THE EFFECT OF ANIMAL MODELS

ON CHILDREN'S KNOWLEDGE, ATTITUDES,

AND PRACTICE OF HEALTH BEHAVIORS

A Dissertation
Presented to
The Academic Faculty

by

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In Partial Fulfillment
of the Requirements for the Degree
of Doctor of Philosophy in the
School of Psychology

Georgia Institute of Technology
August 2011

THE EFFECT OF ANIMAL MODELS ON CHILDREN'S KNOWLEDGE, ATTITUDES, AND PRACTICE OF HEALTH BEHAVIORS

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ACKNOWLEDGEMENTS

Many people were instrumental in helping me to reach this point in my life and I can never truly thank them all for their love and support. To everyone who listened to my ideas, my fears, and at times, my rants, I thank you for your input and for keeping me sane through the entire process. My family has been a constant source of support, guidance, inspiration, and humor through this long and strange trip. Their unwavering belief in me has always helped me to stay true to my course and to keep pushing forward when the goal seemed out of reach. My parents instilled a love of the world and all of its inhabitants in me. Our house became a home to a variety of creatures and this started me on a path to wanting to better understand those creatures. Every day, I still watch Louis, the coolest turtle I know, who came into my life sixteen years ago thanks to my mom. I am incredibly fortunate to have been encouraged to follow an unusual path and to continue to grow because of it. To those I love and hold in my heart, you have given me the greatest gifts, that of unconditional love and belief, without which I would not be the person I am today.

I want to thank my committee members for their guidance and input on a project that fell outside of everyone's normal sphere. No one knew for sure how it would develop, but I thank each one for you for believing that it was a project worth undertaking and always being available to figure out how to deal with the hurdles as they came along.

I want to thank the staff at the Palm Beach Zoo and at the Boys & Girls Club locations who provided assistance during this project as it would not have happened without everyone's help. I also want to thank the children who participated in the study, their enthusiasm for the animals and the zoo was contagious and I learned much more from them than they did from me!

Finally, I want to thank the animals I am privileged to work with each and every day. They are the source of my inspiration and I hope that the work I do helps to improve their lives just as they help to improve mine.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	vi
SUMMARY	ix
CHAPTER	
1 Introduction	1
Overweight Measures and Definitions	1
Rates of Obesity	3
Consequences of Obesity-Physiological	5
Consequences of Obesity-Psychological	6
Consequences of Obesity-Financial	7
Causes of Obesity-Biological	8
Causes of Obesity-Behavioral	8
Causes of Obesity-Environmental	10
Intervention Programs	11
Physical Activity Programs	12
Nutrition Programs	15
Mixed Interventions	17
Attitude and Behavior	21
Programs Targeting Behavior	23
Teaching Using Animals	26
Study Purpose	30
Research Questions and Hypotheses	31

2 Methods 34

Subjects and Study Location 34

Materials and Methods 38

Data Analysis 42

3 Results 43

4 Discussion 76

Limitations 87

Future Investigations 88

Conclusions 90

APPENDIX A: PARENTAL PERMISSION FORM 91

APPENDIX B: PHYSICAL ACTIVITY CLASS 93

APPENDIX C: NUTRITION CLASS 94

APPENDIX D: BODY IMAGE CLASS 95

APPENDIX E: HEALTH MONITORING CLASS 96

APPENDIX F: SURVEY 97

REFERENCES 103

LIST OF TABLES

Page

Table 1: Participant Distribution 37

Table 2: Percentages of Affirmative Responses 45

Table 3: Group 1 Pre Experimental vs. Post Experimental Knowledge Questions 47

Table 4: Group 1 Pre Control vs. Post Control Knowledge Questions 47

Table 5: Group 2 Pre Experimental vs. Post Experimental Knowledge Questions 49

Table 6: Group 2 Pre Control vs. Post Control Knowledge Questions 49

Table 7: Group 1 Pre Experimental vs. Post Experimental Attitude Questions 51

Table 8: Group 1 Pre Control vs. Post Control Attitude Questions 51

Table 9: Group 2 Pre Experimental vs. Post Experimental Attitude Questions 53

Table 10: Group 2 Pre Control vs. Post Control Attitude Questions 53

Table 11: Group 1 Pre Experimental vs. Post Experimental Practice Questions 55

Table 12: Group 1 Pre Control vs. Post Control Practice Questions 56

Table 13: Group 2 Pre Experimental vs. Post Experimental
Practice Questions 58
Table 14: Group 2 Pre Control vs. Post Control
Practice Questions 59
Table 15: Group 1 Pre Experimental vs. Group 2 Pre Experimental
Knowledge Questions 61
Table 16: Group 1 Pre Experimental vs. Group 2 Pre Experimental
Attitude Questions 62
Table 17: Group 1 Pre Experimental vs. Group 2 Pre Experimental
Practice Questions 63
Table 18: Group 1 Post Experimental vs. Group 2 Post Experimental
Knowledge Questions 65
Table 19: Group 1 Post Experimental vs. Group 2 Post Experimental
Attitude Questions 66
Table 20: Group 1 Post Experimental vs. Group 2 Post Experimental
Practice Questions 67
Table 21: Group 1 Control 1 vs. Group 1 Post Control
Knowledge Questions 69
Table 22: Group 1 Control 1 vs. Group 1 Post Control
Attitude Questions 70
Table 23: Group 1 Control 1 vs. Group 1 Post Control
Practice Questions 71
Table 24: Group 2 Control 1 vs. Group 2 Post Control
Knowledge Questions 73

Table 25: Group 2 Control 1 vs. Group 2 Post Control Attitude Questions 74

Table 26: Group 2 Control 1 vs. Group 2 Post Control Practice Questions 75

SUMMARY

Obesity has been described as a global health crisis due to the rapid increases seen worldwide (Whitlock et al., 2005; Harris et al., 2009; Yetter, 2009). The consequences of obesity are far-reaching and include the physiological and psychological implications for obese individuals, as well as the financial impact it has on both the individual and national health care. Children, especially those of minority ethnic background and lower socioeconomic status, are at increased risk for developing obesity (Yetter, 2009; Veldhuis et al., 2009). Intervention programs targeting underlying causes of childhood obesity have been developed, but little consistent success has been achieved (Summerbell et al., 2005; Sherry, 2005). One factor that could be influencing the lack of success is the stigmatization that can be felt by children taking part in intervention programs. Furthermore, many programs have targeted behavior change without determining underlying attitudes about behaviors. It is critical that effective obesity intervention programs be developed for children at high risk of developing obesity. This study used indirect messaging to address health issues related to overweight and obesity in children. An education program about animal health was presented to two groups of eight and nine year old children. The program included a combination of classroom instruction and practical application both in the classroom and at the Palm Beach Zoo with real animals. The children's attitude, knowledge, and practice of healthy behavior were measured before and after exposure to the program to evaluate its effect. It was hypothesized that learning about what being healthy entails for animals will have positive implications for the children's own health. It was found that children who participated in this study were already knowledgeable about healthy behaviors and also had overall positive attitudes towards health. However, they did not have high levels of health

behavior practices. Participation in the program did not significantly improve the knowledge, attitudes, or practice of health behavior in the children. Zoos should consider designing program that specifically target increasing the practice of health behaviors in children.

CHAPTER 1

INTRODUCTION

Obesity has been called an epidemic and a public health crisis due to an alarming increase in occurrence (Whitlock, Williams, Gold, Smith & Shipman, 2005). Increases in overweight and obesity are occurring globally, and effective methods to prevent and decrease the prevalence of this crisis are urgently needed. Causes for weight gain and the factors underlying the increases seen are numerous. Understanding how to best address the causes can help to reduce the impact of this health epidemic. Health care professionals, namely medical providers, health educators, and researchers are developing intervention programs designed to accomplish this goal. However, the results of such interventions have been mixed and there is still an urgent need to find an effective method. Without effective programs, it is expected that the prevalence of overweight and obesity will continue to increase worldwide. Children are affected by this epidemic almost as severely as adults and it has so many consequences that it could reverse the life expectancy trends for these younger generations that have been achieved through the control of infectious diseases (Institute of Medicine, 2005). Creating educational and preventative programs for younger children is a critical effort in the fight against these alarming trends.

Obesity Measures and Definitions

Overweight and obesity are labels for ranges of weight considered to be higher than what is regarded as healthy for a given height. Rates of being overweight or obese are typically determined using the body mass index (BMI), a number calculated by

dividing weight in pounds by height in inches squared. It does not directly measure body fat, but is widely accepted because it correlates to the amount of body fat an individual has. Overweight in adults is defined as having a BMI of between 25 and 29.9 and obesity is defined as having a BMI over 30 (Centers for Disease Control and Prevention (CDC), 2009). BMI is calculated slightly differently in children to account for differences in body fat at various ages as well as differences between males and females. In children overweight is defined as having a BMI between the 85^{th} and 94^{th} percentile and obesity is defined as having a BMI above the 95^{th} percentile (Whitlock et al., 2005). These cut-off points are based on two classifications, the CDC growth charts and the International Obesity Taskforce (IOTF) cut-off points. These classifications are based on cross-sectional gender-specific distributions of BMI levels according to age.

BMI is widely used due to ease of application and cost effectiveness. However, some have argued that BMI is not as useful as an estimator of body fat in normal weight children. BMI cannot distinguish between body fat and fat free mass, which includes muscle and skeletal mass. Therefore, BMI may be a better indicator of body fat in heavier children rather than in thin children for which differences in BMI may be due to differences in fat free mass (Freedman & Sherry, 2009).

Other inexpensive methods are also used to estimate body fat, including skin fold thickness measures and circumference measurements. However, errors using these measures are greater than when using BMI (Freedman & Sherry, 2009). There are various other highly accurate ways to measure body fat such as dual energy x-ray absorptiometry and hydrodensitometry weighing, however. These methods, although very accurate, are costly and can be uncomfortable for the individual being measured.

Rates of Obesity

The prevalence of being overweight and obese has doubled in the last 25 years, with the rates in children ages six to eighteen tripling (Veldhuis, Struijk, Kroeze, Oenema, Renders, Bulk-Bunschote, HiraSing & Raat, 2009; Yetter, 2009). In the United States, close to 33 percent of adults were found to be overweight, with 34 percent of those considered obese according to the 2005-2006 National Health and Nutrition Examination Survey (NHANES) (CDC, 2007).

Issues with weight can be manifested early on in life, with an estimated 22 million overweight children under the age of five worldwide. Overall, 155 million children worldwide are overweight and up to 40 million are obese (Lobstein et al., 2004). The rate of obese children between the ages of six and eleven went from 4 percent to 19 percent in the last three decades, an increase of 370 percent (Steele, Nelson & Jelalian, 2008).

The increases have been seen not only in the United States, but in Australia, Canada, and in European countries as well, demonstrating that this is a universal crisis (Harris et al., 2009; O'Dea & Dibley, 2009). Globally, there are more than 1.6 billion overweight adults, with 400 million of those considered obese (WHO, 2006). This trend is not restricted to developed countries, as the rate of increase can be higher in developing countries. This may be a direct result from an increased availability and reliance on processed food and increasingly sedentary lifestyles.

Differences in rates of overweight and obesity have been found across many populations. In the United States, obesity rates differ between males and female as well as between ethnic groups. The results of a 2006-2008 census conducted by the CDC,

show that African Americans have the highest prevalence of obesity at 35.7%, followed by Hispanic Americans at 28.7%, and Caucasians at 23.7%. Within those groups, African American women had the highest rate of obesity at 39.2% followed by African American men at 31.6%. 29.4% of Hispanic women were considered obese and 27.8% of Hispanic men were as well. Finally, Caucasian men had an obesity rate of 25.4% and 21.8% of Caucasian women were found to be obese.

Obesity rates differ between male and female children as well. In a 2008 study of Australian schoolchildren, males were found to have a higher rate of overweight and obesity (O'Dea, 2008). However, this sex difference can also be influenced by ethnicity in children as African American female children and Mexican American male children have the highest rates of overweight and obesity compared with their counterparts (Crothers, Kehle, Bray & Theodore, 2009; Steele et al., 2008). Twenty percent of African American children and fourteen percent of Hispanic American children are considered obese compared with approximately nine percent of European American children (Yetter, 2009). Household income and access to resources can also impact rates of obesity differently for various ethnic groups. Obesity rates in Caucasian schoolchildren tend to decrease with family income and education level, the opposite has been found for African American and Mexican American girls (Crothers et al., 2009). Overall, however, the prevalence of being overweight or obese is especially pronounced in children of low socioeconomic status (Dollman & Lewis, 2009; Jansen, Raat, Joosten-van Zwanenburg, Reuvers, van Walsem & Brug, 2008) and those of some ethnic backgrounds (Veldhuis et al., 2009).

The southeastern United States has higher rates of obesity for both adults and children (Singh, Kogan & van Dyck, 2008). Geographic disparities may be the result of differences in socioeconomic status as well as the state policies regarding health practices for children. Sixty-two percent of adults and 15 percent of high school students reported being overweight or obese in Florida (CDC, 2008). Rates of being overweight increased from 7 percent in 1980 to 17 percent in 2006 in children aged six to eleven years (CDC, 2008).

Consequences of Obesity-Physiological

Increases in the occurrence of overweight and obesity in children must be taken seriously, as overweight children are at increased risk for certain illnesses. The risk of developing cardiovascular disease later in life is significantly higher for overweight and obese children (Crothers et al., 2009). Cardiovascular problems tend to manifest themselves later on in life, making the associations more directly linked to an increased likelihood of overweight children becoming being overweight adults (Steele, van Sluijs, Cassidy, Griffin & Ekelund, 2009).

Other health risks are elevated in overweight and obese children such as an increase in Type II diabetes (Whitlock et al., 2005; Yetter, 2009), nonalcoholic fatty liver disease (Crothers et al., 2009), arthritis, gallstones, and some types of cancer as well (Steele et al., 2009), as well as sleep and respiratory problems (Ward-Begnoche, Pasold, McNeil, Peek, Razzaq, McCrea Fry & Young, 2009). Asthma has also been correlated with higher rates of overweight, although the specific mechanisms underlying this relationship are not yet clear (Ward-Begnoche et al., 2009). Many of these problems can

affect proper development and result in more limited mobility that can in turn contribute to additional weight gain.

Consequences of Obesity-Psychological

In addition to the physiological health consequences associated with being overweight or obese, there are numerous psychological implications as well. Overweight children are more likely to suffer from depression (Gray, Kahhan & Janicke, 2009), and a variety of behavioral problems (Lumeng, Gannon, Cabral, Frank & Zuckerman, 2003; Duarte, Sourander, Nikolakaros, Pihlajamaki, Helenius, Piha, Kumpulainen, Moilanen, Tamminen, Almqvist & Must, 2009). The increased levels of psychopathology have a negative impact on quality of life in overweight and obese children (Steinsbekk, Jozefiak, Odegard & Wichstrom, 2009). Early onset obesity is associated with increased frequency and intensity of emotional distress than is late onset obesity (Crothers et al., 2009), making early prevention and intervention critical. Self-esteem issues stemming from a negative body image can contribute to the distress. Children tend to view overweight individuals in a negative way (Cramer & Steinwert, 1998) and are less likely to choose them as a friend (Kraig & Keel, 2001). Being viewed and treated negatively by others can make overweight children more likely to avoid social situations and adopt more sedentary and solitary lifestyles (Hayden-Wade, Stein, Ghaderi, Saelens, Zabinski & Wilfley, 2005). In turn, this results in less physical activity and a potential increase in weight. The increased prevalence of obesity, and therefore an increased exposure to it, has not resulted in positive changes in children's attitudes towards overweight individuals (Latner & Stunkard, 2003). Stigmatization of overweight children by others has actually increased along with rates of overweight. Furthermore, there is a negative correlation

between overweight and academic achievement, as well as a positive correlation between overweight and the number of school absences (Yetter, 2009). As a result of all of these consequences, an overall decrease in quality of life is a major concern for those who are overweight or obese.

Consequences of Obesity-Financial

There are also financial consequences to being overweight. Increased health problems result in increased health care costs, both direct and indirect. Direct medical costs include preventative, diagnostic, and those associated with treatment. Indirect costs include lost wages for missed work and loss of future income due to premature death.

The costs are not incurred only by the patient. In 1998, 9.1 percent of national medical expenses were related to overweight and obesity. Approximately one half of those costs were paid for through Medicare and Medicaid (Finkelstein, Fiebelkorn, and Wang, 2003). Hospitalizations due to obesity related illnesses have increased in children in the last three decades. The frequency with which obesity is being listed as a secondary diagnosis during hospital stays has increased as well (Wang & Dietz, 2002). Hospital costs associated with obesity have risen as a result, reaching close to 130 million dollars in the last few years (Wang & Dietz, 2002). Adult obesity has been shown to increase overall health care costs and medication costs by up to seventy-seven percent, costs that outweigh those that result from smoking and drinking combined (Sturm, 2002). Proper prevention and intervention are critical to ensuring that a continued increase does not occur. Costs to the national healthcare system promise to be substantial if trends are not reversed.

Causes of Obesity-Biological

There are a number of genetic disorders such as leptin deficiency and mutations in the melanocortin-4 receptors that can result in overweight and obesity. Most of these conditions are rare, but usually result in severe obesity. Some researchers have also proposed the "thrifty gene" theory to explain increases in the prevalence of overweight and obesity (Richards & Patterson, 2006). A "thrifty gene" would control hormonal fluctuations during seasonal changes in food availability. Hormones would be released to increase insulin resistance and fat storage to correspond to times of low food availability and the process would be reversed when food became more readily available. Changes in food production and availability would render this gene useless and could explain increases in obesity and the occurrence of type II diabetes in certain populations.

Some medical conditions can contribute to overweight and obesity, but are rarely the primary cause. Hypothyroidism has been associated with weight gain, although the overall effect is small. Injuries to the hypothalamus can also lead to weight gain, but this is a very rare occurrence (Bray, 2008).

Causes of Obesity-Behavioral

For most individuals, overweight and obesity is the result of behavioral choices. The major cause of being overweight and obese is an excess of energy intake compared to energy expenditure. Increased food consumption and a shift towards more sedentary lifestyles are the underlying factors in the growing prevalence of overweight across cultures, age classes, ethnic groups, and genders.

Poor dietary habits often begin early. Lower levels of consumption of fruit and vegetables as well as higher consumption of sweet beverages have been associated with

overweight and obesity in children (Crothers et al., 2009). Additionally, children consume up to one third of their calories from restaurant meals (Crothers et al., 2009). Food choices at restaurants can often be nutritionally substandard; therefore children who eat out more often could be at a higher risk of being overweight and obese as a result. Not eating breakfast has been linked to higher instances of overweight and obesity (Butcher-Powell, Bordi, Borja, Cranage & Cole, 2003) and up to 30% of children in the U.S. do not eat breakfast (Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). Children should be encouraged to eat breakfast daily.

Food choices can be influenced by television viewing, a sedentary behavior that has also been linked to overweight and obesity. A study evaluating the association between television viewing and food habits in children in various countries found that greater amounts of television watching were positively correlated with sweets and soda consumption as well as a negative correlation with fruit and vegetable consumption (Vereecken, Todd, Roberts, Mulvihill & Maes, 2006). Increased television viewing time is associated with an increased risk of obesity in children as young as three years old (Lumeng, Rahnama, Appugliese, Kaciroti & Bradley, 2006). Additionally, time spent watching television or engaging in other sedentary behaviors such as playing video games or computer games is time not spent being active. Children of lower socioeconomic status have been found to spend more time watching television, adding to their increased risk of being overweight and obese (Dennison, Erb & Jenkins, 2002 in Lumeng et al., 2006). Furthermore, increased television viewing can also expose children to more food related advertising (Brody, Stoneman, Lane & Sanders, 1981).

Food and beverage marketing aimed at children under the age of 12 encourages them to consume highly caloric and less nutritious items (Crothers et al., 2009).

The federal school meal program underwent significant changes in 1996 aimed at lowering fat levels in school meals. However, most schools offer students additional options that are not regulated such as vending machines. In the state of Florida, schools neither require nor recommend that students be offered fruits, vegetables, or healthful beverages whenever other foods or beverages are available (CDC, 2006). Schools are not required to prohibit junk food in any school setting. Additionally, schools do not have to provide any sort of nutrition or dietary counseling.

Decreases in physical activity as more sedentary behaviors increase have been linked to the increase in the prevalence of obesity in children (Yetter, 2009). In Australian children, declines in walking to school along with reductions in physical education at school have occurred (Salmon, Timperio, Cleland & Venn, 2005). Changes in how active children are have contributed to the increase in overweight and obesity. The state of Florida does not require that elementary or middle schools provide children with daily physical education classes (CDC, 2006). If children have decreased opportunities to engage in physical activities in a safe environment, their health will be negatively impacted.

Causes of Obesity-Environmental

There are environmental factors that can contribute to overweight and obesity. Prenatal exposure to certain chemicals can affect weight gain. However, for children the home environment may be a more significant contributor to being overweight and obese. Children are not usually in control of what food is provided for them, nor the manner in

which that food is prepared. Family influences may therefore play a key part in weight gain in children. Parental obesity is a predictor of obesity in children (Reilly, Armstrong, Dorotsy, Emmett, Ness, Rogers, Steer & Sherriff, 2005) and has long-term consequences for weight gain. Having an obese parent doubles the likelihood that a child under the age of ten will become an obese adult as well (Crothers et al., 2009), an association not strictly due to genetic influence. Furthermore, meal practices can also affect obesity. Children who eat more frequently with their parents have healthier diets (American Public Health Organization, 2009). Compared with previous generations, children are now more likely to live in single-parent households or have parents that both work outside of the home. This may result in more children eating without their parents.

Other social factors can act as barriers to healthy lifestyles in children. Young people can associate healthy foods with parents and fast food with socializing, friendship, and fun, resulting in negative feelings about healthy food choices (Fitzgerald & Spaccarotella, 2009). A lack of social support, therefore, can be a barrier to healthy behavior performance. Providing children with knowledge in a group setting could help to combat this effect.

Intervention Programs

The reaction to the growing crisis of overweight and obesity has been seen in an increase in intervention programs aimed to address the underlying factors. Many primary prevention interventions in children are based on lifestyle non-medical changes (Fox & Trautman, 2009). These have included increasing physical activity, decreasing sedentary behaviors, improving knowledge about proper nutrition, and a mixture of various methods. Studies have tended to focus on children between the ages of five to eighteen

that are classified as overweight or obese (for review, see Whitlock, O'Connor, Williams, Beil & Lutz, 2008 and Summerbell, Waters, Edmunds, Kelly, Brwon & Campbell, 2005). Many studies have focused on changing behavior for children already demonstrating an elevated BMI, however, prevention of becoming overweight must also be considered. Various settings have also been used in studies such as schools and specialty health care centers. Most studies have been short-term, lasting twelve weeks or less. Longer-term studies did not have a significantly higher rate of success (Harris, Kuramoto, Schulzer & Retallack, 2009). The results have been mixed overall, and to date, no single type of intervention has emerged as the most successful. Programs have proven to increase knowledge and behaviors, but obesity measures such as BMI have not been shown to improve (Cook-Cottone, Casey & Feeley, 2009).

Physical Activity Programs

With advances in technology and the prevalence of video and computer games, there is a general perception that levels of physical activity have declined in children. There are few data on actual physical activity trends in children however (Dufour, 1997). Nonetheless, many obesity intervention programs have been designed around increasing physical activity, as increasing energy expenditure is still regarded as an important part of reducing weight. Many of these studies have taken place in schools due to the ease of reaching a large number of children. However, schools are also an ideal setting for sedentary behaviors, as children are obligated to sit in a classroom for the majority of the day. A three year study was implemented in Kansas to address this issue by adding moderate to vigorous physical activity at intermittent times throughout the school day (Donnelly, Greene, Gibson, Smith, Washburn, Sullivan, DuBose, Mayo, Schmelze, Ryan,

Jacobson & Williams, 2009). Children in the study were already receiving 60 minutes of physical education each week, so an additional ninety minutes was administered during regular school periods to reach the 150 minutes recommended by the Healthy People 2010 guidelines set forth by the U.S. Department of Health and Human Services (2000). Participants were children in grades two and three (ages eight and nine) and were followed until grades four and five. No significant differences in BMI between the intervention and control groups were found. However, children that received more physical activity as part of the study had significantly smaller increases in BMI than children that completed less physical activity in the program (Donnelly et al., 2009). Interestingly, children in the intervention group also increased physical activity on weekend days compared to children in the control group. This finding would suggest that the children's attitude toward physical activity was improved as a result of participation in the program. Children taking part in the program also showed significantly improved academic achievement (Donnelly et al., 2009). Although a correlation between increased physical activity and better academic performance cannot be inferred, these results do show that incorporating physical activity into the daily classroom routine did not interfere with learning.

The link between sedentary behaviors and obesity is not entirely clear, however. A study conducted with British nine and ten year olds showed that sedentary behaviors were positively associated with waist circumference. This association was attenuated when amounts of time spent in moderate and vigorous physical activity were adjusted for (Steele, van Sluijs, Cassidy, Griffin & Ekelund, 2009). Higher intensity physical activity appears to be more strongly correlated with weight loss than decreases in sedentary

behaviors. Intervention programs should incorporate higher levels of physical activity rather than focusing on simply reducing sedentary behaviors.

In a 2008 study, Norwegian researchers found that physical performance, measured by cardiovascular fitness, was improved by incorporating daily walking into children's school days (Monness & Sjolie, 2009). Children walked for 20 minutes in the rugged area surrounding the school for the duration of the school year. The improvements in fitness were largest for the children with the poorest initial performance. Simple changes can have a positive impact on children's health.

In a study designed to measure the effect of physical activity on insulin levels in Mexican and Hispanic children, researchers found that an increase in physical activity over a 12 week period reduced insulin levels and insulin resistance (Macias-Cervantes, Malacara, Garay-Sevilla & Diaz-Cisneros, 2009). Although BMI was not significantly reduced in the participants, overweight children did benefit from increasing their level of physical activity. Type II diabetes has been correlated with elevated BMI and a reduction in insulin levels is a positive step against the disease for children at higher risk.

Several meta-analyses on the effectiveness of school-based physical activity programs have been conducted and provide mixed results. Many physical activity programs have resulted in no reduction in BMI (Harris et al., 2009), others in only minor reductions in weight (Summerbell et al., 2005), and others reporting only positive outcomes in girls (Cook-Cottone et al., 2009). One review of prevention strategies did find that interventions designed to increase levels of physical activity were effective in reducing weight (Sherry, 2005). BMI was the most widely used effectiveness measure for the studies included in the meta-analyses. However, additional measures such as

blood pressure and fitness have been found to improve even when BMI did not significantly change (Cook-Cottone et al., 2009). Additionally, variation in outcome measures between studies, such as differences in how weight and height are measured to obtain BMI, can limit comparisons between studies. These findings suggest the need for evaluating determinants of success. Given that BMI is accepted as the most reliable measure of overweight and obesity, positive changes in BMI values most readily reflect success. However, other measures should not be overlooked, especially in developing children with naturally occurring increases in BMI. Furthermore, standardized methodology would enable more accurate comparisons between study findings.

Nutrition Programs

If caloric intake exceeds caloric output, weight gain will result. Many intervention programs target reducing unhealthy nutrition by providing educational opportunities and dietary plans. Some studies, including one conducted with French children between the ages of five and twelve have found that providing nutrition education can result in lower levels of BMI (Romon, Lommez, Tafflet, Basvedant, Oppert, Bresson, Ducimetiere, Charles & Borys, 2009). Others that focused on system-wide nutritional changes, such as school meal programs, have been less effective (Cook-Cottone et al., 2009). Providing children with healthy options may not be enough if they do not receive nutrition education as well.

A study in which school nurses provided nutritional advice to overweight children found that the children who visited the nurses for advice more often had greater reductions in BMI scores (Melin & Lenner, 2008). Parents of the children were also

invited to take part in the counseling sessions and it is possible that greater awareness on their parts resulted in better food selection for their children.

Beverages that are high in calories or sugar content can contribute to weight gain in children. Decreasing consumption of less healthy beverages can therefore be helpful in the prevention of overweight and obesity. A study conducted in Germany promoted water consumption through classroom lessons. Water intake was measured using special water fountains and questionnaires. Water flow was highest during the first three months of the study, and although continued decreases were seen, stable levels of consumption remained for seven months following the intervention (Muckelbauer, Libuda, Clausen & Kersting, 2009). Encouraging children to consume water and providing them with the means to do so can have a positive effect on their behavior.

In the meta-analysis conducted by Cook-Cottone and colleagues (2009), three studies were identified as nutrition only interventions. One study used a board game that provided nutrition knowledge and encourage healthy eating choices. This hands-on approach provided the children with the opportunity to learn in a playful way they could relate to. Children who played the game had significant reductions in BMI scores compared with control group children. A study aimed at reducing soda consumption while increasing water consumption found significant differences between the intervention and control groups. Finally, an educational intervention based on the social learning theory showed no differences between intervention and control groups. As studies focusing on nutrition education and diet modification seem to have mixed results, more effective methodology is still needed.

Mixed Interventions

Most intervention programs designed to decrease childhood overweight and obesity include multiple components. The underlying causes of obesity appear to be tied together and addressing them together should prove more effective. In one such study, obese children between the ages of six and eleven were assigned to one of three interventions, diet only, exercise only, and diet and exercise combined, to compare the efficacy of each type. Children in the diet only and the diet and exercise groups had the greatest decreases in BMI, although all three groups showed improvements (Shalitin, Ashkenazi-Hoffnung, Yackobovitch-Gavan, Nagelberg, Karni, Loewenthal, Shtaif, Gat-Yablonski & Phillip, 2009).

Another study compared a traditional weight management counseling program with a more intensive family based program that included nutrition, exercise, and behavior modification. The participants were all considered obese and between the ages of eight and sixteen. The weight managed group saw a slight decrease in BMI over a twelve month period and the control group showed increases in BMI. The intervention group also demonstrated a decrease in percent body fat and insulin resistance when compared with the control group (Savoye, Shaw, Dziura, Tamborlane, Rose, Guandalini, Goldberg-Gell, Burgert, Cali, Weiss & Caprio, 2007).

A German study incorporated education modules about physical activity, nutrition, and coping skills for obese seven to thirteen year old children. This clinical study found significant reductions in BMI, fat mass, and systolic blood pressure one year after the intervention started (Weigel, Kokocinski, Lederer, Dotsch, Rascher & Knerr, 2008). The control group received written therapeutic advice during visits at the

beginning and halfway through the study. In this case, providing obese children with advice was not sufficient in decreasing weight measurements when compared with a more intensive intervention program.

Eight to twelve year old severely obese children were assigned to either an intervention or control group in a 2009 study. The intervention group was given detailed eating plans and strategies to increase physical activity and decrease sedentary behaviors. Parents were also encouraged to model proper behaviors and to lose weight if needed. The control group was offered two nutrition counseling sessions only. Children in the intervention group showed a significant decrease in percent overweight in the sixth months after the intervention (Kalarchian, Levine, Arslanian, Ewing, Houck, Cheng, Ringham, Sheets & Marcus, 2009). Differences ceased to be significant with increased time since the intervention. However, children that had attended more of the sessions maintained decreases in percent overweight for a longer period of time. Better participation can lead to more positive and sustained results.

In a Chilean study, a combination of nutrition education and promotion of physical activity resulted in significant decreases in BMI and the prevalence of obesity in elementary school children (Kain, Uauy, Leyton, Cerda, Olivares & Vio, 2008). The effect was more pronounced in male children. Other studies that have focused on increasing physical activity showed either no or negative results in male children (Cook-Cottone et al., 2009). In this case, using multiple approaches had the opposite effect.

"Planet Health", a program consisting of thirty-two classroom lessons, thirty physical education classes, and behavioral modification units on reducing television viewing and fitness self-assessment was designed for students in sixth and seventh grade.

The program showed significant decreases in overweight in female children only (Gortmaker et al., 1999 in Yetter, 2009). Differences in effectiveness based on gender may be due to what activities are promoted, how the information is delivered, and the ages of the children involved. If either gender feels less able to complete the program, the perceived barrier can influence the outcome of the intervention.

A long-term study combining education about nutrition and physical activity behaviors for kindergarten children demonstrated that providing educational materials for parents and teachers was less effective at improving BMI compared with additional education provided directly to the children (Jouret, Ahluwalia, Dupuy, Cristini, Neger-Pages, Grandjean & Tauber, 2009). The differences were only evident in children of higher socioeconomic status. Underprivileged children appeared to benefit more from increased parental awareness of overweight and periodic monitoring. Children in non-underprivileged areas seemed to show decreases in BMI only with the additional education component. The target audience must be carefully considered when designing an intervention program to ensure effectiveness.

The "Pathways" program was developed to address obesity in Native American children. The study targeted children in the third grade and followed them through the fifth grade. School meals were reduced in fat content, physical activity was increased, and classroom education was conducted using traditional storytelling teaching methods to encourage healthy indigenous behaviors (Lytle, Dixon, Cunningham-Sabo, Evans, Gittlesohn, Hurley, Snyder, Stevens, Weber, Anliker, Heller & Story, 2002). Although no significant differences in body fat were found between the children in the program and the control group, children who took part in the intervention showed significant

improvements in knowledge and behaviors relating to health. Building a foundation of healthy behaviors can be critical in preventing further weight gain as children develop.

After-school programs have also been developed to address obesity. The "Tommie Smith Youth Athletic Initiative" was designed to offer African American children in kindergarten to fifth grade after school sessions for physical activity and nutrition education. Results of this study showed significant improvements in the participants' cardiovascular fitness, body composition, and dietary habits (Topp, Wedig, Newman, Tobe & Hollingsworth, 2009). One of the advantages to implementing intervention programs during school is how many children can be reached. However, after school programs, especially if offered as part of an existing system, can also reach a large number of children. Children at higher risk of obesity due to ethnicity and socioeconomic status can be involved in interventions through existing after-school opportunities.

Advances in more affordable technology have made the internet an appealing route for reaching different audiences. Additionally, children spend leisure time on computers with an average daily use of an hour (Rideout et al., 2005 in Thompson, Baranowski, Cullen, Watson, Liu, Canada, Bhatt & Zakeri, 2008). An internet based health program was developed to address healthy eating and activity behaviors in eight to ten year old African American girls. Participants received a weekly reward for completing activities. Significant improvements in fruit and vegetable consumption as well as in amount of physical activity were seen (Thompson et al., 2008). All results for this study were obtained via self-reports by the children over the internet. It is possible

that responses were mediated by the desire to be socially acceptable. Additional measures, especially objective ones, would help to strengthen the results of this study.

Twenty-two studies using multiple approaches were evaluated during a meta-analysis of school-based intervention programs (Cook-Cottone et al., 2009). Eleven showed positive changes in overweight measures, four actually saw a negative effect, and three did not result in any significant changes. Four of the studies had differences in effects based on gender, with one showing positive effects in male children and negative effects for female children. The other three had the opposite findings, with female children benefiting more than male children. However, these differences were only seen in mixed-gender interventions. No significant effects were seen in female only interventions. Furthermore, programs aimed at elementary school children resulted in significantly better BMI outcomes than those targeting middle school children. Most of the studies included in this meta-analysis were based on body-focused models which center on the environmental and genetic interaction that can result in overweight and obesity. Very few studies address the emotional or psychological cause of over-eating. Underlying attitudes and beliefs that can affect overweight must also be considered if effective intervention programs are to result.

Attitude and Behavior

Much research has been conducted to determine the link between attitudes and behavior. Attitude can be defined as a tendency or internal state that biases or predisposes a person toward either a positive or negative response (Eagly, 1992). It has been proposed that although attitudes do not directly influence behavior, they have an indirect impact on behavior performance through an effect on intentions (Eagly, 1992).

Social cognitive models, such as the Theory of Reasoned Action and the Theory of Planned Behavior have been widely utilized in the prediction of health behaviors (Hunt& Gross, 2009).

The Theory of Reasoned Action (Ajzen & Fishbein, 1977) proposes that attitudes influence the intention to act, which in turn influence behavior. This theory does not account for performance of complex behaviors. Such behaviors involve the individual's perception of how difficult or easy the behavior is to perform. The Theory of Planned Behavior includes the concept of perceived behavior control as an additional predictor of intention and behavior (Azjen, 1991). The difficulty of a behavior influences the likelihood of that behavior being performed. If an individual perceives barriers to performing a behavior, including barriers not under their control, they may be less likely to attempt to act it out. It is important to determine what barriers may be perceived by individuals in order to either address or avoid them. Furthermore, the consequences of performing a behavior must also be taken into consideration. Individuals are more likely to perform behaviors that they believe will result in a good outcome. How an individual will be perceived for performing a behavior is also an influence. Changing attitudes and the factors that influence attitudes can therefore have an impact on behavior change.

Fazio and colleagues have shown that direct experience increases knowledge and the accessibility of attitudes (1982). More accessible attitudes, defined as those that are activated more rapidly, are more highly correlated with behavior (Fazio & Williams, 1986). Providing individuals with the opportunity to learn about an attitude object and to directly experience it can lead to an increase in behavior performance. However, already

formed attitudes can be strengthened resulting in a decreased likelihood that a behavior will be performed if it is not supported by that attitude.

The Theory of Cognitive Dissonance states that individuals will seek out information that supports their attitudes and avoid information that opposes them (Festinger, 1964). Incongruent information can elicit a biased perception resulting in a reduced chance of the behavior being performed. Therefore, providing information that is congruent with an individual's attitudes may lead to an increase in relevant behavior. Attitudes must be determined to achieve this goal.

The Health Belief Model was initially developed to explain the underlying beliefs about the consequences of a health problem and behaviors related to that problem. According to this model, four conditions explain and predict health-related behaviors: an individual believes his or her health is in jeopardy, the individual perceives the seriousness of the problem, the individual perceives the benefits of performing a behavior related to the problem outweigh the costs, and finally, the individual receives a "cue to action" to perform the behavior. This model has been applied to numerous health education and behavior programs. However, it has shown limited predictive power for behaviors not having predisposing factors (Harrison, Mullen & Green, 1992).

Programs Targeting Attitudes

Some programs have been developed in an attempt to change attitudes rather than behavior directly. Studies have found that children hold preconceived attitudes regarding health behaviors and that these attitudes can be modified using age specific interventions (Fleming, Green & Martin, 2000). Others have attempted to measure how attitudes affect health related behaviors. A study based on the Health Belief Model examined the

relationship between nutrition knowledge and attitudes of meal-planners on the diet of the meal-planners and their children. Questionnaires were designed to address perceived benefits and barriers to healthy dietary choices as well as awareness of health consequences of dietary intake and knowledge about nutrition. Parental beliefs were more positively correlated with choices in their own diets and were more influential for meals eaten at home (Colavito, Guthrie, Hertzler & Webb, 1996). One important finding was the perceived barrier of practicality of meals, including price, ease of preparation, and perishability. The importance of perceived barriers to healthy behaviors can be undervalued in obesity intervention programs. Attempts to identify and address such barriers should be incorporated into intervention programs.

A study of middle school children sought to determine the relationship between their knowledge and attitudes of nutrition and eating behaviors (Bordi, Cranage, Lambert & Smith, 2005). Children were found to hold attitudes influenced by beliefs. These attitudes, in turn, influenced their intentions, which consequently influenced their behavior. However, results were significant only for the relationship between attitudes and intention. All other relationships were only marginally related. An additional finding was the revelation that many of the children were using old and false nutrition information on which to base their beliefs (Bordi et al., 2005). This finding demonstrates the importance of providing children with accurate information if positive behavioral changes are hoped for.

Eating behaviors in children are influenced by various factors, including access and availability, palatability, weight concerns, and social pressures. Understanding what contributes to dietary choice-making can help address problems related to overweight and

obesity. Attitudes towards nutrition can be influenced by tasted and specific preferences. In a 2009 study, a survey was used to determine children's food preferences. The results showed sex differences in preferences, and these differences varied based on age group (Caine-Bish & Scheule, 2009). Girls had a greater overall preference for foods categorized as "starches and sweets" by the researchers, although this trend decreased with age. This finding could be a result of girls becoming more body conscious with age. Elementary school girls preferred fruits and vegetables compared to boys in the same age group. However, this trend decreased with increasing age group and actually reversed with high school boys preferring fruits and vegetables more compared with girls in that age group. Programs promoting the benefits of healthy diet choices could positively influence food preferences of children.

Gardening was found to have a positive effect on the attitude and knowledge of nutrition for elementary school children (Nolan, 1979). The children worked in school gardens and received additional nutrition education. The children showed improved attitudes about fruits and vegetables and in their selection of those items for snacks. Their overall nutrition knowledge also improved as a result. Direct experience can have a positive impact and should be incorporated into programs designed to change attitudes and behavior.

Unhealthy attitudes about nutrition can develop early. Children in grades three through six were surveyed to determine eating and dieting attitudes and behavior. Forty-five percent of the children reported wanting to be thinner and thirty-seven percent reported having tried to lose weight (Maloney, McGuire, Daniels & Specker, 1989). Body image can influence dietary choices and teaching children proper nutrition early is

important. Intervention programs designed to impact health related attitudes and behaviors need to take into consideration how body image can affect children's choices.

Teaching using animals

Animals have been used to teach children in various settings (Zasloff, Hart & DeArmond, 1999). Traditionally, animals have been kept in classrooms to help children to learn about science. Animals have also been used widely to teach children about compassion and caring for others. Children can develop strong emotional bonds to animals that contribute to their development and quality of life (Melson, Schwartz & Beck, 1997). Therefore, programs that provide opportunities for children to interact with and observe animals can have positive effects on their lives (Kidd & Kidd, 1996). In a study of animal use in elementary school classrooms, seventy-three percent of the teachers surveyed stated that the presence of animals in the classroom helped their students learn about responsibility and kindness (Zasloff et al., 1999). Forty-one percent reported that the opportunity for first hand observations enabled the children to learn about biology and ecology. Twenty-three percent stated that the animals' presence generated interest and motivation to learn. Introducing children to animals, especially those living in urban areas, can provide them with many benefits.

Attitude towards a subject is a factor in the motivation to study that subject and achievement in it as well. This finding has been demonstrated for science learning (Sorge, 2008). Specifically, hands-on experiences have been found to improve children's attitudes towards science (Ornstein, 2006). A program that allowed children to bond with live animals sought to determine if this connection would result in improved science attitudes. Elementary and middle school children were trained to be rehabilitated animal

handlers and educated about animal biology and ecology to give presentations to other audiences. Science attitude was determined using both qualitative and quantitative surveys at the end of the program. Students were found to be more positive about science, especially those with closer bonds with the animals (Sorge, 2008).

Using animals as a teaching tool can be especially beneficial for children with learning problems or other disabilities (Zasloff et al., 1999). The presence of animals can have a calming effect on some children with developmental disabilities. When an obedience-trained dog was placed in a classroom with developmentally disabled elementary school children, all students showed an increase in positive social behaviors towards their teacher and decreases in negative behaviors (Esteves & Stokes, 2008). Animals have been shown to reduce fear and anxiety in individuals undergoing medical treatment (Barker, Pandurangi & Best, 2003). This overall positive effect could be used to address difficult or sensitive topics with children in a less stressful manner.

Animals may make excellent models when trying to teach children about health as animals in captivity have developed a number of health problems, including being overweight and obese. This finding is often attributed to lower energy expenditures in captive animals when compared with their wild counterparts (Moore, Marsh, Wallis & Foley, 2005). Captive animals are not required to travel to forage or find prey. They are often not required to process food items to be able to consume them. Overall reductions in activity can lead to becoming overweight, even if species appropriate nutritional standards are maintained.

Captive non-human primates have been the focus of various studies related to overweight and obesity. Obesity has been found in captive non-human primate

populations including great apes, baboons, vervet monkeys, macaques, squirrel monkeys, and lemurs (Hansen, 2001; Schwitzer & Kaumanns, 2001). Obesity has physiological consequences in animals just as it does in humans. Cardiovascular disease is the cause of death for approximately 40% of adult captive gorillas. This is even higher in males with 70% of captive male gorillas over the age of thirty dying from cardiovascular disease (Hatt & Liesegang, 2002). Elevated levels of cholesterol are often found in captive gorillas and orangutans (Schmidt, Ellerseck, Cranfield & Karesh, 2006), making this a potential predisposing factor for cardiovascular disease (Hatt & Liesegang, 2002). Captive orangutans have been found to be obese and to develop type II diabetes more frequently. Screening of orangutans for impaired glucose regulation was mandated for orangutans housed in zoos accredited by the Association of Zoos and Aquariums beginning in 1989 to address this issue (Gresl, Baum & Kemnitz, 2000). In a study examining glucose concentrations in captive orangutans, animals diagnosed as having diabetes or those potentially pre-diabetic were also found to have elevated body weights (Gresl et al, 2000). Social stress has also been linked to obesity in non-human primates. In primate species with dominance hierarchies, animals under more stress from social ranking pressures can also have increased body weights, and more specifically, can have more centralized fat deposits which can lead to higher risk for cardiovascular disease (Shively, Register & Clarkson, 2009). Social stress can have a similar effect in humans, an effect that in turn leads to more social isolation and stigmatization.

Captive elephants also suffer from increased rates of obesity. Impaired viability and reduced reproductive success have resulted, with overweight dams having more stillbirths (Clubb, Rowcliffe, Lee, Mar, Moss & Mason, 2009) and showing higher rates

of acyclicity as well (Freeman, Guagnano, Olson, Keele & Brown, 2009). Similar reproductive problems have been linked to obesity in captive crocodilians. Captive crocodilians are typically fed diets high in saturated fats leading to vitamin E deficiency and obesity. Both conditions can lead to reproductive impairment in the form of lower quality eggs with much decreased hatch rates (Lance, Morici, Elsey, Lund & Place, 2001). Direct comparisons, therefore, can be made between the effect of obesity on both humans and animals.

Furthermore, addressing these issues in animals can take similar form to how they are addressed in humans. Weight re-gain almost always occurs after caloric restrictions are lifted in captive non-human primates (Hansen, 2001). However, when a long-term calorie restriction program was implemented with adult rhesus macaques, several health benefits resulted. Obesity prevention, lack of diabetes development, improvements in blood pressure, improvements in body fat distribution, and increased lifespan were all seen when compared with animals not restricted (Hansen, 2001). Modifying how food is presented can also have an effect on obesity in captive animals. Increasing the number of feedings per day has been shown to decrease serum cholesterol levels in non-human primates (Schwitzer & Kaumanns, 2001). Dividing daily food intake into more meals has a positive effect on the animals' health. Animals often develop food preferences early in life. Better food choices can be made by allowing young captive animals to have direct experience with certain foods. Learning about healthy foods is also a way to influence health in animals. Learning principles can also be used to increase levels of physical activity in captive animals. Training animals to perform specific behavior can not only help to monitor their health (Savastano, Hanson & McCann, 2003), but can also cause

them to move around their enclosures and perform movements that can improve their health. We can use these comparisons to teach children about health factors that affect humans without directly addressing these factors.

The lack of success seen in many interventions may be due in part to feelings of stigmatization and low self-esteem that can result from participation typical programs that target overweight children (O'Connor, Steinbeck, Hill, Booth, Kohn, Shah & Baur, 2008). Weight has been shown to be a sensitive topic for overweight children, and addressing it in an indirect manner may result in more positive results. By addressing health issues in animals, the same information can be conveyed to the children without singling out personal issues. Furthermore, teaching children using animals can help to motivate them to learn (Sorge, 2008) and can have a stress-reducing effect as well (Barker, Pandurangi & Best, 2003). This was the first study to attempt to indirectly influence the health-related attitudes and behaviors of children using animal models.

Study Purpose

The prevalence of overweight and obesity is increasing rapidly. Ninety percent of people engaged in weight loss modalities regain the weight and often perform reactive overeating as a result of dieting-related hunger (Hunt & Gross, 2009). Long-term and effective methods must be developed if overweight and obesity in children is to decrease. Intervention programs have been developed targeting changes in nutrition, increases in physical activity, and decreases in sedentary behaviors. There have been mixed results, especially when comparing the effectiveness of programs between sexes. Programs that target multiple causes appear to have more positive results. Overall, however, childhood overweight and obesity are increasing and intervention programs to date have shown

limited success (Summerbell et al., 2005). This study examined the effect of an education program on animal health on children's knowledge, attitudes, and practice of healthy behaviors. The participants for this study were selected from two different populations of eight and nine year old children. One group was selected based being part of a high risk group for overweight and obesity. The second group was selected from children attending summer camp at the Palm Beach Zoo and will be referred to as Group 2. As the children in this group are in a different socioeconomic group than those belonging to Group 1, a comparison between the two groups was included to determine if the effectiveness of such a program is affected by this factor. Educational information about four specific areas of health was provided in a classroom setting, including nutrition, body image, physical activity, and health monitoring. The effect of the program on the children's attitudes, knowledge, and practice of healthy behaviors was determined using a survey administered both before and after the program. It was hypothesized that the use of indirect messaging through animal models for health education can increase the knowledge, improve the attitudes, and increase behaviors that can decrease the likelihood of overweight and obesity in eight and nine year old children regardless of risk for developing obesity.

Research Questions and Hypotheses

1. How do animal models of health affect the health knowledge of eight and nine year old children?

    H0: Animal health models do not affect the health knowledge of eight and nine year old children

    H1: Animal health models increase the health knowledge of eight and nine year old children

2. How do animal models of health affect the health attitudes of eight and nine year old children?

    H0: Animal health models do not affect the health attitudes of eight and nine year old children

    H1: Animal health models improve the health attitudes of eight and nine year old children

3. How do animal models of health affect the health behavior practices of eight and nine year old children?

    H0: Animal health models do not affect the health behavior practices of eight and nine year old children

    H1: Animal health models increase the health behavior practices of eight and nine year old children

4. Is there a difference in the effect of animal health models on the health behavior knowledge, attitudes, and practice of eight and nine year old children belonging to difference socioeconomic groups?

    H0: There is a difference in the effect of animal health models on the health behavior knowledge, attitudes, and practice of eight and nine year old children belonging to difference socioeconomic groups

    H1: There is no difference in the effect of animal health models on the health behavior knowledge, attitudes, and practice of eight and nine year old children belonging to difference socioeconomic groups

5. Is there an effect of taking the survey more than once on the responses of the participants belonging to the control groups?

    H0: there is an effect of taking the survey more than once on the responses of the participants belonging to the control group

H1: there is no effect of taking the survey more than once on the responses of the participants belonging to the control group

CHAPTER 2

METHODS

Subjects and Study Location

The subjects in this study were 100 children between the ages of eight and nine. Children between the ages of six and ten are especially important, as long-term behaviors and attitudes begin to form at this age (Foerster, Silver, Koshatsu, Frieden, Bassett & Horton, 2007).Overweight and obesity can develop early and elementary school children are at a strategic life stage for primary prevention and the formation of long-term behaviors. Two groups of children served as the study population and parental consent was obtained prior to participation in accordance with the Georgia Institute of Technology Institutional Review Board requirements (see appendix A).

The first group was made up of children belonging to two different Boys and Girls Clubs in South Florida. The majority of the children who belong to these clubs are African American. African American and Hispanic children have a higher prevalence of overweight and obesity, and are therefore a key target group for intervention programs (Veldhuis et al., 2009). Over 60 percent of the club members live at or below poverty level. Children of lower socioeconomic status are also more likely to be overweight and are an important group for this type of program (Dollman & Lewis, 2009). The combination of risk factors represented in the study population makes these children well suited for such a program. The children belonging to these club locations are at higher risk for developing overweight and obesity due to ethnic background and socioeconomic status. The Boca Raton club opened in 2004 and currently has 151 members. Eighty-

seven percent are African American and 2% Hispanic. Sixty-two percent of the members live at or below poverty level. The Delray Beach location originally opened in 1994 with a larger location opening in 2005. This club serves over 500 members, 81% of whom are African American and 5% Hispanic. Sixty-three percent of the members live at or below poverty level. A total of 38 children from the two clubs took part in the study. Fewer children from the Boys and Girls Clubs were able to participate than had been anticipated therefore a second group was added to the study. The second group was made up of children attending summer camp at the Palm Beach Zoo. None of these children live at or below poverty level and 90% are Caucasian. If the program is an appropriate way of teaching children about health behaviors, it should be effective regardless of the participants. A total of 62 children from the Palm Beach Zoo summer camp took part in this study. Participants within each of the two groups were randomly assigned to one of three conditions, single trial control (from here on out referred to as control 2), double trial control (from here on out referred to as control), or experimental (see table 1). There was not an even number of children in each group as children did not attend all of the sessions and participation could not be strictly controlled. Participants in the single trial condition took the survey only one time. Participants in the double trial condition took the survey twice. Participants in the experimental condition took part in the classes and took the surveys prior to and after taking the classes. Participants in all of the conditions took the surveys at the same time with the exception that single trial participants only took surveys the first time they were distributed.

This study took place at three locations, the Boys & Girls Club of Boca Raton, the Boys & Girls Club of Delray Beach, and the Palm Beach Zoo. The Boys and Girls Clubs

are community organizations that provide a safe place for children between the ages of five and eighteen to go after school. Clubs have adult supervision and offer a variety of programs to promote positive development in children. Clubs can be found in all fifty states and more than 4.5 million children have taken part in one of 4,300 clubs. Sixty-five percent of the children are from minority families and 43 percent are between the ages of 6 and 11. There are 13 clubs and four extension sites in Palm Beach County, Florida with more than 7,500 members as of 2008.

Table 1. Participant Distribution

Group	**Control 2**	**Control**	**Experimental**
Boys & Girls Clubs	12	14	12
PBZ Camp	11	18	33
Total	23	32	45

Materials and Methods

Data Collection

The study took place in two segments. The segment with the Boys and Girls Clubs children took place from March to May 2010. The children took part in six sessions, for a total time of 10 hours of time per child over a period of six weeks. The segment with the Palm Beach Zoo summer camp participants took place in June 2010. The children took part in six sessions for a total of 10 hours per child over a period of 5 days. Surveys were administered to each child in the control and experimental conditions twice, once during the first session and once during the last session, and to each child in the control 2 condition once during the first session. A total of 64 surveys were completed by the Boys and Girls Club participants and 113 surveys were completed by the Palm Beach Zoo summer camp participants for an overall total of 177 surveys. The Boys and Girls Club participants in the experimental condition came to the zoo on four different occasions and participated in classes on animal nutrition, physical activity, body shapes, and health monitoring. All of the Palm Beach Zoo summer camp participants came to the zoo for five consecutive days, but only the ones in the experimental condition attended the four classes.

Curriculum

These four broad topics were selected based on the major underlying factors that contribute to overweight and obesity in children. However, the materials used in this program focused on animal health, not human health. The education program was designed to address four major health topics in animals including animal activity, animal nutrition, animal body shapes and sizes, and health monitoring. The first session for each

class was an introduction to the program and the pre-intervention evaluation was given at this time. The children in the control groups were excused after they finished their surveys. Each child in the experimental condition selected an animal buddy from a list of species found at the Palm Beach Zoo. Each child was responsible for learning about their animal and was given information and direct observational experience with that animal at the zoo. Four units of health related topics were covered using a combination of classroom time and hands-on experience during the four field trips at the Palm Beach Zoo. The classroom component focused on providing education materials on the topics and activities for the children to apply the information they receive. The information was provided to them through presentations using videos, pictures, animal artifacts, and live animals when applicable. The hands-on component centered around the children applying what they have learned out in the zoo through observations and activities. Each activity was designed to allow the children to practice what they learned in the classroom, as direct experience has been shown to improve attitudes and knowledge (Ornstein, 2006). The post-intervention evaluation was given during the final session which took place week six for Group 1 and on day 5 for Group 2.

The first unit was about physical activity (see Appendix B). Children were provided with information about animal locomotion and how that affects the health of the animals. Activities in the classroom component included games in which the children acted out animal behaviors and selected behaviors that matched animals with their environments. Activities out in the zoo included observing animals being active, and determining why certain animals either were or were not active and how that could affect their health. The children specifically observed their animal buddy as well.

The second unit covered nutrition education (see Appendix C). Children learned about different types of animal categories such as carnivores, herbivores, and omnivores and how their food choices are affected. They also learned about nutritional requirements for proper health in the animals and consequences of poor diets. Activities in the classroom component included matching animals with appropriate diets and building a proper diet for their animal buddy. Children also played a game in which a child was selected to be a mystery animal and the rest of the children had to ask questions about the diet of the animal to figure out what it was. Activities out in the zoo were observations of animals eating with children finding their animal buddies specifically.

The third unit focused on teaching children about different body shapes and sizes in animals (see Appendix D). Different animal body types presented to them to explain why they are or are not healthy. They also learned that health cannot necessarily always be assessed by body shape or size. Activities in the classroom component included selecting healthy body types based on animal species. Activities out in the zoo included finding the different body types and determining if different animals are healthy based on appearance. The children were encouraged to determine if their animal buddy appeared to be healthy based on body size and type.

The fourth and final unit taught the children about the importance of health monitoring (see Appendix E). They provided with information about physical and dental exams, different health measures, and how animals are monitored and treated if they require it. They were introduced to the concept of observing behavior to determine some health parameters in animals. Activities in the classroom included games to figure out what is wrong with an animal and how it could be prevented or treated, as well as games

designed to teach the children what kinds of health monitoring are important and why. Activities out in the zoo included a tour of the veterinary hospital with opportunities to take part in demonstrations and see how the animals are examined and treated. Results from actual examinations and treatment of their animal buddy were shared with the children.

Evaluation

To determine if using indirect messaging is an effective way of improving attitudes, knowledge, and practice of healthy behaviors, a survey was administered during the first and last session for each of the two study groups (see appendix F). Surveys have been widely used to determine attitudes and knowledge, as well as to measure behavior, for physical activity (Kamtsios & Digelidis, 2008; Hagger, Cale, Almond & Kruger, 1997; Birtwistle & Brodie, 1991), and nutrition (Siti Sabariah, Zalilah, Norlijah, Normah, Maznah, Laily, Zubaidah, Sham & Zabidi Ashar, 2006; Bordi et al., 2005; Johnson, Wardle & Griffith, 2002; McDonell et al., 1998). The survey was comprised of forty items total, with eleven assessing attitudes, nine assessing knowledge, and twenty assessing practice. The survey was designed based on the health education level of eight and nine year olds and was reviewed by three independent educators for content validity and language. The survey was pilot tested with eight and nine year old children at a Boys & Girls club not participating in the study for understandability of questions and adjustments were made based on verbal feedback from the children. During the study, the survey was administered both before and after the children took part in the program to measure changes in health-related attitudes, knowledge and behaviors. The survey was administered at the same time to the control 2 groups (pre survey only), the control

groups (pre and post surveys), and the experimental groups to determine if the program improves attitudes and increases knowledge and behavior of children.

Data Analysis

The surveys were scored using a 1/-1 rating. Answers considered correct or positive were given a score of 1 while questions considered incorrect or negative including "do not know" answers were given a -1 score. Three of the questions, numbers 18, 19, and 39, were analyzed with descriptive statistics only. Data from the rest of the survey questions were analyzed using Chi-square tests and Fischer's Exact tests. Fischer's Exact tests were used for questions with five or less observed responses in any cells. Results were considered statistically significant if the p value was equal to or less than 0.05. However, helping each individual child to improve is a positive outcome. Therefore, a difference between statistical and practical significance can be made as scores can show changes that may not result in statistically significant findings but can still mean a child has improved. Scores were ranked as being low if lower than 35%, mid-range if between 35% and 74%, and high if 75% or higher. Comparisons both between and within groups were made to determine if the program had the desired effect. It was hypothesized that participation in the program would have a positive effect on the children's attitude, knowledge and practice of healthy behavior as demonstrated by differences between their pre and post-tests. It was also hypothesized that study participants would show an effect regardless of socioeconomic background. Finally, it was hypothesized that taking the survey more than once would not affect the results.

CHAPTER 3

RESULTS

Descriptive Results

Three of the questions on the survey were analyzed for percentages only. These questions were not meant to have right or wrong answers and the program was not meant to directly influence the answers. It was important to include them simply as a means to gage what the children thought. Question 18 was a nutrition practice question asking them where they learned about healthy eating for which they could answer yes or no to several choices including with their family, with their friends, with their teacher, at the doctor's office, or from television. There were changes in how the children responded after they participated in the program. In the pre surveys for Group 1, the most selected choice was with their family at 92%. After the program, that number dropped to 58% while with their friends rose from 33% to 80% and from television increased from 46% to 80%. Children in Group 2 chose with their family the most with 87% and that number stayed consistent. However, at the doctor's office rose from 81% to 93% and with their friends increased from 66% to 82%. Question 19 was a nutrition attitude question asking them what they thought the best place was to learn about healthy eating with the same options to choose yes or no about. Children in Group 1 originally selected that you should learn about being healthy with your family 91% of the time and that number dropped to 67% in the post surveys. Learning with friends increased from 73% to 89% and from their teacher increased from 70% to 92%. Children in Group 2 remained fairly consistent with most of their choices but learning with their friends increased from 75% to 89%. Finally, question 39 was a body image attitude question asking children to

answer yes or no as to what they think could influence being healthy and the choices were what kind of food you eat, how much food you eat, if you exercise, eating breakfast, going to school, how celebrities look, how your friends act, how you look, going to see the doctor, going to see the dentist, and how much sleep you get. In both groups, children chose yes the least for school affects health with 33% in Group 1 and 36% in Group 2. Most of their other choices remained consistent. Group 1 children did think that going to the dentist could affect your health more after taking part in the program with an increase from 67% to 91%. Group 2 children thought sleep was a factor in health more often in the post surveys with an increase from 80% to 97%.

Table 2. Percentages of Affirmative Responses

	G1 pre exp	G1 post exp	G2 pre exp	G2 post exp
Question 18				
with family	0.917	0.583	0.862	0.862
with friends	0.333	0.8	0.655	0.815
with teacher	0.455	0.7	0.781	0.806
doctor's office	0.636	0.7	0.813	0.933
television	0.455	0.8	0.667	0.786
Question 19				
with family	0.91	0.667	0.862	0.893
with friends	0.727	0.889	0.75	0.885
with teacher	0.7	0.917	0.677	0.733
doctor's office	0.818	0.778	0.8	0.933
television	0.6	0.5	0.821	0.857
Question 39				
what kind	0.917	0.833	0.931	0.97
how much	0.917	0.636	0.862	0.806
exercise	0.833	0.727	0.867	0.903
breakfast	0.818	0.818	0.7	0.613
school	0.333	0.545	0.357	0.323
celebrities	0.727	0.818	0.897	0.9
friends	0.75	0.91	0.893	0.9
how you look	0.833	0.818	0.759	0.759
doctor	0.75	0.727	0.828	0.833
dentist	0.667	0.91	0.862	0.806
sleep	0.917	0.8	0.8	0.968

Knowledge

Group 1 (B&GC) pre experimental versus post experimental knowledge

There were no statistically significant differences in the pre versus post scores for knowledge questions regardless of category. All three nutrition questions had very high baselines including two that were already at 100% correct scores. All three scores remained high in the post surveys. Likewise, the physical activity question scores were already at 100% in the pre surveys and remained high in the post survey. One health monitoring question, can washing your hands help to prevent you from getting sick, had very high scores in both the pre and post, but the other two scored low in both the pre and post surveys. Less than 35% of the children knew how many times a year they should visit the dentist, a score that did not change after participating in the program. 25% of the children knew when they should brush their teeth both before and after participating in the program. There was no significant change in whether the children knew if being underweight or overweight could cause one to become sick. There were no statistically significant differences between the pre and post control scores for Group 1 children on the same questions.

Table 3. Group 1 Pre Experimental vs. Post Experimental Knowledge Questions

Question	Category*	pre exp score	post exp score	p-value	Test
1. are the foods listed good or bad for you	N	0.781	0.8	0.616	Chi
5. is it important to eat breakfast	N	1	0.917	1	Fisher's
17. how much do you know about healthy eating	N	1	1	1	Fisher's
28. is playing sports a good way to exercise	PA	1	0.909	0.478	Fisher's
31. can washing your hands help stop you from getting sick	HM	0.833	0.917	1	Fisher's
34. how many times a year should you see the dentist	HM	0.25	0.25	1	Fisher's
35. when should you brush your teeth	HM	0.333	0.333	1	Fisher's
38. can being under/overweight cause you to be sick	BI	0.6	0.667	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 4. Group 1 Pre control vs. Post Control Knowledge Questions

Question	Category*	pre cont score	post cont score	p-value	Test
1. are the foods good or bad for you	N	0.718	0.718	0.672	Chi
5. is it important to eat breakfast	N	0.929	0.923	0.945	Fisher's
17. how much do you know about healthy eating	N	0.786	0.857	0.859	Fisher's
28. is playing sports a good way to exercise	PA	0.929	0.769	0.672	Fisher's
31. can washing your hands help stop you from getting sick	HM	0.929	0.929	1	Fisher's
34. how many times a year should you see the dentist	HM	0.286	0.357	0.749	Fisher's
35. when should you brush your teeth	HM	0.143	0.308	0.590	Fisher's
38. can being under/overweight cause you to be sick	BI	0.333	0.583	0.590	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Group 2 (PBZ) pre experimental versus post experimental knowledge

The children scored significantly higher for knowing which foods were good or bad for them ($p=0.0001$). Scores were high across the board for both pre and post regardless of category except for two health monitoring questions. Less than 60% of the children knew how many times they should visit the dentist each year and when they should brush their teeth and this knowledge did not change after participating in the program. There were no statistically significant differences between the pre and post control scores for Group 2 children on the same questions.

Table 5. Group 2 Pre Experimental vs. Post Experimental Knowledge Questions

Question	Category*	pre exp score	post exp score	p-value	Test
1. are the foods listed good or bad for you	N	0.809	0.889	0.0001*	Chi
5. is it important to eat breakfast	N	0.969	0.935	0.613	Fisher's
17. how much do you know about healthy eating	N	0.97	1	1	Fisher's
28. is playing sports a good way to exercise	PA	0.97	1	1	Fisher's
31. can washing your hands help stop you from getting sick	HM	0.935	0.969	0.613	Fisher's
34. how many times a year should you see the dentist	HM	0.594	0.688	0.435	Chi
35. when should you brush your teeth	HM	0.594	0.548	0.716	Chi
38. can being under/overweight cause you to be sick	BI	0.742	0.844	0.365	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 6. Group 2 Pre Control vs. Post Control Knowledge Questions

Question	Category*	pre cont score	post cont score	p-value	Test
1. are the foods good or bad for you	N	0.811	0.836	0.199	Chi
5. is it important to eat breakfast	N	0.867	0.833	0.945	Fisher's
17. how much do you know about healthy eating	N	1	1	0.925	Fisher's
28. is playing sports a good way to exercise	PA	1	0.944	0.925	Fisher's
31. can washing your hands help stop you from getting sick	HM	0.889	1	0.915	Fisher's
34. how many times a year should you see the dentist	HM	0.556	0.529	0.590	Fisher's
38. can being under/overweight cause you to be sick	BI	0.706	0.824	0.722	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Attitude

Group 1 (B&GC) pre experimental versus post experimental attitudes

There were no significant results for the attitude questions. Three of the nutrition questions had high scores in the pre survey which did not change in the post surveys and one was in the mid-range, which foods the children liked or disliked, which did not change. Ninety-two percent of children reported that they thought that being active and exercising was important both before and after participating in the program. Slightly more children reported that they would rather play outside than watch television after participating (from 58% to 64%; p=1). Both health monitoring questions had high baseline scores. However, 83% of children felt it was important to visit the doctor after participating compared to 91% prior (p=1). Conversely, 92% of children felt it was important to visit a dentist after participating compared to 73% prior (p=.59). Ninety-one percent of the children felt they were healthy most or all of the time before participating and that number dropped to 73% (p=.59)after participating in the program. There were no statistically significant differences on the pre and post control scores for Group 1 children on the same questions.

Table 7. Group 1 Pre Experimental vs. Post Experimental Attitude Questions

Question	Category*	pre exp score	post exp score	p-value	Test
2. Do you like or dislike the foods listed	N	0.607	0.631	0.597	Chi
12. Do you think it is important to eat veggies each day	N	1	0.917	1	Fisher's
13. do you think it is important to eat fruit each day	N	0.909	0.917	1	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.818	0.833	1	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.583	0.636	1	Fisher's
27. do you think it is important to be active and exercise	PA	0.917	0.917	1	Fisher's
30. do you think it is important to visit the doctor	HM	0.909	0.833	1	Fisher's
33. do you think it is important to visit the dentist	HM	0.75	0.917	0.59	Fisher's
40. How much of the time do you think you are healthy	BI	0.909	0.727	0.587	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Question	Category*	pre cont score	post cont score	p-value	Test
2. do you like or dislike the foods	N	0.603	0.610	0.663	Chi
12. Do you think it is important to eat veggies each day	N	1	0.929	0.902	Fisher's
13. do you think it is important to eat fruit each day	N	0.857	0.929	0.885	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.769	0.846	0.842	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.571	0.462	0.590	Fisher's
27. do you think it is important to be active and exercise	PA	1	0.857	0.835	Fisher's
30. do you think it is important to visit the doctor	HM	0.923	0.846	0.873	Fisher's
33. do you think it is important to visit the dentist	HM	1	0.786	0.661	Fisher's
40. How much of the time do you think you are healthy	BI	0.833	0.667	0.590	Fisher's

Table 8. Group 1 Pre Control vs. Post Control Attitude Questions

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Group 2 (PBZ) pre experimental versus post experimental attitudes

Significantly more children reported that they like foods that were good for them and disliked foods that were bad for them after participating in the program (p=0.002). The other three nutrition questions had very high baselines and that did not change. The percentage of children reporting that they would prefer to play outside rather than watch television increased from 70% to 90% which approached significance (p=0.064). The other physical activity question scored very high in both the pre and post surveys. Both health monitoring questions, whether the children felt it was important to visit the doctor and dentist, had very high scores in the pre and post surveys. More than 90% of the children felt they were healthy most or all of the time prior to participating and this did not change afterwards. There were not statistically significant differences between the pre and post control scores for Group 2 children on the same questions.

Table 9. Group 2 Pre Experimental vs. Post Experimental Attitude Questions

Question	Category*	pre exp score	post exp score	p-value	Test
2. do you like or dislike the foods listed	N	0.545	0.631	0.002*	Chi
12. Do you think it is important to eat veggies each day	N	0.968	0.968	1	Fisher's
13. do you think it is important to eat fruit each day	N	0.938	0.935	1	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.939	1	0.493	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.697	0.9	0.064	Fisher's
27. do you think it is important to be active and exercise	PA	1	0.968	0.484	Fisher's
30. do you think it is important to visit the doctor	HM	0.935	0.969	0.613	Fisher's
33.do you think it is important to visit the dentist	HM	0.969	0.938	1	Fisher's
40. How much of the time do you think you are healthy	BI	0.929	0.9	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 10. Group 2 Pre Control vs. Post Control Attitude Questions

Question	Category*	pre cont score	post cont score	p-value	Test
2. do you like or dislike the foods	N	0.543	0.57	0.283	Chi
12. Do you think it is important to eat veggies each day	N	0.875	0.833	1	Fisher's
13. do you think it is important to eat fruit each day	N	0.875	0.833	1	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.833	0.941	0.859	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.833	0.824	0.945	Fisher's
27. do you think it is important to be active and exercise	PA	1	1	0.964	Fisher's
30. do you think it is important to visit the doctor	HM	0.944	0.944	1	Fisher's
33. do you think it is important to visit the dentist	HM	1	1	1	Fisher's
40. How much of the time do you think you are healthy	BI	1	1	0.961	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Practice

Group 1 (B&GC) pre experimental versus post experimental practice

Children scored significantly higher on the types of healthy snacks they reportedly consumed after participating (p=0.009). Five of the ten remaining nutrition questions had high pre scores and four remained high. The fifth, how many times the children ate at fast food restaurants each week, decreased from 92% going no more than twice a week to 67% (p= 0.317) going no more than twice a week. The last four nutrition questions had mid-range scores pre and post except for one that increased, although not significantly, with 63% of children reporting they did not eat when not hungry compared to 46% (p= 0.67)prior to participating. Children all reported taking a physical education class and no significant changes were seen in the post survey. Two other physical activity questions had mid-range baselines and did not change significantly on the post surveys. Children showed an increase in time spent playing outside with 92% reporting they spend more than an hour a day outside compared with 73% (p=0.317) prior to participating. However, 17% of children stated that they spend less than 1 hour watching television each day compared to 33% (p=0.64) prior to participating. The two health monitoring questions showed no significant changes. The body image questions showed changes, although they were not significant. Ninety-two percent of the children reported that they weighed themselves on a scale prior to the program and only 75% (p=0.59) did after. Fewer children reported being on a diet after participating, with a 17% decrease reported (p=0.68). There were no statistically significant differences between the pre and post control scores for Group 1 children on the same questions.

Table 11. Group 1 Pre Experimental vs. Post Experimental Practice Questions

Question	Category*	pre exp score	post exp score	p-value	Test
3. would you or wouldn't you eat the foods listed	N	0.791	0.765	0.505	Chi
4. how many days a week do you eat breakfast	N	0.75	0.833	1	Fisher's
6. how many sodas do you drink each day	N	0.727	0.833	0.64	Fisher's
7. do you eat until you are full	N	0.818	0.833	1	Fisher's
8. do you eat when you are not hungry	N	0.455	0.636	0.67	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.75	0.833	1	Fisher's
10. do you eat veggies every day	N	0.583	0.545	1	Fisher's
11. do you eat fruit every day	N	0.5	0.583	1	Fisher's
14. do you east snacks between meals	N	0.25	0.167	1	Fisher's
15. what kind of snack do you eat	N	0.083	0.667	0.009*	Fisher's
16. how many times a week do you eat fast food	N	0.917	0.667	0.317	Fisher's
21. how many hours of tv do you watch each day	PA	0.333	0.167	0.64	Fisher's
22. how many hours do you spend playing video games each day	PA	0.545	0.417	0.684	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.667	0.583	1	Fisher's
24. how many hours do you play outside each day	PA	0.727	0.917	0.317	Fisher's
25. do you take a PE class at school	PA	1	0.917	1	Fisher's
29. do you visit a doctor's only when sick	HM	0.5	0.417	1	Fisher's
32. do you visit the dentist	HM	0.818	0.75	1	Fisher's
36. do you weigh yourself on a scale	BI	0.917	0.75	0.59	Fisher's
37. have you ever been on a diet	Bi	0.667	0.5	0.68	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 12. Group 1 Pre Control vs. Post Control Practice Questions

Question	Category*	pre cont score	post cont score	p-value	Test
3. would you or wouldn't you eat the foods	N	0.739	0.731	0.703	Chi
4. how many days a week do you eat breakfast	N	0.846	0.786	0.925	Fisher's
6. how many sodas do you drink each day	N	0.786	0.571	0.312	Fisher's
7. do you eat until you are full	N	0.846	0.786	0.925	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.571	0.786	0.312	Fisher's
11. do you eat fruit every day	N	0.786	0.857	0.859	Fisher's
14. do you east snacks between meals	N	0.143	0.214	0.859	Fisher's
15. what kind of snack do you eat	N	0.143	0.143	1	Fisher's
16. how many times a week do you eat fast food	N	0.786	0.857	0.859	Fisher's
21. how many hours of tv do you watch each day	PA	0.214	0.286	0.819	Fisher's
22. how many hours do you spend playing video games each day	PA	0.615	0.286	0.590	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.538	0.308	0.251	Fisher's
24. how many hours do you play outside each day	PA	0.769	0.571	0.354	Fisher's
25. do you take a PE class at school	PA	0.857	0.929	0.885	Fisher's
29. do you visit a doctor's only when sick	HM	0.286	0.214	0.819	Fisher's
32. do you visit the dentist	HM	1	0.643	0.380	Fisher's
36. do you weigh yourself on a scale	BI	0.750	0.643	0.749	Fisher's
37. have you ever been on a diet	Bi	0.750	0.714	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Group 2 (PBZ) pre experimental versus post experimental practice

There were no significant changes between the pre and post scores for practice questions regardless of category. Six of the eleven nutrition questions scored high both pre and post. Two maintained mid-range scores and three maintained low scores, including both questions pertaining to snacking habits and whether or not they eat when not hungry. Three physical activity questions had high scores both pre and post including all children reporting that they took a physical education class at school. Hours spent watching television each day remained consistently more than an hour a day after participation and no change was seen in time spent paying outside either. Seventy-one percent of the children reported that they would visit the doctor only if sick prior and that decreased to 67% ($p=0.657$) on the post surveys. One hundred percent of the children reported going to see a dentist after participating in the program, however, 97% already stated the same response on their pre surveys ($p=1$). Both body image questions had high scores both pre and post with no significant changes. There was a statistically significant difference between the pre and post control scores for Group 2 children on whether or not they would or would not eat the listed foods. However, there was also a much larger difference in how many responses were given in the post control than in the post experimental when compared with the pre scores for both conditions. 314 responses were given in the pre control and 352 in the post control surveys. 631 responses were given in the pre experimental versus 627 in the post experimental surveys.

Table 13. Group 2 Pre Experimental vs. Post Experimental Practice Questions

Question	Category*	pre exp score	post exp score	p-value	Test
3. would you or wouldn't you eat the foods listed	N	0.822	0.845	0.278	Chi
4. how many days a week do you eat breakfast	N	0.879	0.839	0.729	Fisher's
6. how many sodas do you drink each day	N	0.909	1	0.24	Fisher's
7. do you eat until you are full	N	0.75	0.877	0.339	Fisher's
8. do you eat when you are not hungry	N	0.273	0.276	1	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.844	0.844	1	Fisher's
10. do you eat veggies every day	N	0.719	0.742	1	Fisher's
11. do you eat fruit every day	N	0.697	0.688	0.934	Chi
14. do you east snacks between meals	N	0.212	0.156	0.751	Fisher's
15. what kind of snack do you eat	N	0.333	0.258	0.51	Chi
16. how many times a week do you eat fast food	N	0.969	0.968	1	Fisher's
21. how many hours of tv do you watch each day	PA	0.323	0.345	0.855	Chi
22. how many hours do you spend playing video games each day	PA	0.834	0.867	1	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.813	0.767	0.759	Fisher's
24. how many hours do you play outside each day	PA	0.576	0.567	0.942	Chi
25. do you take a PE class at school	PA	1	1	1	Fisher's
29. do you visit a doctor's only when sick	HM	0.713	0.667	0.657	Chi
32.do you visit the dentist	HM	0.969	1	1	Fisher's
36. do you weigh yourself on a scale	BI	0.844	0.813	1	Fisher's
37. have you ever been on a diet	Bi	0.75	0.719	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 14. Group 2 Pre Control vs. Post Control Practice Questions

Question	Category*	pre cont score	post cont score	p-value	Test
3. would you or wouldn't you eat the foods	N	0.764	0.741	0.027	Chi
4. how many days a week do you eat breakfast	N	0.933	0.889	0.953	Fisher's
6. how many sodas do you drink each day	N	1.000	0.882	0.909	Fisher's
7. do you eat until you are full	N	0.643	0.778	0.484	Fisher's
8. do you eat when you are not hungry	N	0.467	0.333	0.210	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.733	0.722	0.915	Fisher's
10. do you eat veggies every day	N	0.688	0.647	0.885	Fisher's
11. do you eat fruit every day	N	0.813	0.833	0.885	Fisher's
14. do you east snacks between meals	N	0.188	0.059	0.749	Fisher's
15. what kind of snack do you eat	N	0.313	0.222	0.688	Fisher's
16. how many times a week do you eat fast food	N	0.813	0.813	1.000	Fisher's
21. how many hours of tv do you watch each day	PA	0.294	0.313	0.902	Fisher's
22. how many hours do you spend playing video games each day	PA	0.647	0.688	0.885	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.588	0.667	0.688	Fisher's
24. how many hours do you play outside each day	PA	0.765	0.813	0.933	Fisher's
25. do you take a PE class at school	PA	0.944	0.941	0.959	Fisher's
29. do you visit a doctor's only when sick	HM	0.778	0.750	0.859	Fisher's
32. do you visit the dentist	HM	0.938	0.944	0.915	Fisher's
36. do you weigh yourself on a scale	BI	0.765	0.765	1.000	Fisher's
37. have you ever been on a diet	Bi	0.722	0.706	0.915	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Socioeconomic Effect

Group 1 (B&GC) pre experimental versus Group 2 (PBZ) pre experimental

There were no significant differences between the two groups in any of the pre-experimental questions regardless of category, although fewer children in group 2 reported spending more than an hour playing video games (p=0.094). However, Group 2 participants did score higher on 24 out of 37 questions with four out of eight knowledge questions, seven out of nine attitude questions, and 13 out of 20 practice questions receiving higher scores.

Table 15. Group 1 Pre Experimental vs. Group 2 Pre Experimental Knowledge Questions

Question	Category*	G1 pre score	G2 pre score	p-value	Test
1. are the foods listed good or bad for you	N	0.781	0.808	0.361	Chi
5. is it important to eat breakfast	N	1	0.969	1	Fisher's
17. how much do you know about healthy eating	N	1	0.97	1	Fisher's
28. is playing sports a good way to exercise	PA	1	0.97	1	Fisher's
31. can washing your hands help stop you from getting sick	HM	0.909	0.935	1	Fisher's
34. how many times a year should you see the dentist	HM	0.75	0.594	0.487	Fisher's
35. when should you brush your teeth	HM	0.333	0.594	0.179	Fisher's
38. can being under/overweight cause you to be sick	BI	0.6	0.742	0.441	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 16. Group 1 Pre Experimental vs. Group 2 Pre Experimental Attitude Questions

Question	Category*	G1 pre score	G2 pre score	p-value	Test
2. do you like or dislike the foods listed	N	0.607	0.545	0.107	Chi
12. Do you think it is important to eat veggies each day	N	1	0.968	1	Fisher's
13. do you think it is important to eat fruit each day	N	0.909	0.938	1	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.818	0.939	0.257	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.583	0.697	0.496	Fisher's
27. do you think it is important to be active and exercise	PA	0.917	1	0.267	Fisher's
30. do you think it is important to visit the doctor	HM	0.909	0.935	1	Fisher's
33. do you think it is important to visit the dentist	HM	0.818	0.969	0.156	Fisher's
40. How much of the time do you think you are healthy	BI	0.909	0.929	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 17. Group 1 Pre Experimental vs. Group 2 Pre Experimental Practice Questions

Question	Category*	G1 pre score	G2 pre score	p-value	Test
3. would you or wouldn't you eat the foods listed	N	0.791	0.823	0.284	Chi
4. how many days a week do you eat breakfast	N	0.75	0.879	0.362	Fisher's
6. how many sodas do you drink each day	N	0.727	0.909	0.154	Fisher's
7. do you eat until you are full	N	0.818	0.75	1	Fisher's
8. do you eat when you are not hungry	N	0.455	0.273	0.287	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.75	0.844	0.663	Fisher's
10. do you eat veggies every day	N	0.583	0.719	0.475	Fisher's
11. do you eat fruit every day	N	0.5	0.697	0.222	Chi
14. do you east snacks between meals	N	0.25	0.212	1	Fisher's
15. what kind of snack do you eat	N	0.083	0.333	0.136	Fisher's
16. how many times a week do you eat fast food	N	0.917	0.969	0.476	Fisher's
21. how many hours of tv do you watch each day	PA	0.333	0.323	1	Fisher's
22. how many hours do you spend playing video games each day	PA	0.545	0.839	0.094	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.667	0.813	0.423	Fisher's
24. how many hours do you play outside each day	PA	0.727	0.576	0.486	Fisher's
25. do you take a PE class at school	PA	1	1	1	Fisher's
29. do you visit a doctor's only when sick	HM	0.5	0.719	0.284	Fisher's
32. do you visit the dentist	HM	0.833	0.969	0.177	Fisher's
36. do you weigh yourself on a scale	BI	0.917	0.844	1	Fisher's
37. have you ever been on a diet	Bi	0.667	0.75	0.707	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Group 1 (B&GC) post experimental versus Group 2 (PBZ) post experimental

Children in Group 2 scored significantly higher in knowing which foods were good or bad for them (p=0.001) and how many times they should visit the dentist each year (p=0.016). Group 2 participants scored higher on 7 of the 8 knowledge questions total but no others significantly so. Children in both groups all answered positively on the 8th knowledge question which asked how much they knew about health eating. There were no significant differences between the two groups for attitude questions, although both groups showed a similar trend with identical scores for which foods they liked or disliked and Group 2 participants scored higher than Group 1 for the other 8 attitude questions. Two of these, how important you think it is to know what healthy eating is and would you rather play outside or watch television, approached statistical significance with p=0.073 and p=0.069 respectively. Children in Group 2 scored higher on 17 out of 20 practice questions with five of those being statistically significant. Those included which foods the children would or would not eat (p=0.006), how many times they ate at fast foods restaurants each week (p=0.032), How many hours they spend playing video games each week (p=0.017), how many hours they spend playing outside (p=0.036), and whether they go see a dentist (p=0.017). Children in Group 2 scored lower on the remaining three practice questions with the type of snack they eat being significantly lower (p=0.032).

Table 18. Group 1 Post Experimental vs. Group 2 Post Experimental Knowledge Questions

Question	Category*	G1 post score	G2 post score	p-value	Test
1. are the listed foods good or bad for you	N	0.8	0.888	0.001*	Chi
5. is it important to eat breakfast	N	0.917	0.935	1	Fisher's
17. how much do you know about healthy eating	N	1	1	1	Fisher's
28. is playing sports a good way to exercise	PA	0.909	1	0.256	Fisher's
31. can washing your hands help stop you from getting sick	HM	0.917	0.969	0.476	Fisher's
34. how many times a year should you see the dentist	HM	0.25	0.688	0.016*	Fisher's
35. when should you brush your teeth	HM	0.333	0.548	0.31	Fisher's
38. can being under/overweight cause you to be sick	BI	0.667	0.844	0.227	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 19. Group 1 Post Experimental vs. Group 2 Post Experimental Attitude Questions

Question	Category*	G1 post score	G2 post score	p-value	Test
2. do you like or dislike the foods listed	N	0.631	0.631	0.998	Chi
12. Do you think it is important to eat veggies each day	N	0.917	0.968	0.485	Fisher's
13. do you think it is important to eat fruit each day	N	0.917	0.935	1	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.833	1	0.073	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.636	0.9	0.069	Fisher's
27. do you think it is important to be active and exercise	PA	0.917	0.968	0.485	Fisher's
30. do you think it is important to visit the doctor	HM	0.833	0.969	0.176	Fisher's
33. do you think it is important to visit the dentist	HM	0.917	0.938	1	Fisher's
40. How much of the time do you think you are healthy	BI	0.727	0.9	0.166	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 20. Group 1 Post Experimental vs. Group 2 Post Experimental Practice Questions

Question	Category*	G1 post score	G2 post score	p-value	Test
3. would you or wouldn't you eat the foods listed	N	0.765	0.845	0.006*	Chi
4. how many days a week do you eat breakfast	N	0.833	0.839	1	Fisher's
6. how many sodas do you drink each day	N	0.833	1	0.077	Fisher's
7. do you eat until you are full	N	0.833	0.867	1	Fisher's
8. do you eat when you are not hungry	N	0.636	0.276	0.065	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.833	0.844	1	Fisher's
10. do you eat veggies every day	N	0.545	0.742	0.27	Fisher's
11. do you eat fruit every day	N	0.583	0.688	0.722	Fisher's
14. do you east snacks between meals	N	0.167	0.156	1	Fisher's
15. what kind of snack do you eat	N	0.667	0.258	0.032*	Fisher's
16. how many times a week do you eat fast food	N	0.667	0.968	0.017*	Fisher's
21. how many hours of tv do you watch each day	PA	0.167	0.345	0.452	Fisher's
22. how many hours do you spend playing video games each day	PA	0.417	0.867	0.006*	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.583	0.767	0.274	Fisher's
24. how many hours do you play outside each day	PA	0.917	0.567	0.036*	Fisher's
25. do you take a PE class at school	PA	0.917	1	0.279	Fisher's
29. do you visit a doctor's only when sick	HM	0.417	0.667	0.174	Fisher's
32. do you visit the dentist	HM	0.75	1	0.017*	Fisher's
36. do you weigh yourself on a scale	BI	0.75	0.813	0.687	Fisher's
37. have you ever been on a diet	Bi	0.5	0.719	0.173	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Multiple Survey Effect

Group 1 (B&GC) control 2 versus Group 1 (B&GC) post control

Children in the control 2 group scored higher in the post control surveys than did the control 1 children on five out of eight knowledge questions, including which food are good or bad for you which was significantly higher (p=0.008) and how many times they should visit the dentist each year which was also significantly higher (p=0.046). There were no significant differences for any of the attitude questions but the control 2 group did score higher on seven of the nine questions. The control 2 group children scored higher on 12 of the 20 practice questions, with the number of hours spent playing outside approaching significance (p=0.099). They scored lower than the control 1 children on the remaining 8 questions, including a significantly lower score on time spent playing video games each day (p=0.047).

Table 21. Group 1 Control 2 vs. Group 1 Post Control Knowledge Questions

Question	Category*	control 2 score	post cont score	p-value	Test
1. are the foods listed good or bad for you	N	0.604	0.718	0.008*	Chi
5. is it important to eat breakfast	N	0.909	0.923	1	Fisher's
17. how much do you know about healthy eating	N	1	0.929	1	Fisher's
28. is playing sports a good way to exercise	PA	0.9	0.769	0.604	Fisher's
31. Can washing your hands help stop you from getting sick	HM	0.9	0.929	1	Fisher's
34. how many times a year should you see the dentist	HM	0	0.357	0.046*	Fisher's
35. when should you brush your teeth	HM	0.182	0.308	0.649	Fisher's
38. can being under/overweight cause you to be sick	BI	0.6	0.583	0.937	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 22. Group 1 Control 2 vs. Group 1 Post Control Attitude Questions

Question	Category*	control 2 score	post cont score	p-value	Test
2. do you like or dislike the foods listed	N	0.566	0.61	0.375	Chi
12. Do you think it is important to eat veggies each day	N	0.833	0.929	0.58	Fisher's
13. do you think it is important to eat fruit each day	N	0.917	0.929	1	Fisher's
20. Do you think it is important to know what a healthy diet is	N	0.818	0.846	1	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.455	0.462	1	Fisher's
27. do you think it is important to be active and exercise	PA	0.909	0.857	1	Fisher's
30. do you think it is important to visit the doctor	HM	0.727	0.846	0.63	Fisher's
33. do you think it is important to visit the dentist	HM	0.636	0.786	0.656	Fisher's
40. How much of the time do you think you are healthy	BI	0.909	0.667	0.317	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 23. Group 1 Control 2 vs. Group 1 Post Control Practice Questions

Question	Category*	control 2 score	post cont score	p-value	Test
3. would you or wouldn't you eat the foods listed	N	0.695	0.731	0.399	Chi
4. how many days a week do you eat breakfast	N	0.5	0.786	0.218	Fisher's
6. how many sodas do you drink each day	N	0.75	0.571	0.429	Fisher's
7. do you eat until you are full	N	0.583	0.786	0.401	Fisher's
8. do you eat when you are not hungry	N	0.25	0.5	0.248	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.583	0.786	0.401	Fisher's
10. do you eat veggies every day	N	0.6	0.5	0.697	Fisher's
11. do you eat fruit every day	N	0.5	0.857	0.137	Fisher's
14. do you east snacks between meals	N	0.333	0.214	0.665	Fisher's
15. what kind of snack do you eat	N	0.083	0.143	1	Fisher's
16. how many times a week do you eat fast food	N	0.667	0.857	0.365	Fisher's
21. how many hours of tv do you watch each day	PA	0.273	0.286	1	Fisher's
22. how many hours do you spend playing video games each day	PA	0.727	0.286	0.047*	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.455	0.308	0.675	Fisher's
24. how many hours do you play outside each day	PA	0.182	0.571	0.099	Fisher's
25. do you take a PE class at school	PA	1	0.929	1	Fisher's
29. do you visit a doctor's only when sick	HM	0.182	0.214	1	Fisher's
32. do you visit the dentist	HM	0.7	0.643	1	Fisher's
36. do you weigh yourself on a scale	BI	0.7	0.643	1	Fisher's
37. have you ever been on a diet	Bi	0.545	0.714	0.434	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Group 2 (PBZ) control 2 versus Group 2 (PBZ) post control

There were no significant differences between the two control groups for Group 2 regardless of question type and category. The post control scores were higher on three of the knowledge question, the same on two of the knowledge question, and lower on the remaining three than the control 1 children. The post control scores were higher on three of the attitude questions, the same on two, and lower on four than the control 1 children. Finally, post control scores were higher on eight of the practice questions and lower on the remaining 12.

Table 24. Group 2 Control 2 vs. Group 2 Post Control Knowledge Questions

Question	Category*	control 2 score	post cont score	p-value	Test
1. are the foods listed good or bad for you	N	0.733	0.836	0.003*	Chi
5. is it important to eat breakfast	N	0.9	0.833	1	Fisher's
17. how much do you know about healthy eating	N	1	1	1	Fisher's
28. is playing sports a good way to exercise	PA	1	0.944	1	Fisher's
31. can washing your hands help stop you from getting sick	HM	1	1	1	Fisher's
34. how many times a year should you see the dentist	HM	0.444	0.529	1	Fisher's
35. when should you brush your teeth	HM	0.364	0.471	0.705	Fisher's
38. can being under/overweight cause you to be sick	BI	0.9	0.824	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 25. Group 2 Control 2 vs. Group 2 Post Control Attitude Questions.

Question	Category*	control 2 score	post cont score	p-value	Test
2. do you like or dislike the foods listed	N	0.547	0.57	0.584	Chi
12. Do you think it is important to eat veggies each day	N	0.9	0.833	1	Fisher's
13. do you think it is important to eat fruit each day	N	1	0.833	0.533	Fisher's
20. Do you think it is important to know what a healthy diet is	N	1	0.941	1	Fisher's
26. would you rather watch tv/play video games or play outside	PA	0.818	0.824	1	Fisher's
27. do you think it is important to be active and exercise	PA	1	1	1	Fisher's
30. do you think it is important to visit the doctor	HM	1	0.944	1	Fisher's
33. do you think it is important to visit the dentist	HM	1	1	1	Fisher's
40. How much of the time do you think you are healthy	BI	0.909	1	0.393	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

Table 26. Group 2 Control 2 vs. Group 2 Post Control Practice Questions

Question	Category*	control 2 score	post cont score	p-value	Test
3. would you or wouldn't you eat the foods listed	N	0.815	0.741	0.061	Chi
4. how many days a week do you eat breakfast	N	0.9	0.889	1	Fisher's
6. how many sodas do you drink each day	N	0.8	0.882	0.613	Fisher's
7. do you eat until you are full	N	1	0.778	0.265	Fisher's
8. do you eat when you are not hungry	N	0.5	0.333	0.444	Fisher's
9. how many different kinds of food do you eat during one meal	N	0.8	0.722	1	Fisher's
10. do you eat veggies every day	N	0.6	0.647	1	Fisher's
11. do you eat fruit every day	N	0.9	0.833	1	Fisher's
14. do you east snacks between meals	N	0.1	0.059	1	Fisher's
15. what kind of snack do you eat	N	0.3	0.222	0.674	Fisher's
16. how many times a week do you eat fast food	N	1	0.813	0.262	Fisher's
21. how many hours of tv do you watch each day	PA	0.091	0.313	0.35	Fisher's
22. how many hours do you spend playing video games each day	PA	0.364	0.688	0.13	Fisher's
23. how many hours do you play on computer for fun each day	PA	0.333	0.667	0.206	Fisher's
24. how many hours do you play outside each day	PA	0.636	0.813	0.391	Fisher's
25. do you take a PE class at school	PA	0.818	0.941	0.543	Fisher's
29. do you visit a doctor's only when sick	HM	0.444	0.75	0.2	Fisher's
32. do you visit the dentist	HM	1	0.944	1	Fisher's
36. do you weigh yourself on a scale	BI	1	0.765	0.132	Fisher's
37. have you ever been on a diet	Bi	0.727	0.706	1	Fisher's

*Category Key:
N-nutrition
PA-physical activity
HM-health monitoring
BI-body image

CHAPTER 4

DISCUSSION

The prevalence of being overweight and obese is rising in children worldwide and it is therefore critical to find effective methods of prevention. Interventions have to date showed mixed results with little consistency to shed light on what the best methods might be. This was the first study to examine the effect of indirectly addressing health topics with children by using animals as models. Teaching using animals has been shown to increase knowledge (Zasloff et al., 1999), improve attitudes (Sorge, 2008), as well as self-esteem (Zasloff et al., 1999). In turn, improved knowledge and attitudes can positively affect behavior. Using animals as models to teach children indirectly about their own health was hypothesized to have a positive effect on their knowledge, attitudes, and practice of good health independent of socioeconomic status.

Knowledge

Changes in knowledge were assessed with eight questions spanning the four health topics of nutrition, physical activity, health monitoring, and body image. Five of these questions had high scores in the pre surveys for the children in Group 1 and six out of eight had high scores for the children in Group 2. These children, therefore, already knew the correct answers to many of the questions prior to participating in the program, leaving very little room for improvement. One question did have a statistically significant increase for children in Group 2. Children in that group selected significantly more correct answers when asked which of the listed foods were good or bad for them. Both groups started out at very similar scores for this question with Group 1 answering positively 78% of the time and Group 2 children answering positively 81% of the time. Group 1 scores only improved by 2% while Group 2 scores increased by 9%. The same material was presented to both groups in the same manner, therefore this difference appears to be

a result of differences between the groups themselves. Children in Group 2 were more engaged during the sessions, so they may have focused more on the materials being given to them. The children in the control group of Group 2 did not score significantly higher on this question on their post surveys, therefore the effect of belonging to a different socioeconomic group cannot account entirely for the improvement seen in the Group 2 children that participated in the program.

The questions that did not have high scores in the pre surveys did not significantly improve for either group after participating in the program. Two of the questions with consistently low scores were the same for both of the groups, "how many times a year should you visit the dentist" and "when should you brush your teeth". The majority of the children in both groups did not know the correct answer to either of these questions prior to taking part in the program. Dental health in zoo animals is approached differently than it is in humans. Dental exams are typically performed during regular physical exams rather than during separate visits and these exams do not usually happen more than once a year. Additionally, zoo animals do not get regular teeth brushings making a direct comparison with recommended human dental hygiene more difficult.

Group 1 had an additional low scoring question that did not show a similar result for Group 2 children. The majority of Group 1 children did not know that being underweight or overweight can cause you to become sick and this did not change significantly after participation in the program. When addressing body shapes and sizes in animals, it was pointed out to the children that being a large animal such as a hippo or elephant did not equate with being unhealthy. Rather, it was emphasized that relative weight was more important than size. This indirect message may have been confusing to the children, although a similar trend was not seen in the Group 2 children who did show an increase in the score for this question in the post surveys.

Overall, these results allow us to determine that eight and nine year old children are already being provided with this type of information elsewhere and additional exposure to it may not be necessary. More advanced information would be required to have more of an effect, however, this could render the program less age appropriate. Pre-testing to assess knowledge level prior to participation would allow for adjustments to be made to the information included in the program, the method of delivering the information, as well as to the method of assessing effectiveness.

Attitude

Changes in attitudes were assessed with 11 questions also spanning the four health topics. Two of these questions were analyzed for percentages only. The first of these two questions asked children where they felt was the best place to learn about healthy nutrition. The children could select any or all of five possible options which included learning "with their family", "with their friends", "with their teacher", "at the doctor's office", or "from television". Children in both groups stayed fairly consistent, however, both groups showed an increase in selecting "with their friends" and "with their teacher" after taking part in the program, a setting which included both their friends and a teacher. This opportunity may have shown them that learning with peers is also a possibility. The second question analyzed for percentages asked children what factors they felt affected being healthy. The children could select any or all of 11 options which included "what kind of food you eat", "how much food you eat", "how much exercise you get", "eating breakfast", "going to school", "celebrities and how they look", "how your friends act", "how you look", "going to the doctor", "going to the dentist", and "getting enough sleep". Children in both groups stayed consistent in which factors they felt affected being healthy but neither group felt that going to school was one of those factors as often as others they selected. Consistently good attendance has been shown to be correlated with lower levels of obesity (Yetter, 2009). Children in this study did not seem to make an association between school attendance and better health. Most of the children did not report that they learned about good nutrition at school nor did they

believe that it was the best place to learn about good nutrition, so this could have extended to not believing that going to school would affect actually being healthy. These findings suggest that a zoo could be an appropriate place for children to learn about health behaviors since they would not associate it with being in a traditional educational setting.

Seven of the remaining nine attitude questions resulted in high scores in the pre surveys for Group 1 and eight of the remaining nine attitude questions resulted in high scores for Group 2. These results demonstrate an initial positive attitude towards health with not much room for significant improvements, similar to what was seen on the knowledge questions. It is encouraging that the children in this study seemed to have attitudes that matched their high level of knowledge when it came to being healthy. Two of the lower scoring questions were the same for both groups. A little more than half of the children in either group reported that they liked foods that were healthy and disliked foods that were unhealthy and this only improved slightly after participation in the program. Even this slight improvement was significant for children in Group 2, although the higher sample size for that group makes statistical significance easier to attain. The consistency of lower scores for this question suggests that children's food preferences may not always be directly affected by nutritional information as has been the case in other studies (for example, see Nolan, 1979).

The second lower scoring question common to both groups asked children if they would rather play outside or watch television and/or play video games. Approximately 60% of children in Group 1 and 70% of children in Group 2 reported that they would rather play outside than watch television or play video games in their pre surveys. Both groups did show improvements after participation and this approached statistical significance in Group 2 with 90% of children reporting a preference for playing outside after taking part in the program. Group 1 also had lower scores on their pre surveys for the question asking if they felt it was important to go see a dentist. The score to this question did improve from 75% to 92% in the post survey, but this was not a statistically significant improvement. It is encouraging that the questions that resulted in

lower scores in the pre surveys did show an improvement after participation in the program, even if that change was not statistically significant. Children in the control groups of both Group 1 and Group 2 did not show increased scores for any of these three questions and all three scores actually decreased in the post surveys for both control groups.

Practice

Changes in practice of health behaviors were assessed with 21 questions, one of which was analyzed for percentages only. For this question, children were asked where they learned about healthy nutrition and the children could select any of five options which included "with their family", "with their friends", "with their teacher", "at the doctor's office", and "from television". Group 1 children selected learning "with their family" most often and "with their friends" least often. This practice reversed after participation in the program with children now reporting that they learned about healthy nutrition with friends more often than with family. This is a similar trend as to what was seen when the children were asked where they felt the best place was to learn about healthy nutrition. In this case, the practice matched the attitude. Children in Group 2 stayed more consistent in their answers, but did increase the number of times they reported that they learned with friends as well.

Only seven of the remaining 20 practice questions had high scores in the pre surveys for the Group 1 children and 11 of the remaining 20 had high scores for the Group 2 children, none of which significantly improved for either group. Children in this study may have had high pre-existing knowledge of and attitudes about health, but had much lower levels of practice in comparison. Therefore, this should have been an area where more improvements should have been possible. There were no improvements in the low scoring questions for Group 1 children except for one after participation in the program. Children in that group reported choosing significantly more healthy snacks after participating in the program. One of the topics addressed during the nutrition session was that animals will often select foods that are not always good for them if given the choice. At the zoo, we ensure that animals are provided with nutritious options

to allow them to exercise a measure of control over their food selection without compromising their health. The children were surprised to learn that animals like junk food too but that because it isn't healthy for them, we don't feed it to them at the zoo.

Children in Group 2 did not significantly improve in any of the practice questions after taking part in the program. The difference in time between the pre and post surveys between the two groups may have had an effect. Children in Group 2 took the pre and post surveys four days apart when compared to the Group 1 children who took them five weeks apart. Changes in practice of health behaviors may not have had time to occur for Group 2 children. A consistent delivery method of the program would have prevented this potential confound. However, the constraints of the available study groups did not allow for that in this case.

Overall Trends

There are several trends that can be pointed out when looking at the surveys as a whole. Both groups scored high on their pre surveys on the same 19 of the 37 questions, leaving little room for improvement for those questions. More significant improvements should have been possible for questions with mid-range and low scores. There were six mid-range scores common to both groups and three low scores common to both groups on the pre surveys. These nine lower scoring questions common to both groups included two attitude questions (would the children rather play outside or watch television, and do they like or dislike the listed foods), both of which did improve for both groups, and six practice questions. Two of these practice questions decreased in both groups (do they eat snacks between meals, and do you visit a doctor only when you are sick) while the others had mixed results. Consistent results may indicate that participation in the program affected the children similarly for those specific topics. Conflicting results may indicate that the information provided to the children was either not powerful enough or in some way confusing to them to positively affect them. Alternatively, differences in socioeconomic status or in delivery may have caused them to respond differently. There could have been additional factors such as information obtained elsewhere that may have an effect as

well. More control could occur if the same study population was used and if the information could have been presented to all of the children in the same time-frame. Furthermore, changes in how the program effectiveness was measured, such as including other measures in the form of parental and teacher reports, could shed light on some of these conflicting results.

Additional overall trends for both groups can be seen when looking across the three categories and the four topics. Several questions showed improved scores in the post surveys for both groups. These improved questions included "which foods are good or bad for you", "which foods do you like or dislike", "how many sodas do you drink each day", "do you eat until you are full", "do you eat if you are not hungry", "do you think it is important to know what a healthy diet is", "can washing your hands can keep you from getting sick", and "can being underweight or overweight can cause you to be sick". These questions spanned all three categories of knowledge, attitude, and practice and all of the topics except for physical activity. This trend suggests that each class contained information which had a positive impact on the children's knowledge, attitude, and behavior regardless of socioeconomic status and time between each session. The fact that more of the questions that showed consistently improved scores were nutrition questions (6 out of 8) could be a reflection of the fact that more of the survey questions were nutrition questions. Having an equal number of questions for each topic and category could prevent this kind of issue.

Several questions declined in the post surveys for both groups as well. Children in both groups had decreased scores when asked "do you think it is important to eat breakfast", "do you snack between meals", "how many times a week do you eat at fast food restaurants", "how many hours do you spend on the computer for fun each day", "do you only go to the doctor when you are sick", "do you weigh yourself on a scale", "have you ever been on a diet", and "how much of the time do you think you are healthy". These questions that showed decreased scores for both groups after participating in the program spanned all three categories and all four topics. There

were again more nutrition questions that declined than any of the other three topics which may be a reflection of more nutrition questions being included in the survey.

Interestingly, only two questions had low scores on the pre surveys for both groups and both were practice questions. For the first of the two low scoring questions, both groups reported eating snacks between meals and this did not change significantly in the post surveys. In the nutrition class, children were told about feeding practices for animals at the zoo. The way animals are fed is related to how they procure food in the wild. Animals that spend a lot of time foraging are fed multiple times a day to mimic more natural conditions. Children may have taken that information as an indirect correlation to their own snacking practices. For the second low scoring question, few of the children in either group reported watching less than an hour of television per day and this did not improve after participation in the program. According to a recent study by the Kaiser Family Foundation, children between the ages of 8 and 18 reported watching an average of four and a half hours of television programming each day (Kaiser Family Foundation, 2010). The encouraging counterpart to this trend is that more children reported that they spend at least an hour playing outside each day and this actually increased by 19% for Group 1 children. This change in practice matched the change in attitude seen for children reporting that they would prefer to play outside rather than watch TV or play video games. The much shorter time between the pre and post surveys for the Groups 2 children could explain why a similar increase in playing outside was not seen in that group even though an improvement was seen in their attitude towards playing outside.

Difference between Groups

The original study population was made up of children from two different Boys & Girls Club locations in South Florida. However, fewer children were able to participate than anticipated due to irregular attendance and fewer children in the right age groups than had been designated by Boys & Girls Club staff members. Thirty-eight children were able to participate in the study between the two club locations. Fourteen children were randomly assigned to either the

experimental or control condition and an additional 10 were selected to be part of the single trial (control 1) condition. The post surveys from two of the children in the experimental condition were not used in the analyses as both of these children missed one of the sessions at the zoo. Their pre surveys were added to the single trial control group. Other children were brought to the zoo to "replace" missing participants by the chaperones but these children did not complete any surveys.

A second phase was conducted in the month of June with children attending the summer camp at the Palm Beach Zoo in order to increase the number of participants in the study. Children sign up for camp in one week increments and there is no guarantee that a child will attend multiple weeks so it was decided to give one session per day rather than per week allowing the entire program to last one week. Based on registration numbers, the week with the highest number of children in the correct age group was selected for this phase. A total of 62 children participated in the second phase of the study. In order to accommodate camp schedules, more children participated in the experimental condition than in the control condition for Group 2. A total of 34 children took part in the experimental condition, 18 took part in the control condition, and 10 took part in the single control (control 1) condition. One of the children in the experimental refused to take the post survey entirely so the pre survey for that child was added to the single trial condition for a total of 11 children in that group.

The variation in how the program was presented to the children could have affected the results as the group 1 children had five weeks between each time they took the survey while the Group 2 children only had four days. Group 1 children also were presented with the information once a week, allowing for more time to potentially forget or be influenced by other sources of information outside of the study. However, this also presented us with the ability to compare how children belonging to different socioeconomic groups would be affected by the program.

Children in different socioeconomic groups can have differential access to resources such as types of food and food preparation, nutritional information, participation in sports or outdoor

activities, health and dental care, as well as potentially different family structure or support (Chen, Matthews, and Boyce, 2002). This could lead to differences in the baseline scores between the two groups. However, no statistically significant differences were found in how the children in the two groups scored on their pre surveys. Group 2 children did score higher on 24 out of 37 questions. Far fewer of the Group 2 children reported playing video games for more than an hour each day than did the Group 1 children. The choices given to the children were based on hour blocks of time and it is possible that children at that age do not have a firm concept of time and therefore did not accurately report how much time they truly spent performing certain activities. Even if they did not know exactly how much time they spent playing video games for example, the fact that more children reported spending more time on that activity is relevant. To obtain more accurate answers, other ways of measuring behavior could have been incorporated such as asking the children to keep journals about their activities or asking parents and teachers to provide information on the children's activities.

In the post surveys, children in Group 2 scored higher than children in Group 1 on 32 out of 37 questions which is an increase of 8 higher scoring questions from the pre surveys. Several statistically significant differences were found between the two groups. Children in group 2 scored significantly higher than Group 1 children on which foods were good or bad for them, which foods they would or would not eat, how many times a week they eat fast food, how many hours a day they spend playing video games and playing outside, and whether or not they visit a dentist. Group 1 children scored significantly higher for the types of healthy snack they consume. Some of these differences could be explained by the children in the two groups having different access to resources. Since the children did not have significant differences in their responses on the pre surveys, it could be that differential access to resources allowed them to make changes as a result of what they learned during the program. None of the attitude scores were significantly higher in Group 2, however, two approached statistical significance. More children in Group 2 reported that they felt it was important to know what healthy eating is and that they would prefer

playing outside over watching television or play video games. An increase was also seen in both of these questions between the pre and post surveys for both groups reflecting a positive change after participating in the program. This increase was higher for Group 2 which could be a reflection of differences in the children or a result of program presentation. Since the children had no significant differences in the pre survey scores, it can be concluded that differences in the post survey scores could be attributed to differences in the program structure or in how the children processed the information. Some studies have shown that children from different socioeconomic groups are affected differently when their parents are involved in a program with them (Jouret et al., 2009). Children in lower socioeconomic groups participating in an obesity prevention program showed more improvements when they had parental involvement, unlike children in higher socioeconomic groups. Therefore, different approaches may need to be utilized based on the socioeconomic group of a program's participants to maximize effectiveness.

Effect of Taking the Survey Twice

The instrument used to measure the effect of the program was a survey given to each child twice for both the control and experimental groups. It was hypothesized that children who participated in the program would score higher on their post surveys than did the control group children. However, the control group children took the survey twice as well, and this could have affected the results. To determine if this could be the case, a third condition was added to the study in which the children only took the survey once. The participants for this came from the same sample population as the participants for the experimental and control groups. The results of these single trial surveys were then compared to the results of the post surveys for the control group. For Group 1, post survey scores were higher than single trial control scores for 23 out of 37 questions, but not statistically significantly so. For Group 2, post survey scores were higher than single trial scores on 14 out of 37 questions, none of which were statistically significant either.

Limitations

There were a number of study limitations. The children in this study were eight and nine years old as this has been shown to be a critical time period for the development of healthy habits (Foerster et al., 2007). However, children in that age group may be too young to accurately make the connection between information about animals and how that information applies to them. Indirect messaging may not be effective in children in that age group. The children scored very high on many of the questions on the initial surveys, leaving little room for improvement. The small sample size for each question also makes it more difficult to get statistically significant results.

The survey itself could have functioned poorly. The questions may not have addressed what was intended, leading to non-significant results. The survey included no questions about materials they were taught directly, so it is not possible to tell if the children actually learned anything during the sessions or if any of the changes can be attributed to chance. The survey was comprised of 40 questions which may have been too long for the children. The children may have lost motivation or focus and therefore answers may not be as reliable. Children could also only be encouraged to answer all of the questions, resulting in questions having different number of responses if some children left them blank. A survey may not have been the best way to measure program effectiveness as the validity of self-reports in children has been questioned as they may answer to please rather than honestly. However, several studies have shown that children as young as 5 can accurately report on their own behaviors and emotions (Measelle, John, Ablow, Cowan, & Cowan, 2005).

The differences in the demographics of the two study populations could have had an effect on the results. Children from different socioeconomic backgrounds may have differential access to information about health, resources for physical activity, medical and dental care, as well as differences in body image. These differences could have affected how the children received the information given to them and how they related it to themselves.

Finally, the difference in program delivery could have had an effect on the results. More time between sessions and between surveys could allow for more time to forget information. It could also allow for more outside factors to have an influence. However, less time between sessions and surveys could have an effect on results as well as children may have been overloaded with information. There would also be less time for changes in practice to occur in a shorter timeframe.

Future Investigations

Future investigations should be conducted to determine what aspects of the program have the greatest effect and can serve to answer the questions that arose in the course of this study. Additional participants should be added to increase the likelihood that statistically significant results can be obtained. More children in the same socioeconomic group should be included to examine the effect of different demographics and should be specifically designed in the most appropriate way for each group. The program should also be delivered in the same time frame to control for the effects of time. To address if children ages eight and nine are too young to understand indirect messaging, older children should be included. The information being tested on the surveys would likely need to be modified however, to better fit with additional

knowledge in older children. Pre-testing the surveys for each group should occur to determine baselines prior to participation so that the curriculum can be modified to best reflect the baselines demonstrated by the participants. The questions on the survey should also be modified. Questions which had low scores across both groups should be re-structured to ensure that they are clear in case the low scores are a reflection of confusion rather than lack of knowledge. Questions addressing specific information presented to the children should be added to the survey to determine if the children are indeed learning from the program. However, it may be beneficial to shorten the survey to ensure children do not lose focus which could affect their answers. More direct information could also be provided during the sessions to determine if indirect messaging is an ineffective method of information delivery for children. Information that applies to captive animals is not always directly applicable to humans, such as dental care practice and body image, so these topics may need to be addressed more directly to ensure conflicting or confusing information is not imparted on the children. Finally, future investigations should include other measures in addition to the surveys such as parental reports and if possible, direct observations of the children's behaviors. The future of such a program lies in the hands of zoo educators. If children are already being provided with sound information about health behaviors and these children already have positive attitudes towards health behaviors, zoos should not focus their often limited resources into redundant programming. However, children in this study did not demonstrate a high practice of health behaviors and this is an area that a zoo could address. Zoos are places that lend themselves to both being active and to observing activity. Zoos are also places that can inspire and engage children. Programs designed to specifically target increasing the

practice of healthy behaviors can be implemented in zoos by using animals as models and could fill the void seen in young children.

Conclusions

1. Children ages eight and nine already have good knowledge about what it means to be healthy and overall positive attitudes towards health.
2. Children ages eight and nine do not practice health behaviors at a level equivalent to their knowledge of and attitude towards health.
3. Children who participated in a program that taught them about animal health did not have significantly more knowledge of, more positive attitudes towards, nor practice more behaviors related to health after participation.
4. Children from different socioeconomic backgrounds were affected differently by participating in the program with children in higher socioeconomic groups showing more improvements in knowledge, attitudes, and some practices.

APPENDIX A

PARENTAL PERMISSION FORM

Georgia Institute of Technology
Project Title: The effect of using animal models on children's attitude, knowledge and practice of healthy behaviors

Investigators: Terry L. Maple, PhD; Stephanie M. Dampier, MS

Protocol and Consent Title: The effect of using animal models on children's attitude, knowledge, and practice of healthy behaviors

You are being asked to allow your child to be in a research study. The purpose of this study is to evaluate how learning about the health of animals influences how children feel and think about their own health. We expect to enroll 184, 100 of which will take part in the program and 84 who will serve as the control group.

Children in this study must be part of the Boys' and Girls' Club of Boca Raton or Delray Beach. Children in this study must be able to attend each class for the duration of the study.

Children will be selected for the program group based on interest and if more than 100 children want to participate, a lottery system will be used to determine participation. If you decide to allow your child to take part in this study, your child will take a weekly class at his/her club location as well as four trips to the Palm Beach Zoo.

Your child will learn about animals and how they move, what they eat, how we keep them healthy, and how we help them if they get sick or injured. Your child will be close to different animals in a safe and controlled environment and will not be at risk of injury from the animals.

Your child will benefit from this study by learning not only about animals being healthy, but about being healthy themselves. Your child will not be compensated for his/her participation in this study. There is no cost to you or your child for participation in this study.

The following procedures will be followed to keep your child's personal information confidential in this study: the information collected will be kept private to the extent allowed by law and only study staff will have access to it. Your child's name or any identifying information will not appear when results of this study are presented or published.

If your child is injured as a result of being in this study, please contact Dr. Terry Maple at 561-533-0887. Neither Dr. Terry Maple nor the Georgia Institute of Technology has made provision for payment of costs associated with any injury resulting from participation in this study.

Your child's participation in this study is voluntary and your child does not have to participate even if you give your permission. You have the right to change your mind and remove your child at any time without giving any reason and any information that may make you change your mind about allowing your child to participate will be provided to you. You will be given a copy of this Parental Permission form to keep and you do not waive any of your legal rights or those of your child by signing this form.

If you have any questions about the study, you may contact Dr. Terry Maple at 561-533-0887. If you have questions about your child's rights as a research participant, you may contact Ms. Melanie Clark, Georgia Institute of Technology, Office of Research Compliance at 404-894-6942 or Ms. Kelly Winn, Georgia Institute of Technology, Office of Research Compliance at 404-385-2175.

If you sign below, it means that you have read the information given in this Parental Permission form, and you would like for your child to be in this study.

Child's Name (printed)

Parent's Name (printed)

Parent's Signature Date

APPENDIX B

NUTRITION CLASS

Classroom component:

- General nutrition information
    - What type of nutrients are important
- Why good nutrition is important
- Animal nutrition
    - Types of eaters
        - Carnivores
        - Herbivores
        - Omnivores
    - How animals eat at the zoo
        - How do they get it
        - When do they get it
- Differences in the wild and in zoos
- Problems that develop in animals from poor nutrition
    - Too much of something
    - Not enough of something
- How we can help animals make better food choices

Classroom activities:

- What am I-one child is selected to be a mystery animal and the rest have to ask it questions about what they eat and how they get that food to determine what the animal is
- Ocelot and mouse game-children form a circle and toss two bean bags down the line, the first is the "mouse", the second is the "ocelot". The mouse begins first and if the bag that is the ocelot catches up, the mouse is eaten

Zoo activities:

- Visit the commissary
    - Learn how diets are prepared
    - Make a diet for your buddy
- Feed animals
- Observe animals eating
    - Your buddy

APPENDIX C

PHYSICAL ACTIVITY CLASS

Classroom component:

- What does it meant to be physically active-ask and answer
- Why is it important to be physically active-ask and answer
- How are animals active
    - Locomotion types
    - Why do they do that?
        - Habitat
        - Feeding
    - Other types of activity
        - Social play and contact
- What happens when animals are not active enough?
- Grouping animals
    - Activity type
    - Activity times
- How can we get animals to be more active

Classroom activities

- Animal tag relay-children grouped by locomotion type, play relay race
- Animal Athletes-children have to see how they mesure up to different animal athletes such as flaps per second-flap per second rates for different birds, have them try to flap as fast as possible versus for as long as possible, explain why that matters; how far they can jump in one hop or using all four appendages, how fast can they run a certain distance.
- Be your buddy-act out the type of locomotion your buddy animal uses

Zoo activities:

- Find your buddy and observe its activity and how the environment it is in allows it to move the way it should
- Find animals that fit each type of locomotion

APPENDIX D

BODY IMAGE CLASS

Classroom component:

- Explain that animals come in many shapes and sizes
    - Why is this the case
    - How does it relate to how they function
- Explain why relative size is important
- Explain what can happen to animals is they are too thin or too heavy
    - How do we keep animals at the right size
    - Animals don't care how they look but nature has designed them to want to be healthy to survive

Classroom activities:

- Slideshow of animals that we go through 4 times asking 4 different questions
    - Is this animal healthy or unhealthy
    - Is this animal happy or sad
    - Is this animal smart or not smart
    - Is this animal pretty or ugly

Zoo activities:

- Find your buddy and figure out if you think they look healthy or unhealthy and why
- Observe animals of different shapes and sizes and explain why their bodies look the way they do

APPENDIX E

HEALTH MONITORING CLASS

Classroom component: A visit form the zoo vet

- How do you monitor health
    - Physical exams
    - Dental exams
    - Behavior
- Animal wellness at the zoo
    - Preventative
    - Treatment
- Important health measures

Classroom activities:

- Buddy health reports
- What would you do?-pick the best treatment

Zoo activities:

- Tour of ACC
- Flamingo check-up
- Bear surgery

APPENDIX F

SURVEY

1. Do you think the following foods are good for you, bad for you, or you don't know. Circle your answers

Vegetables	good	bad	don't know
Milk	good	bad	don't know
Fried chicken	good	bad	don't know
Fruit	good	bad	don't know
Fish	good	bad	don't know
Bread	good	bad	don't know
Cheese	good	bad	don't know
French fries	good	bad	don't know
Soda	good	bad	don't know
Spaghetti	good	bad	don't know
Cakes	good	bad	don't know
Beef	good	bad	don't know
Soup	good	bad	don't know
Eggs	good	bad	don't know
Chips	good	bad	don't know
Cereal	good	bad	don't know
Ice cream	good	bad	don't know
Water	good	bad	don't know
Pizza	good	bad	don't know
Butter	good	bad	don't know

2. Do you like or don't like the following foods. Circle your answers

Vegetables	like	don't like
Milk	like	don't like
Fried chicken	like	don't like
Fruit	like	don't like
Fish	like	don't like
Bread	like	don't like
Cheese	like	don't like
French fries	like	don't like
Soda	like	don't like
Spaghetti	like	don't like
Cakes	like	don't like
Beef	like	don't like
Soup	like	don't like
Eggs	like	don't like
Chips	like	don't like
Cereal	like	don't like

Ice cream	like	don't like
Water	like	don't like
Pizza	like	don't like
Butter	like	don't like

3. Would you or wouldn't you eat the following foods. Circle your answers

Vegetables	would eat	wouldn't eat
Milk	would eat	wouldn't eat
Fried chicken	would eat	wouldn't eat
Fruit	would eat	wouldn't eat
Fish	would eat	wouldn't eat
Bread	would eat	wouldn't eat
Cheese	would eat	wouldn't eat
French fries	would eat	wouldn't eat
Soda	would eat	wouldn't eat
Noodles	would eat	wouldn't eat
Cakes	would eat	wouldn't eat
Beef	would eat	wouldn't eat
Soup	would eat	wouldn't eat
Eggs	would eat	wouldn't eat
Chips	would eat	wouldn't eat
Cereal	would eat	wouldn't eat
Ice cream	would eat	wouldn't eat
Water	would eat	wouldn't eat
Pizza	would eat	wouldn't eat
Butter	would eat	wouldn't eat

4. How many days a week do you eat breakfast?
    a. 0-2
    b. 3-4
    c. 5-7

5. Do you think it is important to eat breakfast?
    a. Yes
    b. No
    c. Don't know

6. How many sodas do you drink each day?
    a. 0
    b. 1-2
    c. 3-4
    d. 5 or more

7. Do you eat until you are full?
    a. Yes
    b. No

8. Do you eat when you are not hungry?
    a. Yes
    b. No

9. How many kinds of different foods do you eat during the same meal (meat, vegetable, dairy, fruit, grains)?
    a. 1-2
    b. 3-4
    c. 5 or more

10. Do you eat vegetables every day?
    a. Yes
    b. No

11. Do you eat fruit every day?
    a. Yes
    b. No

12. Do you think it is important to eat vegetables every day?
    a. Yes
    b. No

13. Do you think it is important to eat fruit every day?
    a. Yes
    b. No

14. Do you eat snacks between meals?
    a. never
    b. sometimes
    c. everyday

15. What kind of snacks to do you eat?
    a. Cookies
    b. Candy
    c. Fruit
    d. Other

16. How many times do you eat at fast food restaurants each week?
    a. 0
    b. 1-2
    c. 3 or more

17. How much do you know about healthy eating?
    a. I know a lot
    b. I know some
    c. I don’t know anything

18. Where do you learn about healthy eating?

At home with my family	yes	no	
With my friends	yes	no	
At school with my teacher		yes	no
At the doctor's office	yes	no	
From television	yes	no	

19. Where is the best place to learn about healthy eating?

At home with my family	yes	no	
With my friends	yes	no	
At school with my teacher		yes	no
At the doctor's office	yes	no	
From television	yes	no	

20. Do you think it is important to know what a healthy diet is?
    a. Yes
    b. No

21. How many hours of television do you watch each day?
    a. 0-1
    b. 2-3
    c. 4 or more

22. How many hours do you spend playing video games each day?
    a. 0-1
    b. 2-3
    c. 4 or more

23. How many hours do you spend on the computer for fun each day?
    a. 0-1
    b. 2-3
    c. 4 or more

24. How many hours do you spend playing outside each day?
    a. 0-1
    b. 2-3
    c. 4 or more

25. Do you take a PE class at school?
    a. Yes
    b. No

26. Would you rather watch television and play video games or play outside?
    a. Television or video games
    b. Play outside

27. Do you think it is important to be active and exercise?
    a. Yes
    b. No

28. Is playing sports a good way to exercise?
    a. Yes
    b. no

29. Do you go visit a doctor's office only when you are sick?
    a. Yes
    b. No

30. Do you think it is important to go visit a doctor?
    a. Yes
    b. No

31. Can washing your hands help stop you from getting sick?
    a. Yes
    b. No

32. Do you go visit a dentist?
    a. Yes
    b. No

33. Do you think it is important to go visit a dentist?
    a. Yes
    b. No

34. How many times a year should you go see the dentist?
    a. None
    b. Only if you have a cavity
    c. Twice
    d. Every month

35. When should you brush your teeth? Circle your answers
    a. After you get up in the morning
    b. before going to sleep
    c. after you eat a meal

36. Do you weigh yourself on a scale?
    a. Yes
    b. No

37. Have you ever been on a "diet"?
    a. Yes
    b. No

38. Can being overweight or underweight cause you to be sick?
    a. Yes
    b. No

39. What do you think affects being healthy? Circle all the answers you think can make you healthy

What kind of food you eat		yes	no
How much food you eat	yes	no	
How much exercise you get	yes	no	
Eating breakfast	yes	no	
Going to school	yes	no	
Celebrities and how they look	yes	no	
How your friends act	yes	no	
How you look	yes	no	
Going to the doctor	yes	no	
Going to the dentist	yes	no	
Getting enough sleep	yes	no	

40. Do you think you are healthy?
    a. All of the time
    b. Most of the time
    c. Some of the time
    d. never

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