4
T-test comparisons of individual versus group FFQ interviews and FFQ 1st versus 2nd interviews (Phase I)

	Individual Interview - Group Interview (n=13)	**1st Interview – 2nd Interview (n=13)**
n	13	13
Mean ± SD*	-135.27 ± 624.8	115.20 ± 629.2
p-value	0.450	0.522

* Standard Deviation (SD)

The nonparametric sign test looking for differences between the group and individual interview yielded a p-value equal to 1.00, and the sign test looking for differences between students' first and second interviews yielded a p-value of 0.267 (**Table 5**). The results concur with the results of the previous t-tests.

Table 5
Nonparametric sign test comparisons of individual versus group FFQ interviews and FFQ 1st versus 2nd interviews (Phase I)

	Group Interview – Individual Interview	**2nd Interview – 1st Interview**
n	13	0.267
p-value	1.000	

Phase II

In this phase of the study, the FFQ was administered to groups of two to five students by a single interviewer. Demographics were analyzed using the DPQ, and additional dietary calcium information was assessed using the COPA.

Demographics

Thirty out of 126 subjects were dropped from the DPQ for the demographics analysis because they did not complete both the pretest DPQ and posttest DPQ, because they were missing a consent form, or because they were part of the class of ten students who experienced technical difficulties with the website and did not finish going through the site. Four additional subjects were dropped from the Demographics part of the DPQ analysis because they chose not to record demographic information, which resulted in a total of 92 subjects used for demographic analysis. Four subjects from the experimental group were moved to the control group because they were either absent from class on the day the website was used or because their parents had not given the school permission for their child to use the Internet.

The average age for the experimental group was 14.5 years, and their ages ranged from 11 to 19. The average age for the control group was 14.9 years, and their ages ranged from 12 to 18. Age frequencies for the experimental and control groups are shown in Tables D7 and D8, respectively, of APPENDIX D. The experimental group was composed of 72.3% females and 22.5% males, plus one subject who did not record an answer. The control group was composed of 62.5% females and 37.5%

males. The experimental group was 11.8% Black, 65.8% White, 6.6% Hispanic, 14.5% Other, and 1.3% unknown (one student did not record ethnicity). The control group was 87.4% White, 6.3% Hispanic, and 6.3% Other. Again, one student did not record an answer for ethnicity.

The FFQ—Phase II

Forty-five out of 114 total subjects were dropped from the FFQ analysis because they reported either less than 500 kilocalories or they reported greater than three times the Recommended Dietary Allowance (RDA) for calcium (greater than 3,900 mg). Also, any student who did not complete both the pretest and posttest FFQ was excluded.

The 69 subjects remaining in the study were used for statistical analysis. Reported pretest calcium intake values ranged from 425 mg to 3,373 mg, and the posttest values ranged from 138 mg to 3,887 mg.

Ten of the 69 subjects were assigned to the control group and did not receive the intervention (did not view the website). Thus, four sub-groups of subjects existed: pretest experimental, posttest experimental, pretest control, and posttest control. Mean calcium intake for the four groups are displayed in **Table 6**, as well as in Figure D2 of APPENDIX D. Means for the pretest experimental and posttest experimental were 1,931 mg and 1,644 mg of calcium, respectively. Means for the pretest control and posttest control were 1,840 mg and 1,272 mg of calcium, respectively. Thus, reported post-intakes were less than pre-intakes in both experimental and control groups.

Table 6
Comparison of the pre and post-intervention FFQ calcium intakes (experimental and control groups)

		Mean ± SD*	n	Std. Error Mean	Skewness
Experimental	Pretest	1930.5 ± 940.7	59	122.5	0.171
	Posttest	1643.7 ± 812.9	59	105.8	0.358
Control	Pretest	1840.4 ± 994.0	10	314.3	0.110
	Posttest	1271.6 ± 1077.1	10	340.6	1.803

* Standard Deviation (SD)

The histograms in Figure D2 of APPENDIX D and the skewness values shown in **Table 6** suggested that the data were fairly normally distributed except for possibly the posttest control group. Nonetheless, nonparametric tests were performed on all four groups for comparison.

Table 7 displays the results of the paired samples t-tests testing for differences between the pretest and posttest for the experimental and control groups. The p-value for the experimental groups was significant at 0.011. The p-value for the control groups is also significant at 0.018. In addition, the difference in the means was positive. These results indicate that calcium intakes decreased from pretest to posttest in the experimental and control groups. The complete t-test analysis is displayed in Table D6 of APPENDIX D.

Table 7
Comparison of the pre and post-intervention FFQ differences in calcium intake (experimental and control groups)

Paired Differences	**Mean ± SD***	**p-value**
Experimental Pretest - Posttest Calcium Intake (n=59)	286.8 ± 834.5	.011
Control Pretest - Posttest Calcium Intake (n=10)	568.8 ± 626.8	.018

* Standard Deviation (SD)

Independent samples t-tests were also performed to test for differences between the control and experimental pretests and for differences between the control and experimental posttests. These results are displayed in **Table 8**. For the pretest experimental versus control group comparison, the p-value was not significant at 0.782. For the posttest experimental versus control group comparison, the p-value was again not significant at 0.207.

Table 8
Independent samples comparison: differences in mean pre and post-FFQ calcium intake (experimental versus control groups)

	Levene's Test for Equality of Variances		**T-test for Equality of Means**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
	F	**Sig.**	**F**					Lower	Upper
Pretest Calcium Intake (Exp vs Control)	.015	.904	.278	67	.782	90.1	324.2	-557.0	737.2
Posttest Calcium Intake (Exp vs Control)	.411	.524	1.275	67	.207	372.1	291.7	-210.3	954.4

In **Table 9**, the results are displayed for the nonparametric sign tests. For the experimental group, the comparison of the pretest and posttest means yielded a p-value of 0.004. For the control group, the comparison of the pretest and posttest means yielded a p-value of 0.021. These results are consistent with the paired samples t-test results in **Table 7**.

Table 9
Nonparametric comparison (sign test) for the FFQ (experimental and control groups)

	p-value
Experimental Posttest -Pretest Calcium Intake (n=59)	.004
Control Posttest -Pretest Calcium Intake (n=10)	.021

Demographics Plus Questionnaire (DPQ)

A total of 92 students took the pre and post DPQ. Sixteen of these made up the control group, and the other 76 students made up the experimental group. The DPQ is composed of three different types of questions: knowledge, attitude, and behavior. The ratio of questions from each category was irregular; that is, there were more questions in the knowledge category than in the other two categories. To compensate, each category total was transformed so that each category would be weighted equally. The knowledge category contained eight questions; thus, the category total was divided by eight. The attitude category contained two questions; thus, the category total was divided by two. The behavior category contained only one question; thus, the category total was divided by one.

A total score of the three categories added together was also computed using the transformed category totals. Thus, for both the experimental and control groups combined, four sub-groups existed as shown in **Table 10**. Additionally, the change in each category was computed by subtracting the pretest value from the posttest value. For example, the change in experimental knowledge (0.38) was computed by subtracting the pretest experimental knowledge value (2.95) from the posttest experimental knowledge value (3.33). **Table 10** shows the mean values for each category and the standard deviations (SD). The column labeled "p-value" is the p-value computed by a separate Analysis of Variance (ANOVA) for each category (see Table D9 of APPENDIX D for more details). For example, the p-value for the knowledge category (0.056) represents the ANOVA comparison of the experimental change in knowledge scores versus the control change in knowledge scores. Data were checked for homogeneity of variance (see Table D10 of APPENDIX D and normality (see Table D11 of APPENDIX D). These two tests helped assure that the data met the requirements for an ANOVA. The test for skewness showed that the data were normally distributed, and the test for equality of variance showed that the variances were not significantly different. Other descriptive statistics for the DPQ are also located in Table D11 of APPENDIX D. Since none of the categories demonstrated significant change (significant = $p \leq 0.05$), no follow up t-tests were performed.

Table 10
Comparison of DPQ changes in knowledge, attitudes and behavior concerning calcium and osteoporosis

	Experimental Group		**n=76**	**Control Group**		**n=16**	
	Pretest	**Posttest**	**Change**	**Pretest**	**Posttest**	**Change**	**p-value**
Knowledge	2.95± 0.7	3.33± 0.8	0.38±0.7	3.03±0.8	3.03±0.8	-0.34±2.1	0.056
Attitude	2.47±1.0	2.70±1.3	0.23±1.1	2.03±1.4	2.19±1.3	-1.84±4.1	0.814
Behavior	1.50±1.5	1.78±1.5	0.28±1.1	1.81±1.8	1.81±1.8	-0.58±5.0	0.400
Total Scores	30.05±6.4	33.82±7.4	3.76± 6.5	30.13±8.3	30.4±7.8	-2.75±6.5	0.061

*Recorded as Mean ± Standard Deviation (SD)

The change for each individual question was also computed for the experimental and control groups, and an ANOVA on the change for each question was also performed to compare the experimental and control groups. Descriptive statistics for these variables and the p-values are found in Tables D12 and D13, respectively, of APPENDIX D. Only the ANOVA (comparing the change variables) for question 7, which was a knowledge question that asked about the populations of people affected by osteoporosis, had a significant p-value (p= 0.033); therefore, an individual analysis was conducted for question 7 to determine where the differences were. Paired t-tests were used to compare the experimental pretest versus posttest and the control pretest versus posttest. The means, standard deviations, and p-values are shown in **Table 11.** Neither t-test produced results of statistical significance. The analysis in its entirety is displayed in Tables D14 and D15 of APPENDIX D.

Table 11
Comparison of DPQ question 7: knowledge regarding calcium intake of canned fish with bones (experimental and control groups)

	Pretest	**Posttest**	**p-value**
Experimental (n=76)	4.36 ± 1.2	4.55 ± 1.1	0.112
Control (n=16)	4.81 ± 0.8	4.38 ± 1.2	0.110

*Recorded as Mean ± Standard Deviation (SD)

COPA Questionnaire

Ten of the original 126 subjects did not take the posttest COPA (the students were absent from class on the day of testing) and were dropped from the COPA analysis. Of the remaining 116 subjects, 30 additional subjects were dropped. Reasons included missing consent forms, failure to complete the website, failure to complete both the pretest COPA and posttest COPA, and leaving large sections of either the pretest or posttest COPA blank. The latter reason explained the varying number of subjects who completed the DPQ and the COPA. The remaining 86 subjects were used in the analysis of the COPA Questionnaire. The experimental group contained 74 subjects, and the control group contained 12 subjects. No demographics were collected for this questionnaire; however, the makeup of these groups is expected to be similar to the demographics obtained using the DPQ since the questionnaires were administered at the same time.

A total score of the three categories (knowledge, attitude, and behavior) on the COPA Questionnaire added together was also computed. Thus, for the experimental and control groups combined, four sub-groups existed as shown in **Table 12**. Additionally, the change in each category was computed by subtracting the pretest value from the posttest value. For example, the change in experimental knowledge (1.27) was computed by subtracting the pretest experimental knowledge value (10.27) from the posttest experimental knowledge value (11.53). The mean values for each category and the standard deviation (SD) are shown in **Table 12**. Other descriptive statistics for each category may be found in Table D16 of APPENDIX D. The column labeled "p-value" is the p-value computed by separate Analyses of Variance (ANOVA) for each category. For example, the p-value for the knowledge category (0.039) represents the ANOVA comparison of the experimental change in knowledge scores versus the control change in knowledge scores. Details of these ANOVAs may be found in Table D18 of APPENDIX D. The data were checked for normality (see skewness in Table D16 of APPENDIX D) and homogeneity of variance (see Table D17 of APPENDIX D), which confirmed that the data met the assumptions for the ANOVA test.

Table 12
Comparison of changes in COPA knowledge, attitudes and behavior concerning calcium and osteoporosis (experimental and control groups)

	Experimental Group		n=74	Control Group		n=12	
	Pretest	**Posttest**	**Change**	**Pretest**	**Posttest**	**Change**	**p-value**
Knowledge	10.27±2.5	11.53±2.8	1.27±2.5	10.17±2.9	9.83±3.5	-0.34±2.1	0.039
Attitude	51.77±7.6	52.78±7.9	1.01±7.0	52.42±7.6	50.58±8.2	-1.84±4.1	0.178
Behavior	32.58±7.9	32.68±8.2	-0.10±6.8	31.00±10.2	30.42±9.3	-0.58±5.0	0.812
Total Scores	94.70±14.7	96.89±14.3	2.19±10.4	93.58±16.4	90.83±16.6	-2.75±6.5	0.115

*Recorded as Mean ± Standard Deviation (SD)

Since the knowledge category demonstrated significant change, individual paired t-tests were performed for experimental knowledge pretest versus experimental knowledge posttest and for control knowledge pretest versus control knowledge posttest to determine if the changes came from the experimental or control group. The results are shown in **Table 13** below. The p-value for the experimental group was 0.000, and the p-value for the control group was 0.586. See Tables A19 and D20 of APPENDIX D for more details on this analysis.

Table 13
Differences in COPA knowledge (experimental and control groups)

	Knowledge Pretest	**Knowledge Posttest**	**Difference (Pre-Post)**	**p-value**
Experimental (n=74)	10.27±2.5	11.53±2.8	-1.27±2.5	0.000
Control (n=12)	10.17±2.9	9.83±3.5	0.33±2.1	0.586

*Recorded as Mean ± Standard Deviation (SD)

The change for each individual question was also computed for the experimental and control groups, and an ANOVA on the change for each question was also performed to compare the

experimental and control groups. Descriptive statistics for these variables and the p-values are found in Tables D21 and D22 of APPENDIX D. Only the p-value for question 28, which asked how many servings of milk the subjects drank daily, was significant (p= 0.032). The p-value for question 85, which asked subjects if they felt they could ask their parents to buy foods high in calcium, approached significance (p= 0.061).

An individual analysis was conducted for question 28. Frequencies and Descriptive statistics for question 28 may be found in Tables D23 and D24 of APPENDIX D. Paired t-tests were used to compare the experimental pretest versus posttest and the control pretest versus posttest. The means, standard deviations, and p-values are shown in **Table 14**. Neither t-test produced results of statistical significance. The paired t-test analysis in its entirety is displayed in Table D25 of APPENDIX D.

Table 14
Comparison of means for COPA question 28: mean servings of milk consumed daily (experimental and control groups)

	Pretest Mean ± SD*	**Posttest Mean ± SD***	**Paired t-test p-value**
Experimental (n=74)	1.84 ± 1.5	1.92 ± 1.6	.556
Control (n=12)	2.17 ± 1.6	1.42 ± 1.0	.108

* Standard Deviation (SD)

CHAPTER V

DISCUSSION AND CONCLUSIONS

This study successfully validated a food frequency questionnaire, which was designed for use with one interviewer and one subject, to be used in a group setting with one interviewer and up to five subjects. In addition, while previous studies have documented the effectiveness of using computer related technology for other health related behavior interventions (17-28) and several have even documented the use of the Internet as an intervention for health promotion (129-133), none have documented the use of the Internet to teach adolescents about calcium and osteoporosis or to evaluate the effectiveness of such a website to change behavior, such as increase calcium intake.

Phase I

In phase one of this study, the Food Frequency Questionnaire (FFQ) was validated for use in groups of three to five subjects. The mean calcium intakes for the group and individuals interviews were 1,644 mg and 1,509 mg, and the p-value of the testing for significant differences between these means was 0.45. This indicated there was no significant difference between the group versus the individually-administered FFQ. The mean calcium intakes for the first and second interviews were 1,634 mg and 1,519 mg, and the p-value testing for differences between these means was 0.52, indicating that there was no meaningful difference in outcome when the students took the FFQ for the first time or for the second time. It was anticipated that students would record slightly higher calcium intakes in the individual interviews because they would have individualized attention and cues to help them recall what they had eaten. It was also anticipated that students would record slightly higher calcium intakes in their second interviews because they would have more time to think and recall foods they ate. It is interesting to note that the higher means were associated with the group interviews and the first interviews, just the opposite of what we predicted. One possible explanation is that there is a very slight tendency to over report calcium intake in the group interviews without individualized attention. It is also possible that students had more time by their second interviews to recall exactly

what they *did* eat instead of everything they *might* have eaten. Nevertheless, these findings indicated that there was statistically no difference between the two methods of administration. Thus, the FFQ could be used for the larger study in College Station schools.

Phase I Limitations

The timing of the validation (late summer) and lack of motivation for students to participate made recruiting difficult. Specifically, students were at the end of their summer vacation, and many had taken family trips out of town. Also, many of the prospective participants did not own cars or have a driver's license, which meant their families had to be willing to drive back to church to pick their children up at the conclusion of the study. In addition, the youth group at this church is composed of primarily upper middle class white families. Thus, the small sample size (n=13) and lack of ethnic diversity in the validation study leaves the possibility that the sample is not representative of the larger population. Future studies should focus on larger, more ethnically diverse samples of adolescents.

Phase II—Changes in Calcium Intake

In Phase II, the FFQ was used in public schools to detect changes in calcium intake as a result of the calcium website intervention. It was hypothesized that calcium intakes would increase significantly in the experimental group and remain at approximately the same level for the control group. Both the experimental and control groups demonstrated a significant change, but the change was negative. In other words, instead of calcium intakes increasing significantly in the experimental group as hypothesized, calcium intakes actually decreased significantly for both groups. These results are similar to the results from the validation study, in which the students' calcium intakes in their second interviews were lower. Thus, it is possible that a "learning curve" for this particular food frequency questionnaire exists, where the calcium intakes decrease (and become more accurate) as the subjects become more familiar and comfortable with the questionnaire.

It is important to consider that although scores did decrease in both groups, the change from pretest to posttest was smaller in the control group than in the experimental group. Therefore, it is possible that with a different instrument or with proper familiarization of the FFQ, significant results may have been detected in the hypothesized direction.

In national studies on adolescent calcium intake, results consistently demonstrate that adolescents are not meeting their calcium needs; in fact, they are far below recommended levels (5, 6, 95-97). However, in this study, calcium intakes averaged above the Adequate Intake (AI) of 1,300 mg per day (98). One explanation is that this particular sample of students is not representative of the US population. The town in which data were collected is built around a major university; thus, the general education level of the town may be higher than the general US population. This could mean that the students who were used in this study were already more apt to consume adequate calcium intakes. Other studies have documented the relationship between parental education levels, especially mothers' education levels, and nutrition status and calcium intakes of their children (110, 111, 114). Of course, it may also be possible that the higher calcium intakes in this study were the result of the previously discussed "learning curve" or were due to the lack of accuracy (overestimation of calcium) in the FFQ.

Knowledge

Examples of DPQ knowledge questions included "Teens need to reach ___% of the % Daily Value of calcium" and "If you do not get enough calcium in the foods you eat, what diseases can you get?" Examples of COPA questions in the knowledge category included choosing which food was highest in calcium when presented with two choices, such as "Fruit Juice or Milk," "Iceberg Lettuce or Collard Greens," "Cream Cheese or Mozzarella Cheese" and "Sherbet or Frozen Yogurt." The COPA also included multiple choice questions about osteoporosis and bone density, such as "At what age are females increasing their bone mass?"

For the Demographics Plus Questionnaire (DPQ), the change in knowledge category comparing the experimental and control groups approached significance ($p=0.056$). It is possible that this brief questionnaire did not adequately address all areas of calcium knowledge and, therefore, did

not accurately detect changes in knowledge. For the Calcium Osteoporosis Physical Activity (COPA) Questionnaire, the change in knowledge category was significant (p= 0.039), although none of the individual questions demonstrated a significant change. These findings suggest that the website intervention was successful for increasing overall knowledge about the calcium content of foods and the need for calcium in the diet.

Attitude

Examples of DPQ attitude questions included, "On a scale from 1 to 5 (with 5 being very concerned), how concerned are you about getting enough calcium every day?" COPA attitude questions included questions such as, "On a scale from 1 to 5 (with five being strongly disagree), how much do you agree with the following statement: Preventing osteoporosis later in life is important to me now" and "On a scale from 1 to 5 (with five being strongly disagree), how much do you agree with the following statement: I like to drink milk."

For the DPQ, the change in the attitude category comparing the experimental and control groups was not significant (p=0.814). It is possible that this brief questionnaire did not adequately address all areas of attitudes toward calcium and, therefore, did not accurately detect changes in attitudes. Similarly, for the COPA Questionnaire, the change in attitude was also not significant (p=0.178). These results point to the possibility that the website intervention alone is not enough to change attitudes about calcium.

Behavior

The DPQ included one behavior question, "How often do you read the nutrition label when shopping for food at a grocery store?" Examples of the ten COPA questions in this category included, "How many glasses of milk do you usually drink in a day?" and "How confident are you that you could drink milk instead of sodas at dinner?" and "How confident are you that you could ask your parents to buy foods that are high in calcium?"

The change in the behavior category comparing the experimental and control groups was not significant (p=0.40) on the DPQ. This is likely because the instrument was not sensitive enough to detect change due to the fact that the DPQ only contained one question related to behavior. For the COPA Questionnaire, the change in behavior was also not significant (p=0.812). Again, these findings could point to the fact that the website intervention alone is inadequate to evoke changes in behavior.

Calcium Website Study Limitations

1. No dietary measure of nutrient intake is without flaws. Limitations of FFQ's have been recognized (162). However, this particular FFQ presented an extra challenge. This FFQ was developed for an ongoing National Institutes of Health (NIH) calcium intervention study by Hoelscher et al. (164). Thus, when the investigation began, results for the NIH study were pending. After data for the current investigation had been collected, Hoelscher et al. determined that calcium intake values were trending high and that calcium scores were decreasing with each time the subject took the FFQ. This confirmed earlier results in Phase I of the present study that a learning curve may be present for this FFQ. Indeed, the values in this investigation for calcium intake are much higher than previous studies have reported (5, 6). It is also possible that the calcium intake values from this study are accurate and that the sample of subjects is not representative of the US population, as discussed earlier. Problems with this FFQ support the need for more accurate and reliable measures of dietary assessment.
2. Numbers of participants in this study were severely affected by the lack of teachers, parents, and students willing to participate. Dozens of teachers were contacted, yet only three were willing to allow their classes to participate. Still, if every student in the eleven participating classes had given consent, the study would have included 300 plus subjects. Lack of student motivation (lost and forgotten consent forms) limited the number of participants. Additionally, lack of consent from parents limited the number of participants. Even though students were closely monitored while they viewed the website, some parents did not want

their student participating in the study, possibly because of the controversy surrounding use of the Internet (websites with questionable content that may be accessed using the Internet).

3. Technological difficulties at the schools also proved challenging. Available computer labs in College Station schools used a limited bandwidth for the Internet. Thus, when 20 students almost simultaneously attempted to watch a video-streamed link from the website, many encountered delays and long pauses during the videos. Making the best of the situation, the investigators linked the video stream to an overhead television screen where students watched the videos together without interruption at the beginning of the class period. Content was not affected; however, the website as it was designed to be viewed was slightly different for these students. The first class to experience this problem was dropped from the study because the subjects failed to complete even half of the website due to the delay in setup of the overhead screen. Technological difficulties in another classroom resulted in one classroom of computers with no sound because of a malfunction in the computer laboratory. This class completed the website (including the overhead videos), but they did not have the sound effects that help make the website fun and exciting. Since the subjects did receive all necessary information, this class was not dropped from the study. Thus, it is possible that this class caused the results of the intervention to appear less dramatic.
4. An old version of the DPQ Pretest was copied instead of the final version. The error was not discovered until halfway through data collection, therefore, Question 3 “Do you think you are getting enough calcium in the foods you eat?” was omitted from analysis because the Pretest and Posttest contained different versions of the question. This reduced the number of questions related to knowledge.

Comparison of the Study to Current Literature

Since this study began, three Internet-based interventions have been published which document successful behavior changes related to physical activity (129, 132) and weight loss (131). A study published in late 2001 was a physical activity website intervention of 78 subjects with Type 2

diabetes, who were randomized into either a control (information-only) or intervention group (129). During this 8-week study, the information-only group was able to access diabetes-specific articles on the website and track real-time blood glucose with feedback. The intervention group received a personalized physical activity program tailored specifically to their individual needs. Intervention group participants were taken through a 5-step process in which they identified the benefits of physical activity, selected a physical activity goal, selected physical activities from an explorative list of activities, scheduled days of the week and times for these activities, and identified barriers. Subjects were encouraged to log-on at least once per week. Results indicated an overall moderate improvement in levels of physical activity in both groups. In addition, participants within the intervention group who used the website most frequently achieved significantly greater benefits, a finding not observed in the control group. The authors concluded that Internet-based self-management programs show great potential for improving the care of diabetes and other chronic diseases.

The diabetes intervention study differed from the current calcium website study in two crucial aspects. One is that the physical activity website was accessed repeatedly over 8 weeks. In the calcium study, the website was accessed only once by the subjects. Naturally, repeated exposure to the desired change would more likely result in behavior change. Second, the intervention group in the physical activity study received a personalized physical activity plan tailored to their individual needs, whereas the information-only group members were able to use the website only to find related diabetes and physical activity articles, monitor glucose levels, and receive feedback on their glucose levels. While limited compared to the physical activity study, the calcium website does provide some feedback. For example, questions asked of users during their hunt for calcium through the shopping mall called for the user to click on the correct answer choice. The website then flashed a correct or an incorrect answer screen, depending on the answer choice selected. As demonstrated by the physical activity study, personalized programs are more effective than general information. This limited personalization of feedback is a possible area of development for the calcium website.

Internet behavioral counseling and weight loss was also reported in adults at risk for Type 2 diabetes in 2003 (131). Ninety-two participants were recruited by newspaper advertisement who met

eligibility requirements, such as access to a computer, being overweight or obese (body mass index 27-40), and one or more other risk factors for type 2 diabetes. Participants were randomized into an Internet behavioral e-counseling group or basic Internet group and seen at baseline, 3 months, 6 months, and 12 months for measurements including weight, waist circumference, and fasting glucose. All participants were included in an introductory weight loss session, during which Internet navigation and login procedures were demonstrated. During this session, they also received standard weight-control instruction on diet, exercise, and behavior change. In addition, all participants were encouraged to monitor their diet and exercise habits daily using journals and calorie books provided. The basic Internet group used the website for tutorials on weight loss, weekly tips and links, and a directory of Internet weight loss resources. The Internet behavioral e-counseling group followed the same procedures as the basic Internet group. In addition, they communicated by e-mail with a weight loss counselor and were instructed to submit daily diaries for the first month and then were given the option to submit daily or weekly diaries thereafter. During the first month, the counselor sent e-mails five days per week, and in the remaining 11 months, weekly e-mails were sent. These e-mails provided feedback, reinforcement, recommendations for change, and answers to questions. The e-counseling group showed greater reductions in weight, percentage body weight, body mass index, and waist circumference. The basic Internet group lost an average of 4.4 kilograms in one year, while the e-counseling group doubled the percentage of body weight lost by the basic Internet group. Fasting plasma glucose was significantly higher in the e-counseling group at 3 months, but no difference between the two groups was observed at 12 months. Both groups significantly reduced their caloric intake, although the behavioral e-counseling group reduced the percentage of calories from fat by 4% as compared to 1% in the basic Internet group. This study shows that "Internet behavioral programs may offer an alternative to more burdensome clinic programs" (131) and that Internet interventions can be used for longer periods of time, which is necessary for treatment of chronic diseases.

Similar to the previously mentioned physical activity study on adults with Type II diabetes (131), this study also demonstrated that a more personalized intervention was most successful in changing behaviors. While the basic Internet group did not lose as much weight as the behavioral e-

counseling group, the weight loss was significant, nevertheless. This is a further indication that repeated exposure to an intervention, such as the calcium website, with follow-up may be more effective for behavior change than a simple intervention on one occasion without follow-up.

Another study of an Internet-based physical activity intervention was published in 2003 (132). Sixty-five sedentary adult employees of several large hospitals (9 men and 56 women) were randomly assigned to a wait-list control or intervention group. The intervention included access to a web site (based on social cognitive theory and targeted toward the stages of motivational readiness) and weekly e-mail tips sheets. Tip sheets included topics such as getting started, monitoring progress, setting goals, rewards, and getting support. The data was collected via telephone interviews, and these assessments occurred at baseline, one month into the trial, and again at three months. The control group members completed the assessments at the same time as the intervention group but were told they would have to wait three months to participate. At the end of three months, they were given access to the intervention. Results demonstrated that at one month, the intervention group was significantly more likely to have progressed in stage of motivational readiness than the control group ($p<0.05$). They also exhibited significantly higher levels of walking minutes and moderate exercise level minutes than the control group. At three months, only the walking minutes remained significant. This study demonstrates that a theoretically based physical activity website, along with weekly e-mail tip sheets, can have an impact on motivation and behaviors at one and three months.

Unfortunately, due to the nature of the physical activity study, it is impossible to determine whether the website, the weekly emails, or a combination of both was responsible for the changes. However, it is clear that the website, accessed multiple times by each subject, in combination with the weekly emails, was successful for changing behaviors. Thus, these three studies (129, 131, 132) clearly demonstrate that the addition of follow-up, individual tailoring, and multiple viewings of the website may hold the key to website interventions successful at changing behaviors.

Overall Conclusions

An increase in knowledge scores on the COPA Questionnaire was demonstrated from pretest to posttest. This finding is important because knowledge is a predisposing factor that provides rationale or motivation for behavior change (139). Research has also shown that a lack of knowledge about calcium content of foods and daily calcium needs may affect intake (6). The lack of change in attitude and behavior in this study is also important because it demonstrates that a website should not stand alone as a tool for health promotion. Instead, it should be used to promote and reinforce the desired change. The three studies mentioned above (129, 131, 132) published after this investigation began show increased effectiveness of website interventions when used in combination with follow-up techniques and continued monitoring, such as e-counseling and emails with tip sheets and reminders so that a sufficient dose of intervention was achieved.

Future Directions

To assess the effectiveness of nutrition education efforts, a more accurate dietary assessment measurement of calcium intake is needed. In addition, even though the website addressed most aspects of the model, it was not effective in increasing calcium intake in the youth who participated. Unfortunately, the website cannot address certain reinforcers of behavior change, such as tasting high calcium foods. It is possible that the website does not deliver enough of a dose of intervention and should not be expected to stand alone as an intervention, but to serve as a tool to augment other efforts to increase intake of high calcium foods. Therefore, other supplemental activities need to be included as a follow up to the website intervention. Examples of follow up activities may include:

- A recipe testing session might be implemented in days following the classroom viewing of the website to reinforce the recipe ideas given on the website.
- Teachers or practitioners could give students or patients a self-assessment worksheet to keep track of calcium intake for a set period of time. This would help students/patients to identify how much calcium they are consuming and if they are consuming enough.

- A check-sheet to take home and use for a "shelf inventory" or even a field trip to the supermarket might be an effective way to reinforce label reading taught on the website.
- A simple focused classroom or group discussion after viewing the website might be effective for reinforcing information learned on the website.
- Especially for young children, parents have a major influence on learning, calcium attitudes and intake (110, 111, 149). Thus, for maximum effectiveness with children, parents should always be involved. Parents might be invited to participate in follow-up activities using the website at home with their children.

REFERENCES

1. Osteoporosis: National Osteoporosis Foundation; 2002. www.nof.org. Accessed May 2, 2003.

2. Cooper C. The problem: health impact of osteoporosis. *Scand J Rheumatol*. 1996;25 (Suppl):3-5.

3. Matkovic V. Nutrition, genetics, and skeletal development. *J Am Coll Nutr*. 1996;15:556-569.

4. Matkovic V, Kostial K, Simonovic I, Buzina R, Brodarec A, Nordin B. Bone status and fracture rates in two regions of Yugoslavia. *Am J Clin Nutr*. 1979;32:540-549.

5. Cavadini C, Siega-Riz AM, Popkin BM. US adolescent food intake trends from 1965 to 1996. *Arch Dis Child*. 2000;83:18-24.

6. Harel Z, Riggs S, Vaz R, White L, Menzies G. Adolescents and calcium: what they do and do not know and how much they consume. *J Adolesc Health*. 1998;22:225-228.

7. Barger-Lux MJ, Heaney RP. The role of calcium intake in preventing bone fragility, hypertension, and certain cancers. *J Nutr*. 1994;124 (Suppl):1406S-1411S.

8. Flory J, Wayne-Doppke J. Internet 20/20: experts review 1997 and look ahead. *Med On the Net*. 1997;3:9-14.

9. Chapman KM, Chan MW, Clark CD. Factors influencing dairy calcium intake in women. *J Am Coll Nutr*. 1997;14:336-340.

10. Connors P, Bednar C, Klammer S. Cafeteria factors that influence milk-drinking behaviors of elementary school children: Grounded Theory approach. *Society Nutr Educ*. 2001;33:31-36.

11. Horwath CC, Govan CH, Campbell AJ, Busby W, Scott V. Factors influencing milk and milk product consumption in young and elderly women with low calcium intakes. *Nutr Res*. 1995;15:1735-1745.

12. Klesges RC, Harmon-Clayton K, Ward KD, Kaufman EM, Haddock K, Talcott GW, Lando HA. Predictors of milk consumption in a population of 17- to 35-year-old military personnel. *J Am Diet Assoc*. 1999;99:821-826.

13. Zablah EM, Reed DB, Hegsted M, Deenan MJ. Barriers to calcium intake in African-American women. *J Hum Nutr Diet*. 1999;12:122-132.

14. Herrington J, Oliver R. Multimedia, magic, and the way students respond to a situated learning environment. *Austr J Educ Technol*. 1998;13:127-143.

15. Fotheringham MJ, Owies D, Leslie E, Owen N. Interactive health communication in preventative medicine: Internet-based strategies in teaching and research. *Am J Prevent Med*. 2000;19:113-120.

16. Mittman R, Cain M. The Future of the Internet in Health Care: A Five-Year Forecast. In: Rice RE, Katz JE, eds. *The Internet and Health Communication*. Thousand Oaks, CA: Sage Publications, Inc.; 2001.

17. Homer C, Susskind O, Alpert HR, Owusu C, Schneider L, Rappaport LA, Rubin DH. An evaluation of an innovative multimedia educational software program for asthma management: report of a randomized, controlled trial. *Pediatr*. 2000;106:210-215.

18. Bosworth K, Gustafson DH, Hawkins RP. BARN System: use and impact of adolescent health promotion via computer. *Comput Human Behav*. 1994;10:467-485.

19. Schubiner H, Sikand A. Comparison of a computer interactive videodisc program to teacher led sexuality education. *J Adolesc Health*. 1994;15:66 (Abstract).

20. Campbell MK, DeVellis BM, Strecher VJ, Ammerman AS, DeVellis RF, Sandler RS. Improving dietary behavior: the effectiveness of tailored messages in primary care settings. *Am J Public Health*. 1994;84:783-787.

21. Brug J, Steenhuis I, Van Assema P, De Vries H. The impact of a computer-tailored nutrition intervention. *Prevent Med*. 1996;25:236-242.

22. Evans JHC, Collier J, Crook I, Garrud P, Harris P, Mackinlay DRE, Redsell SA. Using multimedia for patient information--A program about nocturnal enuresis. *Br J Urol*. 1998;81:120-122.

23. Hornhung RL, Lennon PA, Garrett JM, DeVellis RF, Weinberg PD, Strecher VJ. Interactive computer technology for skin cancer prevention targeting children. *Am J Prevent Med*. 2000;18:69-76.

24. Lindsay GM, Christie J, Gaw A, Packard CJ, Shepherd J. Educating children about heart disease. *Nurs Stand*. 1994;8:32-35.

25. Petersen M. What are blood counts? A computer-assisted program for pediatric patients. *Pediatr Nurs*. 1996;22:21-25.

26. Paperny DMN. Automated adolescent preventative services using computer-assisted video multimedia. *J Adolesc Health*. 1994;15:66 (Abstract).

27. Schinke SP, Moncher MS, Singer BR. Native American youths and cancer risk reduction. *J Adolesc Health*. 1994;15:105-110.

28. Thomas R, Cahill J, Santilli L. Using an interactive computer game to increase skill and self-efficacy regarding safer sex negotiation: field test results. *Health Educ Behav*. 1997;24:71-86.

29. Reed DB, Bielamowicz MK, Frantz CL, Rodriguez FM. Clueless in the Mall: a website on calcium for teens. *J Am Diet Assoc*. 2002; 102:S73-S76.

30. Miller GD, Jarvis J, McBean LD. The importance of meeting calcium needs with foods. *J Am Coll Nutr*. 2001;20:168S-185S.

31. National Institutes of Health. NIH Consensus Panel on optimal calcium intake: optimal calcium intake. *JAMA*. 1994;272:1942-1948.

32. National Institutes of Child Health and Human Development, National Institutes of Health, US Department of Health and Human Services. Childhood and adolescent nutrition: Why milk matters now for children and teens. Rockville, MD: NICHD Clearinghouse; 1998.

33. Institute of Medicine. Dietary Reference Intakes for Calcium. Phosphorus, Magnesium, Vitamin D, and Fluoride. Washington, DC: Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, National Academy Press; 1997.

34. US Department of Health and Human Services. Healthy People 2010. Conference Edition, in two volumes ed. Washington, DC; 2000:19-32. Available at www.health.gov/healthypeople.

35. The American Dietetic Association. Position of the American Dietetic Association: Vitamin and mineral supplementation. *J Am Diet Assoc*. 1996;96:73-77.

36. The American Dietetic Association and Dietitians of Canada. Position of the American Dietetic Association and Dietitians of Canada: women's health and nutrition. *J Am Diet Assoc*. 1999;99:738-751.

37. American Medical Association, Council on Scientific Affairs. Intake of dietary calcium to reduce the incidence of osteoporosis. *Arch Fam Med*. 1997;6:495-499.

38. American Academy of Pediatrics Committee on Nutrition. Calcium requirements of infants, children and adolescents. *Pediatr*. 1999;104:1152-1157.

39. National Osteoporosis Foundation. Physician's Guide to Prevention and Treatment of Osteoporosis. Washington, DC: National Osteoporosis Foundation; 1999.

40. Murray TM. Prevention and management of osteoporosis: Consensus statements from the Scientific Advisory Board of the Osteoporosis Society of Canada. *Canadian Med Assoc J*. 1996;155 (Suppl):935S-939S.

41. Dawson-Hughes B. Calcium, vitamin D, and risk of osteoporosis in adults: essential information for the clinician. *Nutr Clin Care*. 1998;1:63-70.

42. Packard PT, Heaney RP. Medical nutrition therapy for patients with osteoporosis. *J Am Diet Assoc*. 1997;97:414-417.

43. Recker RR, Hinders S, Davies KM, Heaney RP, Stegman MR, Lappe JM, Dimmel DB. Correcting calcium nutritional deficiency prevents spine fractures in elderly women. *J Bone Miner Res*. 1996;11:1961-1966.

44. Heaney RP, McCarron DA, Dawson-Hughes B, Oparil S, Berga SL, Stern JS, Barr SI, Rosen CJ. Dietary changes favorably affect bone remodeling in older adults. *J Am Diet Assoc*. 1999;99:1228-1233.

45. Devine A, Prince RL, Bell R. Nutritional effect of calcium supplementation by skim milk powder or calcium tablets on total nutrient intake in postmenopausal women. *Am J Clin Nutr*. 1996;64:731-737.

46. Heaney RP. Food: what a surprise! *Am J Clin Nutr*. 1996;64:791-792.

47. Heaney RP. Calcium, dairy products and osteoporosis. *J Am Coll Nutr*. 2000;19 (Suppl):83S-99S.

48. Gerrior S, Putnam J, Bente L. Milk and milk products: their importance in the American diet. *Food Rev*. 1998;21:29-37.

49. Fleming KH, Heimbach JT. Consumption of calcium in the US: food sources and intake levels. *J Nutr*. 1994;124 (Suppl):1426S-1430S.

50. Barr SI. Associations of social and demographic variables with calcium intakes of high school students. *J Am Diet Assoc*. 1994;94:260-269.

51. US Department of Agriculture, Agriculture Research Service. USDA Nutrient Database for Standard Reference, Release 12: Nutrient Data Laboratory; 1998. Available at www.nal.usda.gov/fnic/foodcomp.

52. Whitney EN, Rolfes SR. *Understanding Nutrition*. Ninth ed. Belmont, CA: Wadsworth/Thompson Learning; 2002.

53. Weaver CM, Heaney RP, Martin BR, Fitzsimmons ML. Human calcium absorption from whole-wheat products. *J Nutr*. 1991;121:1769-1775.

54. Gueguen L, Pointillart A. The bioavailability of calcium. *J Am Coll Nutr*. 2000;19 (Suppl):119S-136S.

55. Weaver CM, Proulx WR, Heaney RP. Choices for achieving adequate dietary calcium with a vegetarian diet. *Am J Clin Nutr*. 1999;70 (Suppl):543S-548S.

56. Heaney RP. Dietary protein and phosphorus do not affect calcium absorption. *Am J Clin Nutr*. 2000;72:758-761.

57. Parker-Pope T. Flood of new products may push some to get too much calcium. *Wall St J*; 2000.

58. Springen K. Calcium overload. *Newsweek*; 2000. www.MSNBC.com. Accessed March 14, 2001.

59. Bryant RJ, Cadogan J, Weaver CM. The new dietary reference intakes for calcium: implications for osteoporosis. *J Am Coll Nutr*. 1999;18 (Suppl):406S-412S.

60. Miller GD, Anderson JJB. The role of calcium in prevention of chronic diseases. *J Am Coll Nutr*. 1999;18:371S-372S.

61. Anonymous. Too many calcium-fortified foods? *Tufts University Health & Nutrition Newsletter*. 2000;17:6-7.

62. Heaney RP, Dowell MS, Rafferty K, Dierman J. Bioavailability of the calcium in fortified soy imitation milk, with some observations on method. *Am J Clin Nutr*. 2000;71:1166-1169.

63. Lindner L. New! Improved! Dangerous! *Special to the Washington Post*; 2000:z12.

64. Anonymous. How to choose a calcium supplement. *Nutr Clin Care*. 1998;1:100.

65. Sarubin A. *The health professional's guide to popular dietary supplements*. Chicago, IL: The American Dietetic Association; 1999:55-63.

66. Ilich-Ernst JZ, McKenna AA, Badenhop NE, Clairmont A, Andon M, Nahhad R, Goel P, Matkovic V. Iron status, menarche, and calcium supplementation in adolescent girls. *Am J Clin Nutr*. 1998;68:880-887.

67. Kalkwarf HJ, Harrast S. Effects of calcium supplementation and lactation on iron status. *Am J Clin Nutr*. 1998;67:1244-1249.

68. McKenna A, Ilich-Ernst JZ, Andon M, Wang C, Matkovic V. Zinc balance in adolescent females consuming a low-or high-calcium diet. *Am J Clin Nutr*. 1997;65:1460-1464.

69. Stang J, Story M, Harnack L, Neumark-Sztainer D. Relationships between vitamin and mineral supplement use, dietary inake, and dietary adequacy among adolescents. *J Am Diet Assoc*. 2000;100:905-910.

70. McBean LD, Forgac T, Finn SC. Osteoporosis: visions for care and prevention--a conference report. *J Am Diet Assoc*. 1994;94:668-671.

71. Shils ME, Olson JA, Shike M, Ross AC. Osteoporosis. *Modern Nutrition in Health and Disease*. 9th ed. Baltimore, MD: Lippincott Williams and Wilkins; 1999:1353-1364.

72. Lane NE. *The Osteoporosis Book*. New York, NY: Oxford University Press; 1999.

73. Ullom-Minnich P. Prevention of osteoporosis and fractures. *Am Fam Physician*. 1999;60:194-202.

74. Heaney RP. Normalizing calcium intake: projected population effects for body weight. *J Nutr*. 2003;133 (Suppl):268S-270S.

75. Terry P, Baron J, Bergkvist L, Holmberg L, Wolk A. Dietary calcium and vitamin D intake and risk of colorectal cancer: a prospective cohort study in women. *Nutr Cancer*. 2002;43:39-46.

76. Teegarden D. Calcium intake and reduction in weight regulation. *J Nutr*. 2003;133:249S-251S.

77. Zemel M, Shi H, Greer B, DiRienzo D, Zemel P. Regulation of adiposity by dietary calcium. *FASEB J*. 2000;14:1132-1138.

78. Miller GD, DiRienzo D, Reusser ME, McCarron DA. Benefits of dairy product consumption on blood pressure in humans: a summary of the biomedical literature. *J Am Coll Nutr*. 2000;19 (Suppl):147S-164S.

79. Appel LJ, Moore T, Obarzanek E, Vollmer W, Svetdey L, Sacks F, Bray G, Vogt T, Cutler J, Windhauser M, Lin P, Karanja N, for the DASH Collaborative Research Group. A clinical trial of the effects of dietary patterns on blood pressure. *N Engl J Med*. 1997;336:1117-1124.

80. Birkett N. Comments on a meta-analysis on the relationship between dietary calcium intake and blood pressure. *Am J Epidemiol*. 1998;148:223-228.

81. Griffith L, Guyatt G, Cook R, Bucher H, Cook D. The influence of dietary and nondietary calcium supplementation on blood pressure: an updated meta-analysis of randomized controlled trials. *Am J Hypertens*. 1999;12:84-92.

82. McCarron DA, Reusser ME. Finding consensus in the dietary calcium-blood pressure debate. *J Am Coll Nutr*. 1999;18 (Suppl):398S-405S.

83. Miller GD, Jarvis J, McBean LD. *Handbook of Dairy Foods and Nutrition*. 2nd ed. Boca Raton, FL: CRC Press; 1999.

84. Obarzanek E, Moore T. The Dietary Approaches to Stop Hypertension (DASH) Trial. *J Am Diet Assoc*. 1999;99 (Suppl):9S-104S.

85. Holt PR. Dairy foods and prevention of colon cancer: human studies. *J Am Coll Nutr*. 1999;18 (Suppl):379S-391S.

86. Holt PR, Atillasoy E, Gilman J, Guss J, Moss S, Newmark H, Fan K, Yang K, Lipdin M. Modulation of abnormal colon epithelial cell proliferation and differentiation by low-fat dairy foods: a randomized controlled trial. *JAMA*. 1998;280:1074-1079.

87. Lupton J. Dairy products and colon cancer: mechanisms of the protective effect. *J Am Coll Nutr*. 1997;66:1065-1066.

88. Baron J, Beach M, Mandel J, Van Stolk R, Haile R, Sandler RS, Rothstein R, Summers R, Snover D, Beck G, Bond J, Greenberg E, for the Calcium Polyp Prevention Study Group. Calcium supplements for the prevention of colorectal adenomas. *N Engl J Med*. 1999;340:101-107.

89. Iso H, Stampfer MJ, Manson J, Rexrode K, Hennekens CH, Colditz GA, Speizer FE, Willett WC. Prospective study of calcium, potassium, and magnesium intake and risk of stroke in women. *Stroke*. 1999;30:1772-1779.

90. Abbott R, Curb J, Rodriguez B, Sharp D, Burchfiel C, Yano K. Effect of dietary calcium and milk consumption on risk of thromboembolic stroke in older middle-aged men. The Honolulu Heart Program. *Stroke*. 1996;27:813-818.

91. Curhan G, Willett WC, Speizer FE, Spiegelman D, Stampfer MJ. Comparison of dietary calcium with supplemental calcium and other nutrients as factors affecting the risk for kidney stones in women. *Ann Intern Med*. 1997;126:497-504.

92. Heller H. The role of calcium in the prevention of kidney stones. *J Am Coll Nutr*. 1999;18 (Suppl):373S-378S.

93. Thys-Jacobs S. Micronutrients and the premenstrual syndrome: the case for calcium. *J Am Coll Nutr*. 2000;19:220-227.

94. Thys-Jacobs S, Starkey P, Bernstein D, Tian J, and the Premenstrual Syndrome Study Group. Calcium carbonate and the premenstrual syndrome: effects on premenstrual and menstrual symptoms. *Am J Obstetrics Gynecol*. 1998;179:444-452.

95. Alaimo K, McDowell M, Briefel R, Bischof A, Caughman C, Loria C, Johnson C. Dietary intake of vitamins, minerals, and fiber of persons ages 2 months and over in the United States: Third National Health and Nutrition Examination Survey, phase 1, 1988-1991. Hyattsville, MD: National Center for Human Statitstics; 1994.

96. U.S. Department of Agriculture, Agricultural Research Service. Data Tables: Results from USDA's 1994-96 Continuing Survey of Food Intakes by Individuals and 1994-96 Diet and Knowledge Survey. Riverdale, MD: ARS, USDA; 1999. Available at www.barc.usda.gov/bhnrc/foodsurvey/home.htm.

97. US Department of Agriculture, Agricultural Research Service. Food and Nutrient Intakes by Children 1994-96, 1998. Beltsville, MD: ARS, USDA; 1999. Available at www.barc.usda.gov/bhnrc/foodsurvey/home.htm.

98. Yates AA, Schlicker SA, Suitor CW. Dietary Reference Intakes: the new basis for recommendations for calcium and related nutrients, B vitamins, and choline. *J Am Diet Assoc*. 1998;98:699-706.

99. Teegarden D, Proulx WR, Martin BR, Zhao J, McCabe GP, Lyle RM, Peacock M, Slemenda C, Johnston CC, Weaver CM. Peak bone mass in young women. *J Bone Miner Res*. 1995;10:711-715.

100. U.S. Department of Agriculture, Agricultural Research Service, Food Surveys Research Group. Pyramid servings data. Results from USDA's 1994-96 continuing survey of food intakes by individuals. Riverdale, MD: ARS, USDA; 1999. Available at www.barc.usda.gov/bhnrc/foodsurvey/home.htm.

101. Putnam J. Major trends in US food supply, 1909-99. *Food Rev*. 2000;23:8-15.

102. Albertson AM, Tobelmann RC, Marquart L. Estimated dietary calcium intake and food sources for adolescent females: 1980-92. *J of Adolesc Health*. 1997;20:20-26.

103. Neumark-Sztainer D, Story M, Dixon LB, Resnick MD, Blum RW. Correlates of inadequate consumption of dairy products among adolescents. *J Nutr Educ*. 1997;29:12-20.

104. Subar A, Krebs-Smith S, Cook A, Kahle L. Dietary sources of nutrients among US children, 1989-91. *Pediatr*. 1998;102:913-923.

105. Johnson RK, Panely C, Wang MQ. The association between noon beverage consumption and the diet quality of school-age children. *J Child Nutr Management*. 1998;22:95-100.

106. Harnack L, Stang J, Story M. Soft drink consumption among US children and adolescents: nutritional consequences. *J Am Diet Assoc*. 1999;99:436-441.

107. Lytle LA, Seifert S, Greenstein J, McGovern P. How do children's eating patterns and food choices change over time? Results from a cohort study. *Am J Health Promot*. 2000;14:222-228.

108. Wyshak G. Tenaged girls, carbonated beverage consumption, and bone fractures. *Arch Pediatr Adolesc Med*. 2000;154:610-613.

109. Guthrie JF. Dietary patterns and personal characteristics of women consuming recommended amounts of calcium. *Fam Econ Nutr Rev*. 1996;9:33-49.

110. Ulrich CM, Georgiou CG, Snow-Harter CM, Gillis DE. Bone mineral density in mother-daughter pairs: relations to lifetime exercise, lifetime milk consumption, and calcium supplements. *Am J Clin Nutr*. 1996;63:72-79.

111. Novotny R, Han J-S, Biernacke I. Motivators and barriers to consuming calcium-rich foods among Asian adolescents in Hawaii. *J Nutr Educ*. 1999;31:99-104.

112. Gillman MW, Rifas-Shiman SL, Frazier L, Rockett HR, Camargo CA, Field AE, Berkey CS, Colditz GA. Family dinner and diet quality among older children and adolescents. *Arch Fam Med*. 2000;9:235-240.

113. Chapman G, Maclean H. "Junk food" and "healthy food": Meanings of food in adolescent women's culture. *J Nutr Educ*. 1993;25:108-113.

114. Neumark-Sztainer D, Story M, Perry C, Casey MA. Factors influencing food choices of adolescents: findings from focus group discussions with adolescents. *J Am Diet Assoc*. 1999;99:929-934, 937.

115. Reed DB, McCarron Meeks P, Nguyen L, Cross EW, Garrison B. Assessment of nutrition education needs related to increasing dietary calcium intake in low-income Vietnamese mothers using focus group discussions. *Society Nutr Educ*. 1998;30:155-163.

116. Bonjour JP, Carrie AL, Ferrari S, Clavien H, Slosman D, Theintz G, Rizzoli R. Calcium-enriched foods and bone mass growth in prepubertal girls: a randomized, double-bling, placebo-controlled trial. *J Clin Invest*. 1997;99:1287-1294.

117. McBean LD, Miller GD. Allaying fears and fallacies about lactose intolerance. *J Am Diet Assoc*. 1998;98:671-676.

118. Suarez FL, Savaiano DA, Levitt MD. A comparison of symptoms after the consumption of milk or lactose-hydrolyzed milk by people with self-reported severe lactose intolerance. *N Engl J Med*. 1995;333:1-4.

119. Suarez FL, Savaiano DA, Arbisi P, Levitt MD. Tolerance to the daily ingestion of two cups of milk by individuals claiming lactose intolerance. *Am J Clin Nutr*. 1997;65:1997.

120. Suarez FL, Adshead J, Fume JK, Levitt MD. Lactose maldigestion is not an impediment to the intake of 1,500 mg calcium daily as dairy products. *Am J Clin Nutr*. 1998;68:1118-1122.

121. Pribila BA, Hertzler SR, Martin BR, Weaver CM, Savaiano DA. Improved lactose digestion and intolerance among African-American adolescent girls fed a dairy-rich diet. *J Am Diet Assoc*. 2000;100:524-528.

122. Guthrie F, Derby BM, Levy AS. What people know and do not know about nutrition. In: Frazao E, ed. *America's Eating Habits: Changes and Consequences*. Agriculture Information Bulletin No. 750 vol. Washington, DC: US Department of Agriculture, Economic Research Service, Food and Rural Economics Division; 1999:243-280.

123. Food Marketing Institute. Trends in the United States. Consumer attitudes and the supermarket. Washington, DC: Food Marketing Institute; 2000.

124. Carruth BR, Skinner JD, Moran III JD, Coletta F. Preschoolers' food product choices at a simulated point of purchanse and mothers' consumer practices. *J Nutr Educ*. 2000;32:146-151.

125. Tepper BJ, Nayga RMJ. Awareness of the link between bone disease and calcium intake is associated with higher dietary calcium intake in women aged 50 years and older: results of the 1991 CSFII-DHKS. *J Am Diet Assoc*. 1991;98:196-198.

126. Elbon SM, Johnson MA, Fischer JG. Milk consumption in older Americans. *Am J Public Health*. 1998;88:1221-1224.

127. Stehr-Green P, Dini E, Lindergren M, Patriarca P. Evaluation of telephoned computer generated reminders to improve immunization coverage at inner-city clinics. *Public Health Rep*. 1993;108:426-430.

128. Alemi F, Alemangno S, Goldhagen J. Computer reminders improve on-time immunization rates. *Med Care*. 1996;34:OS45-51.

129. McKay H, King D, Eakin E. The Diabetes Network Internet-based Phsical Activity Intervention. *Diabetes Care*. 2001;24:1328-1334.

130. Helwig A, Lovelle A, Guse C, Gottlieb M. An office-based internet patient education system: a pilot study. *J Fam Pract*. 1999;48:123-127.

131. Tate D, Jackvony E, Wing R. Effects of Internet behavioral counseling on weight loss in adults at risk for Type 2 Diabetes. *JAMA*. 2003;289:833-836.

132. Napolitano M, Fotheringham MJ, Tate D, Eva L, Bauman A, Marcus B. Evaluation of an Internet-based physical activity intervention: a preliminary investigation. *Ann Behav Med*. 2003;25:92-99.

133. Kolasa K, Poehlman G, Jobe A. Virtual seminars for disseminating medical nutrition education curriculum ideas. *Am J Clin Nutr*. 2000;71:1403-1404.

134. Lewis D, Nath C. Feasibility of a kiosk-based patient education system in a busy outpatient clinic setting. *Diabetes Educ*. 1997;23:577-81, 585-586.

135. Schneider W, Furth P, Blalock T, Sherrill T. A pilot study of a headache program in the workplace: the effect of education. *J Occup Environ Med*. 1999;41:202-209.

136. Patrick K. Information technology and the future of preventative medicine. *Am J Prevent Med*. 2000;19:132-135.

137. Fox S, Rainie L. The online health care revolution: how the web helps Americans take better care of themselves. Washington, DC: Pew Internet and American Life Project; 2000:1-23. http://www.pewinternet.org/. Accessed May 15, 2003.

138. Rainie L, Packel D, Fox S. More online, doing more: 16 million newcomers gain Internet access in the last half of 2000 as women, minorities, and families with modest incomes continue to surge online: Pew Internet and American Life Project; 2001. www.pewinternet.org. Accessed May 15, 2003.

139. Fotheringham MJ, Bauman A, Leslie E, Owen N. Computer use and physical activity in young adults: public health perils and potentials of new information technologies. *Ann Behav Med*. 2000;22:269-275.

140. Fotheringham MJ. Computer use-- a barrier to physical activity? *2nd annual meeting of the Society of Behavior Medicine*. Seattle, WA; 2001.

141. A nation online: how Americans are expanding their use of the Internet. Washington, DC: Department of Commerce, National Telecommunications and Information Administration and Economics and Statistics Administration; 2002.

142. Horrigan J, Rainie L. Getting serious online. Washington, DC: Pew Internet and American Life Project; 2002. www.pewinternet.org. Accessed May 15, 2003.

143. Taylor H. Cyberchondriacs Update, Harris Poll No. 19; 2003. www.harisinteractive.com. Accessed May 15, 2003.

144. Taylor H. Cyberchondriacs Update, Harris Poll No. 21; 2003. www.harrisinteractive.com. Accessed May 15, 2003.

145. Baker L, Wagner T, Singer S, Bundorf K. Use of the Internet and e-mail for health care information. *JAMA*. 2003;289:2400-2406.

146. Horrigan J. Pew Internet Project data memo: adoption of broadband to the home. 2003 vol: Pew Internet and American Life Project; 2003. www.pewinternet.org. Accessed May 15, 2003.

147. NPR, Kaiser, and Kennedy School. Kids and technology survey 2000; October 2000. Available at www.npr.org/programs/specials/poll/technology.

148. Borzekowski DLG, Vaughn R. Adolescent cybersurfing for health information: a new resource that crosses barriers. *Arch Pediatr Adolesc Med*. 2001;155:813-817.

149. Hughes FP, Noppe LD, Noppe IC. Cognitive Development. *Child Development*. Upper Saddle River, NJ: Prentice-Hall, Inc.; 1996:167-192.

150. Marcus B, Nigg C, Riebe D, Forsyth L. Interactive communication strategies: implications for population-based physical activity promotion. *Am J Prevent Med*. 2000;19:121-126.

151. Robinson TN, Patrick K, Eng T, Gustafson DH. An evidenced-based approach to interactive health communication. *JAMA*. 1998;280:1264-1269.

152. Gustafson DH, Robinson TN, Ansley D. Consumers and evaluation of interactive health communication application. *Am J Prevent Med*. 1999;16:23-29.

153. Lenhart A, Horrigan J, Rainie L, Allen K, Boyce A, Madden M, O'Grady E. The ever-shifting Internet population. Washington, DC: Pew Internet and American Life Project; 2003. www.pewinternet.org. Accessed May 15, 2003.

154. Borzekowski DLG, Rickert VI. Urban girls, Internet use, and accessing health information. *J Pediatr Adolesc Gynecol*. 2000;13:94-95.

155. 50% of Hispanic adults are now online. Washington, DC: Pew Internet & American Life Project; 2001. www.pewinternet.org. Acessed May 15, 2003.

156. Field AE, Peterson KE, Gortmaker SL, Cheung L, Rockett HR, Fox MK, Colditz GA. Reproducibility and validity of a food frequency questionnaire among fourth to seventh grade inner-city school children: implications of age and day-to-day variation in dietary intake. 1999.

157. Nicklas TA. Dietary studies of children and young adults (1973-1988): the Bogalusa Heart Study. *Am J Med Sci*. 1995;310 (Suppl):S101-S108.

158. Field AE, Wolf AM, Herzog DB, Cheung L, Colditz GA. The relationship of caloric intake to frequency of dieting among preadolescent and adolescent girls. *J Am Acad Child Adolesc Psychiatry*. 1993;32:1246-1252.

159. Merzenich H, Boeing H, Wahrendorf J. Dietary fat and sports activity as determinants of menarche. *Am J Epidemiol*. 1993;138:217-224.

160. Block G. A review of validations of dietary assessment methods. *Am J Epidemiol*. 1982;115:492-505.

161. Friis S, Kruger Kjaer S, Stripp C, Overvad K. Reproducibility and relative validity of a self-administered semiquantitative food frequency questionnaire applied to younger women. *J Clin Epidemiol*. 1997;50:303-311.

162. Briefel R, Flegal K, Winn D, Loria C, Johnson C, Sempos C. Assessing the nation's diet: limitations of the food frequency questionnaire. *J Am Diet Assoc*. 1992;92:959-962.

163. Krall EA, Dwyer JT, Coleman KA. Factors influencing accuracy of dietary recall. *Nutr Res*. 1988;8:829-841.

164. Hoelscher D. Personal Communication; 2001.

165. Street RL, Rimal RN. Health Promotion and Interactive Technology: A Conceptual Foundation. In: Street RL, Gold WR, Manning T, eds. *Health Promotion and Interactive Technology: Theoretical Applications and Future Directions*. Mahwah, New Jersey: Lawrence Erlbaum Associates; 1997:1-18.

APPENDIX A

INFORMED CONSENT DOCUMENTS

Parental Consent Form

Decision about My Son's/Daughter's Participation in the Testing of a Food Frequency Questionnaire (FFQ) Research Study

My son/daughter is invited to participate in a nutrition education research study. The purpose of this study is to test a Food Frequency Questionnaire (FFQ) given in a small group of two to four students compared to the same questionnaire given individually by a researcher. Students will be placed in either the small group FFQ category or the individual FFQ category. Then all students will switch groups and complete the questionnaire a second time. This questionnaire will be used this fall with a different group of students to test the effect of a website about nutrition.

I understand that for my son/daughter to take part in the study, he/she will:

1. Sign up during Wednesday night or Sunday morning activities.
2. Fill out a survey individually with a researcher about food and exercise habits
3. Fill out the same survey in a small group including one or two other students with a researcher guiding all students at the same time on **Sunday, September 9th at 12:15pm in the Maxwell Center.**

I understand that participation is voluntary and that my son/daughter will be one of an estimated 30 students from First Baptist Church, Bryan that will take part. The study will take about 2 hours of my child's time.

I understand that there are no risks or discomforts involved in the study. Answers from the questionnaires will be confidential. Students will put their names on the surveys, but the names will be removed as soon as the student's two questionnaires are matched. However, my son/daughter may choose not to answer any questions on these surveys that make him/her feel uncomfortable.

As a benefit for participating in the study, the researchers will provide the youth group with a **free pizza lunch in the Maxwell Center** following the 10:50 worship service as well as an estimation of my son's/daughter's dietary calcium intake. They will also be informed of how their intake compares to recommended levels.

I understand that this research study has been reviewed and approved by the Institutional Review Board –Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

I understand that I must sign and return the form below by Sunday, September 9th to Carlos or Kerri for him/her to participate. My son/daughter must also sign and return the Student Assent form to indicate his/her willingness to participate.

I, _____, will allow my child,
(Printed parent/guardian's name)

_____, to participate in this study.
(Student's printed name)

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study. I have been given a copy of this consent form.

Parent/Guardian Date

_____ _____
(Signature)

Principal Investigators Date

_____ and _____ _____
(Signature) (Signature)

Valerie Henry and Amira Gerges

This study will be part of the theses of two Texas A&M graduate students, Valerie Henry and Amira Gerges.

If I have any questions about the study, I may contact the researchers:

Valerie Henry
Texas A&M University
Nutrition Graduate Student
219 Kleberg Center, 2471 TAMU
College Station, TX 77843-2471
(979) 268-4783
val_aggie@hotmail.com

or

Dr. Debra Reed, R.D., L.D.
Texas A&M University
TX Agricultural Extension Service
223 Kleberg Center, 2471 TAMU
College Station, TX 77843-2471
(979) 845- 6390
d-reed@tamu.edu

or

Amira Gerges
Texas A&M University
Nutrition Graduate Student
219 Kleberg Center, 2471 TAMU
College Station, TX 77843-2471
(979) 260-2069
amira-gerges@tamu.edu

Student Assent Form

Decision about My Participation in the Testing of a Food Frequency Questionnaire (FFQ) Research Study

I am invited to participate in a nutrition education research study. The purpose of this study is to test a Food Frequency Questionnaire (FFQ) given individually by a researcher compared to the same questionnaire given by a researcher to a small group of two to four students. I will be placed in either the small group FFQ category or the individual FFQ category. Then I will switch groups and complete the questionnaire a second time. This questionnaire will be used this fall with a different group of students to test the effect of a website about nutrition.

I understand that for me to take part in the study, I must:

1. Sign up on Wednesday night or Sunday morning activities
2. Fill out a survey individually with a researcher on my food and exercise habits and
3. Fill out the same survey in a group with one to three other students with a researcher guiding us on **Sunday September 9th at 12:15 pm in the Maxwell Center.**

I understand that participation is voluntary and that I will be one of an estimated 30 students ages 11-19 from First Baptist Church, Bryan that will take part. The study will take about 2 hours of my time.

I understand that there are no risks or discomforts involved in the study. Answers from the surveys will be confidential. I will put my name on the survey, but it will be removed as soon as the researchers match my 2 questionnaires so that my answers are kept private. However, I may choose not to answer any questions on these surveys that make me feel uncomfortable.

As a benefit for participating in the study, the researchers will provide a pizza lunch as well as an estimation of my dietary calcium intake, and I will be informed of how my intake compares to recommended levels.

I understand that this research study has been reviewed and approved by the Institutional Review Board –Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

I understand that I must sign and return the form below by Sunday, Sept. 9th to Kerri or Carlos to participate.

I, _____, want to participate in this study.
(Student's printed name)

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study. I have been given a copy of this consent form.

Student Date

_____ _____
(Signature)

Principal Investigators Date

_____ and _____ _____
(Signature) (Signature)

Valerie Henry_____ and Amira Gerges_____
(Printed Name) (Printed Name)

This study will be part of the theses of two Texas A&M graduate students, Valerie Henry and Amira Gerges.

If I have any questions about the study, I may contact the researchers:

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College Station, TX 77843-2471
(979) 260-2069
amira-gerges@tamu.edu

Parental Consent Form

Decision about My Son's/Daughter's Participation in a Nutrition Education Research Study

My son/daughter is invited to participate in a nutrition education research study. The study has two parts: one will look at the relationship between calcium intake and weight status. The purpose of this part of the study is to find out if a low calcium intake is related to being overweight. The other part will look at the effectiveness of a nutrition education website. The subject of the website is calcium, and the purpose of this part of the study is to find out if a website education approach is effective for improving eating habits.

I understand that the requirements for my son/daughter to take part in the study are:

1. That he/she fills out a survey on his/her food and exercise habits during class time at school.
2. That he/she will allow the researcher to take measurements such as height and weight during class time at school in a private room.
3. That he/she will allow the researcher to measure skinfold thickness. This process has been demonstrated by the researchers to my child. It involves a slight pinching of the skin with a small instrument. This will take place during class time at school in a private room. A witness of the same sex as my child will be present.
4. That he/she view the website during class time at school.
5. That he/she fills out a follow up survey on his/her food and exercise habits during class time at school.

I understand that participation is voluntary and that my son/daughter will be one of an estimated 300 students in grades 7-12 in the Bryan/College Station area who will take part. My son/daughter's grade will NOT be affected whether he/she participates or not, even if he/she chooses to withdraw in the middle of the study. The study will take about 4 ½ hours (5 sessions: one 30 minute session and 4 one-hour sessions) of my child's class time during this fall semester of 2001.

I understand that there are no risks or discomforts involved in the study. Answers from the surveys will be confidential. Students will put their names on the survey, but the names will be removed as soon as the student's surveys are matched so that their answers are kept private. However, my son/daughter may choose not to answer any questions on these surveys that make him/her feel uncomfortable. The benefit to my son/daughter is that he/she will learn about calcium (a critical nutrient for youth for preventing future diseases, such as osteoporosis). In addition, the researchers will provide my child an estimation of his/her calcium intake and body fat level, and he/she will be informed of how this compares to normal levels.

I understand that this research study has been reviewed and approved by the Institutional Review Board –Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

For my son/daughter to participate, I understand that I must sign and return the form below by _____ to my son/daughter's teacher. My
(date)
son/daughter must also sign and return form A to indicate his/her willingness to participate.

I, _____, will allow my child,
(Printed parent/guardian's name)

_____, to participate in this study.
(Student's printed name)

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to allow my son/daughter to participate in this study. I have been given a copy of this consent form.

Parent/Guardian Date

_____ _____
(Signature)

Principal Investigators Date

_____ and _____ _____
(Signature) (Signature)

_____ and _____ _____
(Printed Name) (Printed Name)

This study will be part of the theses of two Texas A&M graduate students, Valerie Henry and Amira Gerges.

If I have any questions about the study, I may contact the researchers:

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Student Assent Form

Decision about My Participation in Nutrition Education Research Study

I am invited to participate in a nutrition education research study. The study has two parts: one will look at the relationship between calcium intake and weight status. The purpose of this part of the study is to find out if a low calcium intake is related to being overweight. The other part will look at the effectiveness of a nutrition education website. The subject of the website is calcium, and the purpose of this part of the study is to find out if a website education approach is effective for improving eating habits.

I understand that the requirements for me to take part in the study are:

1. That I fill out a survey on my food and exercise habits during class time at school.
2. That I allow the researcher to take measurements such as height and weight during class time at school in a private room.
3. That I allow the researcher to measure skinfold thickness at different body sites. The researchers have demonstrated this process to me. This will take place during class time at school in a private room. There will be a witness there who is the same gender as me.
4. That I view the website during class time at school.
5. That I fill out a follow up survey on my food and exercise habits during class time at school.

I understand that participation is voluntary and that I will be one of an estimated 300 students in grades 7-12 in the Bryan/College Station area who will take part. My grade will NOT be affected whether I participate or not, even if I choose to withdraw in the middle of the study. The study will take about 4 ½ hours (5 sessions: one 30 minute session and 4 one-hour sessions) of my class time during the fall semester of 2001.

I understand that there are no risks or discomforts involved in the study. Answers from the surveys will be confidential. I will record my name on the survey, but it will be removed as soon as the researchers match my surveys so that my answers are kept private. However, I may choose not to answer any questions on these surveys that make me feel uncomfortable. The benefit of the study to me is that I will learn about calcium (a critical nutrient for people my age for preventing future diseases, such as osteoporosis). In addition, the researchers will provide me with an estimation of my calcium intake and body fat level, and I will be informed of how it compares to normal levels.

I understand that this research study has been reviewed and approved by the Institutional Review Board –Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

To participate, I understand that I must sign and return the form below by _____to my teacher.
(date)

I, _____, want to participate in this study.
(Student's printed name)

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study. I have been given a copy of this consent form.

Student Date

_____ _____
(Signature)

Principal Investigators Date

_____ and _____ _____
(Signature) (Signature)

_____ and _____ _____
(Printed Name) (Printed Name)

This study will be part of the theses of two Texas A&M graduate students, Valerie Henry and Amira Gerges.

If I have any questions about the study, I may contact the researchers:

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Parental Consent Form

Decision about My Son's/Daughter's Participation in a Nutrition Education Research Study

My son/daughter is invited to participate in a nutrition education research study. The study will look at the effectiveness of a nutrition education website. The subject of the website is calcium, and the purpose of the study is to find out if a website education approach is effective for improving eating habits. My son/daughter will be part of the experimental control group, thus, they will not view the website during class. Instead they will be given the website address to view it on their own if they choose after the study is completed.

I understand that the requirements for my son/daughter to take part in the study are:

1. That he/she fills out a survey on his/her food and exercise habits during class time at school.
2. That he/she fills out a follow up survey on his/her food and exercise habits during class time at school.

I understand that participation is voluntary and that my son/daughter will be one of an estimated 300 students in grades 7-12 in the Bryan/College Station area who will take part. My son/daughter's grade will NOT be affected whether he/she participates or not, even if he/she chooses to withdraw in the middle of the study. The study will take about 2 hours of my child's class time during study hall this fall semester of 2001.

I understand that there are no risks or discomforts involved in the study. Answers from the surveys will be confidential. Students will put their names on the survey, but the names will be removed as soon as the student's surveys are matched so that their answers are kept private. However, my son/daughter may choose not to answer any questions on these surveys that make him/her feel uncomfortable. The benefit to my son/daughter is that he/she will have the opportunity to learn about calcium (a critical nutrient for youth for preventing future diseases, such as osteoporosis) from the website. In addition, the researchers will provide my child an estimation of his/her calcium, and he/she will be informed of how this compares to normal levels.

I understand that this research study has been reviewed and approved by the Institutional Review Board –Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

For my son/daughter to participate, I understand that I must sign and return the form below by _____ to my son/daughter's teacher. My son/daughter must also sign and return form A to indicate his/her willingness to participate.

(date)

I, _____, will allow my child,
(Printed parent/guardian's name)

_____, to participate in this study.
(Student's printed name)

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to allow my son/daughter to participate in this study. I have been given a copy of this consent form.

Parent/Guardian Date

_____ _____
(Signature)

Principal Investigator Date

_____ _____
(Signature)

_____ _____
(Printed Name)

This study will be part of the theses of two Texas A&M graduate students, Valerie Henry and Amira Gerges.

If I have any questions about the study, I may contact the researchers:

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Student Assent Form

Decision about My Participation in Nutrition Education Research Study

I am invited to participate in a nutrition education research study. The study will look at the effectiveness of a nutrition education website. The subject of the website is calcium, and the purpose of this part of the study is to find out if a website education approach is effective for improving eating habits. I will be part of an experimental control group, which means I will not view the website in class. Instead, after the study is completed, I will be given the website address to view it on my own if I choose to.

I understand that the requirements for me to take part in the study are:

1. That I fill out a survey on my food and exercise habits during class time at school.
2. That I fill out a follow up survey on my food and exercise habits during class time at school.

I understand that participation is voluntary and that I will be one of an estimated 300 students in grades 7-12 in the Bryan/College Station area who will take part. My grade will NOT be affected whether I participate or not, even if I choose to withdraw in the middle of the study. The study will take about 2 hours of my class time during study hall this fall semester of 2001.

I understand that there are no risks or discomforts involved in the study. Answers from the surveys will be confidential. I will record my name on the survey, but it will be removed as soon as the researchers match my surveys so that my answers are kept private. However, I may choose not to answer any questions on these surveys that make me feel uncomfortable. The benefit of the study to me is that I will have the opportunity to learn about calcium (a critical nutrient for people my age for preventing future diseases, such as osteoporosis) from the website. In addition, the researchers will provide me with an estimation of my calcium intake, and I will be informed of how it compares to normal levels.

I understand that this research study has been reviewed and approved by the Institutional Review Board –Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Support Services, Office of Vice President for Research at (979) 458-4067.

To participate, I understand that I must sign and return the form below by _____to my teacher.
(date)

I, _____, want to participate in this study.
(Student's printed name)

I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study. I have been given a copy of this consent form.

Student Date

_____ _____
(Signature)

Principal Investigators Date

_____ _____
(Signature)

_____ _____
(Printed Name)

This study will be part of the theses of two Texas A&M graduate students, Valerie Henry and Amira Gerges.

If I have any questions about the study, I may contact the researchers:

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APPENDIX B

FOOD FREQUENCY QUESTIONNAIRE PROTOCOL SHEETS

Instructions to the Interviewers for the Validation Study

1. Arrive at First Baptist Church, Bryan in the Maxwell Center no later than 11:30. Bring your protocols, Food Description list, a light jacket, and a cheerful attitude! =) Meet in Room 100 of the Maxwell Center for last minute instructions.

2. Locate the room you are assigned to and be sure your station is ready to go (check for a table, the proper number of chairs, pencils, etc). If you need chairs or tables, find Valerie. If you are in a room with curtain dividers, be sure they are not closed completely so that we may enter easily to evaluate your interviews. Prop doors open with doorstops when available. Only close doors if distraction becomes a problem.

3. You may be asked to help get the kids signed in. Their name does NOT go on the official sign in sheet until you see their signed assent and parental consent forms. You may also be asked to help serve pizza to the kids. (2 slices each. When everyone has been served, they may come back for seconds.)

4. Pizza arrives about noon. As the kids trickle in, get them signed in if they have their consent forms signed. Have them put on a name tag with their sign in number written in a top corner (Ex: 01, 12, 24, etc.) You should also be wearing a name tag. The maximum number of kids we can take is 35. After that, we will not have enough pizza to feed them.

5. Eat with the kids. Also, go to the bathroom because you may not have a chance for the next 2 hours. At 12:30, we will get on a microphone and tell the kids which interviewer they are assigned to and where to go. Take the student/students assigned to you and go directly there. Start the interview promptly.

6. After 30 minutes (or less if everyone is finished), the students will all change rooms. A runner will escort the students to the appropriate room. Do not let them leave by themselves. Please note that there may be time left while you are waiting for the cue to tell the students to switch rooms. DO NOT let the student leave early. Please be friendly and talk to the student/students. Don't forget to thank the student/students and tell them they did a great job!

7. After 30 minutes (or when all interviewers are finished—you will be notified), tell the kids they are free to leave or go back to the room we ate in. At this point, you should stay in your room. The next student/students will be brought TO YOU. Begin the interview when all are present.

8. Repeat step 6.

9. At the end of the 4th interview time slot, tell your student/students they are free to leave. Please make sure your station is as clean as it was when you found it. Everyone meets in room 102 for debriefing.

Food Frequency Questionnaire (FFQ)
1 to 1 Protocol for Validation of the FFQ

I. Purpose

The purpose of the food frequency questionnaire is to collect information from students about their food intake for the previous week.

II. Study Sample and Administration

The food frequency questionnaire should be administered to Middle/High School students in the fall of 2001 pilot test.

III. Administration Protocol

A. Staff requirements

IMPACT FFQ are administered one-on-one, so each student requires one IMPACT staff member/interview. Student interviews should be conducted in a semi-private location (e.g. separate tables in an office), so that one interview does not disturb or distract the student in another interview.

B. Equipment

1. FFQ
2. Food Descriptions List
3. Supplemental Information/Interviewer Evaluation Form
4. Pencils, 1 per interviewer plus extras
5. FFQ protocol
6. Sign-in sheets
7. Name tags

C. Preparation

1. On the day of measurement, arrive no later than 11:30am at the Maxwell Center of First Baptist Church, Bryan and locate the room where you will be interviewing students. Be sure to bring your two protocol sheets for the interviews with you.
2. Make sure that you have 1 table and 2 chairs in your room at your station (Room 103 will have 3 interviewers with dividers separating each interviewer).
3. Pick up FFQ, supplemental information/interviewer form, and pencils from Valerie, Amira, or Dr. Reed. Wear a name tag.
4. Pizza is scheduled to arrive at noon. Eat lunch with the kids in Maxwell Center room 102 after your station is set up.

5. Help make sure the kids are writing their name and sign-in number on a nametag and wear it in plain view.
6. When all the kids have arrived and finished eating, we will call for the first half of the students and interviews will begin (12:30pm). Every 30 minutes, the students will move to another room. Interviewers stay in the same room for the duration of the validation study (so make sure you go to the bathroom before 12:30!).

Note: Instructions to be read aloud to the students are in *italic* types. Instructions for the IMPACT staff administrators are in plain type.

IV. Instructions for Conducting the Interview

[Introduce yourself to the student. Be friendly and relaxed. Talk with the student until he or she seems comfortable with you.]

Please fill in your sign-in number in the first 2 spaces of the "subject number" bubbles. In the third bubble column enter 1 (for a one-on-one interview*). If this is your first interview fill in a 1 in the fourth bubble or a 2 if it is your second interview.*

We would like to know what students your age eat. There are no right or wrong answers. We realize that you may eat differently each day, depending on your mood. We are interested in the foods that you ate last week-from Monday through Friday. We want you to think about those 5 days as we ask you to report how often you ate the foods on our list. Whatever you did or did not eat last week is fine.

I am going to be asking you if you have eaten a list of foods during the last week. You will answer yes or no then tell me how many times during the week or a day you ate each food.

Do you have any questions for me before we begin?

<u>Dialogue: What food did the student eat:</u>

The first food I am going to ask you about is _____. Please tell me yes or no- if you ate this food last week on Monday-Friday.

[if yes--]

You said you ate _____ last week. How many times did you eat _____? Was it weekly or daily?

So if I understood you correctly, you said you ate _____ every day/week _____ times. Is that correct? [This ensures that the response was correctly

communicated from student to interviewer and allows the student to correct him/herself if they misstated their response.]

[Write the answer- a single number in the appropriate box and then move to the next food on the FFQ.]

[if no--]

Did you eat _____ (next food on list) last week?

[Tell the student frequently that he or she is doing a good job. Smile and speak softly. Be patient and positive. Do not be surprised by what the student tells you. Respond in a neutral way to food choices (neither positive or negative). If you need to ask the student to repeat what he or she said, ask in a non-judgmental manner. Take ownership such as "It is hard for me to hear sometimes…"]

[Continue through the entire food list. The last question on the FFQ is to be read to the student.]

Please tell me if there are other foods that you ate last week that we have not mentioned on this list?

[If any food is reported ask the same questions as above about the frequency of consumption during the week or day and record the answers in the space provided.]

Review of FFQ:

[Review the completeness and the accuracy of the entire FFQ interview. Complete the FFQ by answering the questions on the FFQ Supplemental Information Form.]

[Ask the student whether last week was typical of how much he or she usually eats and record the response, along with a reason if the week was not typical.]

[At this point, be sure to prompt for vitamin/mineral supplement intake.]

Did you take a vitamin or mineral pill last week? If so, was it a multivitamin or a specific vitamin or mineral by itself?

[Be sure to collect as much information about the multivitamin/mineral supplement as possible.]

[Convey to the student his or her importance to the study and thank the student for his or her participation.]

Do you have any questions for me? You did a great job! Thanks very much for your help. You may go back to the main room now.

V. Editing interview data

The interviewer should complete the Interviewer Evaluation immediately after the interview. The FFQ should be thoroughly reviewed and edited using any notes made during the interview. Any changes to corrections to the data should be made by the interviewer on the FFQ before the end of data collection today. At the end of the data collection day, the nutrition coordinator or interviewers should review the FFQs for all students.

Food Frequency Questionnaire (FFQ)
1 to 4 Protocol

I. Purpose

The purpose of the food frequency questionnaire is to collect information from students about their food intake for the previous week. Traditionally, FFQ's are administered one to one. However, for this study we are testing whether this FFQ is valid if administered one to four.

II. Study Sample and Administration

The food frequency questionnaire should be administered to the Baptist Church youth group in Bryan, Texas in the summer of 2001, and then to middle school or high school students in the fall of 2001.

III. Administration Protocol

A. Staff Requirements

IMPACT FFQ are administered one to four, so each staff member/interviewer interviews four students at a time. Student interviews should be conducted in a semi-private location (e.g., separate tables in a room), so that one interview does not disturb or distract the students in another interview.

B. Equipment

1. FFQs
2. Supplemental Information/Interviewer Evaluation Form
3. Pencils, 3 per interviewer plus extras
4. FFQ Protocol
5. Sign in sheet
6. Name tags
7. Food Descriptions

C. Preparation

1. On the day of measurement, arrive no later than 11:30 am at the Maxwell Center of First Baptist Church, Bryan and locate the room where you will be interviewing students. Be sure to bring your 2 protocol sheets for the interviews with you.
2. Make sure that you have 1 table and five chairs in your room at your station. Room 100 will be split by dividers, so that interviewers will have a private space for interviews.
3. Pick up FFQ, Supplemental Information/Interviewer Form, pencils from Valerie, Amira, or Dr. Reed.
4. Pizza is scheduled to arrive at noon. Eat lunch with the kids in Maxwell Center 102 after your station is set up.
5. Help make sure the kids write their sign in number and name on a name tag and wear it in plain view.
6. After the kids are all there and have finished eating, we will call for the first 16 students and interviews will begin at 12:30.

IV. Instructions for Conducting the Interview

Note: Instructions to be read aloud to the students are in *Italics* type. Instructions for the IMPACT staff administrators are in plain type.

[Introduce yourself to the student. Be friendly and relaxed. Talk briefly with the student until he or she seems comfortable with you.]

Please fill in your sign-in number in the first two spaces of the "subject number" bubbles. In the third bubble column, enter 4 (for group interview). If this is your first interview, fill in a "one" in the fourth bubble or "two" if this is your second interview.

We would like to know what students your age eat. There are no right or wrong answers. We realize that you may eat differently each day, depending on your mood. We are interested in the foods that you ate last week—from Monday through Friday. We want you to think about those 5 days as we ask you to report how often you ate the foods on our list. Whatever you did or did not eat is fine.

I am going to ask the four of you if you have eaten foods from our list. I will walk you through several examples of how to answer the questions. First, decide if you have eaten the food. If not, fill in the "No" bubble, and wait for me to move on to the next question. If you did eat that food, then think about how many times you have eaten that food. For example, if you ate an apple once every day this week, you will fill in the bubble "per day" and then bubble in the "1." Or, if you ate two apples this week, bubble in "per week" and "2." Do not answer out loud, but feel free to ask any questions if you are not sure whether a food fits the question being asked.

Do you have any questions for me before we begin?

Dialogue: What Food Did the Student Eat:

The first food I am going to ask you about is _____. Bubble in "No" if you did not eat that food last Monday through Friday.

[Pause to let them think]

If you did eat _____ last week, think about how many times you ate it. [Speak slowly so they can think as you talk] *Did you eat it every day or a few times during the week? If you ate _____ every day, fill in the "per day" bubble and then bubble in the number of times per day you ate _____. If you ate the food a few times last week, bubble in "per week" and the number of times in the week you ate _____.*

[Pause to let them answer]

Moving on to the next question, think about whether or not you ate _____ (next food on list) last week.

[Tell the student frequently that he or she is doing a good job. Smile and speak softly. Be patient and positive. Do not be surprised if you see a student bubbling in surprising answer, such as 5 soft drinks per day. Respond in a neutral way to food choices (neither positive or negative). [Continue through the entire food list. The last question on the FFQ is to be read to the student.]

Please write down any other foods that you ate last week that we have not mentioned on this list.

[If any food is reported ask the same questions as above about the frequency of consumption during the week or day and record the answers in the space provided.]

Review of FFQ:

[Review the completeness and the accuracy of the entire FFQ interview. Have the student complete the FFQ by answering the questions on the FFQ Supplemental Information Form.]

[The student should write down whether last week was typical of how much he or she usually eats, along with a reason if the week was not typical.]

[At this point, be sure to prompt for vitamin/mineral supplement intake.]

Did you take a vitamin or mineral pill last week? If so, was it a multivitamin or a specific vitamin or mineral by itself? Write down as much information about the supplement as you can.

[Convey to the student his or her importance to the study and thank the student for his or her participation.]

Do you have any questions for me? You did a great job! Thanks very much for your help.

[If they have not done the individual interview, tell them to go to Room _____ (look at the map and give them the correct room number). If they have, they are free to leave or go back to the pizza room.]

V. Editing Interview Data

The interviewer should complete the Interviewer Evaluations immediately after the interviews. The FFQs should be thoroughly reviewed and edited using any notes made during the interview.

How to use the scan forms for FFQ

- √ For the subject number, the student will record their 2-digit sign-in number in the first two blanks. In the third blank, the student records a "4" for a group interview or a "1" for an individual interviewer. In the fourth blank, the student enters a "1" for their first interview or a "2" for their second interview.
- √ Watch the students while they are filling them out to make sure there are no stray marks anywhere on the forms.
- √ On the questionnaire, make sure you read the "marking instructions." It will give an example of how to determine what boxes to fill in. If you do not understand, do not guess, find someone and ask.
- √ For the milk with cereal questions (# 75 and #76), you will fill in a bubble for "83, 84, 85, or 86" that is out to the side. Questions 83, 84, 85, and 86 will show what type of milk you can select from. You will still fill in questions 83, 84, 85, and 86 when you get to them for how many times they drank milk. This will make more sense when you see the form. If you do not understand, do not guess, find someone and ask.
- √ Food Description list goes from specific to general. If the student can answer specific items, it is more accurate to use these than the generic option. For example, if they ate fruit salad, enter the individual fruits if they know specifically what they ate instead of the generic "fruit salad."
- √ Controlling the interview—If a student starts to act out, it is better to dismiss him/her and lose one student than to let the interview get out of hand and lose all four students' data because it is inaccurate or biased. In the actual study, you can say "Do you want to participate or go back to class?" and usually that will calm them down.

Food Frequency Questionnaire
Food Descriptions

1. **Oranges, Tangerines, or Grapefruit**- include raw, whole, sections; include canned or frozen, sweetened or unsweetened, juice pack, light syrup, or not specified as to sweetener; include mandarin

2. **Apples or Pears**- include raw, cooked, canned or frozen, sweetened or unsweetened, juice pack, light syrup or not specified as to sweetener

3. **Applesauce**- include with or without added sweeteners

4. **Banana**- include raw

5. **Cantaloupe or Mango**- include raw, not specified as to color

6. **Grapes**- include raw, European type (including Tokay, Emperor, Thompson, Red Flame) or American type (including Concord), seedless, cooked or canned, sweetened or unsweetened

7. **Peaches or Nectarines**- include raw, cooked or canned, sweetened or unsweetened

8. **Strawberries**- include raw, fresh or frozen

9. **Watermelon**- include raw, not specified as to color

10. **Raisins**

11. **Avocado or Guacamole**- include fresh, raw avocado; homemade, with or without tomatoes; include avocado dip; include any avocados or guacamole on fajitas

12. **Fruit Salad or Fruit Cocktail**- include fresh made from raw or canned with or without added sweeteners or syrup, with or without dressing; If they have already named the individual fruits above, do not include here.

13. **V-8, Tomato or Vegetable Juice**- include tomato juice cocktail, carrot juice or other mixed vegetable juices, canned or homemade; include low sodium

14. **Calcium Fortified Orange Juice**- calcium fortified fresh, canned or frozen, sweetened or unsweetened

15. **Regular Orange Juice**- include fresh, canned, or frozen, sweetened or unsweetened

16. **Other Fruit Juice such as Grape, Apple, or Pineapple**

17. **Kool-Aid, Wylers, Hi-C, Hawaiian Punch or Other Fruit Flavored Drinks**- include all flavors sweetened with sugar, with or without vitamin C added

18. **Broccoli with Cheese**- include cooked or raw, fresh or frozen, with or without fat or sauces

19. **Broccoli without Cheese**

20. **Carrots or Carrot Salad**- include cooked or raw, fresh, canned or frozen, prepared with or without fat or sauces; exclude carrot juice

21. **Cauliflower**- include cooked or raw, fresh or frozen, with or without fat or sauces

22. **Corn**- include cooked or raw, fresh, frozen, or canned, with or without fat or sauces, not specified as to type or color; include hominy

23. **Green Beans**- include cooked or raw, fresh, frozen, or canned, with or without fat or sauces

24. **Pinto, Kidney, Black, or Lima Beans, Pork & Beans, Black Eyed Peas**- include any dried bean, pea or lentil, cooked without or without fat or any seasonings; include any beans on fajitas

25. **Refried Beans**- include refried beans plain or with cheese, cooked with or without fat; include any beans on fajitas

26. **Raw Tomatoes Other Than in Salad**- include tomatoes peeled or unpeeled, green, plum, Italian, and/or cherry

27. **Kale, Mustard or Chard Greens**- include cooked or raw, fresh, frozen, or canned, include prepared any way, with or without fats or sauces

28. **Spinach, Collards or Turnip Greens**- include cooked or raw, fresh, frozen, or canned, include prepared any way, with or without fats or sauces

29. **Acorn, Butternut, Zucchini, Crooked Neck Squash, or Eggplant**- include raw and cooked, with or without fat

30. **Mixed Vegetables Such as Stir-Fry**- include any combination of at least two vegetables, fresh, frozen, cooked or raw, with or without fat or sauces. If they have already named the individual vegetables, do not include here.

31. **Chef Salad or Lettuce Salad with Cheese**- include tossed, mixed green, Caesar, Greek and/or garden salad, with cheese, with or without dressing; major ingredient must be a green type of lettuce

32. **Chef Salad or Lettuce Salad without Cheese**- include tossed, mixed green, Caesar, Greek and/or garden salad, with cheese, with or without dressing; major ingredient must be a green type of lettuce

33. **Regular Salad Dressing**- include oil-and cream-based dressings; including mayonnaise; include only regular salad dressing; do not include low fat or fat free

34. **Reduced Calorie or Light Salad Dressing**- include oil-and cream-based dressings; including mayonnaise; include reduced calorie or fat free mayonnaise

35. **Spanish Rice**- include Spanish rice or any rice made with tomatoes or tomato sauce

36. **Fried Rice**- include all types with and without vegetables or meat

37. **Brown, White, or Mixed Rice**- include white rice, brown rice, or wild rice, cooked with or without fat

38. **Macaroni or other Pasta with Cheese**- include creamed macaroni, macaroni and cheese or noodles and sauce mixes, not low fat; include canned, ready prepared, mix or homemade

39. **Pasta with Tomato or Meat Sauce such as Spaghetti**- include all types of pasta with homemade or store bought sauce with tomato base, with and without meat; if the pasta is stuffed or uses cheese as a main ingredient, include with number 44

40. **Potato Salad**- include potato salad prepared with mustard or mayonnaise, include German

41. **Hash Browns, Tater Tots or French Fries**- include fresh or frozen, French fried, hash browns, home fries or puffs, with or without skin, include oven baked, deep fried, breaded or battered

42. **Stuffed Baked Potato with Cheese or Au Gratin Potatoes**- include with cheese or cheese sauce, with or without meat or vegetable toppings, with or without peel eaten

43. **Boiled, Mashed or Baked Potato w/o Cheese Topping** – include raw, instant or canned, with out without peel, cooked with or without fat, with or without milk

44. **Lasagna, Cannelloni, or Ziti**- include any type of filling or sauce; include canned, frozen or homemade

45. **Casseroles: Beef or Pork, including Oriental Dishes, Chili, Barbecue, or Goulash**- include beef or pork prepared as a stew with added moisture and any assortment of vegetables such as potatoes, corn, tomatoes and/or onions; include casseroles with cheese, noodles, rice, potatoes and/or vegetables, homemade or frozen; include stir-fries, oriental style, goulash or meatloaf; include carne guisada, arroz con carne, carne con papas, conchitas con carne, carne empanizada etc.

46. **Casseroles: Chicken, Turkey, Seafood including Oriental Dishes, or Barbecue**- include casseroles with cheese, noodles, rice, potatoes and/or vegetables, homemade or frozen; include stir-fries and oriental style; include arroz con pollo, pollo en salsa, pollo guisado, pollo mole, etc.

47. **Egg Rolls**- include with or without meat, include spring rolls

48. **Bean Soup**- include milk and water-based soups with any type bean, with or without noodles; include homemade, canned or instant

49. **Vegetable, Tomato, Noodle, or Broth Soup- include water**- or tomato-based soups with vegetables, with or without meat, noodles or rice (more vegetables than noodles); include homemade, canned or instant; include bacalao; include pozole

50. **Cream Soup**- include any cream based soup prepared with milk or water; include homemade, canned or instant

51. **Cheese Nachos with any Topping**- include with or without meat

52. **Cheese Enchiladas or Quesadillas**- include cheese with flour or corn tortillas

53. **Meat or Bean Enchiladas, Burritos, Tacos, Flautas, or Chalupas**- include chicken, beef, bean and/or cheese with flour or corn tortillas

54. **Taco Salad**- include with cheese, include with or without meat

55. **Chili Con Carne**- Chili with meat; include with or without beans, include with or without cheese

56. **Cheeseburger**- include fast food or homemade, with cheese, with or without condiments such as catsup, mustard, onion, pickle, lettuce and/or tomato; including double meat

57. **Hamburger**- include fast food or homemade, without cheese, with or without condiments such as catsup, mustard, onion, pickle, lettuce and/or tomato; including double meat

58. **Tuna, Chicken, or Egg Salad Sandwich**- include with or without condiments such as lettuce, tomato, mayonnaise and/or salad dressing; include all varieties of bread, rolls, bagels or pita bread

59. **Hot Dog or Corn Dog**- Include frankfurter with or without condiments such as catsup, mustard, relish, onions, chili and/or cheese; include beef, pork, or turkey; include low fat types

60. **Cheese Sandwich**- include any type cheese, include grilled, include cheese spread

61. **Meat Sandwiches with Cheese**- include any deli style lunchmeat, without cheese, with or without condiments such as mayonnaise, mustard, lettuce and/or tomato; include all varieties of breads, rolls, bagels or pita bread

62. **Meat Sandwiches without Cheese**- include any deli style lunchmeat, without cheese, with or without condiments such as mayonnaise, mustard, lettuce and/or tomato; include all varieties of breads, rolls, bagels or pita bread

63. **Pizza or Calzone**- include pizza frozen, homemade or commercial, with or without meat, cheese and/or vegetables; include any type of crust

64. **Peanut Butter or Peanut Butter Sandwich**- include all types of peanut butter, with or without jelly or other condiments

65. **Beef or Pork as a Main Dish such as Fajitas (include fajita meat only)**- include other cuts of meat such as steak or ribs, eaten alone, with or without fat trimmed; code tortillas, cheese, guacamole, sour cream, and beans separately

66. **Fried Chicken**- include any piece of chicken, bone in or boneless, battered and fried; with or without skin eaten

67. **Baked or Broiled Chicken or Turkey**- include any piece, bone in or boneless, with or without skin eaten

68. **Shrimp**- include baked, broiled, steamed, or boiled in the oven or on the grill

69. **Canned Salmon, Sardines, or Mackerel**- include canned in oil or water; do not include tuna fish

70. **Fried Fish or Shellfish**- include any piece of fish or shellfish that is fried

71. **Baked or Broiled Fish or Shellfish**- include any piece of fish or shellfish that is baked or broiled in the oven or on the grill

72. **Sausage, Bacon, or Chorizo**- include any type of meat including turnkey; include low salt, thick or thin sliced beef or pork sausage; include fresh bulk, patties or links

73. **Eggs Prepared Any Way with Che**ese- include scrambled eggs, omelets with cheese, meat and/or vegetables, poached eggs or fried eggs, with or without fat; include all types of quiche, breakfast sandwiches and breakfast burritos

74. **Eggs Prepared Any Way without Cheese**- include scrambled eggs, omelets without cheese, meat and/or vegetables, poached eggs or fried eggs, with or without fat; include all types of quiche, breakfast sandwiches and breakfast burritos

75. **Fortified Cereals, Basic 4, Total, Raisin Bran or Corn Flake Total**- include only fortified cereals; also include Harmony (General Mills), Country Corn Flakes (General Mills), Golden Grams, Kix

76. **Other Dry Cereals**- include the store brands as well as the other types of dry cereal regardless of fiber content, with or without added sugar, fruit or nuts

77. **Cooked Cereal or Grits**- include oatmeal, barley, cream of whet or bulgur; include regular, quick or instant; cooked with or without fat, with or without milk

78. **Pancakes, Waffles or French Toast**- include from mix, frozen or homemade, with or without fat, with or without fruit

79. **Doughnuts, Sweet Rolls, Croissants, Muffins, or Coffee Cake**- include cinnamon buns, muffins, pastries and/or croissants; include cake, raised/yeast or custard filled doughnuts; include banana or other quick breads; include pop-tarts

80. **Breakfast Bar of Granola Bar**- include with or without nuts; include any flavor; include regular and reduced calorie/low sugar; include any type granola bar

81. **Tortillas**- include tortillas made with white flour, wheat flour or corn meal

82. **Bread, Rolls, Pita, Bagels, Biscuits, English Muffins or Cornbread**- include those made with any type of flour; include homemade, bakery or commercial, regular or reduced calorie; include pita bread

83. **Skim or ½ % Milk**- include skim or ½ %; include chocolate milk if syrup was added to skim or ½ % milk; write in the chocolate syrup at the end of the questionnaire

84. **1% Milk**- include 1%; include chocolate milk if syrup was added to 1 % milk; write in the chocolate syrup at the end of the questionnaire

85. **2% Milk or Buttermilk**- include 2% or buttermilk; include chocolate milk if syrup was added to 2 % milk; write in the chocolate syrup at the end of the questionnaire

86. **Whole Milk, Chocolate Milk, or Milkshakes**- include all brands of whole milk; include any

type of commercial or homemade milkshake; **include hot chocolate**

87. **Liquid Meals such as Instant Breakfast, Slim Fast, Sego, Dynatrim**- include ready to eat or prepared from dry powder

88. **Yogurt Made with Whole Milk**- include plain or flavored, with or without fruit or nuts

89. **Low fat or No-Fat Yogurt**- include plain or flavored, with or without fruit or nuts

90. **Frozen Yogurt, Ice Milk or Low fat Ice Cream**- include plain or flavored, with or without fruit or nuts; include all types of frozen yogurt bars

91. **Sherbet**- include all flavors

92. **Ice Cream or Ice Cream Bar**- include any flavor, with or without fruit or other additions, include all bars and sticks

93. **Pudding, Flan, or Custard**- include homemade, mix or commercial, made with any type of milk; include all flavors

94. **Sour Cream or Sour Cream Dip**- include any type

95. **Cottage Cheese**- include any type

96. **Mozzarella or String Cheese**- include low-fat or fat-free, include cheese sticks

97. **Cheddar, Swiss, American or Other Cheese**- include only these cheeses; do not include if already included
on cheeseburger or sandwich

98. **Nuts**- include all types of nuts; include honey roasted or unroasted, with our without salt

99. **Pretzels**- include all pretzels; also include saltine or low-fat crackers

100. **Salty Snacks, Corn Chips, Tortilla Chips or Potato Chips**- include regular or flavored chips, with or without salt; include all other crackers

101. **Taco Sauce, Picante Sauce or Salsa**- include homemade or commercial salsa or picante sauce

102. **Popcorn**- include all types popped in oil or air popped, with or without cheese, with or without butter

103. **Chile Con Queso or Cheese Sauce**- include with or without tomatoes or peppers, include low fat

104. **Cream Cheese or Cheese Spread**- include any type; include Cheeze Whiz

105. **Cookies or Brownies**- include homemade, mix or bakery, with or without nuts; include any flavor; include regular and reduced calorie/low sugar; include any type brownies

106. **Cake, Pie or Cobbler**- include all types of cakes, with or without icing; include fruit, cream, custard, pecan or pumpkin pie

107. **Chocolate Candy**- include all types of chocolate candy, homemade or commercial

108. **Other Candy**- include all types of candy, homemade or commercial

109. **Diet Soft Drink**- include with or without caffeine

110. **Regular Soft Drink**- include with or without caffeine

111. **Iced or Hot Tea**- include tea bag, instant or flavored teas, with or without sugar, with or without caffeine

112. **Coffee**- include instant, drip, or flavored coffees, with or without sugar, with or without cream

APPENDIX C

WEBSITE PROTOCOL

Website Protocol and Reminders for Interviewers

1. The day before you are scheduled to monitor the website, review the website and make sure you are familiar with all components. Look at each "store" in the mall (Sports & More, Food Court, etc.) so that you will be able to see if the students are actually going to all of these when you "monitor" their classes.

2. Once you check in at the main office and find the correct room, make sure that you know how to use the master computer so that the monitor is reflected on the screen. Go to http://calcium.tamu.edu

3. If you have time before class starts, view the website to refresh/review what's on it in case you get questions from students.

4. When the class gets there and it's time to start, introduce yourself (name, major and class at TAMU, etc). Tell them the website is a scavenger hunt through the mall. At each place, they will get a clue to the next place to visit. Along the way, they will learn about calcium. Remind them that there will be post-test (not for a grade if they ask) to see how much they remember when we come back in a few weeks. Tell them that it is important to visit every site in the mall including the ATM machine!

5. Pass out the headphones and have them plug them in to the computer jacks.

6. Direct the students to the website http://calcium.tamu.edu.

7. They should enter their information on the first screen (name).

8. On the next screen, they should choose the high-tech option and the network connection.

9. From there, the website is self-directed.

10. Tell them to print the certificate at the end of the scavenger hunt.

11. If time remains, have the students go to the "extra" section that gives a lot of useful tips and ways to get them started consuming more calcium. This will also keep the students busy until the end of the period if they do it all.

APPENDIX D

RESULTS APPENDIX

Table D1
Frequencies of calcium intakes (in mg) recorded in the individual interviews of the FFQ Phase I

Calcium Intake (mg)	Frequency
494.04	1
542.03	1
885.32	1
889.07	1
1220.34	1
1259.04	1
1317.75	1
1580.52	1
1850.24	1
1950.71	1
2023.71	1
2510.88	1
3094.11	1
Total	13
Missing	1
Total	14

Table D2
Frequencies of calcium intakes (in mg) recorded in the group interviews of the FFQ Phase I

Calcium Intake (mg)	Frequency
281.39	1
550.83	1
802.43	1
1134.91	1
1244.00	1
1449.38	1
1765.99	1
1774.35	1
1776.00	1
2436.31	1
2451.16	1
2642.01	1
3067.57	1
Total	13
Missing	1
Total	14

Table D3
Frequencies of calcium intakes (in mg) recorded in the subjects' 1st interviews of the FFQ Phase I

Calcium Intake (mg)	Frequency
494.04	1
542.03	1
802.43	1
1134.91	1
1259.04	1
1317.75	1
1449.38	1
1774.35	1
1850.24	1
2023.71	1
2436.31	1
3067.57	1
3094.11	1
Total	13
Missing	1
Total	14

Table D4
Frequencies of calcium intakes (in mg) recorded in the subjects' 2nd interviews of the FFQ Phase I

Calcium Intake (mg)	Frequency
281.39	1
550.83	1
885.32	1
889.07	1
1220.34	1
1244.00	1
1580.52	1
1765.99	1
1776.00	1
1950.71	1
2451.16	1
2510.88	1
2642.01	1
Total	13
Missing	1
Total	14

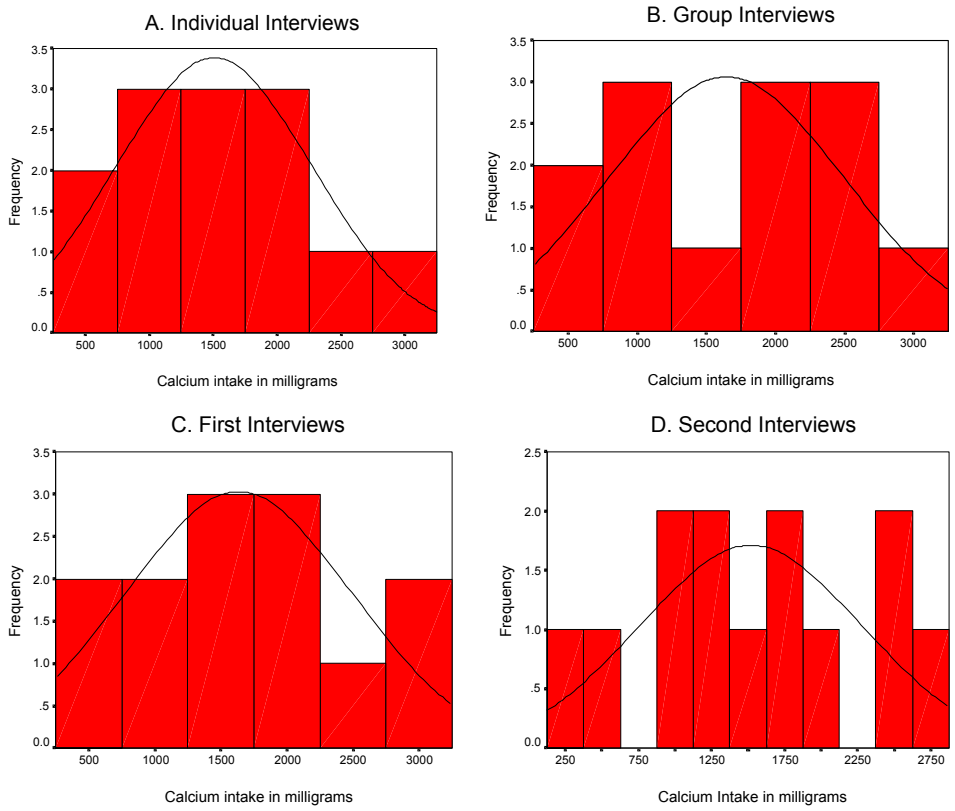

FIG D1. *Histograms recording the frequencies of calcium intake (in mg) as recorded in individual, group, first, and second interviews for the FFQ Phase I. According to these histograms, the data seemed fairly normally distributed.*

Table D5
Paired t-tests for the FFQ Phase 1

			Individual Interview - Group Interview	**1st Interview – 2nd Interview**
Paired Differences	Mean ± SD		-135.2727 ± 624.8	115.2032 ± 629.2
	Std. Error Mean		173.30022	174.50466
	95% Confidence Interval of the Difference	Lower	-512.8614	-265.0098
		Upper	242.3161	495.4162
t			-.781	.660
df			12	12
Sig. (2-tailed)			.450	.522

Table D6
Experimental group age frequencies (as recorded by the DPQ)

Age	**Frequency**	**Percent**
11	1	1.3
12	14	18.4
13	15	19.7
14	9	11.8
15	9	11.8
16	13	17.1
17	9	11.8
18	5	6.6
19	1	1.3
Total	76	100.0

Table D7
Control group age frequencies (as recorded by the DPQ)

Age	Frequency	Percent
12	2	12.5
14	3	18.8
15	6	37.5
16	4	25.0
18	1	6.3
Total	16	100.0

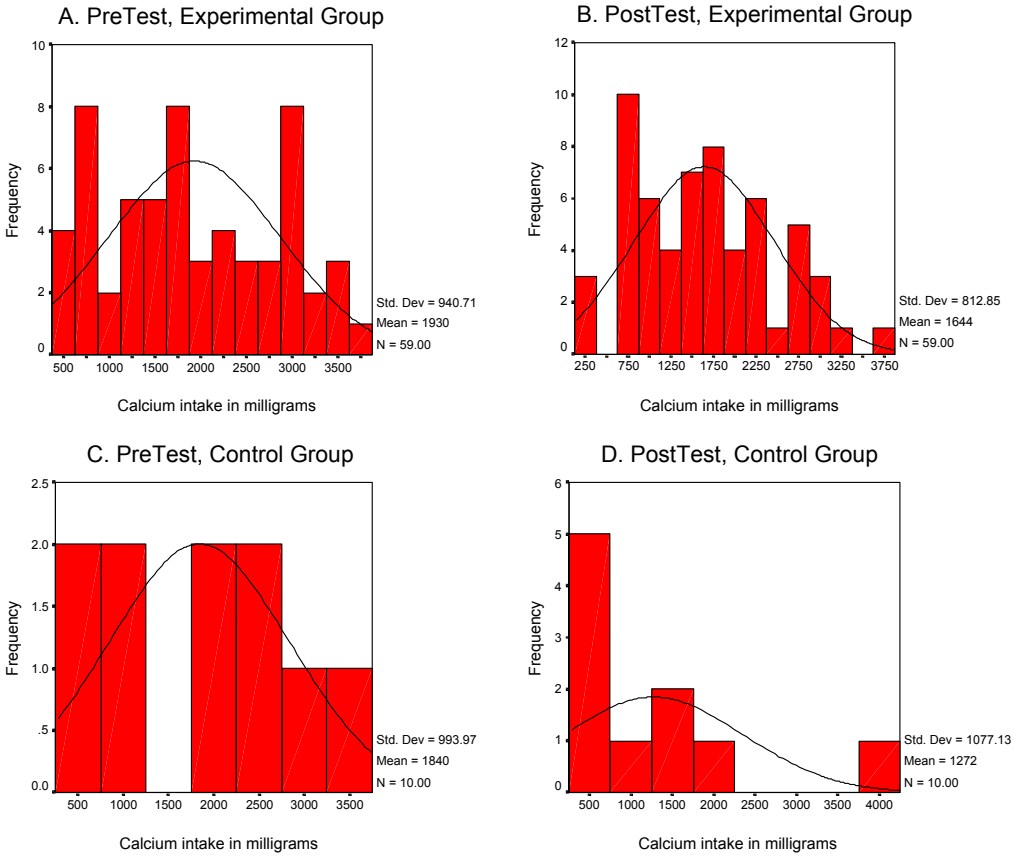

FIG D2. *Histograms recording the frequencies of reported calcium intakes (in mg) on the FFQ Phase II for the four groups. According to these histograms, the data seemed normally distributed except for the posttest control group.*

Table D8
Paired samples test for the FFQ Phase II

	Statistic		Experimental Pretest - Posttest Calcium Intake	Control Pretest – Posttest Calcium Intake
Paired Differences (Pretest – Posttest Calcium Intake)	Mean		286.8	568.8
	Std. Deviation		834.5	626.8
	Std. Error Mean		108.6	198.2
	95% Confidence Interval of the Difference	Lower	69.3	120.4
		Upper	504.2	1017.1
	t		2.6	2.869
	df		58	9
	Sig. (2-tailed)		.011	.018

Table D9
Separate ANOVA for each category in the DPQ

Variable		Sum of Squares	df	Mean Square	F	Sig.
Knowledge Change (Post-Pre)	Between Groups	1.891	1	1.891	3.734	.056
	Within Groups	45.593	90	.507		
	Total	47.484	91			
Attitude Change (Post-Pre)	Between Groups	.072	1	.072	.056	.814
	Within Groups	116.580	90	1.295		
	Total	116.652	91			
Behavior Change (Post-Pre)	Between Groups	1.009	1	1.009	.714	.400
	Within Groups	127.197	90	1.413		
	Total	128.207	91			
Total Change (Post-Pre)	Between Groups	157.380	1	157.380	3.612	.061
	Within Groups	3921.174	90	43.569		
	Total	4078.554	91			

Table D10
Test of homogeneity of variances for the DPQ

	Levene Statistic	df1	df2	Sig.
Attitude Change (Post-Pre)	.002	1	90	.969
Knowledge Change (Post-Pre)	.099	1	90	.754
Behavior Change (Post-Pre)	.173	1	90	.678
Total Score Change (Post-Pre)	.227	1	90	.635

Table D11
Descriptive statistics for each category in the DPQ

Group	Variable	Minimum	Maximum	Mean	Std. Deviation	Skewness	Skewness Std. Error
Experimental (n=76)	Total Score Change (Post-Pre)	-11.00	22.00	3.763	6.53170	.246	.276
	Pretest Total Score	14	48	30.05	6.406	.083	.276
	Posttest Total Score	18	51	33.82	7.397	.329	.276
	Knowledge Change (Post-Pre)	-1.00	2.38	.3783	.71995	.392	.276
	Knowledge Pretest	1.38	4.38	2.9523	.67945	.015	.276
	Knowledge Posttest	1.88	5.00	3.3306	.78600	.392	.276
	Attitude Change (Post-Pre)	-3.00	3.00	.2303	1.12972	-.353	.276
	Attitude Pretest	-.50	5.00	2.4671	.99108	-.350	.276
	Attitude Posttest	-.50	5.00	2.6974	1.25454	-.119	.276
	Behavior Change (Post-Pre)	-3.00	3.00	.2763	1.09055	.248	.276
	Behavior Pretest	0	5	1.50	1.536	.918	.276
	Behavior Posttest	0	5	1.78	1.484	.749	.276
Control (n=16)	Total Score Change (Post-Pre)	-10.00	17.00	.3125	6.93512	.920	.564
	Pretest Total Score	12	41	30.13	8.286	-.859	.564
	Posttest Total Score	13	40	30.44	7.763	-.775	.564
	Knowledge Change (Post-Pre)	-1.00	1.63	.0000	.66927	.637	.564
	Knowledge Pretest	1.38	4.00	3.0313	.75069	-.534	.564
	Knowledge Posttest	1.75	4.00	3.0313	.75208	-.450	.564
	Attitude Change (Post-Pre)	-2.00	2.00	.1563	1.17925	-.428	.564
	Attitude Pretest	.00	4.50	2.0313	1.39605	.473	.564
	Attitude Posttest	-.50	4.50	2.1875	1.30224	-.032	.564
	Behavior Change (Post-Pre)	-5.00	3.00	.0000	1.59164	-1.701	.564
	Behavior Pretest	0	5	1.81	1.834	.760	.564
	Behavior Posttest	0	5	1.81	1.834	.760	.564

Table D12
Descriptive statistics for changes in individual questions on the DPQ

Variable	Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Q1 CHANGE	Experimental	76	.0132	.82451	.09458	-2.00	2.00
	Control	16	.0625	.77190	.19298	-2.00	1.00
	Total	92	.0217	.81170	.08463	-2.00	2.00
Q2 CHANGE	Experimental	76	.4474	2.20542	.25298	-6.00	6.00
	Control	16	.2500	2.29492	.57373	-4.00	4.00
	Total	92	.4130	2.20963	.23037	-6.00	6.00
Q4 CHANGE	Experimental	76	-.2895	1.77250	.20332	-3.00	3.00
	Control	16	.4375	1.50416	.37604	-3.00	3.00
	Total	92	-.1630	1.74329	.18175	-3.00	3.00
Q5 CHANGE	Experimental	76	.1842	1.81630	.20834	-3.00	5.00
	Control	16	-.3750	1.85742	.46435	-3.00	3.00
	Total	92	.0870	1.82565	.19034	-3.00	5.00
Q6 CHANGE	Experimental	76	.5921	3.05146	.35003	-5.00	5.00
	Control	16	-.9375	2.01556	.50389	-5.00	.00
	Total	92	.3261	2.94681	.30723	-5.00	5.00
Q7 CHANGE	Experimental	76	.1974	1.07107	.12286	-3.00	3.00
	Control	16	-.4375	1.03078	.25769	-3.00	.00
	Total	92	.0870	1.08590	.11321	-3.00	3.00
Q8 CHANGE	Experimental	76	.5263	2.39151	.27432	-5.00	5.00
	Control	16	.6250	3.59398	.89849	-5.00	5.00
	Total	92	.5435	2.61615	.27275	-5.00	5.00
Q9 CHANGE	Experimental	76	.2763	1.09055	.12509	-3.00	3.00
	Control	16	.0000	1.59164	.39791	-5.00	3.00
	Total	92	.2283	1.18696	.12375	-5.00	3.00
Q10 CHANGE	Experimental	76	.2632	2.41312	.27680	-5.00	5.00
	Control	16	.0000	2.12916	.53229	-5.00	5.00
	Total	92	.2174	2.35725	.24576	-5.00	5.00
Q11 CHANGE	Experimental	76	1.3816	2.52965	.29017	-5.00	5.00
	Control	16	.3125	1.25000	.31250	.00	5.00
	Total	92	1.1957	2.38696	.24886	-5.00	5.00
Q12 CHANGE	Experimental	76	.1711	1.80657	.20723	-3.00	3.00
	Control	16	.3750	1.50000	.37500	-3.00	3.00
	Total	92	.2065	1.75122	.18258	-3.00	3.00

Table D13
Separate ANOVAs for each individual question on the DPQ

		Sum of Squares	df	Mean Square	F	Sig.
Q1 CHANGE	Between Groups	.032	1	.032	.048	.826
	Within Groups	59.924	90	.666		
	Total	59.957	91			
Q2 CHANGE	Between Groups	.515	1	.515	.104	.747
	Within Groups	443.789	90	4.931		
	Total	444.304	91			
Q4 CHANGE	Between Groups	6.985	1	6.985	2.332	.130
	Within Groups	269.569	90	2.995		
	Total	276.554	91			
Q5 CHANGE	Between Groups	4.133	1	4.133	1.243	.268
	Within Groups	299.171	90	3.324		
	Total	303.304	91			
Q6 CHANGE	Between Groups	30.925	1	30.925	3.666	.059
	Within Groups	759.293	90	8.437		
	Total	790.217	91			
Q7 CHANGE	Between Groups	5.327	1	5.327	4.702	.033
	Within Groups	101.977	90	1.133		
	Total	107.304	91			
Q8 CHANGE	Between Groups	.129	1	.129	.019	.892
	Within Groups	622.697	90	6.919		
	Total	622.826	91			
Q9 CHANGE	Between Groups	1.009	1	1.009	.714	.400
	Within Groups	127.197	90	1.413		
	Total	128.207	91			
Q10 CHANGE	Between Groups	.915	1	.915	.163	.687
	Within Groups	504.737	90	5.608		
	Total	505.652	91			
Q11 CHANGE	Between Groups	15.107	1	15.107	2.701	.104
	Within Groups	503.372	90	5.593		
	Total	518.478	91			
Q12 CHANGE	Between Groups	.550	1	.550	.178	.674
	Within Groups	278.526	90	3.095		
	Total	279.076	91			

Table D14
Paired samples statistics for question 7 on the DPQ

Group	Variable	Mean	N	Std. Deviation	Std. Error Mean
Experimental	Question 7 Knowledge Pretest	4.36	76	1.230	.141
n=76	Corresponding Q7 on Posttest	4.55	76	1.063	.122
Control	Question 7 Knowledge Pretest	4.81	16	.750	.188
n=16	Corresponding Q7 on Posttest	4.38	16	1.204	.301

Table D15
Paired samples t-test for question 7 on the DPQ

Group	Variable	Mean Paired Differences	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Experimental (n=76)	Question 7 Pre-Q7 Post	-.20	1.071	.123	-1.606	75	.112
Control (n=16	Question 7 Pre-Q7 Post	.44	1.031	.258	1.698	15	.110

Table D16
Descriptive statistics for each category of questions in the COPA Questionnaire

Group	N	Minimum	Maximum	Mean	Std. Dev.	Skewness	Skewness Std. Error
Experimental							
Total Pretest Scores	74	63	119	94.70	14.730	-.360	.279
Total Posttest Scores	74	62	122	96.89	14.332	-.162	.279
Change in Total Scores (post-pre)	74	-21.00	32.00	2.1892	10.39978	.446	.279
Knowledge Pretest Scores	74	4	14	10.26	2.455	-.465	.279
Knowledge Posttest Scores	74	4	17	11.53	2.815	-.423	.279
Knowledge Change (post-pre)	74	-5.00	6.00	1.2703	2.50642	-.278	.279
Attitude Posttest Scores	74	30	67	52.78	7.892	-.576	.279
Attitude Pretest Scores	74	28	64	51.77	7.637	-.721	.279
Attitude Change (post-pre)	74	-21.00	38.00	1.0135	7.04874	1.705	.279
Behavior Pretest Scores	74	18	47	32.68	7.899	-.134	.279
Behavior Posttest Scores	74	13	49	32.58	8.243	-.288	.279
Behavior Change (post-pre)	74	-15.00	23.00	-.0946	6.79679	.763	.279
Control							
Total Pretest Scores	12	76	124	93.58	16.384	.717	.637
Total Posttest Scores, Excluding 25, 29-31	12	71	119	90.83	16.634	.398	.637
Change in Total Scores (post-pre)	12	-13.00	10.00	-2.7500	6.49650	.486	.637
Knowledge Pretest Scores	12	4	13	10.17	2.918	-.882	.637
Knowledge Posttest Scores	12	3	15	9.83	3.486	-.389	.637
Knowledge Change (post-pre)	12	-4.00	2.00	-.3333	2.05971	-.885	.637
Attitude Posttest Scores	12	37	63	50.58	8.240	.036	.637
Attitude Pretest Scores	12	38	64	52.42	7.561	-.132	.637
Attitude Change (post-pre)	12	-11.00	2.00	-1.8333	4.13045	-1.508	.637
Behavior Pretest Scores	12	17	49	31.00	10.216	.350	.637
Behavior Posttest Scores	12	16	43	30.42	9.288	-.397	.637
Behavior Change (post-pre)	12	-6.00	12.00	-.5833	5.01739	1.508	.637

Table D17
Test of homogeneity of variances for each category in the COPA Questionnaire

Variable	Levene Statistic	df1	df2	Sig.
Change in Total Scores (post-pre)	2.386	1	84	.126
Change in Knowledge Scores (post-pre)	1.086	1	84	.300
Change in Attitude Scores (post-pre)	.996	1	84	.321
Change in Behavior Scores (post-pre)	.798	1	84	.374

Table D18
ANOVA for each category in the COPA Questionnaire

Variable		Sum of Squares	df	Mean Square	F	Sig.
Change in Total Scores (post-pre)	Between Groups	251.899	1	251.899	2.531	.115
	Within Groups	8359.601	84	99.519		
	Total	8611.500	85			
Change in Knowledge Scores (post-pre)	Between Groups	26.553	1	26.553	4.414	.039
	Within Groups	505.261	84	6.015		
	Total	531.814	85			
Change in Attitude Scores (post-pre)	Between Groups	83.684	1	83.684	1.843	.178
	Within Groups	3814.653	84	45.413		
	Total	3898.337	85			
Change in Behavior Scores (post-pre)	Between Groups	2.466	1	2.466	.057	.812
	Within Groups	3649.255	84	43.444		
	Total	3651.721	85			

Table D19
Paired samples t-test descriptive statistics for the knowledge category of the COPA Questionnaire

Group	Variable	Mean	N	Std. Deviation	Std. Error Mean
Experimental	Pretest Scores	10.26	74	2.455	.285
	Posttest Scores	11.53	74	2.815	.327
Control	Pretest Scores	10.17	12	2.918	.842
	Posttest Scores	9.83	12	3.486	1.006

Table D20
Paired samples t-test for the knowledge category of the COPA

Group	Variable	Paired Differences Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Experimental (n=74)	Pretest-Posttest Scores	-1.27	2.506	.291	-4.360	73	.000
Control (n=12)	Pretest-Posttest Scores	.33	2.060	.595	.561	11	.586

Table D21
Descriptive statistics for individual questions on the COPA

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Q1 CHANGE	Experimental	74	.0135	.45309	.05267	-1.00	1.00
	Control	12	-.2500	.62158	.17944	-1.00	1.00
	Total	86	-.0233	.48451	.05225	-1.00	1.00
Q2 CHANGE	Experimental	74	.0811	.46099	.05359	-1.00	1.00
	Control	12	-.0833	.28868	.08333	-1.00	.00
Q3 CHANGE	Total	86	.0581	.44337	.04781	-1.00	1.00
	Experimental	74	.0946	.55317	.06430	-1.00	1.00
	Control	12	-.0833	.51493	.14865	-1.00	1.00
	Total	86	.0698	.54860	.05916	-1.00	1.00
Q4CHANGE	Experimental	74	.0676	.34447	.04004	-1.00	1.00
	Control	12	.0000	.42640	.12309	-1.00	1.00
	Total	86	.0581	.35495	.03828	-1.00	1.00
Q5CHANGE	Experimental	74	.1757	.55784	.06485	-1.00	1.00
	Control	12	.0833	.51493	.14865	-1.00	1.00
	Total	86	.1628	.55009	.05932	-1.00	1.00
Q6CHANGE	Experimental	74	.0676	.55717	.06477	-1.00	1.00
	Control	12	.1667	.57735	.16667	-1.00	1.00
	Total	86	.0814	.55762	.06013	-1.00	1.00
Q7CHANGE	Experimental	74	.0135	.50999	.05929	-1.00	1.00
	Control	12	.0000	.73855	.21320	-1.00	1.00
	Total	86	.0116	.54220	.05847	-1.00	1.00
Q8CHANGE	Experimental	74	.2297	.60923	.07082	-1.00	1.00
	Control	12	.1667	.38925	.11237	.00	1.00
	Total	86	.2209	.58211	.06277	-1.00	1.00
Q9CHANGE	Experimental	74	.0135	.30936	.03596	-1.00	1.00
	Control	12	.0833	.28868	.08333	.00	1.00
	Total	86	.0233	.30589	.03299	-1.00	1.00
Q10CHANGE	Experimental	74	-.0405	.62896	.07312	-1.00	1.00
	Control	12	.0833	.66856	.19300	-1.00	1.00
	Total	86	-.0233	.63202	.06815	-1.00	1.00
	Experimental	74	-.0270	.36911	.04291	-1.00	1.00

Table D21 Continued

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Q11CHANGE							
	Control	12	.0000	.00000	.00000	.00	.00
	Total	86	-.0233	.34220	.03690	-1.00	1.00
Q12CHANGE	Experimental	74	.1351	.44796	.05207	-1.00	1.00
	Control	12	-.0833	.28868	.08333	-1.00	.00
	Total	86	.1047	.43465	.04687	-1.00	1.00
Q20CHANGE	Experimental	74	.1081	.48449	.05632	-1.00	1.00
	Control	12	-.0833	.51493	.14865	-1.00	1.00
	Total	86	.0814	.49026	.05287	-1.00	1.00
Q21CHANGE	Experimental	74	.0135	.58505	.06801	-1.00	1.00
	Control	12	-.1667	.57735	.16667	-1.00	1.00
	Total	86	-.0116	.58399	.06297	-1.00	1.00
Q22CHANGE	Experimental	74	.0946	.52783	.06136	-1.00	1.00
	Control	12	.0000	.42640	.12309	-1.00	1.00
	Total	86	.0814	.51370	.05539	-1.00	1.00
Q23CHANGE	Experimental	74	.1081	.39056	.04540	-1.00	1.00
	Control	12	-.0833	.28868	.08333	-1.00	.00
	Total	86	.0814	.38241	.04124	-1.00	1.00
Q27CHANGE	Experimental	74	.1216	.59571	.06925	-1.00	1.00
	Control	12	-.0833	.66856	.19300	-1.00	1.00
	Total	86	.0930	.60640	.06539	-1.00	1.00
Q28CHANGE	Experimental	74	.0811	1.17924	.13708	-3.00	3.00
	Control	12	-.7500	1.48477	.42862	-5.00	.00
	Total	86	-.0349	1.25039	.13483	-5.00	3.00
Q38CHANGE	Experimental	74	.0811	.80677	.09378	-3.00	2.00
	Control	12	.0000	1.65145	.47673	-4.00	2.00
	Total	86	.0698	.95537	.10302	-4.00	2.00
Q40CHANGE	Experimental	74	-.0676	1.12665	.13097	-3.00	3.00
	Control	12	-.4167	1.24011	.35799	-3.00	1.00
	Total	86	-.1163	1.14191	.12314	-3.00	3.00
Q41CHANGE	Experimental	74	.0270	1.05950	.12316	-2.00	4.00
	Control	12	-.4167	.66856	.19300	-2.00	.00
	Total	86	-.0349	1.02266	.11028	-2.00	4.00
Q42CHANGE	Experimental	74	.2838	1.21091	.14077	-3.00	4.00
	Control	12	.1667	.71774	.20719	-1.00	1.00
	Total	86	.2674	1.15223	.12425	-3.00	4.00
Q45CHANGE	Experimental	74	.0135	.99991	.11624	-4.00	4.00
	Control	12	.2500	.96531	.27866	-1.00	3.00
	Total	86	.0465	.99300	.10708	-4.00	4.00
Q46CHANGE	Experimental	74	.0135	1.12862	.13120	-3.00	4.00
	Control	12	.1667	1.26730	.36584	-3.00	2.00
	Total	86	.0349	1.14221	.12317	-3.00	4.00
Q48CHANGE	Experimental	74	.3514	1.02613	.11929	-2.00	4.00
	Control	12	-.0833	.66856	.19300	-1.00	1.00
	Total	86	.2907	.99252	.10703	-2.00	4.00
Q49CHANGE	Experimental	74	-.0405	.85109	.09894	-2.00	4.00
	Control	12	-.2500	1.05529	.30464	-3.00	1.00
	Total	86	-.0698	.87838	.09472	-3.00	4.00

Table D21 Continued

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Q52CHANGE							
	Experimental	74	.0405	1.14005	.13253	-3.00	4.00
	Control	12	-.4167	.51493	.14865	-1.00	.00
	Total	86	-.0233	1.08440	.11693	-3.00	4.00
Q56CHANGE	Experimental	74	.0541	.99163	.11528	-2.00	4.00
	Control	12	-.2500	.62158	.17944	-2.00	.00
	Total	86	.0116	.95171	.10263	-2.00	4.00
Q59CHANGE	Experimental	74	.1081	1.07992	.12554	-4.00	4.00
	Control	12	-.5000	1.56670	.45227	-4.00	2.00
	Total	86	.0233	1.16797	.12595	-4.00	4.00
Q60CHANGE	Experimental	74	-.2703	.70802	.08231	-2.00	2.00
	Control	12	.1667	1.52753	.44096	-2.00	4.00
	Total	86	-.2093	.86930	.09374	-2.00	4.00
Q61CHANGE	Experimental	74	.2297	1.27728	.14848	-4.00	4.00
	Control	12	.0833	.66856	.19300	-1.00	1.00
	Total	86	.2093	1.20895	.13036	-4.00	4.00
Q63CHANGE	Experimental	74	.1892	1.10634	.12861	-2.00	4.00
	Control	12	-.3333	.98473	.28427	-2.00	2.00
	Total	86	.1163	1.09993	.11861	-2.00	4.00
Q65CHANGE	Experimental	74	.0541	1.54292	.17936	-4.00	4.00
	Control	12	.0833	1.08362	.31282	-2.00	2.00
	Total	86	.0581	1.48209	.15982	-4.00	4.00
Q66CHANGE	Experimental	74	-.0946	1.50040	.17442	-4.00	4.00
	Control	12	-.3333	2.05971	.59459	-4.00	4.00
	Total	86	-.1279	1.57776	.17013	-4.00	4.00
Q67CHANGE	Experimental	74	.1081	1.71670	.19956	-4.00	4.00
	Control	12	-.4167	1.08362	.31282	-3.00	1.00
	Total	86	.0349	1.64816	.17773	-4.00	4.00
Q68CHANGE	Experimental	74	-.0811	1.54172	.17922	-4.00	4.00
	Control	12	.0000	1.27920	.36927	-2.00	2.00
	Total	86	-.0698	1.50130	.16189	-4.00	4.00
Q70CHANGE	Experimental	74	-.1351	1.51995	.17669	-4.00	4.00
	Control	12	.2500	1.48477	.42862	-2.00	3.00
	Total	86	-.0814	1.51242	.16309	-4.00	4.00
Q72CHANGE	Experimental	74	.0270	1.50772	.17527	-4.00	4.00
	Control	12	-.5000	1.38170	.39886	-4.00	1.00
	Total	86	-.0465	1.49436	.16114	-4.00	4.00
Q74CHANGE	Experimental	74	-.1216	1.41376	.16435	-4.00	4.00
	Control	12	.1667	.93744	.27061	-1.00	2.00
	Total	86	-.0814	1.35660	.14629	-4.00	4.00
Q84CHANGE	Experimental	74	.1351	1.19731	.13918	-2.00	4.00
	Control	12	.3333	1.30268	.37605	-2.00	3.00
	Total	86	.1628	1.20646	.13010	-2.00	4.00
Q85CHANGE	Experimental	74	-.0676	1.05117	.12220	-4.00	2.00
	Control	12	.5833	1.37895	.39807	-2.00	4.00
	Total	86	.0233	1.11647	.12039	-4.00	4.00

Table D22
ANOVA for individual questions on the COPA

Variable		Sum of Squares	df	Mean Square	F	Sig.
Q1CHANGE	Between Groups	.717	1	.717	3.131	.080
	Within Groups	19.236	84	.229		
	Total	19.953	85			
Q2 CHANGE	Between Groups	.279	1	.279	1.427	.236
	Within Groups	16.430	84	.196		
	Total	16.709	85			
Q3 CHANGE	Between Groups	.327	1	.327	1.087	.300
	Within Groups	25.255	84	.301		
	Total	25.581	85			
Q4 CHANGE	Between Groups	.047	1	.047	.371	.544
	Within Groups	10.662	84	.127		
	Total	10.709	85			
Q5 CHANGE	Between Groups	.088	1	.088	.289	.593
	Within Groups	25.633	84	.305		
	Total	25.721	85			
Q6 CHANGE	Between Groups	.101	1	.101	.324	.571
	Within Groups	26.329	84	.313		
	Total	26.430	85			
Q7 CHANGE	Between Groups	.002	1	.002	.006	.937
	Within Groups	24.986	84	.297		
	Total	24.988	85			
Q8 CHANGE	Between Groups	.041	1	.041	.120	.730
	Within Groups	28.761	84	.342		
	Total	28.802	85			
Q9 CHANGE	Between Groups	.050	1	.050	.535	.467
	Within Groups	7.903	84	.094		
	Total	7.953	85			
Q10 CHANGE	Between Groups	.158	1	.158	.394	.532
	Within Groups	33.795	84	.402		
	Total	33.953	85			
Q11 CHANGE	Between Groups	.008	1	.008	.064	.801
	Within Groups	9.946	84	.118		
	Total	9.953	85			
Q12 CHANGE	Between Groups	.493	1	.493	2.660	.107
	Within Groups	15.565	84	.185		
	Total	16.058	85			
Q20 CHANGE	Between Groups	.378	1	.378	1.585	.211
	Within Groups	20.052	84	.239		
	Total	20.430	85			
Q21 CHANGE	Between Groups	.335	1	.335	.983	.324
	Within Groups	28.653	84	.341		
	Total	28.988	85			
Q22 CHANGE	Between Groups	.092	1	.092	.347	.557
	Within Groups	22.338	84	.266		
	Total	22.430	85			

Table D22 Continued

		Sum of Squares	df	Mean Square	F	Sig.
Q23 CHANGE	Between Groups	.378	1	.378	2.638	.108
	Within Groups	12.052	84	.143		
	Total	12.430	85			
Q27 CHANGE	Between Groups	.434	1	.434	1.182	.280
	Within Groups	30.822	84	.367		
	Total	31.256	85			
Q28 CHANGE	Between Groups	7.132	1	7.132	4.763	.032
	Within Groups	125.764	84	1.497		
	Total	132.895	85			
Q38 CHANGE	Between Groups	.068	1	.068	.074	.787
	Within Groups	77.514	84	.923		
	Total	77.581	85			
Q40 CHANGE	Between Groups	1.258	1	1.258	.965	.329
	Within Groups	109.579	84	1.305		
	Total	110.837	85			
Q41 CHANGE	Between Groups	2.033	1	2.033	1.966	.165
	Within Groups	86.863	84	1.034		
	Total	88.895	85			
Q42 CHANGE	Between Groups	.142	1	.142	.106	.746
	Within Groups	112.707	84	1.342		
	Total	112.849	85			
Q45 CHANGE	Between Groups	.577	1	.577	.583	.447
	Within Groups	83.236	84	.991		
	Total	83.814	85			
Q46 CHANGE	Between Groups	.242	1	.242	.184	.669
	Within Groups	110.653	84	1.317		
	Total	110.895	85			
Q48 CHANGE	Between Groups	1.951	1	1.951	2.004	.161
	Within Groups	81.782	84	.974		
	Total	83.733	85			
Q49 CHANGE	Between Groups	.453	1	.453	.584	.447
	Within Groups	65.128	84	.775		
	Total	65.581	85			
Q52 CHANGE	Between Groups	2.158	1	2.158	1.854	.177
	Within Groups	97.795	84	1.164		
	Total	99.953	85			
Q56 CHANGE	Between Groups	.955	1	.955	1.055	.307
	Within Groups	76.034	84	.905		
	Total	76.988	85			
Q59 CHANGE	Between Groups	3.818	1	3.818	2.860	.094
	Within Groups	112.135	84	1.335		
	Total	115.953	85			
Q60 CHANGE	Between Groups	1.971	1	1.971	2.660	.107
	Within Groups	62.261	84	.741		
	Total	64.233	85			
Q61 CHANGE	Between Groups	.221	1	.221	.150	.700
	Within Groups	124.011	84	1.476		
	Total	124.233	85			

Table D22 Continued

		Sum of Squares	df	Mean Square	F	Sig.
Q63 CHANGE	Between Groups	2.819	1	2.819	2.368	.128
	Within Groups	100.018	84	1.191		
	Total	102.837	85			
Q65 CHANGE	Between Groups	.009	1	.009	.004	.950
	Within Groups	186.700	84	2.223		
	Total	186.709	85			
Q66 CHANGE	Between Groups	.589	1	.589	.234	.630
	Within Groups	211.005	84	2.512		
	Total	211.593	85			
Q67 CHANGE	Between Groups	2.844	1	2.844	1.047	.309
	Within Groups	228.052	84	2.715		
	Total	230.895	85			
Q68 CHANGE	Between Groups	.068	1	.068	.030	.863
	Within Groups	191.514	84	2.280		
	Total	191.581	85			
Q70 CHANGE	Between Groups	1.532	1	1.532	.667	.416
	Within Groups	192.899	84	2.296		
	Total	194.430	85			
Q72 CHANGE	Between Groups	2.868	1	2.868	1.289	.260
	Within Groups	186.946	84	2.226		
	Total	189.814	85			
Q74 CHANGE	Between Groups	.858	1	.858	.463	.498
	Within Groups	155.572	84	1.852		
	Total	156.430	85			
Q84 CHANGE	Between Groups	.406	1	.406	.276	.601
	Within Groups	123.315	84	1.468		
	Total	123.721	85			
Q85CHANGE	Between Groups	4.375	1	4.375	3.618	.061
	Within Groups	101.579	84	1.209		
	Total	105.953	85			

Table D23
Frequencies of answer choices for question 28 on the COPA

Group	Number of Milk Servings per Day	Pretest	Posttest
Experimental	0	15	14
(n=74)	1	20	22
	2	20	15
	3	7	11
	4	5	3
	5 or more	7	9
	Total	74	74
Control	0	1	2
(n=12)	1	5	5
	2	2	3
	4	3	2
	5 or more	1	0
	Total	12	12

Table D24
Descriptive statistics for question 28 of the COPA

Group	Statistic	Q 28 Pretest	Q 28 Posttest	Q28Change
Experimental (n=74)				
	Mean	1.84	1.92	.08
	Std. Error of Mean	.176	.183	.137
	Std. Deviation	1.517	1.577	1.179
	Skewness	.718	.676	-.006
	Std. Error of Skewness	.279	.279	.279
	Minimum	0	0	-3
	Maximum	5	5	3
Control (n=12)				
	Mean	2.17	1.42	-.75
	Std. Error of Mean	.474	.288	.429
	Std. Deviation	1.642	.996	1.485
	Skewness	.569	.274	-2.512
	Std. Error of Skewness	.637	.637	.637
	Minimum	0	0	-5
	Maximum	5	3	0

Table D25
Paired samples t-test for question 28 on the COPA

Group	Variable	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig.
					Lower	Upper			
Experimental (n=74)	Q28 Pre-Q28 Post	-.08	1.179	.137	-.35	.19	-.591	73	.556
Control (n=12)	Q28 Pre-Q28 Post	.75	1.485	.429	-.19	1.69	1.750	11	.108

APPENDIX E

DEMOGRAPHICS PLUS QUESTIONNAIRE (DPQ)

Calcium Pre-test

Please complete:

Age	Date of Birth	Class Period	Teacher
_____	___/___/___ mo./day/yr.	_____	_____

Please check all that apply:

Male	Female	Caucasian	African American	Hispanic	Other

1) What feelings do you have towards dairy foods? Mark **all** that apply.
    a. I like dairy foods.
    b. I eat dairy foods because I know they are good for me.
    c. I would eat/drink more dairy foods if I liked the taste.
    d. I avoid dairy foods because I think they are fattening.
    e. I avoid dairy foods because they make my stomach hurt.

2) On a scale of 1 to 5 (with 5 being very concerned), how concerned are you about getting enough calcium everyday?
    a. 1 not concerned.
    b. 2
    c. 3
    d. 4
    e. 5 very concerned.

3) Do you think you are getting enough calcium in the foods you eat?
    a. Yes.
    b. No.
    c. Not sure

4) If you do not get enough calcium in the foods you eat, what diseases can you get?
    a. High blood pressure.
    b. Osteoporosis
    c. Cancer
    d. All of the above

5) Osteoporosis is:
    a. A disease of thin bones.
    b. A disease that cannot be cured.
    c. A disease that causes you to lose height.
    d. All of the above.

6) Which milk has the most calcium?
    a. Whole milk.
    b. 1% milk.
    c. Skim milk.
    d. They are all equal in calcium.

7) Osteoporosis is a disease that can affect:
    a. Females and males.
    b. The old.
    c. The young.
    d. All of the above.

8) You have until the age of about_____ to build your calcium stores.
    a. 55.
    b. 18.
    c. 30.
    d. None of the above.

9) How often do you read the nutrition label when shopping for food?
    a. Never.
    b. Sometimes.
    c. Always.
    d. I do not shop for food.

10) How would you use the nutrition label on a food to see if it is high in calcium?
    a. Calcium is listed as a % Daily Value on the "Nutrition Facts" section of a food label.
    b. Look for the serving size and the amount of calcium per serving size to determine if a food is a good source of calcium or not.
    c. a and b
    d. I do not know how to interpret the information on a food label.

11) Teens need to reach _____% of the %Daily Value of calcium:
    a. 80%
    b. 90%
    c. 110%
    d. 120%

12) What are my options if milk makes my stomach hurt?
    a. Drink lactose free milk.
    b. Drink milk with a meal.
    c. Drink small amounts of milk at a time and gradually increase intake.
    d. All of the above

Calcium Post-test

Please complete:

Age	Date of Birth	Class Period	Teacher
_____	___/___/___ mo./day/yr.	_____	_____

Please check all that apply:

Male	Female	Caucasian	African American	Hispanic	Other

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    b. I eat dairy foods because I know they are good for me.
    c. I would eat/drink more dairy foods if I liked the taste.
    d. I avoid dairy foods because I think they are fattening.
    e. I avoid dairy foods because they make my stomach hurt.

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    a. 1 not concerned.
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    c. 3
    d. 4
    e. 5 very concerned.

3) Do you think you are getting enough calcium in the foods you eat?
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4) If you do not get enough calcium in the foods you eat, what diseases can you get?
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   c. Drink small amounts of milk at a time and gradually increase intake.
   d. All of the above.

Please fill out the following questions to help us improve the website:

13) What have you learned from the website?

14) What did you like most about the website?

15) What did you like least about the website?

APPENDIX F

FOOD FREQUENCY QUESTIONNAIRE (FFQ)

See Accompanying File Ffq2.pdf

APPENDIX G

CALCIUM OSTOPOROSIS PHYSICAL ACTIVITY (COPA) QUESTIONNAIRE

See Accompanying File Copa2.pdf

VITA

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EDUCATION & HONORS

2000 – 2003 Texas A&M University
Combined Master of Science/ Dietetic Internship Program

2001 Texas A&M University
Robertson Fellowship

1996-2000 Texas A&M University
Bachelor of Science in Nutritional Sciences

PROFESSIONAL EXPERIENCE

2003 – Present Kindred Hospital
Registered Dietitian (2/03 – present)

2003 – Present Millwood Psychiatric Hospital
Consultant Dietitian (2/03 – present)

1999 – 2002 Texas A&M University
Dietetic Intern (1/02 – 7/02)
- Scott & White Memorial Hospital
- Central Texas Veteran's Health Care System
- Women, Infants, and Children (WIC)
- Brazos Valley Women's Center
- Bryan Independent School District, Child Nutrition Services
- Gambro Health Care, Inc.
- MD Anderson Cancer Center

Teaching Assistant (5/01 – 12/01)
Nutrition Assistant, Student Health Services, A.P. Beutal Health Center (5/99-5/00)

2000-2001 Texas Cooperative Extension, Expanded Nutrition Program
Nutrition Student Assistant (5/00 – 8/00, 5/01 – 8/01)