THESIS

MINI-PROGRAM ENERGY CORTEZ: OBESITY AND TYPE 2 DIABETES PREVENTION THROUGH SCIENCE ENRICHMENT FOR ELEMENTARY SCHOOL CHILDREN IN RURAL SOUTHWESTERN COLORADO

Submitted by

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WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY DIANA LYNN CULBERTSON ENTITLED MINI-PROGRAM ENERGY CORTEZ: OBESITY AND TYPE 2 DIABETES PREVENTION THROUGH SCIENCE ENRICHMENT FOR ELEMENTARY SCHOOL CHILDREN IN RURAL SOUTHWESTERN COLORADO BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

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ABSTRACT OF THESIS

MINI-PROGRAM ENERGY CORTEZ: OBESITY AND TYPE 2 DIABETES PREVENTION THROUGH SCIENCE ENRICHMENT FOR ELEMENTARY SCHOOL CHILDREN IN RURAL SOUTHWESTERN COLORADO

Background: Over the past 30 years, the rate of overweight (BMI $\geq 95^{th}$ percentile) children aged 6-11 years has all but tripled. NHANES data for 2003-2006 show the prevalence of at risk of overweight ($\geq 85^{th}$ percentile) at 30% and overweight at nearly 16% for this age group (1). Overweight in childhood often persists into adulthood and greatly increases the risk of developing type 2 diabetes (2). The prevalence of obesity and diabetes rates are higher for Native American populations and due to their often remote rural locations, prevention services are often limited (3). Although data on specific tribes, including the Ute Mountain Ute tribe of Colorado, are not available, surveys indicate that, of Native American children aged 5-18 years, 39% have a BMI $>85^{th}$ percentile of the second National Health and Nutrition Examination Survey.

Lifestyle modification interventions have been shown to prevent the development of type 2 diabetes (4). Program ENERGY is an obesity and diabetes prevention through science-enrichment intervention for elementary school children (5). The goal of this study was to evaluate the effectiveness and feasibility of a mini-version of Program ENERGY for second and third grade children in Cortez, a rural community of southwestern Colorado that services the Ute Mountain Ute Native American tribal community. <u>Methods:</u> The participants in this intervention were 42 second grade children and 40 third grade children from the intervention and comparison groups attending two schools in the Montezuma RE-1 school district of Cortez, Colorado. The intervention children received the mini-Program ENERGY, which included 12 bimonthly classroom interactions and a healthy snack. The comparison school did not receive this intervention. Children completing year 1 (2004-2005) as second graders comprise Cohort A (37 children), those completing year 2 (2005-2006) as third graders comprise Cohort B (40 children) and those completing both years (2004-2006) comprise Cohort C (29 children). Baseline and post assessments were performed each year in the fall and spring respectively. Variables measured were food and physical activity knowledge, attitude and behavior using validated surveys, BMI, body image using validated pictorial questionnaires, and pedometer step counts. <u>Results:</u> Significant ($p<0.05$) improvements in measured outcomes varied by year and cohort. For food and physical activity surveys, year 1 (Cohort A) did not produce significant results compared to the comparison school, although the food total score (max=46) and health knowledge score improved significantly ($p<0.01$) from pre to posttesting within the intervention ($p<0.05$). In year 2 (Cohort B), food health knowledge and physical activity outcomes improved significantly from pre to post and physical activity total score ($p<0.05$), attitude ($p<0.01$) and knowledge and attitude ($p<0.02$) scores increased significantly over the comparison school children. Over the 2 full years of the program children in the intervention (Cohort C) made the most gains in food knowledge with fewer significant gains in physical activity. The total food health knowledge score increased significantly from baseline ($p<0.0001$). The total food score improved significantly ($p<0.02$), however neither result was significant to comparison school outcomes. Of the physical activity written assessments, only the attitude score improved significantly ($p<0.05$) over the two years from baseline to post test. Body image improved significantly in female children at the intervention in year 1 (Cohort A) and over the 2 years of the intervention (Cohort C). In year 1 (Cohort A), the desired body image (1= thin, 7=obese) of female students at baseline was an unhealthy 2.67 and increased to a healthy 3.47 ($p<0.04$, *1 tail*) at posttest. After 2 years of the intervention (Cohort C), females' on average desired image improved from a 2.70 to 4.10 ($p<0.03$). Body satisfaction scores also improved as female children's desired image and self-image came into alignment at post test. In the fall of 2004 (baseline), on average female children (Cohort C) reported a self image of 3.8 and a desired image of 2.7, by the spring of 2006 (post) they reported a self image of 4.20 and a desired image of 4.10 ($p<0.04$). Mean BMI z-scores did not change significantly in year 1 (Cohort A and Cohort C). In year 2, for both Cohort B and C, the mean BMI z-scores decreased significantly from baseline to post test ($p<0.01$, $p<0.03$ respectively). Cohort B children also significantly ($p<0.02$) decreased mean scores in relation to the comparison school children. Over the 2 years of the intervention, there was no significant change in mean BMI z-scores. The methods used for the pedometer step counts in Cortez were different than those used in Fort Collins. As a result, the mean step count data in Cortez were erratic. <u>Conclusion:</u> Program ENERGY was successfully disseminated in a rural area of southwestern Colorado. Food and physical activity health, knowledge, behaviors, and attitudes improved significantly at the intervention school but actual physical activity (step counts) changes were not significant. Female students significantly improved their body image. The mini-Program ENERGY may achieve

similar results to its parent version with fewer resources and reduced lesson intensity in diverse populations.

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INTRODUCTION

Obesity and type 2 diabetes are ever-growing health problems among U.S. children. Over the past 30 years, the rate of overweight (BMI $\geq 95^{th}$ percentile) for children aged 6-11 years has all but tripled. NHANES data for 2003-2006 show the prevalence of at-risk of overweight ($\geq 85^{th}$ percentile) at 30% and overweight at nearly 16% for this age group (1). Type 2 diabetes, once rare in children, is now also on the rise and is expected exceed the diagnoses of type 1 diabetes within the next 10 years (2).

Like other chronic conditions, not all populations are equally affected. Native American children have increased rates of obesity and a higher prevalence of type 2 diabetes than children of other ethnicities (3). A study in Oklahoma found that by age 7, 44% of Native American children were at risk of overweight or overweight and by age 12, that number had risen to 60% percent (4). Native American children in rural settings are particularly affected as many live on isolated reservations with limited access to fresh fruits and vegetables and opportunity for physical activities.

The Ute Mountain Ute Tribe of southwestern Colorado is located on a reservation in Towaoc, 15 miles south of Cortez in a remote dessert landscape, near the border with New Mexico. The reservation has an active tribal counsel and many residents are employed both on and off the reservation. The Utes have a rich culture and, like many Native American tribes, are concerned with preserving their autonomy and heritage in an ever increasingly “Americanized” world. The total population in Towaoc in 1999 was

1,097 (5). The children from the reservation are bused each day to attend one of several elementary schools in Cortez. Manaugh and Mesa Elementary are two of these schools located only several blocks from one another on the southwestern side of Cortez. Because of the demographics of the population, these children are considered at increased risk for the development of obesity and the type 2 diabetes.

The American Diabetes Association has issued a consensus statement on youth, reporting that 8-45% of newly diagnosed diabetes in youth are non-immune mediated or the type 2 form of diabetes (6). Many of these cases were of American Indian, African American, Mexican American, or Pacific Islander ethnicity, overweight, insulin-resistant, had a family history of type 2 diabetes, and often had Acanthosis Nigricans (AN) (2,7). AN is a dark, thick area of skin in body folds that may indicate hyperinsulinemia and therefore an increase in risk for type 2 diabetes (7).

In addition to increasing the risk of health problems during childhood, overweight, for 70% of adolescents, persists into adulthood continuing the course toward obesity-related chronic diseases later in life (8). Lifestyle modification interventions aimed at improving diet and increasing exercise have been shown to successfully prevent the development of type 2 diabetes and promote weight loss (9). The American Dietetic Association (ADA) recently performed a systematic evidence-based analysis of overweight interventions for children and adolescents. For primary prevention of childhood overweight, ADA recommends family-based, multi-component programs and behaviorally based, multi-component programs in the school setting with a parent/family component for younger children (10). In the ADA analysis, evidence was available to support behavioral counseling and nutrition education (based on the use of behavior change theories, such as Social Cognitive Theory and the Theory of Reasoned Action), physical activity education, and parental/family involvement as effective components (10).

The Colorado Science Education Partnership (CSEP) has developed and implemented for six years a successful school-based intervention that meets and exceeds these new ADA recommendations. CSEP is a collaboration among Colorado State University educators and scientists, local elementary schools, and community organizations and businesses with the goal of preventing obesity and type 2 diabetes through community-based participatory research. CSEP's Program ENERGY (Education, Nutrition, Exercise, and Recreation for Growing Youth) was developed using behavioral strategies, and educates elementary school students in nutrition, physical activity, and diabetes prevention through science enrichment (11-15).

The full version of Program ENERGY is a 35-week program of weekly classroom lessons, physical activities, and parent involvement through newsletters, family challenges, and community events. It has been shown to increase children's knowledge and appreciation of health and science, raise physical activity levels, increase body acceptance, and elevate children's interest in science careers (11-17). The mini-version of Program ENERGY is a shorter, less-resource and time-intensive version of the program that provides two one-hour classroom lessons per month (12). A pilot program of mini-Program ENERGY in Cortez, Colorado has produced results similar to the full Program ENERGY implemented in Fort Collins, Colorado.

Program ENERGY was initially designed to target children in grades 2-6 in low income, suburban and rural elementary schools with high Hispanic enrollments. The goals of this study were to evaluate the effectiveness of mini-Program ENERGY for second and third graders and their parents in a low-income, rural population with a high Native American population. The mini-Program was carried out over two full school years (September 2004 to May 2006) for second, third and forth graders. However, only the assessments of the children who were present in second grade (2004-2005) and third grade (2005-2006) are presented here. The data are subdivided into children who attended each of these schools years individually, as well as reporting the data for the students who attended for two consecutive years (2 full years of mini-Program ENERGY). The objectives for the children were to (1) increase knowledge and appreciation of healthy foods and physical activity, (2) increase physical activity, (3) improve body acceptance, and (4) to maintain BMI scores.

Cortez is in a beautiful rural setting surrounded by both mountains and dessert. It has a uniquely rich culture, with influences from the Ute Mountain Ute tribe and those of early pioneers, farmers, and ranchers. It sits in a remote region that is often overlooked by nutrition interventions provided to underserved areas on the Front Range of Colorado. This project grew out aspirations of my advisor and I to bring community-based, high-quality nutrition education to rural underserved regions of Colorado, in particularly to Native Americans who are disproportionately facing the dire consequences (type 2 diabetes, kidney failure, heart disease, cancer, etc) of our nation's struggle with obesity. As a native Coloradoan, I hoped to bring a cultural sensitivity and enthusiasm for improving health in my home state.

METHODS

Setting & Sample

The choice of Cortez, Colorado as the site for the dissemination of mini-Program ENERGY was based on its remote location and its underserved population. Cortez is located in the far southwestern corner of Colorado. Its residents and nearby Native American members of the Ute Mountain Ute Tribe, located in Towaoc, Colorado, attend schools in the Montezuma-Cortez RE-1 school district. The 2002-2003 school year data shows the student population at Manaugh Elementary was 55% White (non Hispanic), 30% Native American, 12% Hispanic and 2% other (18). Of the 370 children at Manaugh, 54% received free or reduced school lunch (18). Mesa Elementary was chosen as the comparison school because of its analogous child population and locale. Mesa is located only blocks from Manaugh and its children share socioeconomic and ethnic similarities. According to the 2002-2003 school year data, the school enrollment was 52% White (non Hispanic), 36% Native American, 11% Hispanic, and 1% other (18). Of the 351 children attending Mesa, 50% received free or reduced lunch (18).

The second and third grade classroom educators, at both the intervention and comparison schools, approved the program after a meeting introducing the program's objectives and methods. At each school, the participating educators presented the program to the principal and written authorization to conduct the program was obtained.

Informed parental consent and child assent were obtained prior to the beginning of the intervention. Children were sent home with a folder containing a consent form approved by Colorado State University Human Research Committee (CSUHRC). In addition to the official consent form, the folder contained a letter from the classroom educator explaining the program. The children were asked to return their folders either with a signed consent form or the word “No” if they did not want to participate. Questions about the consent form were first addressed to the educator and the project investigator handled issues needing further explanation. Child assent was obtained in the classroom. Children were informed that their participation was not mandatory and would not affect their grades in class. Everyone would participate in the program activities regardless of consent, but data would not be collected on children without consent/assent. In year 1, at the intervention school, 30 out of 35 children (86%) returned signed consent/ assent forms. In year 2, 28 out of 39 (72%) consented/assented. The comparison school returned 12 out of 16 consent/assent forms (75%) in year 1, and 12 out of 23 (52%) in year 2.

The mini-Program ENERGY was staffed by the author and volunteers recruited from the community. Volunteers included both high school and nursing students from the area. The school’s D.A.R.E. police officer and a local veterinarian also donated their time as guest speakers. Donations were provided by Wal-Mart and several small local businesses, providing materials for teaching aids, rewards and snacks.

Intervention

The Cortez mini-Program ENERGY began September 2004 following a pilot program that was implemented in the spring of the 2003-2004 school year. Parental consent and child assent were obtained prior to baseline assessments, which were preformed in year 1 and 2 during the first part of September. All of the children participated in all the activities. However, data were not collected on children who never returned their consent form.

In year 1, the second grade children completed 12 interactions, 6 each semester, from September 2004 to May 2005. The physical education teacher at Manaugh focused on increasing physical activity, both in and out of the classroom, with the 100 Mile Club. Children aimed to walk 100 miles during the school year and were recognized with certificates and toe tokens at monthly assemblies for each 10 mile increment they completed. For this reason, and lack of comparable resources to the Fort Collins Program, no additional physical activity component was planned for the mini-Program in Cortez. The classroom component, however, did incorporate physical activity into some of the lessons and sought to improve overall attitudes and knowledge about physical activity (see Table 1 and 2).

In both second grade classrooms the lesson frequency was every other week. One class was on Tuesdays and the other on was on Thursdays from 3:00-3:50 pm. The only exception being the "Walking Field Trip" lesson which was 1 hour and 55 minutes in duration. The educators selected the time and days of the week for the lessons with input from the lesson leader. Times were selected that would allow high school students to volunteer after their classes, which let out at 2:50 pm. The lesson leader and two to three high school volunteers delivered 10 of the 12 lessons. Occasionally a nursing student from a nearby nursing program would volunteer to help with the classroom implementation. Guest speakers from the community (a veterinarian and a police officer) delivered the other two lessons. The total intervention time in year 1 was 11 hours and 5 minutes over 36 weeks.

In year 2, the third grade students again completed 12 interactions, 6 per semester, from September 2005 to May 2006. As in the year before, the lessons were every other week and occurred on Tuesdays and Thursdays. The lesson were 5 minutes longer in third grade and took place on Tuesday from 1:00-1:55 pm for one class and Thursday from 2:15-3:10 pm for the other. Educators selected the days and times that worked best with their schedules, although these times were not as conducive for high school students and thus there were fewer volunteers. The total intervention time was 11 hours over 36 weeks.

Most of the lessons that were implemented had been previously developed at Colorado State University by the Program ENERGY research team. Program ENERGY lessons are based on three behavior change theories; Theory of Reasoned Action, Social Cognitive Theory, and the Health Belief Model. Lessons are designed to be inquiry based with a focus on science, math, literacy, and health. The lessons cover many topics but primarily the focus is on energy balance and type 2 diabetes. Some lessons were modified from their original form to fit the individual circumstances. For example, there were fewer volunteers in Cortez as well as less lesson materials available. Therefore, some lessons could not be conducted in small groups with one leader per group. Instead, lessons were conducted in stations, and children rotated to each station facilitated by the lesson leader, the educator, and a single volunteer. ***Tables 1*** and ***2*** describe the lessons from year 1 and 2 respectively, and note the modifications that were made. One lesson that was not implemented in Fort Collins Program ENERGY was the “Walking Field

Trip." This lesson was done only in Cortez and is described in ***Table 1***. In general, all lessons began with a brief introduction and vocabulary words followed by a hands-on science activity and ended with a snack and a discussion of what was learned. Snacks were used as a way to reinforce lesson ideas, introduce a new food, and/or practice reading food labels. The snacks are described in ***Table 3***. Lessons that were repeated in third grade explored in greater depth the topic and served as a review from second grade.

Table 1: Classroom lessons selected for Year 1 Program ENERGY-Cortez

Lesson	Description
Food Guide Pyramid (FGP)	Introduction to the FGP; categorization of (FGP) foods into food groups; identify key nutrients from each group and the number of servings per day from each.
Reading Food Labels	Review the FGP; define calorie, fat, carbohydrates, and grams (g), determination of the amount of calories, fat and total carbohydrates in foods by reading food labels.
Diversity: Stars, Planets, Habitats, Food and People	Exploration of diversity through food; observing, measuring, and weighing food; connection of diversity in food and diversity in people.
Insect Gourmets *Lesson Modifications	Identification of insect mouth types and insect food; form fits function; explore the relationship between human and insect nutrition. * Shortage of materials and volunteers; rotated students in 3 stations, each led by a volunteer, group leader or teacher; clip from video *MicroCosmos* was added as a station, other stations: insect collection and insect mouths (scissors, straw, clothespin).
FGP Snack Face	Use of foods from each food group to create a healthy and artistic snack; exploration of new foods and ways to prepare them.
Energy Balance: Apple vs. Chocolate	Making healthy choices about food and physical activity to stay in energy balance; use of pedometers, 400 steps for apple slices and 800 steps for chocolate. apple slices and 800 steps for chocolate.
Sugar Regulation	Introduction to blood glucose and insulin in a healthy individual compared to a diabetic; make and measure a glucose solution and record results on a data sheet
Fat and Diabetes	Comparison of fat contents in food; discussion of the role of fat in health; introduction to the 3 keys of diabetes prevention.
Careers Guest Speaker	A veterinarian from the community visited the class; diabetes in animals; what vets do and related careers; science career paths.
"Who Wants to Have Fun with Food" Game	Quiz game that test students' knowledge of food and health; reviews previous topics and introduces new ones.
Health Fair 101	Focused interactive learning stations about heart health, nutrition, and hand washing.
Walking Field Trip	Stranger and walking safety led by school resource police officer; students mapped out steps of different treks around the school and surrounding neighborhood; parents were invited to attend; received brochure containing map of our treks and healthy nutrition and physical activity ideas; Lesson time was 1hr 55min

Table 2: Classroom lessons selected for Year 2 Program ENERGY-Cortez

Lesson	Description
Food Guide Pyramid (FGP)	Review concepts of FGP introduced in year 1; compare different types of fat and sources of protein (animal versus plant); whole grains versus refined and sources of each.
Reading Food Labels	Review concepts of year 1 lesson; add %Ca if included on food label; compare differences in fat, carbohydrates, and calories in different food groups.
Healthy Habits Restaurant	Interpret data from graphs comparing fat, calories and/or sugar in similar foods and select the healthiest option for a menu at a healthy restaurant.
Pumpkin Pie	Exploration of pumpkin and squash history, uses and health benefits; follow a recipe to create a healthy pumpkin snack
Are you a Super Taster	Exploration of the different regions of the tongue and taste buds; experiment- dye tongue blue and count taste buds to see if you are a supertaster?
ENERGY Balance	Review concept of ENERGY IN=ENERGY OUT; calculate energy consumption for Mrs. Long and balance with physical activities and BMR; visual demonstrations of ENERGY BALANCE with chips and scales.
Amazing Life of Mosquito *Lesson Modification	Exploration of the mosquito lifecycle and its role in the environment; prevention of West Nile Virus. *Shortage of materials and volunteers; rotated students in 3 stations, each led by a volunteer, group leader or teacher; clip from video *MicroCosmos* was added as a station, other stations: poster on what is West Nile and how to prevent it; datasheet and review of life cycle.
Sugar Regulation I	Review sugar regulation from year 1; tank demonstration of glucose in and out; role of insulin in normal a diabetic state; measurement of different glucose concentrations; making a glucose solution.
Sugar Regulation II	Review diabetes prevention; measurement of glucose solution made in Sugar Regulation I lesson; making a dilution and calculating predicted concentrations then testing concentrations; use of laboratory materials: test tubes and transfer pipettes
Fat and Diabetes	Exploration of the role of fat in health and disease; comparison of fat in similar foods: ice cream vs. frozen yogurt, buttered popcorn vs. popcorn, and french fries vs. baked potato; which is better for health?
MTVW	Exploration of the metric system and its use in science using a **M**icroscope, **T**emperature (℉ vs ℃), **V**olume(ml, L), **W**eight (g).
How Many Steps in a Mile?	Determination of the number of steps in a mile using a pedometer; graph results of class; discussion of number of steps needed each day for health and what activities could be done to get more steps everyday.

Table 3: Snacks for Year 1 and 2 for Program ENERGY-Cortez

Year 1 **Snack**	**Lesson**
Crackers, raisins, baby carrots, peanuts, string cheese, Hershey Kiss	Food Guide Pyramid; snack was part of the lesson; reinforced lesson concepts.
Twix Cookie bar	Reading Food Labels; reinforce reading food labels and "sometimes foods" in moderation can be part of a healthy diet.
Go-gurt	Diversity; reinforce reading food labels and food group classification discussion
Naked Juice Nectar	Insect Gourmets; snack was part of lesson; demonstration of foods insects eat; taste exploration of different fruits.
Snack Face	Food Guide Pyramid Snack Face; students made a snack from a variety of foods using an English muffin as the base; encouraged eating new foods and eating healthy is fun, easy, and creative!
Apple slices and Hershey Kisses	Apple vs. Chocolate; used as part of the lesson; exploration of energy in different types of food.
Trail Mix	Sugar Regulation; reinforce reading food labels and food group classification discussion.
Fruit Roll-up	Fat and Diabetes; reinforce reading food labels and food group classification discussion.
No Snack	Veterinary guest Speaker
Pudding Cups	Who Wants to Have Fun with food game; reinforce reading food labels and food group classification discussion.
Kashi Crackers	Health Fair 101; reinforce reading food labels and food group classification discussion.
Stoplight Graham Crackers Bottled Water	Walking Field Trip; stoplight themed snack to tie in healthy eating with the activity; graham cracker, peanut butter, strawberry, banana and kiwi slice.

Year 2 **Snack**	**Lesson**
Crackers, raisins, baby carrots, peanuts, string cheese, Hershey Kiss	Food Guide Pyramid; snack was part of the lesson; reinforced lesson concepts.
Fruit Snacks	Reading Food Labels; reinforce reading food labels and food group classification discussion.
Snow Peas	Healthy Habits Restaurant; reinforce reading food labels and food group classification discussion; explore new vegetables.
Pumpkin Pie Snack	Pumpkin Pie; snack was made as part of the lesson; healthy ways to use pumpkin; ingredients –pumpkin, applesauce, cinnamon, brown sugar, pre-made mini graham pie crust
Pretzels	Are you a Super Taster; exploration of salt taste region of the tongue, reinforce reading food labels and food group classification.
Cheese: Gouda, Brie, Goat	ENERGY Balance; exploration of new foods, making of cheese, nutrients and food group Classification.
Naked Juice Nectar	Amazing Life of the Mosquito; used as part of the lesson to show how and what mosquitoes eat.
Soy Nuts	Sugar Regulation I; exploration of a new food; food group classification.
Soy Milk, Chocolate and Vanilla	Sugar Regulation II; exploration of a new food; food group classification.
Flaxseed Cookies	Fat and Diabetes; exploration of different types of fat in foods; some fat is healthier than others.
Baby Carrots	MTVW; reinforcement of low-fat healthy snacks
Kashi Crackers	How Many Steps in a Mile; reinforce reading food labels and food group classification discussion.

Children completed data sheets during most lessons. The data sheets were used to reinforce the lessons message and to give students an opportunity to record data as a "scientist." The data sheets were collected at the end of each lesson by the lesson instructor and compiled into science folders. At the end of the last lesson, the science folders were given to the children. They were encouraged to share their data sheets with their parents and explain to them the lessons they had learned throughout the year. For example, from the Fat and Diabetes lesson, children shared that fat is important but too much fat on our bodies can make us sick with diseases like diabetes.

Variables and their Measures

The Cortez mini-Program ENERGY was evaluated using the same assessment tools that were previously used in the assessment of the full Program ENERY in Ft. Collins, Colorado. Pre and posttest measurements were made at both the intervention and comparison schools during the 2-year implementation of the program in Cortez. In year 1, baseline measurements were made in the fall (September, 2004) and post testing was completed in the spring (end of April and early May, 2005). Year 2 measurements followed the same schedule, with pretesting in the fall (September, 2005) and post assessments being completed in the spring (end of April and early May, 2006). Measurements assessed several variables using validated questionnaires and measurements; food and physical activity knowledge, behaviors and attitudes, pedometer steps counts, body image perceptions, BMI, and waist circumference. Other measures included child and educator evaluations of the lessons and/or program. Child ethnicity was based on the US Census categories and was reported by parents or guardians who completed and returned consent forms. Gender was recorded by the educator or by classroom observation.

Measures of Child Variables

Previously validated questionnaires from the Child and Adolescent Trial for Cardiovascular Health (CATCH) and Project SPARK (Sports, Play and Active Recreation for Kids) were adapted to assess the children's knowledge, attitudes, and behaviors related to food and physical activity (19,20). The food questionnaire (CATCH) used dichotomous forced-choice picture items to assess dietary intention (9 questions), usual dietary intake (14 questions), food knowledge (14 questions), and included nine yes-or-no questions on dietary behavior. Together, these 46 questions were used to calculate the total food score. The health score was calculated using the subset of 14 questions in the food knowledge section of the questionnaire. This score was based on dichotomous forced-choice questions that asked students to select the food item based on the statement "which food is better for your health?" The CATCH questionnaire has been shown to have reasonable reliability values for students in the third and fifth grade (standardized α coefficient values from .76 to .78), content validity and concurrent validity using the usual food scale as a dependent variable in a multiple regression analysis (19).

Physical activity behaviors and attitudes were assessed in a similar manner using the SPARK questionnaire. Attitudes were calculated using four Likert scale items that were scored on a scale of one to six, with six being the most positive answer. Forty-eight questions analyzed combined knowledge and attitude scores and an additional 11 questions assessed behaviors related to physical activity. Together, these categories comprised the total physical activity score with a maximum possible score of 58. SPARK has demonstrated one-way model intraclass reliability r values ranging from .51 to .74 in a test-retest analysis for fourth grade children (20). In our evaluation, both CATCH and SPARK questionnaires were analyzed by assigning a one for the healthiest or most positive response and a 0 for an unhealthy or negative response.

Pedometers (Walk4Life Model LS 2500) were used to evaluate physical activity over a three-day period. Children received the pedometers in the afternoon on day 1 and were instructed to wear the pedometer continuously (except to bed) until the next day at the same time (24 hour period), when the pedometers would be collected, reset, and their steps would be recorded. The pedometers would be returned and worn again for the next 24-hour period. This process was repeated for day 3 and 4. However, on day 4 the pedometers were collect but not returned to the children. This allowed for three full 24-hour time periods in which to assess the daily number of child's steps. Three days has been established as an adequate period to determine routine activity levels in second, fourth, and sixth grade children at a coefficient α value of .74 (21). However, in our analysis we used two-day averages because many children did not return their pedometers consistently enough to use three days of data. For those children who had three days worth of steps recorded, the outlier day was removed from the analysis.

The Walk4Life Model LS 2500 pedometer, used in this study, has the same internal mechanism as the reliable and valid Model NEO 2500 (22). Intraclass coefficients α values were .957 for bilateral attachment and .959 for unilateral attachment (22,23). The Yamax MLS 2500 pedometer was used to establish criterion validity for the NEO 2500. The intraclass coefficient between these two pedometers was significant at an *r* value of .843 (22, 23).

Height, weight, and waist circumference were also measured and used to compute the BMI for each child. The schools' scale was used to determine height and weight, and tape measures were used on the waist. Measurements were taken to the nearest .25 inch for height and waist and nearest .50 pound for weight and converted to BMI scores (weight (kg) / [height $(m)^2$]). Program ENERGY volunteers and the program leader made the measurements in the hallway, one student at a time, for privacy. BMI has been shown to be a valid measure of fatness in children age 5 to 19 years when compared to dual energy x-ray absorptiomerty (DXA) estimates for total body fat (R^2 =0.85 and 0.89 for boys and girls, respectively) and percent body fat (R^2 =0.63 and 0.69 for boys and girls, respectively) (24). The BMI scores were than converted into BMI z-scores using a calculation program from a link (http://www.kidsnutrition.org/bodycomp/bmiz2.html) on the Baylor College of Medicine website. BMI z-scores are a direct extension and representation of the CDC growth chart and percentiles of BMI distributions (25). The z-scores provide a means of comparing change in BMI over time with respect to the expected change in the distribution of age and gender (26). Thus BMI z-scores are a better measure of longitudinal childhood weight and weight for height than raw BMI scores (26).

Body image was assessed using Body Satisfaction Silhouettes (BSS) (27). In order to determine the child's perceived self-image, the children are asked to circle one of seven pictorial figures of the male or female silhouette that they believed most resembles how they look. Next, they are asked to put an "X" on the figure that they would most like to look like (desired body image). They are instructed that the figure they "X" may be the same as the one they circled or it can be a different one. The silhouettes were scored on a scale of one (*very thin*) to seven (*obese*). The body satisfaction score is the difference between the two images that each child selects, indicating how satisfied the child is with his or her body. A test-retest for the BBS gave reliability coefficients among first through third grade children as .71 for self and .59 for ideal (27). To establish criterion validity, actual weight (.36, $p<0.05$) and BMI (.37, $p<0.05$) have been used as a comparison to the BBS (27).

Some of the ENERGY lessons were evaluated by the students using the same type of Likert scale as used in the SPARK questionnaire. The scale uses six faces expressing emotions from “Awesome” to “Yucky.” The lesson leader asked the students to mark the face that best showed how they felt about each lesson. Each response was then scored as from one to six, with a six being the most positive or the “Awesome” response.

Collection of Child Data

An assessment week was set-up for both the pretesting in the fall and the posttest in the spring. On day one of this week, children completed the questionnaires (CATCH, SPARK, BBS) in a 60-minute time period that was chosen by the educators. During the test administration, children used their folders as privacy screens. They were told that the information was to be kept private; no one at home or school would know how they answered the questions. They were also told that there was no right or wrong answer and they would not receive a grade for how they responded to the question. While administering the survey, the project coordinator read each question aloud twice and a volunteer walked around the room to answer individual questions and check that children were following along and participating appropriately.

On day two, pedometers were given to the children. The children had previously taken home a letter explaining the upcoming pedometer activity and the proper use and care of it. In class, the procedure for properly wearing the pedometer was demonstrated by the program coordinator. The use and care of the pedometer was reviewed with class participation and then pedometers were passed out to the individual children whose parents had consented to take part in the program (22). Volunteers helped make sure that pedometers were properly placed on the child’s waist and recorded the number of the pedometer that each child received. Children were reminded of the importance of remembering the pedometer each day and were shown the small prizes (pencils, stickers, rulers, etc.) that they could win for returning with their pedometer each day. In the third grade, we also conducted a name draw as part of the reward for returning the pedometers. Each day the children remembered their pedometer, they could write their name on a piece of paper and place it in a designated bucket for a drawing at the end of the week. The prize (water bottle and pedometer) for the drawing was shown to the students on day one and left on the educator's desk as a reminder.

Log sheets were used to track the pedometer assignments, step counts, collection and distribution times, child absences, forgotten or lost pedometers, and any relevant notes such as the pedometer was not worn correctly or was untied. Pedometers were sealed with cable ties to prevent children from viewing or resetting their step counts. For the next three days, pedometer data were collected at the same time (time chosen by the educators). During the collection process, the children read silently at their desk while volunteers and the program coordinator went around to each desk to unseal the pedometer by cutting the cable tie around it, record the step counts and notes, reset and reseal the pedometer, distribute a small prize to those who remembered or record those who had lost or forgotten their pedometer. If a child forgot his or her pedometer, he or she was given a new one asked to return both pedometers the next day. If he or she forgot on following day no new pedometers were given until both were returned. Children were able to view the number of steps that were taken daily when the volunteer recorded the step count. Children were reminded that the step counts were not a competition and that they should be trying to do normal activities each day. The collection process took 15 to 20 minutes per class each day and was preferred by the educators to be towards the end of the day. On day four, the last day of collection, the pedometers were not returned to the children and only prizes were given.

Anthropometric measures were collected on day two of the assessment period before pedometers were handed out. The procedure was explained to the children by the program coordinator. The children read quietly at their desk or worked on homework (as dictated by the educator), as one by one they were called into the hallway to have their height, weight, and waist circumference measured. Children were asked to remove their shoes before coming into the hallway for the measurements. The program coordinator made all of the measurements and a volunteer recorded them on a data sheet. Only children with parental consent were measured.

Statistical Methods

Data were analyzed only for children who returned a completed parental consent form and with an active child assent. The number of subjects with consent who were included in the analysis for each cohort in year one and year two from both the intervention and the comparison are shown in ***Table 4***. Also presented is the ethnic distribution of children consenting to the program in each cohort.

Statistical analyses were performed using the Microsoft Excel 2003 and 2007 Analysis ToolPak and Minitab 14. Statistical significance was determined using $p<0.05$.

The food and physical activity questionnaires (CATCH and SPARK) were analyzed using paired sample or "within subjects" t-tests (two-tailed or one-tailed as appropriate), comparing the means of individual change ("difference scores") of the intervention and comparison children from pretest to posttest. The pretest and posttest scores were then analyzed using paired sample t-tests for the intervention and comparison schools. Significance was determined for a change from pre to post within the intervention and comparison schools. Differences in group means between the intervention and comparison schools were compared using unpaired t-tests. Two-tailed t-tests were used when the hypothesis was no difference in means, while one-tailed t-tests were used when the hypothesis was the difference in means was not larger than pretest or comparison school score. Effect size (r) was also calculated using the effect size calculator from the website **http://www.uccs.edu/~faculty/lbecker/.** The calculation uses the mean difference and standard deviation of the intervention and comparison school scores to calculate an effect size (r). Effect size measures the magnitude of an apparent relationship independent of the sample size, rather than the significance level to whether the relationship is due to the intervention or to chance. Effect size is reported as small ($r = 0.10$ to 0.23), medium ($r = 0.24$ to 0.36) and large ($r > 0.37$).

The body satisfaction silhouette (BSS) questionnaire was analyzed using paired sample t-tests. The self image and desired image results were each analyzed separately by comparing the means of individual change from pretest to posttest. The means of the individual change from pretest to posttest of the body satisfaction score (self image-desired image) were compared.

Heights and weights were converted to BMI scores (weight (kg) / $[\text{height (m)}]^2$), and then into BMI z-scores as previously described. Similarly, they were analyzed using paired sample t-tests comparing the means of individual change from pretest to posttest.

The pedometer step counts were also analyzed using paired samples t-tests comparing the means of individual change. The means were calculated from two-day averages of individual child step counts.

Table 4: Children from each cohort with consent/assent from the intervention and comparison schools. Includes number of children in each assessment analysis. Also presented is the ethnic distribution of children consenting to the program in each cohort.

	Intervention			**Comparison**		
	Year 1 (04-05)	Year 2 (05-06)	2 Year (04-06)	Year 1 (04-05)	Year 2 (05-06)	2 Year (04-06)
Cohort	**A**	**B**	**C**	**A**	**B**	**C**
Consent	30/35	28/39	30/35	12/16	12/23	12/16
Retained	26/30	28/28		11/12	12/12	8/12
Food	22	20	14	11	6	6
Physical Activity	22	19	11	10	10	7
Body Image	21	18	12	11	9	7
BMI	22	20	13	8	10	5
Pedometer	17	15	8	9	8	5

	Intervention			**Comparison**		
	Year 1 (04-05)	Year 2 (05-06)	2 Year (04-06)	Year 1 (04-05)	Year 2 (05-06)	2 Year (04-06)
Ethnicity / Cohort	**A**	**B**	**C**	**A**	**B**	**C**
Native American/ Alaskan Native	46%	30%	50%	7%	8%	0%
White Non-Hispanic	32%	26%	30%	67%	50%	57%
Hispanic	7%	17%	5%	13%	25%	29%
African American	4%	4%	5%	0%	0%	0%
Decline/Unknown	7%	20%	10%	13%	17%	14%
Other	4%	2%	0%	0%	0%	0%

RESULTS

Retention

Although the number of children completing each assessment of the classroom component at baseline and the end of year one varied, a total of 42 out of the 52 eligible second graders attending the intervention and comparison schools were enrolled in the Cortez min-Program ENERGY study at baseline, for an initial participation rate of 81%. At Manaugh Elementary School (intervention), 30 of 35 (Cohort A) children or 86% of the second graders enrolled in the study. None of these children withdrew from the program; however, 4 students moved during the school year for a retention rate of 87% at the end of year 1. In year 2, 40 of 62 eligible children enrolled in the study. At Manaugh, 28 of 39 eligible children enrolled (Cohort B) for a participation rate of 72%. Of the 39 children in third grade, 13 children were new to the program and 4 of their parents consented and they assented to participate in the program. There were 3 returning children who had not consented to enroll in year 1, but had participated in the program as second graders with their classmates. As third graders, having seen the program for a year, their parents chose to consent and the children assented to enroll in year 2. Thus, there were 21 returning enrolled children and 7 newly enrolled children for a total enrollment of 28 children in year 2. The retention rate at the end of year two was 100%, as no children moved or withdrew from the program. Over the two-years of the program implementation, from second to third grade, 21 out of the original 30 (70%) children whose parents consented and they assented were retained for the two year data analysis (Cohort C).

Food and Physical Activity - ***Overall Results***

The results for food and physical activity questionnaires for all children completing year 1 (Cohort A), children completing year 2 (Cohort B), and children completing years 1 and 2 (Cohort C) of the Cortez mini-Program can be found in ***Table 5 and 6***. Significant ($p<0.05$) increases in mean scores varied by year and cohort. There were significant changes from the pre and post scores within the intervention group in all three cohorts. However, the differences between the comparison and intervention were only significant for total physical activity and selected subscores of the physical activity questionnaire in year 2 (05-06) for both Cohort B and Cohort C.

Table 5: Physical Activity and Food Questionnaire Results: Year 1 (Cohort A) and Year 2 (Cohort B)

Questionnaire Results **Year 1** (04-05) Cohort A		Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance and Effect Size, between Int and Com
		Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)	
Physical Activity	Total Score (Max score 59)	45.2	47.5	2.3 ± 1.8	ns	48.8	48.1	-0.7 ± 1.5	ns r=0.200 small
n_{Int}=22 n_{Com}=10	Attitude (Max score 24)	20.5	20.4	-0.1 ± 1.1	ns	20.7	19.4	-1.3 ± 1.0	ns r=0.153 small
	Knowledge and Attitude (Max score 48)	37.9	39.6	1.7 ± 1.6	ns	39.9	39.0	-0.9 ±1.4	ns r=0.212 small
	Behavior (Max score 11)	7.3	7.9	0.6 ± 0.6	ns	8.9	9.1	0.2 ± 0.6	ns r=0.085 no effect
Food	Total Score (Max score 46)	21.0	23.7	3.7 ± 1.4	p<0.01	22.5	26.5	4.0 ± 2.8	ns r=-0.024 no effect
n_{Int}=22 n_{Com}=11	Health Knowledge (Max score 14)	6.7	8.4	1.7 ± 0.8	p<0.05	8.3	9.8	1.6 ± 0.9	ns r=0.015 no effect

Questionnaire **Year 2** (05-06) Cohort B		Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance and Effect Size, between Int and Com
		Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)	
Physical Activity	Total Score (Max score 59)	45.5	48.1	2.5 ± 1.2	p<0.05	47.4	44.1	-3.3 ± 1.8	p<0.02 r=0.469 large
n_{Int}=19 n_{Com}=10	Attitude (Max score 24)	18.1	21.2	3.1 ± 1.0	p<0.01	19.6	19.2	-0.4 ± 0.7	p<0.01 r=0.446 large
	Knowledge and Attitude (Max score 48)	37.8	40.9	3.1 ± 1.3	p<0.02	39.0	36.1	-2.9 ± 1.9	p<0.02 r=0.467 large
	Behavior (Max score 11)	7.7	7.1	-0.6 ± 0.6	ns	8.4	8.0	-.40 ± 1.0	ns r=-0.035 no effect
Food	Total Score (Max score 46)	24.1	25.7	1.7 ± 1.4	ns	22.5	26.0	3.5 ± 1.6	ns r=-0.169 small
n_{Int}=20 n_{Com}=6	Health Knowledge (Max score 14)	8.6	9.9	1.3 ± 0.7	p<0.04 (1 tail)	7.0	10.0	3.0 ± 1.2	ns r=-0.268 medium

Year 1 Results, Cohort A

In year 1, second graders at Manaugh (intervention) made significant gains in their understanding of making healthy food choices. The mean total food score (maximum score=46) increased from a 21.0 (46%) in the fall to 23.7 (52%; 3.7 ± 1.4, *p<0.01*) in the spring. Similarly, the food health knowledge score increased from a mean of 6.7 (48%) to 8.4 (60%; 1.7 ± 0.8, *p<0.05*) (**Figure 1**). Specific questions with significant improvements from the food health knowledge section of the CATCH questionnaire are highlighted in **Figure 2**. Conversely, Year 1 did not produce any significant changes in attitudes, knowledge, or behaviors about physical activity.

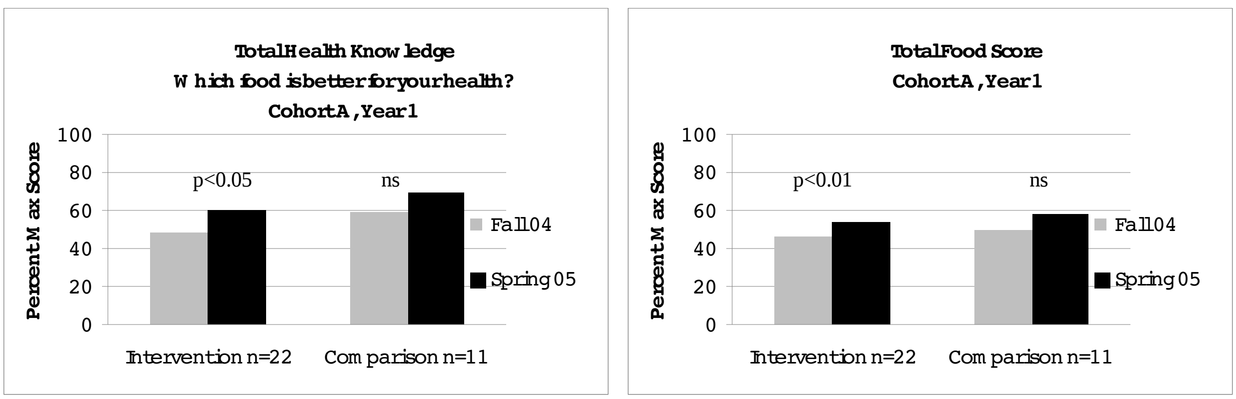
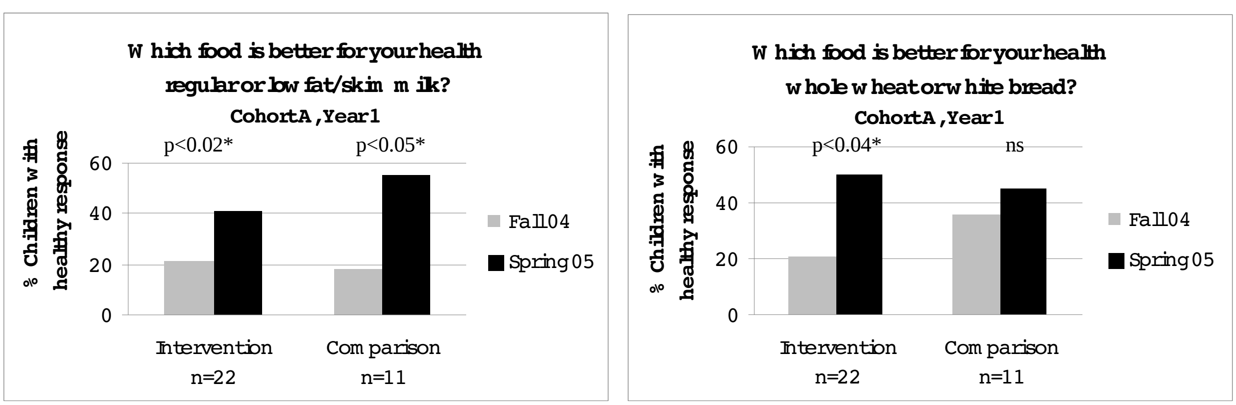


Figure 1: Cohort A, Significant results from CATCH questionnaire, Total Food Score and Total Food Health Knowledge. *Significance from pre to post only, ns=not significant, *1-tail only*



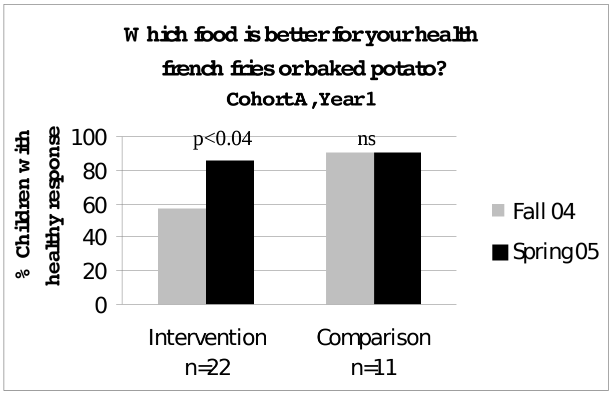


Figure 2: Cohort A, Significant results from CATCH questionnaire, Food Health Knowledge Section. Comparison of % children choosing the healthy response (skim milk, whole wheat bread, baked potato) at baseline (Fall 04) and post (Spring 05) test. *Significance from pre to post only, ns=not significant, *1-tail only*

Although physical activity total and subscores did not change significantly, there were significant improvements in individual questions. On average, children gained confidence in their ability to participate in games and sports. Children choosing "I feel I am good enough at games and sports" increased from 45% in the fall to 75% ($p<0.01$) in the spring.

<u>Year 2 Results, Cohort B</u>

As third graders, in year 2 (Cohort B), some children were new to program ENERGY (7 children) while for others, it would be their second year to participate in the program (21 children). During this year of the program, children improved significantly in their physical activity attitude and knowledge scores (***Table 5***). The gains made in physical activity were significant within the intervention group and also between the intervention and comparison children. The intervention children increased their mean scores significantly in total physical activity ($p<0.02$, r=.469 large effect), attitude and knowledge ($p<0.02$, r=.467 large effect), while the comparison school children's mean scores decreased in all categories from the beginning to the end of the third grade year (***Figure 3, Table 5***).

The physical activity scores at baseline of year 2 (fall 05) were similar to baseline scores in year 1 (fall 04). However, the increases in attitude and knowledge made during year 2 (Cohort B) were greater than those of year 1 (Cohort A), making the year 2 changes significant.

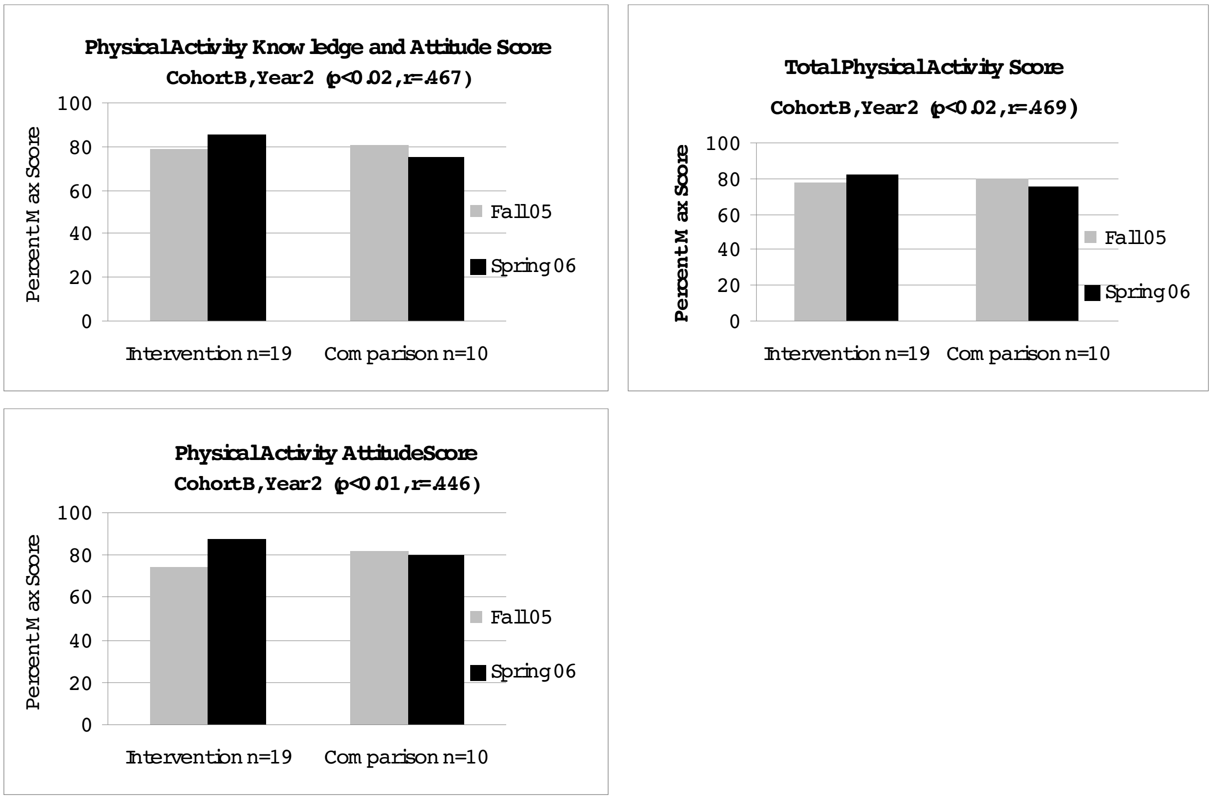


Figure 3: Cohort B, Significant results from Physical Activity (SPARK) questionnaire
P values represent significance between intervention and comparison schools.

Conversely, the year 2 (fall 05) baseline food scores were similar to the post scores of year 1 (spring 05). Smaller gains were made in food scores over year 2, with only the health knowledge subscore increasing significantly. The health knowledge sub score (max score =14) increased from a mean score of 8.6 in the fall to a mean score of 9.9 in the spring (1.3 ± 0.7; $p<0.04$, 1 tail). There was not a significant increase in the total food score in year 2 (Cohort B), as there was in year 1 (Cohort A). The individual food health knowledge questions that increased significantly are shown in ***Figure 4*** along with the total health knowledge score.

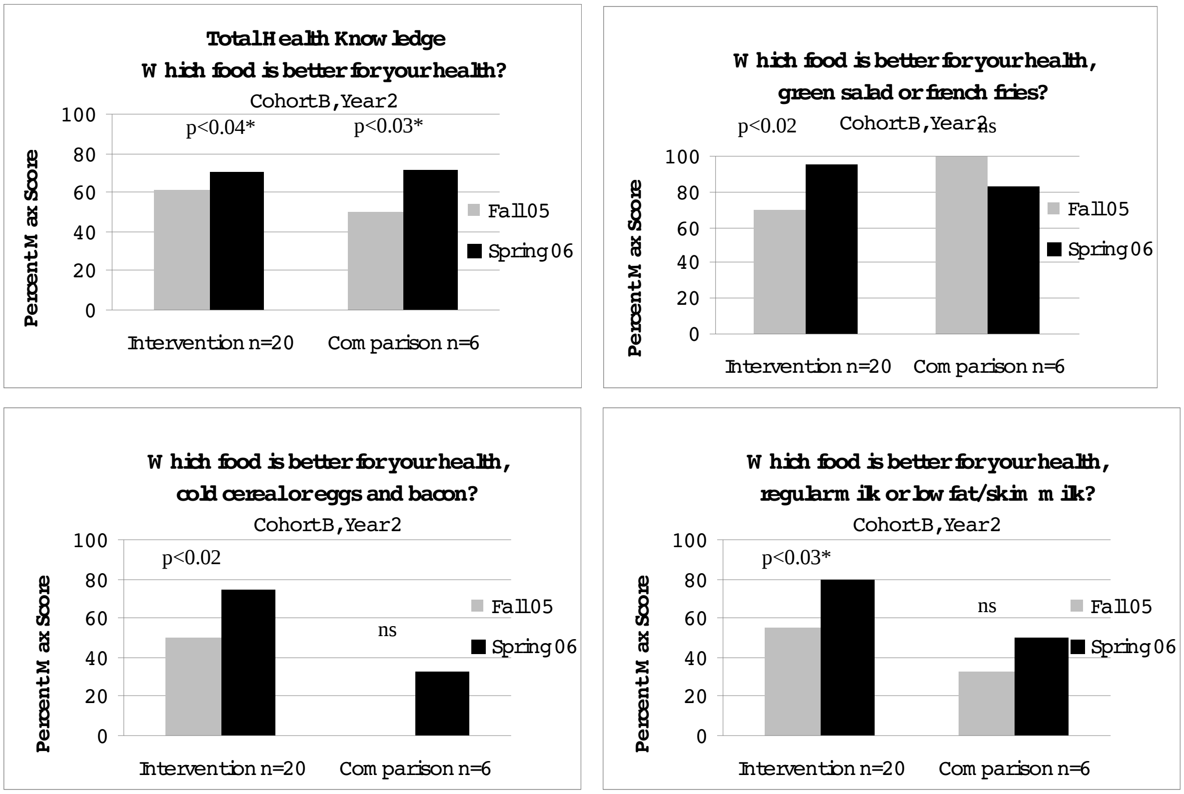
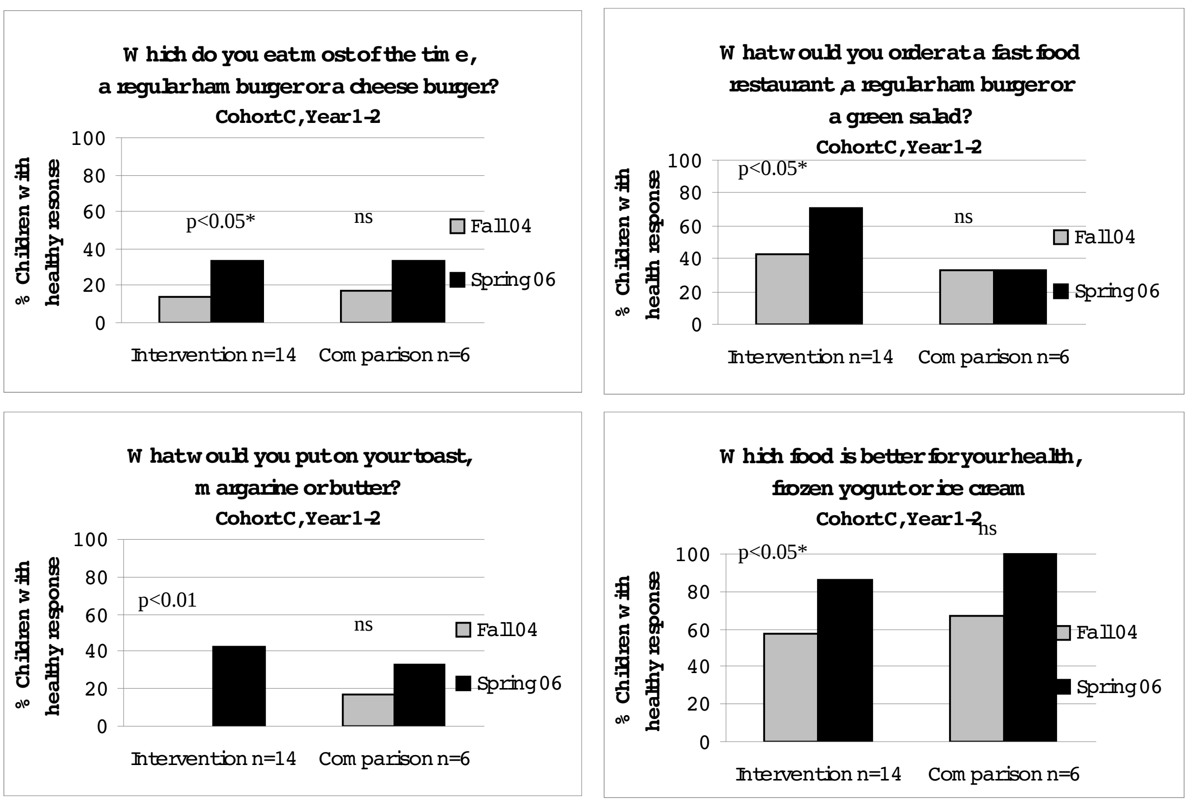


Figure 4: Cohort B, Significant results from CATCH questionnaire, Food Health Knowledge Section
Comparison of % children choosing the healthy response (green salad, cold cereal, lowfat milk) at baseline (Fall 05) and post (Spring 06) test between the intervention and comparison schools. *Significance from pre to post only, ns=not significant, *1-tail only*

2 Year Results, Cohort C

Over the two full years of Program Energy-Cortez, children participating in the program (Cohort C) made significant improvements in food scores, while there were fewer significant gains in physical activity. Total food health knowledge increased from 6.4 (46%) in the fall of 2004 to 9.8 (70%; 3.4 ± 0.6, $p<.00004$) in the spring of 2006. Children increased their total food score from a mean of 20.4 (44%) to 25.6 (56%; 5.1 ± 1.9, $p<0.02$). Most of the gains in food knowledge were made during year 1 and then maintained in year 2. In year 1, the total food score increased significantly ($p<0.03$, 1 tail) by a mean change of 3.8 ± 1.8 (20.4 to 24.2), compared to a non-significant increase of 1.1 ± 1.9 (24.4 to 25.6) in year 2 (***Table 6***). Individual questions were analyzed to assess the effectiveness of specific lessons. Some of those questions with significant changes pre to post are shown in ***Figure 5.*** The only food questions which improved significantly to the comparison school were the questions related to regular vs. low fat/skim milk. At the intervention school, the number of children choosing low fat milk as better for their health increased from 21% (pre) to 79% (post; $p<0.04$, 1 tail) and the number of children choosing it as the food they eat most of the time increased from 14% (pre) to 36% (post; $p<0.04$, 1 tail) (***Figure 6***).



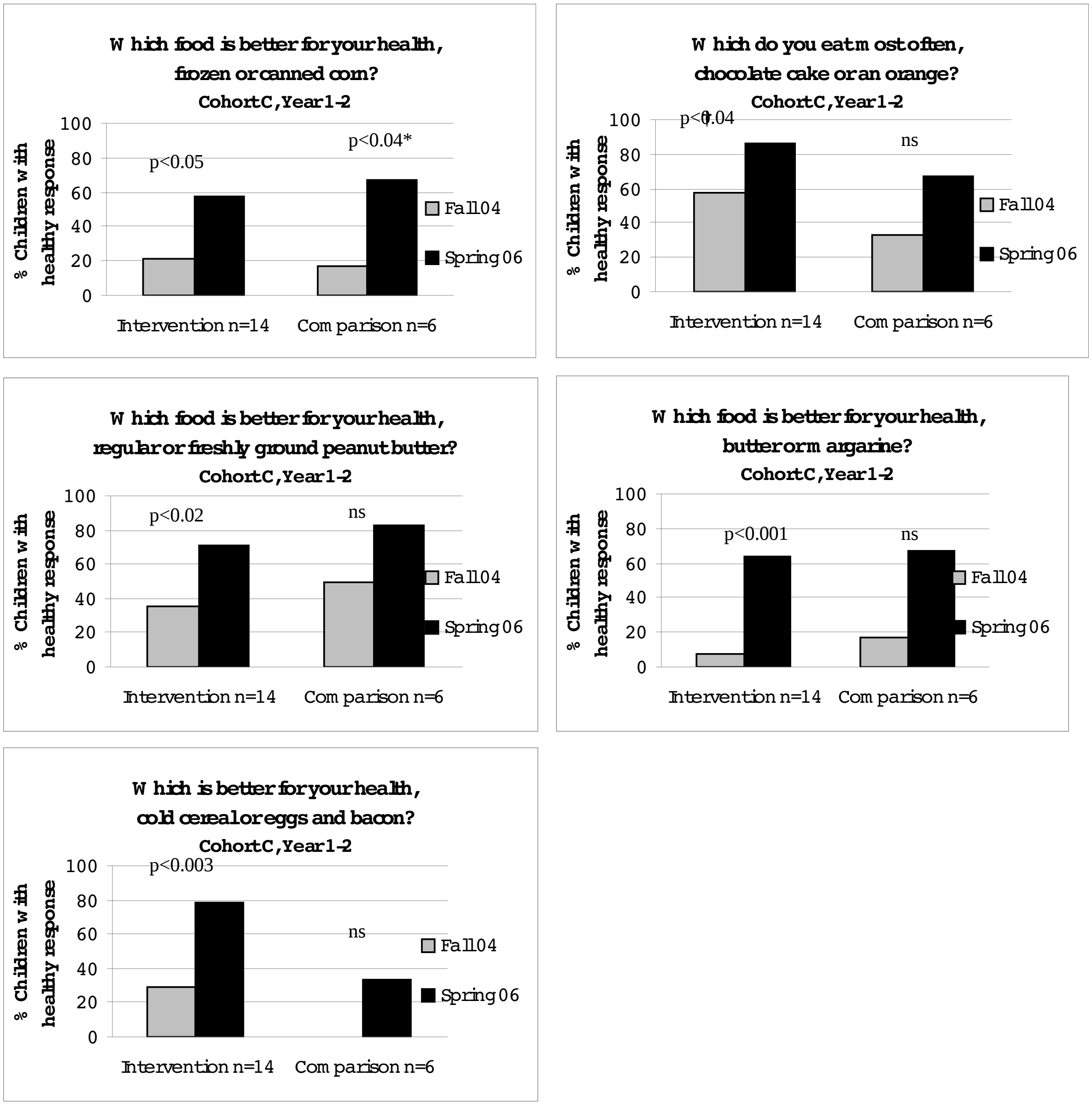


Figure 5: Cohort C, Significant results from CATCH questionnaire
Comparison of % children choosing the healthy response (regular hamburger, green salad, margarine, frozen yogurt, frozen corn, orange, freshly ground peanut butter, margarine, cold cereal) at baseline (Fall 04) and post (Spring 06) test between the intervention and comparison schools. *Significance from pre to post only, ns=not significant, *1-tail only.*

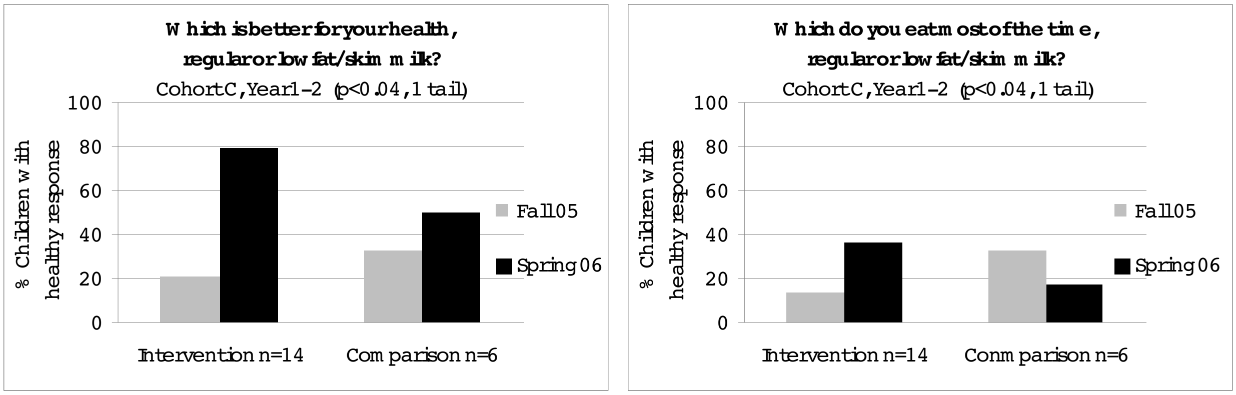


Figure 6: Cohort C, CATCH Questionnaire, significant results between intervention and comparison school. Comparison of % children choosing the healthy response (low fat/skim milk) at baseline (Fall 04) and post (Spring 06) test between the intervention and comparison schools. *Significance between intervention and comparison school.*

In contrast, the gains made in attitude toward physical activity were not significant in either year 1 or year 2 individually, although the trend in each year was toward a modest improvement. The cumulative effect of both years, however, produced a significant increase in the physical activity attitude score (max=24) from a baseline of 19.0 (79%) in fall 2004 to 21.5 (90% 2.5 ± 1.1, $p<0.05$) in the spring of 2006. The other physical activity scores were not significant in either year individually or taken cumulatively over the 2 years. However, compared to the comparison school, which showed a negative trend in mean score changes, the intervention school trend was positive for all scores in physical activity except for the behavior score (***Table 6***).

Table 6: Attitude Toward Physical Activity and Food Questionnaire Results - (Cohort C) Year 1, Year 2 and 2 Year

Questionnaire Results **Year 1** (04-05) **Cohort C**		Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance and Effect Size, between Int and Com
		Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)	
Physical Activity	Total Score (Max score 59)	47.7	49.5	1.8 ± 2.8	ns	47.4	47.3	-.14 ± 1.3	ns r=0.139 small
n_{Int}=11 n_{Com}=7	Attitude (Max score 24)	19.0	20.8	1.8 ± 1.8	ns	20.4	19.6	-.86 ± 1.2	ns r=0.267 medium
	Knowledge and Attitude (Max score 48)	39.7	40.6	.91 ± 2.6	ns	39.0	38.1	-.86 ± 1.5	ns r=0.130 small
	Behavior (Max score 11)	8.0	8.9	.91 ± .76	ns	8.4	9.1	.71 ± .64	ns r=0.047 no effect
Food	Total Score (Max score 46)	20.4	24.2	3.8 ± 1.8	p<0.03 (1 tail)	22.5	26.5	4.0 ± 2.8	ns r=-0.015 no effect
n_{Int}=14 n_{Com}=6	Health Knowledge (Max score 14)	6.4	7.8	1.4 ± 1.0	ns	7.0	9.5	2.5 ± 1.3	ns r=-0.151 no effect

Questionnaire Results **Year 2** (05-06) **Cohort C**		Intervention School (Int)			Signif-icance From pre to post	Comparison School (Com)			Signif-icance and Effect Size, between Int and Com
		Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)	
Physical Activity	Total Score (Max score 59)	47.8	48.4	0.5 ± 1.6	ns	48.6	46.4	-2.1 ± 2.1	ns r=0.220 small
n_{Int}=11 n_{Com}=7	Attitude (Max score 24)	20.0	21.5	1.5 ± .1	ns	20.4	19.6	-0.9 ± 0.3	p<0.03 r=0.500 large
	Knowledge and Attitude (Max score 48)	39.6	41.0	1.4 ± 1.5	ns	40.6	37.1	-3.4 ± 12.6	ns r=0.373 large
	Behavior (Max score 11)	8.2	7.4	-0.8 ± 0.7	ns	8.0	9.3	1.3 ± 0.7	p<0.05 r=-0.437 small
Food	Total Score (Max score 46)	24.4	25.6	1.1 ± 1.9	ns	24.3	26.0	1.7 ± 0.9	ns r=-0.058 no effect
n_{Int}=14 n_{Com}=6	Health Knowledge (Max score 14)	8.4	9.8	1.4 ± 0.9	ns	8.2	10.0	1.8 ± 0.7	ns r=-0.074 no effect

Questionnaire Results 2 Year (04-06) Cohort C		Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance and Effect Size, between Int and Com
		Baseline Score; Fa 04 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 04 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)	
Physical Activity	Total Score (Max score 59)	47.7	48.4	0.6 ± 1.4	ns	47.4	46.4	-1.0 ± 3.2	ns r=0.118 small
n_{Int}=11 n_{Con}=7	Attitude (Max score 24)	19.0	21.5	2.5 ± 1.1	P<0.05	18.6	19.6	1.0 ± 1.2	ns r=0.218 small
	Knowledge and Attitude (Max score 48)	39.7	41.0	1.3 ± 1.1	ns	39.0	37.1	-1.9 ± 2.5	ns r=0.282 medium
	Behavior (Max score 11)	8.0	7.4	-.64 ± 0.7	ns	8.4	9.3	0.9 ± 1.1	ns r=-0.283 medium
Food	Total Score (Max score 46)	20.4	25.6	5.1 ± 1.9	P<0.02	22.5	26.0	3.5 ± 1.6	ns r=0.137 small
n_{Int}=14 n_{Con}=6	Health Knowledge (Max score 14)	6.4	9.8	3.4 ± 0.6	P<0.001	7.0	10.0	3.0 ± 1.2	ns r=0.077 no effect

Body Image -*Overall Results*

The body image assessment analyzed the children's body self image, desired body image, and from these two scores computed a body satisfaction score (self-desired). At the intervention school there were significant improvements from baseline in body satisfaction (self-desired) and desired body image scores among female and male/female (combined results) children. As third graders (Cohort C), in their second year of the program, combined male/female desired body image scores improved significantly over the comparison school (**Figure 8-10**). Generally, however, the most significant improvements were seen in the female children. At the comparison school, any significant changes from pre to post showed decreased unhealthy body image results. Overall, the Cortez mini-Program ENERGY produced a healthier desired body image and improved body satisfaction scores among female children participants.

Table 7: Body Satisfaction Silhouettes Results Year 1 (Cohort A) and Year 2 (Cohort B)

Year 1 (04-05) Cohort A	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Assessment	n	Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)	Effect size reported for female results only
Body satisfaction (self-desired)									
Female only	n_{Int}=15 n_{Com}=4	1.00	0.27	-0.73 ± 0.38	p<0.04 (1 tail)	1.00	1.50	0.50 ± 0.96	ns r=0.338 medium
Male only	n_{Int}=6 n_{Com}=7	-0.33	-0.17	0.17 ± 0.60	ns	0.57	0.43	-0.14 ± -0.26	ns
Male/Female	n_{Int}=21 n_{Com}=11	0.62	0.14	-0.48 ± 0.31	ns	0.73	0.82	0.09 ± 0.37	ns
Self Image (1=thin, 7=obese)									
Female only	n_{Int}=15 n_{Com}=4	3.67	3.73	0.07 ± 0.37	ns	3.00	3.50	0.50 ± 0.65	ns r=0.155 small
Male only	n_{Int}=6 n_{Com}=7	3.33	3.00	-0.33 ± 0.33	ns	3.86	3.71	-.14 ± .40	ns
Male/Female	n_{Int}=21 n_{Com}=11	3.57	3.52	-0.05 ± 0.28	ns	3.55	3.64	0.09 ± 0.34	ns
Desired Image (1=thin, 7=obese)									
Female only	n_{Int}=15 n_{Com}=4	2.67	3.47	0.80 ± 0.42	p<0.04 (1 tail)	2.00	2.00	0.00 ± 0.71	ns r=0.256 medium
Male only	n_{Int}=6 n_{Com}=7	3.67	3.17	-0.50 ± 0.56	ns	3.29	3.29	0.00 ± 0.38	ns
Male/Female	n_{Int}=21 n_{Com}=11	2.95	3.38	0.43 ± 0.36	ns	2.82	2.82	0.00 ± 0.33	ns

Year 2 (05-06) Cohort B	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Assessment	n	Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)	Effect size reported for female results only
Body satisfaction (self-desired)									
Female only	n_{Int}=11 n_{Com}=5	0.55	0.09	-0.45 ± 0.27	ns	0.40	0.40	0.00 ± 0.00	ns r=0.293 medium
Male only	n_{Int}=7 n_{Com}=4	0.29	0.86	0.57 ± 0.53	ns	-0.50	0.50	1.00 ± 0.41	ns
Male/Female	n_{Int}=18 n_{Com}=9	0.44	0.39	-0.06 ± 0.30	ns	0.00	0.44	0.44 ±0.24	ns
Self Image (1=thin, 7=obese)									
Female only	n_{Int}=11 n_{Com}=5	4.18	4.27	0.09 ± 0.21	ns	3.40	4.00	0.40 ± 0.24	ns r=0.224 small
Male only	n_{Int}=7 n_{Com}=4	3.57	4.29	0.71 ± 0.36	p<0.05 (1 tail)	3.75	4.00	0.25 ± 0.25	ns
Male/Female	n_{Int}=18 n_{Com}=9	3.94	4.28	0.33 ± 0.20	ns	3.56	4.00	0.33 ± 0.17	ns
Desired Image (1=thin, 7=obese)									
Female only	n_{Int}=11 n_{Com}=5	3.64	4.18	0.55 ± 0.31	ns	3.00	3.60	0.40 ± 0.24	ns r=0.090 no effect
Male only	n_{Int}=7 n_{Com}=4	3.29	3.43	0.14 ± 0.46	ns	4.25	3.50	-0.75 ± 0.63	ns
Male/Female	n_{Int}=18 n_{Com}=9	3.50	3.89	0.39 ± 0.26	ns	3.56	3.56	-0.11 ± 0.35	ns

<u>Year 1 Results, Cohort A</u>

In year 1, female children (n=15) saw a healthier and more realistic body image as desirable in the spring (post) compared to the image they initially found most desirable in the fall (pre). The baseline mean desired body image score was 2.67 (1=very thin, 4=normal, 7=obese) and by the spring the mean score was a healthier 3.47 (0.80 ± 0.42; $p<0.04$, 1 tail). The mean self image score remained unchanged (3.67 to 3.73, 0.07 ± 0.37), translating into improved body satisfaction (self-desired) ***Figure 8***. There were no significant changes among the male (n=6) children or the combined male/female (n=21) children in year 1 Cohort A. At the comparison school there was no change among the female (n=4), male (n=7) or combined male/female (n=11) responses in any category. Comparison female children did not have any change in desired body image (2.0 to 2.0, 0.00 ± 0.71), with children preferring to look like the same an unhealthful thin image in the fall and again in the spring. The differences between the intervention and comparison children were not significant, however there was a medium effect size for the desired image (r=.256) and the body satisfaction score (r=.338) and a small effect size on the self image(r=.155) of the female children.

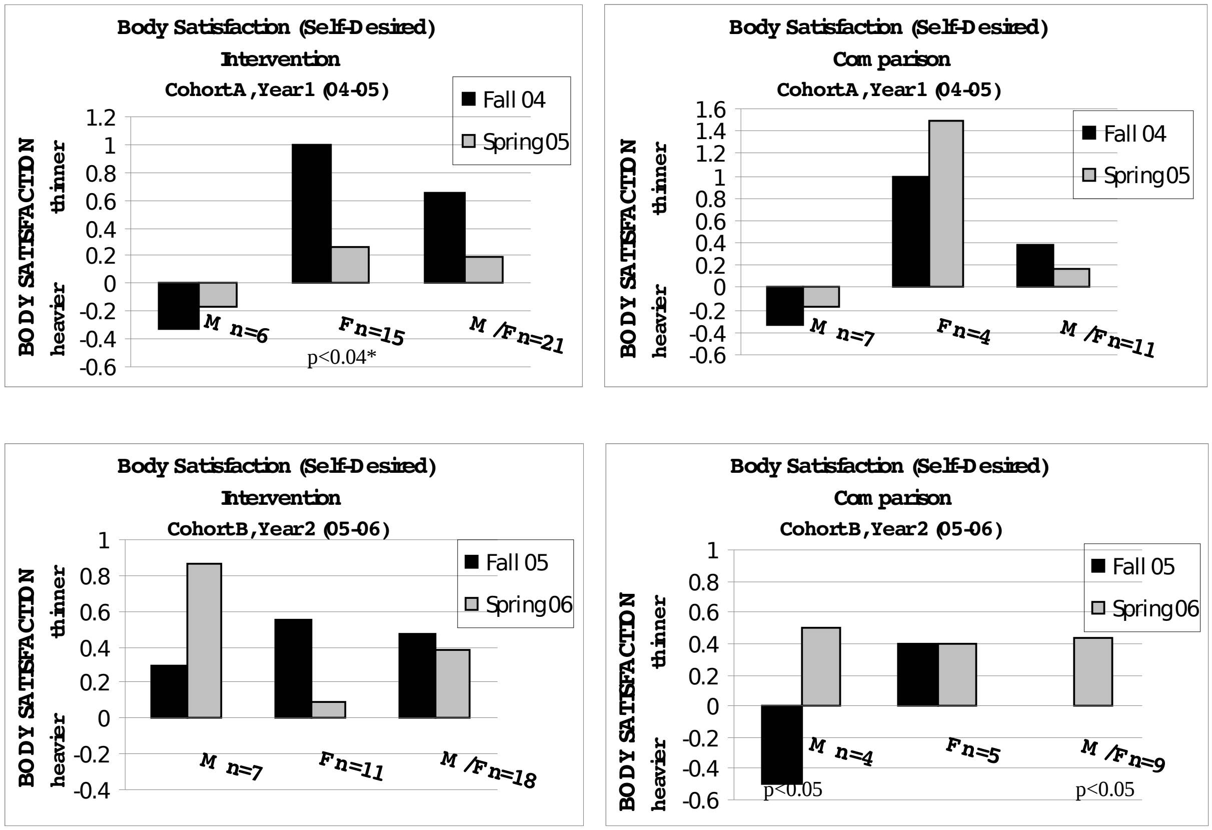


Figure 8: Body Satisfaction Mean Score Changes. Results from baseline to the end of the school year for Year 1 (04-05, Cohort A), and Year 2 (05-06, Cohort B). Intervention and Comparison Male, Female and combined Male/Female results shown individually. *Significance from pre to post only, ns=not significant, *1-tail only. (M=male, F=female)*

Year 2 Results, Cohort B

In year 2, the male children (n=7) had a significant change in their self image from 3.57 (pre) to 4.29 (post, 0.71 ± 0.36; $p<0.05$, 1 tail) but no significant change in their desired image or body satisfaction scores. The female children did not have any significant changes in body image score in year 2 either pre to post or between the intervention and comparison school. The effect sizes were also not as large as in year one. The body satisfaction score had a medium effect score (r=.239), the self image had a small effect score (r=.224) and the desired image had no measured effect (r=.090) between the two groups. However, there were pre to post changes at the both schools that are worth noting. Similar to year 1, the self image of the intervention female children remained relatively unchanged while the desired image showed a trend ($p<0.06$) towards improvement. Female children desired to look like a 3.64 in the fall and a 4.18 (0.55 ± 0.31) in the spring. This is in contrast to the comparison school where the mean self (3.40 to 4.00, 0.40 ± 0.24, $p<0.04$, 1 tail) and desired image (3.00 to 3.60, 0.40 ± 0.24, $p<0.04$, 1 tail) both changed significantly from pre to post. Therefore, the comparison female children had no change in their body satisfaction, while the trend at the intervention was towards improved body satisfaction (***Figure 8***).

The combined male/female results also showed no significant changes between the intervention and comparison and the changes at the intervention were not significant from pre to post. The comparison school combined data showed a pre to post significant change in body satisfaction. In the fall male and female students combined had a mean score of 0.00 (complete body satisfaction) which changed to a 0.44 ± 0.24 in the spring ($p<0.05$, 1 tail). This result was not significant compared to the intervention school but again shows an opposite trend.

Table 8: Body Satisfaction Silhouettes Results: Cohort C Year 1, Year 2 and 2 Year

Year 1 **(04-05)** **Cohort C**	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Assessment	n	Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 04 (**x**)	Post Score; Sp 05 (**x**)	Mean of Individual Change (**x** ± SE)	Effect size reported for female results only
Body satisfaction (self-desired)									
Female only	n_{Int}=10 n_{Com}=3	1.10	0.00	-1.10 ± 0.48	p<0.05	1.33	1.33	0.00 ± 1.15	ns r=0.297 medium
Male only	n_{Int}=2 n_{Com}=4	0.50	0.00	-0.50 ± 0.50	ns	0.25	0.25	0.00 ± 0.41	ns
Male/Female	n_{Int}=12 n_{Com}=7	1.00	0.00	-1.00 ± 0.41	p0.03	0.71	0.71	0.00 ± 0.36	ns
Self Image (1=thin, 7=obese)									
Female only	n_{Int}=10 n_{Com}=3	3.80	3.70	-0.10 ± 0.53	ns	3.33	3.67	0.33 ± 0.88	ns r=0.133 small
Male only	n_{Int}=2 n_{Com}=4	3.50	3.50	0.00 ± 0.00	ns	3.75	3.25	-0.50 ± 0.65	ns
Male/Female	n_{Int}=12 n_{Com}=7	3.75	3.67	-0.08 ± 0.43	ns	3.57	3.43	-0.14 ± 0.37	ns
Desired Image (1=thin, 7=obese)									
Female only	n_{Int}=10 n_{Com}=3	2.70	3.70	1.00 ± 0.49	p<0.04 (1 tail)	2.00	2.33	0.33 ± 0.88	ns r=0.211 small
Male only	n_{Int}=2 n_{Com}=4	3.00	3.50	.50 ± 0.50	ns	3.50	3.00	-0.50 ± 0.50	ns
Male/Female	n_{Int}=12 n_{Com}=7	2.75	3.67	0.92 ± 0.42	0.05	2.86	2.71	-0.14 ± 0.46	p<0.05

Year 2 (05-06) Cohort C	Sample	Intervention School			Signif-icance From Pre to Post	Control School			Signif-icance between Int and Com
Assessment	n	Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 05 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)	Effect size reported for female results only
Body satisfaction (self-desired)									
Female only	n_{Int}=10 n_{Com}=3	0.50	0.10	-0.40 ± 0.34	ns	0.67	0.67	0.00 ± 0.00	ns r=0.249 medium
Male only	n_{Int}=2 n_{Com}=4	-0.50	0.50	1.00 ± 1.00	ns	-0.50	0.50	1.00 ± .41	ns
Male/Female	n_{Int}=12 n_{Com}=7	0.33	0.17	-0.17 ± 0.34	ns	0.00	0.57	0.57 ± 0.28	(0.06) ns
Self Image (1=thin, 7=obese)									
Female only	n_{Int}=10 n_{Com}=3	4.10	4.20	0.10 ± 0.25	ns	3.67	4.00	0.33 ± 0.33	ns r=0.170 small
Male only	n_{Int}=2 n_{Com}=4	3.00	4.00	1.00 ± 1.00	ns	3.75	4.00	0.25 ± 0.25	ns
Male/Female	n_{Int}=12 n_{Com}=7	3.92	4.17	0.25 ± 0.25	ns	3.71	4.00	0.29 ±0.14	ns
Desired Image (1=thin, 7=obese)									
Female only	n_{Int}=10 n_{Com}=3	3.60	4.10	0.50 ± 0.34	ns	3.00	3.33	0.33 ± 0.33	ns r=.096 no effect
Male only	n_{Int}=2 n_{Com}=4	3.50	3.50	0.00 ± 0.00	ns	4.25	3.50	-0.75 ± 0.63	ns
Male/Female	n_{Int}=12 n_{Com}=7	3.58	4.00	0.42 ± 0.29	ns	3.17	3.43	-0.29 ± 0.36	ns

Year 1-2 (04-06) Cohort C	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Assessment	n	Baseline Score; Fa 04 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa 04 (**x**)	Post Score; Sp 06 (**x**)	Mean of Individual Change (**x** ± SE)	Effect size reported for female results only
Body satisfaction (self-desired)									
Female only	n_{Int}=10 n_{Com}=3	1.10	0.10	-1.00 ± 0.42	p<0.04	1.33	0.67	-0.67 ± 1.20	ns r=0.093 no effect
Male only	n_{Int}=2 n_{Com}=4	0.50	0.50	0.00 ± 1.00	ns	0.25	0.50	0.25 ± 0.63	ns
Male/Female	n_{Int}=12 n_{Com}=7	1.00	0.17	-0.83 ± 0.39	p<0.05	0.71	0.57	-0.14 ±0.56	ns
Self Image (1=thin, 7=obese)									
Female only	n_{Int}=10 n_{Com}=3	3.80	4.20	0.40 ± 0.48	ns	3.33	4.00	0.67 ± 1.20	ns r=0.074 no effect
Male only	n_{Int}=2 n_{Com}=4	3.50	4.00	0.50 ± 1.50	ns	3.75	4.00	0.25 ±0.75	ns
Male/Female	n_{Int}=12 n_{Com}=7	3.75	4.17	0.42 ±0.43	ns	3.57	4.00	0.43 ± 0.44	ns
Desired Image (1=thin, 7=obese)									
Female only	n_{Int}=10 n_{Com}=3	2.7	4.10	1.40 ± 0.54	p<0.03	2.00	3.33	1.33 ± 0.67	ns r=0.024 no effect
Male only	n_{Int}=2 n_{Com}=4	3.00	3.50	0.50 ± 0.50	ns	3.50	3.50	0.00 ± 0.71	ns
Male/Female	n_{Int}=12 n_{Com}=7	2.75	4.00	1.25 ± 0.46	p<0.02	2.86	3.43	0.57 ± 0.47	ns

2 Year Results, Cohort C

In year 1 (Cohort C), as second graders, the male/female (n=12) combined mean desired image improved significantly to the comparison school (***Figure 9***). The change in mean desired body image from a 2.75 in the fall to 3.67 in the spring (0.92 ± 0.42, ($p<0.03$) was also significant ($p<0.05$) to the comparison (n=7) school where there was no difference in mean desired image from pre to post (0.71 to 0.71, 0.00 ± 0.36). Additionally, the combined male/female body satisfaction score changed significantly from a 1.00 (pre) to 0.00 (post, -1.00 ± 0.41; $p<0.03$, (***Figure 10***) with children choosing identical self and desired images (mean scores of a 3.67) in the spring compared to the dissimilar means of 3.75 (self) and 2.75 (desired) in the fall. The comparison combined male/female desired image showed no significant change. The female (n=10) children in year 1 Cohort C, had similar results to the combined children outcomes, although the changes were not significant to the comparison school. The mean female desired image improved by a mean change of one entire silhouette, from a thin 2.7 (pre) to a healthier 3.7 (post, 1.00 ± 0.49, $p<0.04$, *1 tail*; ***Figure 9***). The mean female body satisfaction score also improved significantly from 1.10 (pre) to 0.00 (post, -1.10 ± 0.48, $p<0.05$; ***Figure 10***). None of the male (n=2) only results were significant.

In year 2, the children participating in their second year of the program, there were no significant additional changes among the male, female or combined male/female data. Most of the changes were made in year 1 and maintained through year 2. For example, the improvements made in female desired body image in second grade (2.7 to 3.70, 1.00 ± 0.49; $p<0.04$, *1 tail*) were maintained and further improved in third grade. The mean desired image at the baseline of the third grade year was nearly identical to the post mean desired image of the second grade year (3.6 ± 0.27 and 3.7 ± 0.21) and improved further to 4.1 ± 0.45 by the end of third grade. This change in year 2 was not significant but the cumulative effect of the 2 year intervention produced a significant change (2.7 to 4.1, 1.40 ± 0.54, $p<0.03$). This trend was also seen with the combined male/female data.

Over the two full years of the Cortez mini-Program ENERGY the female children made significant improvements in both mean desired body image and body satisfaction scores (***Figures 9 and 10***). As second graders in the fall of 2004, the female children initially reported a thinner than normal silhouette as most desirable. The mean of the figure chosen in the fall of the second grade year was a thin 2.7 and by the end of third grade had risen to a 4.1 (1.4 ± 0.54, $p<0.03$; ***Figure 10***), a healthy normal silhouette. This change translated into an improved body satisfaction score (1.10 to 0.10; -1.00 ± 0.42, $p<0.04$) by the end of the two years of intervention. On average, female children reported their self image (4.20 ± 0.33) as nearly identical to their desired image (4.1 ± 0.28). This was a significant improvement ($p<0.04$) from the fall of the second grade year when female students desired an average thin image of 2.7 ± 0.50 and reported their self image as a 3.8 ± 0.42, more than a one figure discrepancy between self and desired (**Table 8**). Although these differences were not significantly different from the comparison school, female children participating in program ENERGY showed a trend toward a healthier desired body image. After two years in the program, females at the intervention school on average desired a 4.1 ± 0.28 figure (4=normal), where as at the comparison school the average desired figure was 3.33 ± 0.33.

The male children did not make any significant improvements when analyzed separately (n=2) but the combined male/female results were similar to the female children only results with children improving their desired image toward a healthier figure and (2.75 to 4.00, 1.25 ± 0.46, $p<0.02$) and improving their body satisfaction (1.00 to 0.17, -0.83 ± 0.39; $p<0.05$). None of the male score changes made at the comparison school over the 2 years were significant from baseline.

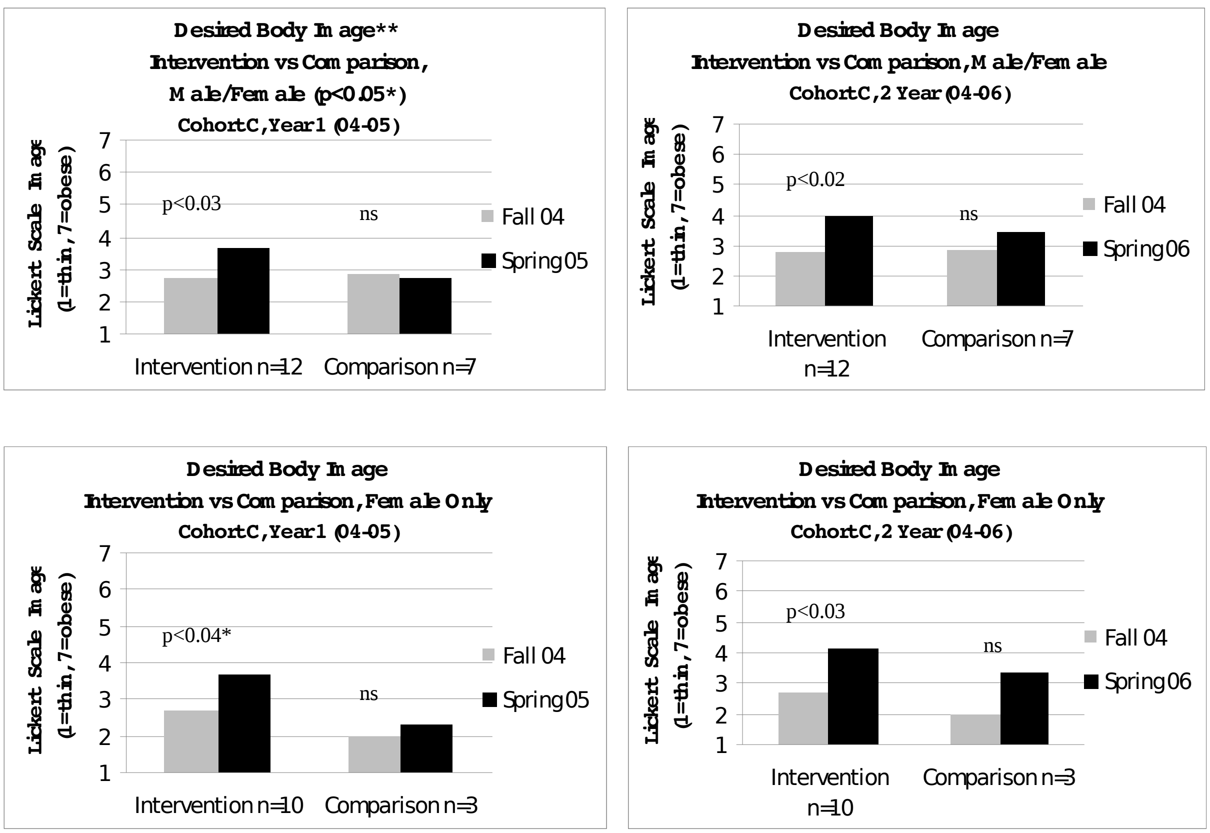


Figure 9: Improvements in Desired Body Image for combined Male/Female data in Cohort C, Year 1 (04-05), Year 2 (05-06) ** and 2 Year (04-06) results. Intervention vs Comparison results shown at baseline and post test. *Significance from pre to post only, ns=not significant, *1-tail only. **p<0.05 significant change between intervention and comparison children.*

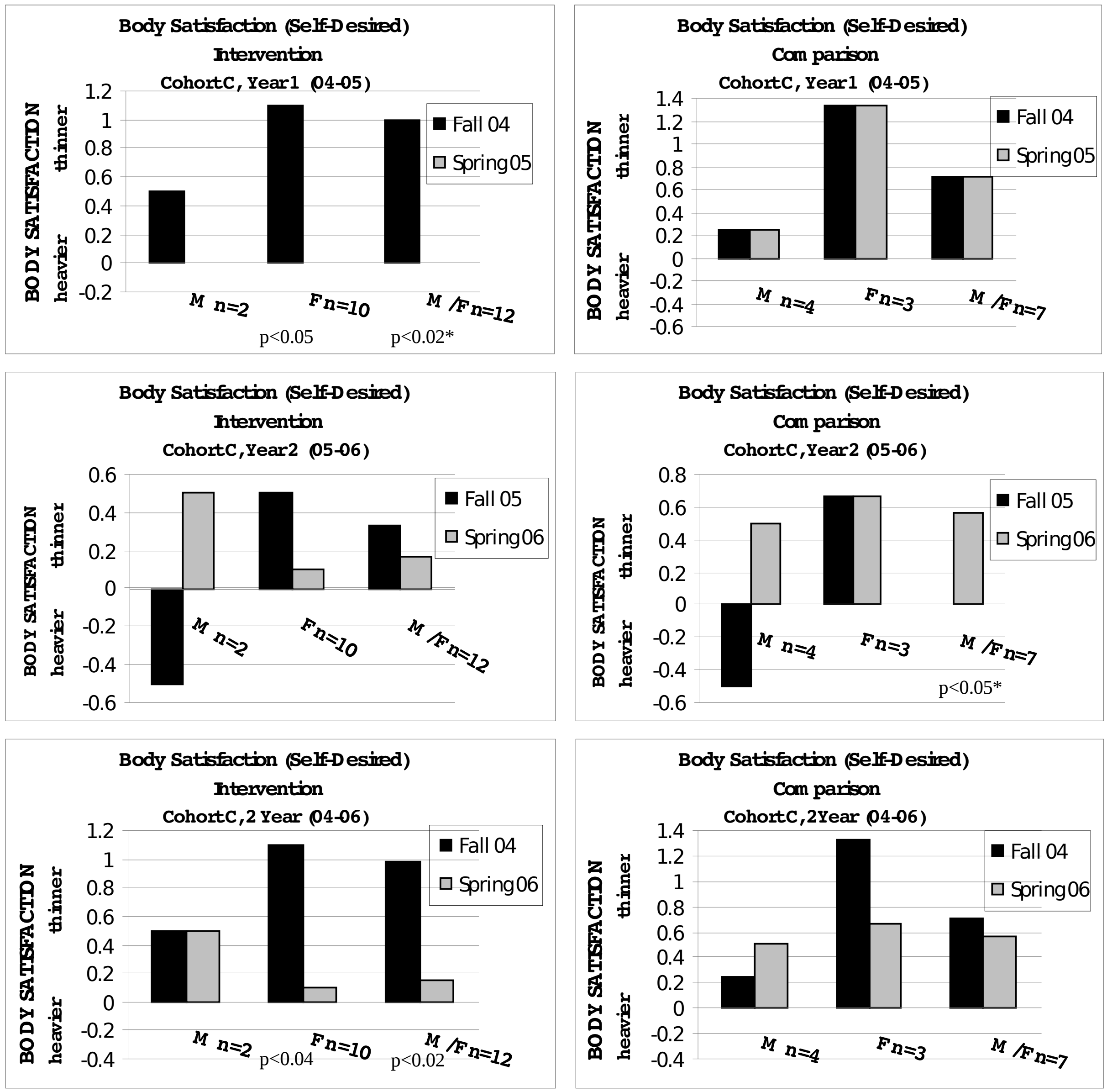


Figure 10: Body Satisfaction Mean Score Changes. Results from baseline to the end of the school year for Cohort C in Year 1 (04-05), and Year 2 (05-06) and 2 Year (04-06) analysis. Intervention and Comparison Male, Female and combined Male/Female results shown individually. *Significance from pre to post only, ns=not significant, *1-tail only.*

BMI z-scores - *Overall Results*

Changes made in body size, as measured using BMI that were then converted into BMI z-scores, varied at the intervention school in year 1 and 2, and between the intervention and comparison schools (***Table 9 and 10***). Year 1 (Cohort A and C) did not produce any significant changes in mean BMI z-scores. The only significant difference between the intervention and comparison school mean z-scores occurred in year 2 (Cohort B). The intervention school children showed a significant decrease in mean z-scores from fall to spring, while the comparison school children showed a trend toward increased mean z-scores. However, for children completing two years of the program, the mean BMI z-scores at the intervention did not change. At the comparison school, BMI z-scores tended to decrease in year 1 and increase in year 2 for an overall effect of small increase (not significant) in mean scores from second to third grade.

<u>Year 1 Results Cohort A</u>

In second grade, the changes in mean BMI z-scores were not significant at either school or between schools. The intervention children mean BMI z-score was a 0.61 in the fall of 2004 and increased to a 0.73 (.12 ± 0.11) in the spring, while the comparison school children showed a trend toward a decreased mean score (0.93 to 0.47; -0.46 ± 0.38) (***Table 9*)**. However, neither result was significant and thus BMI scores were unchanged in Year 1 Cohort A children.

BMI z-score Fa 04 = age 7 Sp /Fa 05 = age 8 Sp 06 =age 9	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Year/Cohort	n	Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change(**x** ± SE)		Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change(**x** ± SE)	
Year 1 (04-05) Cohort A	n_{Int}=22 n_{Com}=8	0.61	0.73	0.12 ± 0.11	ns	0.93	0.47	-0.46 ± 0.38	ns
Year 2 (05-06) Cohort B	n_{Int}=20 n_{Com}=10	1.19	1.05	-0.14 ± 0.05	0.01*	0.59	0.96	0.38 ± 0.18	0.02

Table 9: BMI z-score Results: Year 1 (Cohort A) and Year 2 (Cohort B)

Year 2 Results Cohort B

The intervention children started the third grade year at a mean BMI z-score of 1.19 ± 0.20. While, at the comparison school, the year 2 baseline score was 0.59 ± 0.16. The mean BMI z-score decreased significantly (p<0.01) over the third grade year at the intervention school. The score changed from a mean of 1.19 to 1.05 (-.014 ± 0.05; *p<0.01*). This change was distinguished from the comparison school were it actually increased significantly from 0.59 to 0.96 (0.38 ± 0.18; *p<0.04, 1 tail*). The decrease at the intervention and the increase at the comparison created a significant difference between the two schools (*p<0.02*) (**Table 9**).

2 Year Results, Cohort C

As was seen in Year 1 Cohort A, Year 1 Cohort C did not produce any significant changes in BMI z-scores from pre to post or between the intervention and the comparison school children (***Table 10*).** Over the summer, between the second and third grade year, the children's mean BMI z-scores tended to increase at both schools. At the intervention school the baseline in the fall of third grade was higher than the previous year's baseline and post measurements but significantly (*p<0.03*) decreased over the third grade year.

This was not significant *(p<0.06,* 1-tail) to the comparison school which showed a trend toward increasing BMI in year 2 (0.67 to 1.15, 0.48 ± 0.32) (***Table 10***).

Although there was a significant decrease in BMI z-scores in year 2, the net effect of the program over the 2 years did not produce a significant change. The post mean score in the fall of 2006 was 0.83, which was close to the baseline mean in the fall of 2004 of 0.78 (0.05 ± 0.12, not significant). Males and females taken separately also produced non significant changes. The male mean BMI z-score changed from a 0.76 (±0.41) to a 0.99 (±0.08), while females had a mean score of 0.78 (±0.97, ±0.29) in both 2004 (pre) and 2006 (post). In the case of BMI, a non-significant effect is actually a desired goal of an obesity prevention program. Obesity prevention is not intended to decrease BMI but rather to maintain it. This was the trend at the intervention school were mean BMI z-scores did not significantly change over the 2 years of the program. The comparison school result was not significant but the trend was for an increase in BMI over the same time period. The comparison school mean BMI z-score in the fall of 2004 was 0.66 and rose to 1.15 (0.49 ± 0.37) in the spring (***Table 10***).

Table 10: BMI z-score Results: Cohort C Year 1, Year 2 and 2 Year

BMI z-score Fa 04 = age 7 Sp/Fa 05 = age 8 Sp 06 =age 9	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Year/Cohort	n	Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change(**x** ± SE)		Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change(**x** ± SE)	
Year 1 (04-05) Cohort C	n_{int}=13 n_{Com}=5	0.78	0.73	-0.06 ± 0.10	ns	0.66	0.43	-0.23 ± 0.52	ns
Year 2 (05-06) Cohort C	n_{Int}=13 n_{Com}=5	0.99	0.83	-0.16 ± 0.07	0.03*	0.67	1.15	0.48 ± 0.32	0.06 (1 tail)
2 Year (04-06) Cohort C	n_{int}=13 n_{Com}=5	0.78	0.83	0.05 ± 0.12	ns	0.66	1.15	0.49 ± 0.37	ns

Important to the success of an obesity prevention program is whether children change in classification from “healthy weight” to “at risk of overweight”, or “overweight” or from “at risk of overweight” to “overweight”. In ***Figure 11,*** the solid line represents the 85th percentile (at risk for overweight) and the dashed line represents the 95th percentile (overweight). Of the 13 children, 9 (69% of total) were of normal weight at baseline (fall 2004) and 7 of the 9 (78%) children remained in the healthy weight classification, while 2 (22%) increased to “at risk of overweight” by spring 2006. There were 2 (15%) children who began the program “overweight” and remained at this classification over the two years. There were 2 (15%) children who began the program “at risk of overweight”. One child did not increase to “overweight” but remained weight stable and in the “at risk of overweight” category. The other child, classified as “at risk of overweight” at baseline, returned to a “healthy” weight classification at the end of the 2 years (***Figure 11***).

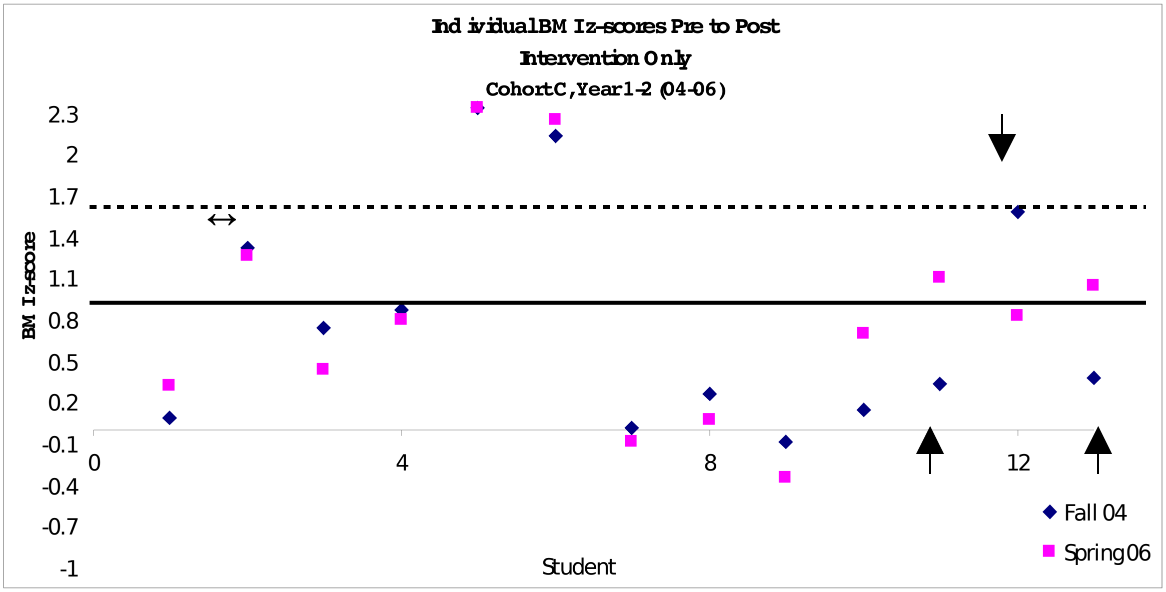


Figure 11: Individual BMI z-scores in the fall of 2004 and the spring of 2006 at the intervention school. The solid line represents the 85th percentile (at risk of overweight) and the dashed line represents the 95th percentile above which is considered overweight. The ↔ arrow indicates the child with maintenance, ↓ arrow indicates the child whose weight decreased into the "healthy" category, and the arrows ↑ indicate the 2 children that moved from "healthy" to "at risk of overweight".

2-Day Pedometer Step Counts - *Overall Results*

The activity level of the children was analyzed by comparing mean 2-day step counts. The summary of the results can be found in ***Table 11.*** The mean 2-day step counts increased significantly in year 1 at the intervention (11227 to 13256; 2029 ± 980, *p<0.03, 1 tail*) and comparison (9269 to 13762; 4444 ± 1320) school. In year 2, there was a divergence in results between children new (Cohort B) to Program ENERGY and those children who were returning (Cohort C). The children new to the program had no significant change in mean step counts from pre to post at either the intervention or the comparison. However, the returning children had a significant decrease (13791 to 9527; -4264 ± 1133, *p<0.01*) in year 2 at the intervention school, and a trend towards a decrease (13935 to 11588; -2347 ± 1548, ns) at the comparison school.

Table 11: 2-Day Pedometer Step Count Results: Year 1, 2 and 2 Year (Cohort A, B and C)

2-Day Pedometer Step Count (Steps per day)	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Year/Cohort	N	Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change (**x** ± SE)		Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change (**x** ± SE)	
Year 1 (04-05) Cohort A	n_{Int}=17 n_{Com}=9	11227	13256	2029 ± 980	0.03* (1 tail)	9269	13762	4441 ± 1320	ns
Year 2 (05-06) Cohort B	n_{Int}=15 n_{Com}=8	13389	12541	-312 ± 2048	ns	12521	12477	-44 ± 1629	ns

2-Day Pedometer Step Count (Steps per day)	Sample	Intervention School (Int)			Signif-icance From Pre to Post	Comparison School (Com)			Signif-icance between Int and Com
Year/Cohort	n	Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change(**x** ± SE)		Baseline Score; Fa (**x**)	Post Score; Sp (**x**)	Mean of Individual Change (**x** ± SE)	
Year 1 (04-05) Cohort C	n_{int}=8 n_{Com}=5	10721	12903	2182 ± 1962	ns	8860	14819	5919 ± 1586	ns
Year 2 (05-06) Cohort C	n_{Int}=8 n_{Com}=5	13791	9527	-4264 ±1133	.004*	13935	11588	-2347 ±1548	ns
2 Year (04-06) Cohort C	n_{int}=8 n_{Com}=5	10721	9527	-1194 ±1879	ns	8860	11588	2729 ± 1239	0.05* (1 tail)

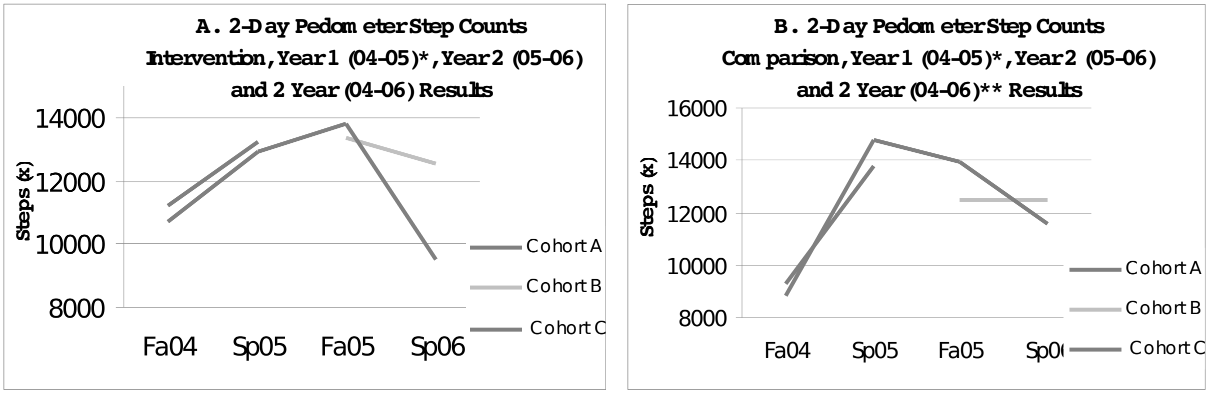
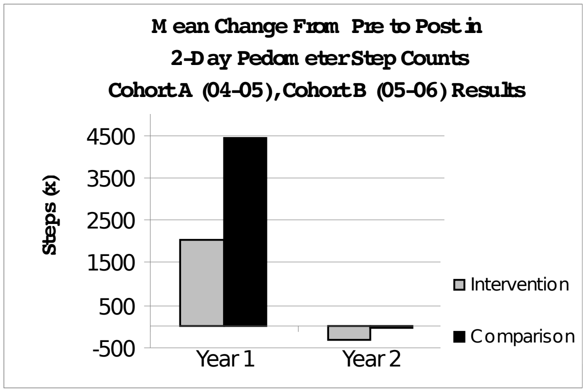


Figure 12: Summary of 2-day Pedometer step counts for each cohort at the intervention and comparison school. Graph A (Intervention): *Significance from Pre to Post *p<0.03, 1 tail*; Graph B (Comparison)*: Significance from Pre to Post *p<0.01, **p<0.01, 1tail. Significant (p<0.05, 1 tail) results between Intervention and Comparison for Cohort C, 2 Year (04-06) results only*

Taken over the two years (04-06, Cohort C), the intervention children did not change their 2-day mean step counts significantly from pre to post. However, the difference between the intervention and comparison was significant (*p<0.05, 1 tail*) with the comparison school significantly increasing the mean step count over the two year period (8860 to 11588; 2729 ± 1239, *p<0.01, 1 tail*) (***Table 11***). Overall gains in physical activity were made during the second grade school year and maintained over the summer, into the fall of the third grade year. However, over the third grade year the step counts either did not significantly change (Cohort B) or significantly decreased (Cohort C), negating the gains made by these children in year 1. This was in contrast to the comparison school, where year 1 gains were not completely negated by year 2 decreases, thus resulting in an overall (04-06) significant increase in physical activity.



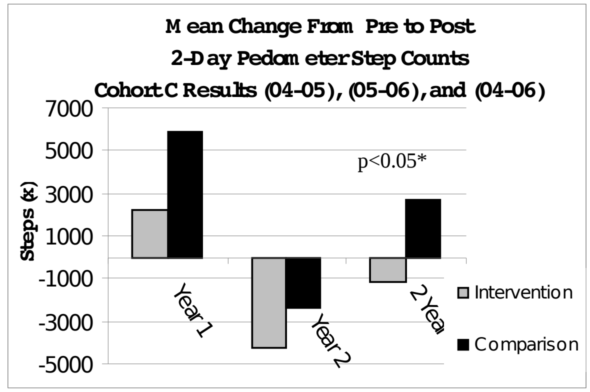


Figure 13: Comparison of Mean Change in 2-Day Step Counts
Graph A, Cohort A (Year 1) B (Year 2); Graph B, Cohort C Year 1, Year 2 and 2 Year Results
**Significant (p<0.05, 1 tail) results between Intervention and Comparison for Cohort C, 2 Year (04-06) results only.*

DISCUSSION

Over the two year implementation of the Cortez mini-Program ENERGY, food, health, and physical activity knowledge and attitudes of children, as well as body image of the female children, improved significantly. Some of these changes were significant within the intervention group only (from pre to post), while others were significant between the intervention and comparison school. In contrast, physical activity (step counts) did not improve. Furthermore, while not significant, the two-year mean BMI z-score trend was toward BMI maintenance at the intervention school, in contrast to an increasing trend at the comparison school. Hence, the Cortez mini-Program ENERGY improved the health knowledge and attitudes of local elementary students in a rural setting.

Program ENERGY is an obesity and type 2 diabetes prevention program that has been successfully implemented in low-income schools in Fort Collins, Colorado (11-15). One of the goals of the program is to reach underserved populations in rural, low-income communities. Hence, intervention trials to disseminate the program to locations in Cortez, Colorado, West Virginia, and Texas have commenced over the last several years. The mini-Program, which is implemented in the rural locations, is less intensive but teaches the same principles of energy balance and wellness with fewer resources (12). It is therefore useful and important to compare the effectiveness of the mini-program to its parent version for future decisions on dissemination of the program to rural locations.

The parent version of Program ENERGY, which began in classrooms in Fort Collins, Colorado, was modeled after seminal interventions that showed the feasibility of nutrition interventions in the classroom setting (11-15). These earlier interventions included Child and Adolescent Trial for Cardiovascular Health (CATCH), Sports, Play, and Active Recreation for Kids (SPARK), Planet Health, and Pathways and focused on improving nutrition and increasing physical activity (19, 28). CATCH was a three-year intervention with 3^{rd}, 4^{th}, and 5^{th} grade students. It included a family component to reinforce the concepts taught in the classroom at home. In year one, CATCH produced improvements in dietary knowledge, intake, and intent but these improvements decreased by year three of the intervention. It was also able to increase the time students spent moving during their physical education class (19, 28-32).

The aim of the SPARK intervention was to increase the time students spent in physical education (PE) and to determine if increased time in PE translated into improved academic performance as measured by standardized tests. SPARK was a two year intervention following students through 4^{th} and 5^{th} grade, and although it was effective at increasing time spent in PE, it was unable to show a correlation to PE duration and test performance (29, 30).

Planet Health was a two-year behavior-based intervention designed to decrease obesity in 6^{th} through 8^{th} grade students. The prevalence of obesity in female students decreased by 3.3% among participants, while increasing 2.2% at the comparison school. There was no significant change in obesity among male students (31).

Pathways was a three-year intervention involving 3^{rd}, 4^{th}, and 5^{th} grade children in schools serving Native American children. Pathways focused on four components;

classroom, increasing physical activity, changing dietary intake, and family involvement. Students received two 45-minute lessons weekly from teachers trained to present the material. In addition, three 30-minute moderate to vigorous physical activity sessions were added to increase in-school energy expenditure. The school's food service was also given guidelines for reducing fat intake in the school meals. Finally, there was a family component that included information and healthy snacks being sent home with the children as well as planned after-school activities like cooking classes for the family. Pathways increased the health knowledge of children participating in the intervention over that of the comparison group. Intervention students reported more healthy food choice intentions than comparison children, and increased self-efficacy to be more physically active. However, the 24-hour motion sensor measurements showed no significant difference to the comparison school. Percent calories from fat and total energy intake, as measured by 24 hour recall, significantly decreased but these changes did not result in a significant decrease in body fat (32).

Overall, these programs showed that interventions in the classroom were feasible and significant increase in health knowledge and attitudes could be gained by multi-component school based programs. Program ENERGY incorporated the foundations of these seminal programs with additional principles including concepts of balance (energy, blood sugar, body composition, food selection and life activities), health at any size, and prevention of obesity and type 2 diabetes through science inquiry based lessons and community-based partnerships (11-15).

As was seen with these interventions, the full weekly Program ENERGY resulted in significant increases in food and health knowledge, food attitudes and behaviors, and physical activity (step counts). Program ENERGY also produced increased body acceptance among female students, increased interest in health and science-based careers, and the adoption of a community-based model (11-15). The Cortez mini-Program also achieved many of these outcomes with fewer interactions, and less intensive physical activity and family components.

Although the mini-version and the full weekly program had congruent goals, comparisons made between the programs must take into account their many differences such as scope of the lesson subject matter, intensity of lessons, materials used, physical activity sessions, community support, and population demographics. Both programs aimed at reducing obesity and type 2 diabetes through science enrichment, physical activity, and parent-child communication. The full weekly program was built through a partnership with the community and emphasized cultural sensitivity and community involvement (11-15). The Cortez mini-program sought to do this by incorporating aspects of Cortez life into lessons, asking for donations from the community, inviting parents and family to attend the field trip and 9News Student Health Fair, and building a Cortez ENERGY Team including the project coordinator and local high school and nursing students to deliver the lessons. This was meant to replicate the team atmosphere created by the Green Team; a group of Colorado State University nutrition graduate and undergraduate students who volunteer in the weekly classroom lessons and are collectively known as the "Green Team" by the children (12).

The foremost differences between the two programs were intervention intensity (lesson contact time and volunteer to child ratio) and the sample populations. The full program provided two 45 to 60-minute interactions (classroom and physical activity) each week and had a chef visit for hands-on food activities every five weeks. The lessons were taught by university professors and researchers, and graduate students with the aid of volunteer college students majoring in human nutrition or a related field (11-15). The ratio of children to volunteers was about 4 or 5:1.

The mini-Program ENERGY implemented, on average, two interactions (classroom or physical activity) per month. Most of the interactions were classroom components, with one or two physical activity lessons per year. The decreased focus on the physical activity lessons in Cortez may explain why there was not any improvement in step counts. Another difference was that volunteers had to be drawn from the community as there are no major universities nearby to provide a similar volunteer base. Local high school students volunteered as group leaders but there were obvious differences between them and the college student volunteers. The biggest difference was the lack of general health and nutrition knowledge that was essential in answering questions and guiding small group discussions. The child to volunteer ratio was also much larger, usually around 6 to 8:1 (including the lesson leader as one of the volunteers). There were also fewer lesson materials available for use in Cortez (see Methods Section, Table 1). This coupled with less supervision, meant that some of the lessons were changed in order to accommodate the circumstances. Some lessons were even changed up to the minute before they began because volunteers would not show up for the lesson that day. The changes in content were minor, but there was less time spent with each student and more time was spent on classroom management than in the full program. These differences meant the mini-version was not as intensely implemented as its parent version.

The sample populations were also different, although they each focused on low-income children and ethnic groups at increased risk for obesity and type 2 diabetes. Program ENERGY was originally developed for Hispanic children and parents because the Hispanic community is at high risk for these diseases (11). One third of the children in the full program had reported awareness of type 2 diabetes through family members (33). The sample population in Cortez was largely rural non-Hispanic White and Native American, a population that is often underserved in many aspects of public health intervention, including diabetes and obesity prevention (4). According to the National Indian Child Welfare Association, the Indian Health Service appropriation meets less than 60% of the need, and of that, only 1% is budgeted for designated behavioral health programs (34) Initial enrollment in the study was slightly lower for the mini-program (86% year 1, 72% year 2 mini compared to 92% for the full program (11)). However, the retention rates for the mini-program were slightly higher than the full program (87% year 1, 100% year 2 and 70% for year 1 and 2 combined mini compared to 87% year 1 and 62% year 1 and 2 combined for the full program (11)). All withdrawals were because the child left the school during or between the school year(s).

The enrollment rates may have been lower due to lower literacy and fewer years of education among the adult population in southwestern Colorado (35). The legal format of the CSUHRC approved informed consent form caused many parents to hesitate to sign it, even after contacting teachers and the project coordinator with concerns and questions. The retention rates were high, however, once students, teachers and parents experienced the program lessons and gained a better understanding about the program's intentions. Two students, whose parents previously denied consent, consented to participate in year two. Many of the children, who did not enroll in the intervention, did so by not returning the consent form at all, rather than returning a negative consent. Students who left the program did so because they moved either to another classroom in the school or they left the school. No parents asked to withdraw their child from the intervention.

This mini-Program ENERGY helped to expand the range and depth of communities reached by Program ENERGY and is unique in being the only program for this age group in Cortez that focuses on diabetes prevention and teaching healthy lifestyles through science enrichment in the classroom. It is also the only program in southwestern Colorado, of which we are aware of, to meet the ADA recommendation for school-based interventions for younger children to provide multiple components that include parents or family (10).

Although this program is unique, and overweight interventions are much needed in rural areas with pockets of underserved populations, these results reveal some limitations that must be considered before warranting program expansion and dissemination to other sites. First, the sample size was small compared to the full program. One reason for this is rural schools tend to have smaller classrooms with fewer children in each grade level. Other reasons were related to the nature of enrolling in a research study. Rural populations have less exposure and opportunity to enroll in research studies and therefore may be more hesitant to participate. Cortez also had a lower literacy rate among parents and guardians, which may have made the consent form intimidating thus they were reluctant to consent. This was especially true at the comparison school where children would not benefit from the intervention in exchange for participation. Many children reported to their teachers and the project coordinator that their parents would not give consent due to the photo permission requested on the consent form. A note informing control school parents that they could give participation consent without photo consent resulted in the majority of the comparison school participation. Eliminating the photo permission section from the comparison school consent form may increase sample size in the future.

The small sample size at the comparison school did not give enough power to find statistical significance when comparing some of the results to the intervention. In these cases the results from the intervention may have been impressive from pre to post but there is not a fair objective measure to compare them against.

Another sample limitation was that the comparison school children were also receiving a nutrition education intervention. The students were being taught lessons by the school nurse who was a diabetes educator, as well as participating in a program that was being provided by state funded nutrition education outreach programs. Although the comparison children were not participating in the mini-Program ENERGY intervention, exposure to this educational material may explain why significant differences between the intervention and comparison schools were not observed in Cortez in contrast to the results observed in Fort Collins and West Virginia (12, 36).

The study evaluation also has limitations. The evaluations performed in Cortez were done by the author and occasionally one or two volunteers. This is in contrast to the evaluation process in Fort Collins where there are more volunteers to assist each child and make sure all the questionnaires are answered completely. With fewer volunteers, children more often skipped questions they did not understand, making for incomplete evaluations. The methods used for pedometer collection was also different. In Fort Collins, the children turned their pedometers into a box and then the volunteers and investigator opened the pedometers, recorded the data, resealed them and then returned them to the children within the hour (22). The children were not present to see their step counts as the data were recorded. In Cortez, the lesson leader and one or two other volunteers went around the room during silent reading and opened the pedometers at the child's desk. The steps were recorded and then the pedometers were resealed. This allowed the children to see their step counts.

As an unintended consequence of this data collection method, a competitive atmosphere was created and the children felt like they were competing with each other to see who could get the most steps. This may have also contributed to the pedometers being seen as a novelty item and to their improper use (shaking, wearing incorrectly, leaving them at home, opening them and resetting). The lesson leader and the educator in the classroom emphasized the importance of using the pedometers properly. The children were reminded daily that it was not a competition but instead they were participating in a research project. They were told that doing a good job meant doing a normal amount of activities and following the pedometer guidelines that were reviewed daily before the children went home. This is definitely a different atmosphere then the children in Fort Collins had when they were wearing their pedometers for data collection.

As a result, the step count data in Cortez were erratic. The pedometer data were collected for 3-days but only a 2-day average is reported. The day that most differed from the other days was not used in the analysis to help obtain a stable set of step counts. This may also explain why children who were in both years of the mini-program (Cohort

C) had a greater decrease in step counts in year 2 than children in Cohort B. The novelty effect of the pedometers may have worn off by the end of year 2, as it would be the fourth time the students had done this assessment and they had also used the pedometers in the classroom over the 2 years. The step counts of children in Cohort B (which includes Cohort C children as well as children new to the program in year 2) also decreased but not much as the Cohort C children analyzed separately. This suggests that the novelty effect of wearing the pedometers and aiming for as many steps as possible may have worn off by the end of year 2 and may partially explain the decreased step counts.

The pedometer data are also incongruent with the written assessment of attitudes toward physical activity. It was expected that if attitude is improving it would make sense that steps would also increase and vice versa. In year 1 (Cohort A), there was no significant change in the written assessment of attitudes toward physical activity (SPARK). However, there was a significant increase in 2-day step counts at both the intervention and comparison schools. In year 2 (Cohort B), there was no significant change in step counts (but a negative trend), but the written assessment shows significant increases in physical activity knowledge, attitude and total scores. This change is significant from baseline for the intervention school and also between the two schools. The 2 year data (Cohort C) showed no significant difference in the written assessment between the schools with a significant improvement in attitude from baseline at the intervention school. However, the pedometer data showed a trend toward a decreased step count at the intervention and a significant increase at the comparison school compared to the intervention. This incongruent result of the physical activity written assessment and step count assessment may be partially accounted for by the novelty effect of the pedometers on physical activity. The effect of the mini-Program ENERGY on physical activity (measured by step counts) is confounded by fact that the evaluation was done differently in Cortez and that these differences likely have affected the outcome. The data collected in Cortez suggest that the mini-program may not increase physical activity the way that the full version did. The mini-version could have a greater impact on physical activity if more of the lessons focused on this component. An assessment done more similarly to the one in Fort Collins may also improve the ability to demonstrate a correlation between the written assessment of attitudes toward physical activity and step count assessment of physical activity and provide a more accurate picture of the programs effect on actual physical activity.

During the time period of this intervention, there was an increased public awareness about childhood obesity in the local and national media. As a result, the public schools were making an effort to address this concern. The educators at both the intervention and comparison school already had Food Guide Pyramids on their classroom walls and incorporated them into a health unit they taught during the school year. The comparison school received an education outreach program from the Extension office in Cortez. The school lunch program did not appear to be any different between the two schools in Cortez but did differ from the fresh fruit and salad bar offered to children in Fort Collins. These different environments could also contribute to the differences seen in the full and mini-Program.

The evaluation of the program was also limited by the assessments. The program, both the full and mini-version, focused on energy balance, reading and evaluating nutrition labels, developing an appreciation for the scientific process, and improving body image. The CACTH and SPARK assessment tools do not directly evaluate these concepts and skills, instead evaluating general health knowledge and attitudes towards health and physical activity. Although these assessments evaluate components of the program, an assessment tool that directly evaluated these concepts would better reflect the effectiveness of Program ENERGY.

Another inherent limitation of the study evaluation is that the pre and post test occurred at different time of the year. The pretesting was done in the fall, during the early part of September, and the posttesting was done in the spring during the month of April. In Cortez, Colorado the weather is warm and mild in September, but April is very unpredictable with some days mild and sunny and other days can be cold and snowy or rainy. This means that certain weather-dependent assessments can vary greatly based almost exclusively on the weather. The assessment most affected by weather is the pedometer step counts. In the fall, students were coming into the assessment fresh from their summer break where they are used to playing outside and being more active. In the spring they are coming off the cold winter months where there is less opportunity for outdoor activities and may still be detoured from activity by the colder weather that persists on and off through May. Therefore, the baseline scores may be artificially elevated above those in the spring, making it not a true assessment of actual change in physical activity. However, this is also an issue in Fort Collins and the step counts there improved from baseline. Thus, a similar result (increase in mean step counts) should be expected from a comparable mini-program.

Another assessment affected by the weather is the BMI measurements. Occurring during warmer months, the baseline measurements are done in lighter weight clothing than the post measurements done in the spring. In the fall (August and September) children tended to wear shorts and short sleeves, while in the spring (April and May) children wore pants and often hoodies or other long sleeve clothing. Children are asked to remove their shoes at both measurements but their clothing remains. Thus a few pound's difference can come from clothing alone, and most likely causes an artificially higher weight, and hence increased BMI.

There are also possible seasonal weight variations that could have affected the BMI results. In the fall, the students are coming out of summer where they are likely to have been active outside and in the spring they are coming out of the winter months were there is less opportunity for outdoor activities. A change of a couple pounds could cause a false shift in a BMI category and not accurately reflect the programs effectiveness.

However, the goal of an obesity prevention program is not weight loss but BMI maintenance. A successful obesity prevention program should keep children in their BMI category (healthy, at risk of overweight, overweight) from baseline to post testing. Thus, a significant change from pre to post testing is not required because the goal is for the results to remain the same. A significant difference between the intervention and the comparison may be desired if it shows no change at the intervention compared to a shifting BMI at the comparison.

The result of the mini-Program ENERGY demonstrates desirable BMI outcomes. There was not a significant change in BMI z-scores over the 2 years of the intervention, meaning that BMI's were maintained. The mean change in BMI over the 2 years of the intervention was 1.71 ± 0.36 with males having a mean change of 1.76 ± 0.60 and a mean change of 1.69 ± 0.45 for females. Individually most of the children remained in there

BMI classification. Of the children participating in both years, with measurements at all time points (n=13), 2 (15%) moved up from “healthy” to “at risk of overweight”, 1 (8%) moved down from “at risk of overweight” to “healthy”, and 1 (8%) maintained his/her classification of “at risk of overweight”. These results were comparable to those seen in the parent version of the Program.

In the initial cohort of 2nd grade children in the full Program ENERGY intervention in Fort Collins, 70% of the boys and 40% of girls were overweight (BMI>85%) and 20% of boys and 13% of girls were obese. The mean change in BMI over the two years of the study was 1.6 ± 0.4 in boys and 1.0 ± 0.3 in girls. After 2 years, 70% of the boys and 33% of girls were overweight and 30% of boys and 13% of girls were obese. After two school years, the BMI of all four obese children remained obese and one overweight child had become obese and three decreased to healthy weight and five remained overweight. Two healthy weight children had become overweight and ten remained at a healthy weight. In the comparison school, initial BMI ranges and the mean change in BMI over the two years of the study were similar (11-15).

The Cortez mini-Program ENERGY was the first attempt at disseminating Program ENERGY to a rural school with a high proportion of Native American children. Many parts of the Program were convertible to a small rural town serving this demographic, but certain improvements should be considered if the program were to be implemented again in this population or one similar to it.

The biggest challenge at this dissemination site was finding volunteers that created the “team” like feeling that the full Program in Ft. Collins has with its “Green Team” volunteer squad from Colorado State University. In Cortez, the volunteer base is limited to parents, high school students and local nursing students. These community members did not have flexible schedules that allowed for reliable and frequent participation. They also lacked nutrition/health and wellness knowledge that the Green Team volunteers are well versed in. One suggestion would be to tailor the lessons so that they can be conducted by one or two leaders instead of a team. This takes away some of the one-on-one time and mentoring that the children in full program receive. This is a significant part of program ENERGY but as this mini-Program ENERGY demonstrated, results can still be obtained when lessons and the volunteer to child ratio is scaled back.

A more ideal alternative could be to create a volunteer lesson/activity guide packet that would include information specifically tailored to volunteers not studying in the nutrition field. The program coordinator made an attempt to put together emails for the volunteers before each lesson to help explain the lesson material. It is not known how in depth the high school volunteers reviewed this information before the lesson. A more structured format could be beneficial. An online tutorial that the volunteers could access before the lesson, and had a mini quiz at the end that the program leader could review the volunteer answers, would allow the leader to address areas of specific concern and give confirmation that the most pertinent material had been covered before the lesson. Another form of education could be a volunteer training session at the beginning of the year or several trainings throughout the dissemination of the program that could help clarify the material being covered. A training session was attempted by the research coordinator but it had low attendance as it was difficult to coordinate the high school volunteer schedules (meeting outside school hours was discouraged as it required permission forms through the school). An incentive such as free food or prize give a ways may have helped to increase attendance.

Additionally, a potential area of improvement would be in standardizing the assessment methods. A manual of assessments for the lesson leader would help insure that each component of the assessment was being carried out in an identical manner to the parent Program. The manual should provide specific instructions for conducting each piece of the assessment; CATCH and SPARK questionnaires, height, weight and waist circumference and pedometer step counts. This manual could help make consistent the types of clothing that are permissible during the height, weight and waist circumference measurements and which articles should be removed. A policy of removing heavy outer clothing and shoes would be useful in making comparisons between pre and post as well as between schools. The pedometer method should be standardized and include an option for conducting the assessment with a minimal number of volunteers that produces a comparable collection environment to the parent Program. This standardization will facilitate future comparisons between disseminations and the parent Program.

Furthermore, other improvements could include increasing the amount of community and family involvement. The community setting in Cortez was different than that of Fort Collins as there are not nearly the resources to draw from. More use could have been made of the National Parks and monuments near by that are rich in Native American heritage and provide ample opportunity for outdoor recreation and education. Children frequent these parks (Mesa Verde, Anasazi Heritage Center, and Crow Canyon Archaeological Center) as part of regular school field trips but Program ENERGY could collaborate with the teachers to make lifestyle and wellness components of these field trips, perhaps by comparing the hunter/gather lifestyle to that of today. Another element of the community that was different is that many of the Native American children, belonging to the Ute Mountain Ute Tribe, did not live in the city of Cortez but resided 45 minutes south on the Towaoc Reservation. This made it difficult to directly involve tribal members. The program coordinator attempted to reach out to the tribal community by volunteering at an after school program that taught everything from health and environmental issues to arts and crafts. This allowed her to meet health officials that came to volunteer at a booth at the school's 9News Health Fair. Another way to reach out to the tribal community may be to offer a family component that is taught out at the reservation so that they do not have to commute into town. Healthy cooking lessons (with recipe modification of local foods) with free food and day care for younger siblings may have been an attractive offer. This would also be a good component to add to the mini-Program ENERGY and offer it to all families at the school.

The family component in the mini-Program ENERGY was minor. At the end of each lesson children were encouraged to share lessons they learned with their families and were asked what things they had or were going to share with there family. Informal feedback seemed to show this had a positive effect. Another way to involve the family more effectively would be heavier recruitment of parent volunteers with incentives like day care for younger siblings and afterschool family activities. Adding a component like the full Program's Diabetes Challenge, which involves the family in a series of challenges to be completed in competition with the other classrooms in the same grade level, would also increase the family out reach component (16, 17).

Many components of Program ENERGY are suited to Native American cultural ideals as with the idea of balance (energy balance, balance of blood sugar, balanced diet, lifestyle, etc). This concept could be taken a step further by incorporating aspects of Native American culture such as story telling into the individual lessons.

As a result of Program ENERGY's presence at the intervention school, an overall increase in health awareness was created. Educators made an increased effort to be healthy role models and made class rules like only healthy snacks allowed at snack time. Classroom parties, for birthdays and holiday events, focused on incorporating healthy foods as a way to enjoy the celebration in moderation or "balance" as a part of a healthy life style. The school nurse also took an increased interest in promoting health and wellness and was instrumental in helping the author implement a 9NEWS Health Fair at the end of year 2. The nurse expressed interest in implementing parts of the program and was trained on lesson implementation so that she could give some of the lessons the following year. The Program also reached out to the Native American community to help the Ute Tribe gain access to health materials that they were interested in. A Ute Tribal Health member invited the author to participate as a group leader in an after school health and wellness program that focused on healthy lifestyles and environmental issues. The program involved children from kindergarten through 6th grade. The author was able to lead lessons on the food guide pyramid, reading food labels, and energy balance (Apple vs. Chocolate, see Methods Section, Table 1). Even in the mini-version form, the Program was incorporated into the community and its principles help shaped the attitudes and environment of the local elementary school.

To continue outreach to the Cortez and Towaoc communities the author provided the Manaugh school nurse with training and materials to continue to implement Program ENERGY lessons as she saw fit. The author will also provide the intervention and comparison schools, as well as the Ute Tribal Health Counsel with a written summary of the results of this intervention and a letter of her sincere appreciation for their participation in this project. She will offer to participate in face-to-face presentations and discussions of these results with the educators, school district and the Ute Mountain Ute Tribal Health Counsel. She will continue to make herself available as a resource for, outreach materials and consultation.

The results of the Cortez mini-Program ENERGY demonstrate that the dissemination of the full program in a condensed version is feasible and produces similar results to the parent version. This is important because it shows that a less intensive Program ENERGY can be brought to rural areas which serve diverse populations and significantly improve health and physical activity knowledge and attitudes. An important finding is that significant improvement in self image among the female children is also achieved by the mini-Program ENERGY as it was been in the parent program. However, the results of this intervention suggest that for significant improvement in actual physical activity (steps counts) it may be necessary to have a more intensive physical activity component as part of the mini-Program ENERGY. Overall, the Cortez mini-Program ENERGY demonstrated the feasibility of adapting the full Program to a rural setting and that such a program can significantly improve the health knowledge and attitudes of local elementary children in similar ways to the full Program.

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