FOOD COST ANALYSIS ASSOCIATED WITH FRUIT AND VEGETABLE INTAKE

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ABSTRACT

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The purpose of this study was to investigate how food costs effects adolescents' healthy eating habits related to their shopping habits, fruit and vegetable intake, and number of meals eaten away from home. A total of 60 single day food records of 7th and 8th graders in a low income area were analyzed based on daily food costs. Daily food costs were split into three methods: generic brand, brand name, and 'alternate'. ANOVA and a *t*-test was utilized to analyze the hypotheses with a significance level set at $p \leq 0.05$. The daily food cost using generic brand items was significantly less (\$3.78+/-2.08) ($p = 0.000$) than buying name brand items (\$5.10+/-2.16). There was no significant difference between high and low fruit and vegetable consumption groups and all three costing methods ($p = 0.337$, $p = 0.732$, $p = 0.384$). Adolescents who ate one or more restaurant/fast food meals had significantly higher food costs across all three pricing methods ($p = 0.001$, $p = 0.036$, $p = 0.000$). Daily food costs were similar to those described in the Thrifty Food Plan, and it appears that buying generic name foods, obtaining adequate fruit and vegetable intake, and limiting meals eaten away from home will aide in decreasing food costs and increasing nutrient value.

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CHAPTER I

INTRODUCTION

Obesity rates in the United States have been on a constant increasing trend for the past 20 years. Additionally, more children and adolescents are exhibiting the effects of early childhood obesity than ever before. As obesity increases during childhood, these adolescents will develop medically related health problems that will affect them in various ways throughout their lifetime. Recently, many reports have distinguished this new generation of children with the possibility that they may have a lower life expectancy than their parents that can be related to the multitude of health problems that obesity generates such as diabetes, cardiovascular disease, and even cancer.

There are no obvious all encompassing motivators to obesity. Obesity has resulted for many reasons which include but are not limited to socio-economics, environment, culture, and society. However, the basic causes are related to decreased activity and increased dietary intake. One study reported an average daily energy intake increase of approximately 12 % between the years 1985 and 2000. Grains, added fats, and added sugars accounted for 46%, 24%, and 23%, respectively, of this reported increase (Putnum, Allshouse, & Kantor, 2002). Furthermore, actual consumption of nutrient dense foods such as fruits and vegetables is less than recommended amounts within the U.S. population. According to the Continuing

Survey of Food Intakes by Individuals (CSFII), between 1994 and 1996, less than 25 % of children met the five a day goal for fruit and vegetable consumption (Krebs-Smith et al., 1996). Parents/Guardians have a large impact on the diets/eating habits of their children.

A study published in 2001 investigated the relationship of home fruit, 100% fruit juice, and vegetable availability and accessibility among adolescents. Results of the study showed a significant association between child-reported availability and parental reported accessibility of the child's fruit, 100% fruit juice, and vegetable consumption (Cullen et al., 2001). Parents control most of the foods entering their home, the way the food is prepared, and the selection of where the family decides to eat.

Ricciuto, Tarasuk, and Yatchew (2006) reported that the average purchasing patterns of Canadian households were largely dependent on household composition, income, size, and education. Results of this study showed that household socio-demographic characteristics appear to negatively influence fruit and vegetable purchasing for the home. Other important factors related to fruit and vegetable purchasing patterns are associated with accessibility and convenience. Specifically, there appears to be differences in grocery store availability of fruits and vegetables related to low income groups/areas.

A few studies investigated the cost of adopting healthy diets. Results indicated that food cost may increase or decrease. Two separate studies, a United Kingdom

cohort of women and a Danish children's hypercholesterolemia intervention study, reported that consuming a healthy diet was more expensive (Stender et al., 1993). In contrast, a study assessing the average Italian food pattern and how it affected expenditure for food related to following the Recommended Dietary Allowance (RDA) cut-offs, determined that buying foods only to meet the RDA was minimal in cost (Conforti & Amicis, 2000). In 2003, a report showed that low-income households appear to purchase 3.3 % less fruits and vegetables by weight than higher-income households. Yet lower income households are paid 13 % less. Researchers theorized that lower-income households purchased fruits and vegetables that were less expensive (Leitbag & Kaufman, 2003). Thus, those who are lower income may compensate their economic disadvantage through smarter, cost-saving techniques at the grocery store.

Statement of the Problem

The general public is aware that healthy eating may lead to healthy living. However, many people have developed misconceptions about the cost of following healthy diets. There is limited and contradicting evidence to compare the costs of meal pricings of fruit and vegetable consumption, buying generic brand vs. name brand pricing, and eating meals away from home pricing. The cost of meeting recommended fruit and vegetable intakes and thereby following healthy eating habits remain undecided. This indicates a need to determine what actual daily food costs are through investigation of variables related to general food patterns and daily intake habits of adolescents related to purchasing store/generic brand compared with name

brand foods, the cost differential between high and low fruit and vegetable consumption, and associated costs of fast food restaurant usage.

Hypotheses

Based upon previous research and an extensive review of the literature surrounding this topic, the following hypotheses were proposed:

1. Daily food costs will not differ for adolescents based on meal pricings of store/generic name foods compared with name brand foods.
2. Daily food costs will not differ for adolescents consuming >/= four servings of fruits and vegetables compared with those consuming zero servings of fruits and vegetables based on
    a. Generic brand average food costing.
    b. Name brand average food costing.
    c. "Alternate" average food costing.
3. Daily food costs will not differ from those adolescents that ate >/= one restaurant meal compared with those adolescents that ate zero restaurant meals based on
    a. Generic brand average food costing.
    b. Name brand average food costing.
    c. "Alternate" average food costing.

CHAPTER II

LITERATURE REVIEW

Obesity

The term obesity is used to describe individuals' who have a BMI > 25 (overweight) and BMI >30 (obese) in adults and in children, this usually refers to those that are plotted at >85th percentile (overweight) and >95th percentile (obese).The consequences of being overweight or obese in both children and adults have been well documented, however, rates continue to increase at an alarming rate.

Rising Obesity Rates

Ogden and colleagues reported on the most recent estimates of obesity as of 2004. The prevalence rates for childhood and adolescent obesity are as follows: one third (33.6%) are at risk of overweight/overweight, and 17.1 % are overweight in the United States. Adult rates have not faired better, with 66.3% overweight (Body Mass Index >25), 32.2% obese (BMI >30), and 4.8 % extremely obese (BMI >40). Research appears to show that the obesity epidemic is still on a continual upward slope. From 1999-2004, percentages of adolescents at risk of overweight and overweight have increased by 5.4% and 3.2%, respectively. Adult rate increases between 1999 and 2004 were 1.8%, 1.7%, and 0.1% for overweight, obese, and extreme obesity, respectively. Interestingly, obesity rates appear to be higher in Non-Hispanic black

and Mexican American minorities both in children and adults (Ogden et al., 2006).This seems to suggest that this epidemic is showing no signs of slowing down. This raises more concern for child care providers and parents as research shows that obese children tend to become obese adults, which would further increase their risk for developing heart disease, hypertension, diabetes, and cancer (Magarey, Daniels, Boulton, & Cockington, 2003) Thus, there may be cultural/ethnic influences on obesity rates. Furthermore, studies have shown that those who are more disadvantaged or have lower socioeconomic means appear to have higher body mass indices (Inagami, Cohen, Finch, & Asch, 2006).

Associated Health Costs

Obesity and its related health consequences have had drastic effects on economic costs. Recent surveys of the effects of obesity on health costs and cost to the economy reported similar findings. One study collected data from the 1998 Medical Expenditure Panel Survey (MEPS) and data from the 1996 and 1997 National Health Interview Surveys (NHIS) to estimate and assess the monetary impacts that obesity is causing in the United States (Finklestein, Fiebelkorn, & Wang, 2003). The study reported average total increases in adult per capita medical spending due to being overweight and obese as $247 and $732, respectively. These translate into 14.5% and 37.4% increases for overweight and obese individuals, respectively, in health care related costs. These costs include money out-of-pocket and money spent from private insurance as well as Medicaid and Medicare. Additionally, the authors reported that in

the U.S. adult population, as a whole, 5.3 % of medical spending is related to obesity. Overall, medical spending is estimated in the billions of dollars. In Finklestein et al.'s (2003) study, using the NHIS, estimated total medical spending for overweight and obesity for 1998 correlated to $78.5 billion.

Another survey recently published by Sturm determined that "the effects of obesity on the number of chronic conditions are larger than those of current or past smoking or problem drinking" (Sturm, 2002, p. 247). Sturm used data obtained from the Healthcare for Communities telephone survey to track his results. Reported absolute changes in costs for inpatient ambulatory care, obesity and overweight were associated with increases in healthcare spending of approximately $395 and $125 per year, respectively. These were reported to be more than increases seen as results of smoking ($230), drinking ($150), or aging ($225). Importantly, Sturm further reported medical and medication increases at 36 % and 77 %, correspondingly. Sturm reported confirmation regarding the statistically significant associations of other health problems that are linked to overweight and obesity such as cancer, diabetes, and cardiovascular disease. Many studies show that these health problems are additional explanations for the large increases seen in health costs (Popkin, Kim, Rusev, & Zizza, 2006; Sturm, 2002).

Associated Economic Costs

Economic costs associated with obesity are mostly related to loss of productivity that correlates with related health issues stemming from obesity.

According to a recently published article in The American Journal of Preventative Medicine, researchers reported that in the year 2000, the approximate total cost of overweight and obesity was $117 billion (Kim & Kawachi, 2006). This figure included the burdens reflected in morbidity as well as loss of work productivity. Examining this large number separately, $61 billion were due to direct healthcare costs while $56 billion were due to indirect costs associated with the economic pitfalls felt. There have been various studies that have investigated the economic associated costs of obesity. One study discovered that body mass index predicted both average annual health care costs as well as absence hours from work (Bungum, Satterwhite, Jackson, & Morrow, 2003). Other studies with similar findings include a study conducted by Ricci and Chee (2005) whom discovered that obese workers were more likely to report lost productive time more frequently than those of normal or overweight workers. Furthermore, it was estimated by Ricci and Chee (2005) that obese workers cost approximately $42.29 billion in lost productive time. This was $11.7 billion higher than the workers that were of normal weight. Also, researchers reported that approximately two-thirds of the cost in lost productive time of obese workers is explained by reduced work performance rather than absenteeism.

Importantly, adults are not the only persons affected by the obesity epidemic with regards to productivity. In a review of literature, Taras and Potts-Datema (2005) investigated the association of obesity in school aged children and academic outcomes. Based on their review, they concluded that overweight and obesity are associated with

poorer levels of academic achievement. This has potential economic consequences for children later in life regarding future educational advancement and thus job placement.

Causes of Obesity

At the most basic level, weight gain is attributed to a simple equation: calories in plus calories out equals a positive number. Of note, one group of researchers explained that the obesity epidemic can be elucidated by persons receiving as small excess of approximately 50-100 calories per day (Hill, Wyatt, Reed, & Peters, 2003). In the end, there are two main reasons for the positive caloric levels: reductions in energy expenditure and/or increases in energy consumption.

Physical Inactivity

Current U.S. 2005 dietary guidelines recommend at least 30-60 minutes of vigorous activity daily. With increases in technology and its presence in the workplace, home, and at school, individuals are less apt to be physically active. For instance, in a study of physical activity, television (TV) viewing, and weight of high school students in the U.S., increased levels of physical activity were associated with lower body mass indices and less TV watching. Eisenmann, Bartee, and Wang (2002) pointed out that the results of their study of high school students show that the mean body mass index was significantly lower in the most vigorous physically active group compared with the less physically active groups. More importantly, the study pointed out that the relationship between TV watching and weight status appears to be more pronounced in terms of a graded response. This response showed that within both

sexes, the high school students were approximately 20 % to 25 % less likely to be classified as overweight if they only watched 2 to 3 hours of TV per day and about 40 % less likely to be overweight if they watched less than 1 hour of TV per day compared with high school students that reported watching over 4 hours of TV a day. Eisenmann et al. (2002) came to a general consensus that youth who were less physically active ended up watching more TV per week.

The association between TV watching, physical inactivity, and body mass index is not only seen in children but also in adults. In a study published in the Journal of the American Medical Association, researchers found that sedentary behaviors such as watching television were coupled with significantly higher risks of obesity and type 2 diabetes (Hu, Li, Colditz, Willett, & Manson, 2003). An interesting statistic noted in this study was that for every 2 hours per day increment of television watched, researchers discovered an associated 23 % increase in obesity. In contrast, investigators discovered that for every one hour per day of walking, there was a 24 % decrease in obesity. Much other research has been completed that concurs with similar findings of physical inactivity and associated obesity risks (Gillman et al., 2001; Gordon-Larsen, McMurray, & Popkin, 2000; Katazamrzyk, Janssen, & Ardern, 2003). Additionally, in a review of literature, Popkin, Duffey, and Gordon-Larsen (2005) reviewed multiple studies that relate the effect of our environment on physical activity or the lack there of. Popkin et al's (2005) conclusions were that environments tend to restrict multiple physical activity behaviors by either promoting or discouraging

physical activity through issues such as access to safe recreation, accessibility to recreational facilities, and transportation options.

Excessive Caloric Intake

The second reason for positive caloric levels is also troubling due to the different aspects that contribute to our current food environment that cause the increases in caloric intake and obesity. There are multiple studies that document the increases in daily energy intake of persons over the past 15 to 25 years. Data collected from the NHANES studies associated the rise in energy intake with an increase in carbohydrate intake of 6 % over the last 20 years (Centers for Disease Control and Prevention, 2004). Another study published by Putnum et al. (2002) reported an average daily energy intake increase of approximately 12 % between 1985 and 2000. They discovered that grains, added fats, and added sugars accounted for 46%, 24%, and 23%, respectively, of this reported increase.

Nutrient density and portion size. To date there are hundreds of studies that have investigated the reasons for increased caloric consumption in the U.S. Most of these studies relate to decreased consumption of nutrient dense foods. Currently, actual consumption of nutrient dense foods such as fruits and vegetables is less than recommended amounts. According to the Continuing Survey of Food Intakes by Individuals (CSFII), between 1994 and 1996, less than 25 % of children met the five a day goal for fruit and vegetable consumption (Krebs-Smith et al., 1996). Patrick and Nicklas (2005) reported that TV viewing has been linked to current food consumption

patterns of children. They suggested that television viewing is a normal part of an eating experience in which fewer fruits and vegetables are consumed, and more snack foods, sodas, and pizzas which are high in sugar and fat are the preferred choice.

Viewing this issue from another direction, results of a study by Kant (2003) between 1988 and 1994 illustrated that greater than 30% of the daily energy intake in the diets of 8 to 18 year olds was from low-nutrient-dense foods such as carbonated beverages, snacks, baked goods, and others in this category. Further analysis showed that sweeteners and desserts accounted for nearly 25% of those low-nutrient-dense foods. With increased television viewing, adolescents are often reported losing track of how much they have actually eaten; this is commonly referred to as 'mindless eating'. According to an article published in the American Journal of Nutrition, portions sizes influence the energy intake of adolescents at meals. Just by doubling the portion sizes of meals and snacks during a 24 hour period contributed to an increase in energy by 23% (Fisher, Arreola, Birch, & Rolls, 2007).

Restaurant meals. Increases in portion sizes were observed in surveys of foods sold for immediate consumption in 2002. Like those found in restaurants, all food portions with the exception of sliced white bread surpassed United States Department of Agriculture (USDA) and Food and Drug Administration (FDA) standard portions (Tohill, Seymour, Serdula, Kettel-Khan, & Rolls, 2004). Furthermore, Patrick and Nicklas (2005) noted a sharp increase, from 34% to 47%, in the normal family's eating out patterns between 1970 and 1990. Further review of the literature illustrated that

meals eaten out are associated with higher intakes of fat and energy compared to meals eaten at home. In a study directed towards obesity prevention, reported increases in the frequency of fast food restaurant use was associated with an increase in body weight, total energy intake, lower dietary restraint, less low-fat eating behaviors, and increased television viewing (French, Harnack, & Jeffery, 2000). As the frequency of eating at fast food restaurants has increased, the consumption of fruits, vegetables, and dairy has decreased. One review conducted revealed that although most data on children remain slightly inconclusive, the data on adults have shown a significant association between higher intakes of fruit and vegetable consumption and lower weight status (Tohill et al, 2004). Additionally, a study published in the International Journal of Obesity reported that fast food/restaurant use frequency was associated with a significantly lower intake of fruits and vegetables, grains, and milk as well as higher intake of soft drinks, cheeseburgers, pizza, and French fries (French, Story, Neumark-Sztainer, Fulkerson, & Hannan, 2001).

Home meals. French et al. (2001) illustrated that at home meals were composed of approximately 31% fat whereas meals eaten away from home were composed of about 38% fat. The presence of fruits and vegetables in the home has been shown to contribute to a healthier diet in adolescents. An additional study investigated the relationship of home fruit, 100% fruit juice, and vegetable availability and accessibility among adolescents (Cullen et al., 2001). Results of the study showed a significant association between child-reported availability and parental reported

accessibility of the child's fruit, 100% fruit juice, and vegetable consumption. Parents control most of the foods entering their home, the way the food is prepared, and the selection of where the family decides to eat.

Further research on correlates of fruit and vegetable consumption among adolescents completed by Neumark-Sztainer, Wall, Perry, and Story (2003) examined the different personal factors, behavioral factors, and socio-environmental factors associated with fruit and vegetable intake. They discovered that the strongest correlates of fruit and vegetable intake were home availability and taste preferences of fruits and vegetables. Furthermore, interaction testing on home availability of fruits and vegetables indicated that when availability was low, intake patterns showed no difference regardless of taste. However, when taste preferences for fruits and vegetables were low, and fruits and vegetables were made available, fruit and vegetable intake increased. This correlates with previous research showing that if fruits and vegetables are available in the home, adolescents report a healthier diet. Social support for healthy eating, family meal patterns, family food security, and socio-economic status were also discovered to be associated with home availability and consumption of fruit and vegetable. Overall, research shows that meals eaten at home and the presence of fruit and vegetables lead adolescents to follow a healthier diet.

Fruit and vegetable consumption. Multiple factors contribute to low fruit and vegetable consumption. Thus, most of the American population is not meeting their

recommended fruit and vegetable intake. Based on the 2003 food supply, according to the *Amber Waves* USDA publication, the average consumption of fruits was at 1.4 servings- well below the recommended 4 servings or 2 cups per day. Additionally, it appears that although vegetable consumption increased to 3.7 servings per day, it still fell short of the recommended 5 servings or 2.5 cups per day that the average adult American should be consuming (Leitbag, 2005).

Purchasing "Healthy" Food

As discussed previously, economics play a large role in healthy eating patterns and consumption of fruits and vegetables. Interestingly, researchers are now recognizing the association between low income, ethnicity, obesity, and higher rates of obesity related disease (Bowman, 2006). What is described by many as somewhat of a paradox, more in-depth research is now being done to determine the causal factors of this association. The paradox being: those individuals who are of low income status and have less money to buy food, in fact, have higher obesity rates. Research has even illustrated that high intake of low-nutrient-dense foods was related to higher energy intake and lower intake of the five major food groups and most micronutrients (Kant, 2003). Ricciuto et al. (2006) found that by large, the average purchasing patterns of Canadian households were largely dependant on household composition, income, size, and education. Results of this study showed that household socio-demographic characteristics appear to negatively influence fruit and vegetable purchasing for the home. Through a review of literature, studies relating to the shopping drive,

purchasing factors, and barriers to buying adequate amounts of fruits and vegetables for appropriate consumption appear to be associated to health, environmental accessibility and convenience, and pricing.

Health Motivations

In studies investigating influences of fruit and vegetable purchasing patterns, health, disease prevention, or weight control never appeared to be of consequence to participants. Furthermore, in a research comparison of socioeconomic characteristics, dietary practices, and health status of women food shoppers with different food price attitudes, participants were found to be aware of the diet and disease relationship. Approximately two-thirds of women in both groups thought that what they ate could make a difference in disease prevention such as heart disease or cancer. However, most of these women reported having heart disease, diabetes, or high blood pressure (Bowman, 2006). This indicates that health is not the primary motivator of fruit and vegetable purchasing in the United States.

Additional research performed in the United Kingdom reported that those connections made by individuals about the diet and disease relationships revolved around beliefs about food processing and the associated chemicals (Dibsdall, Lambert, & Frewer, 2002). Further investigations discovered that the importances of nutrition and weight control were third and fifth, respectively, out of five factors related to food choices (Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). Interestingly, in an investigation of low income consumers' attitudes and behavior towards access,

availability, and motivation to eat fruit and vegetables, greater than 70 % of participants believed that they were already eating healthily. However, only 18 % of participants claimed to eat five or more portions of fruits and vegetables daily that correspond to recommended intake guidelines (Dibsdall et al., 2002). Despite the known relationships, research continues to show that health is not a predominate factor in food purchasing, especially that of fruits and vegetables.

Accessibility Motivations

Important factors related to fruit and vegetable purchasing patterns are associated with accessibility and convenience. Availability and cost may not be the only barrier to adequate fruit and vegetable intake. Many lower-income groups may not believe that frozen and canned vegetables account for actual recommended intake as well as fresh produce. Yoo et al. (2005) determined that the frequency of food shopping allows families to keep a variety of fresh fruit and vegetables at home while less frequent shopping appears to require the purchase of frozen and canned fruits and vegetables to enhance home availability. Less frequent food shopping may correspond to those individuals or families that may be receiving food stamps or may be participating in food assistance programs and thus have lower incomes. Some studies researched the education effect on treatment groups (Mitchell et al., 2000; Raynor, Kilanowski, Esterlis, & Epstein, 2002). Thus the inclusion of canned or frozen fruits and vegetables in diet recalls may be needed to assess any difference in cost or if there

a possible lack of education that may contribute to decreased fruit and vegetable intake (Mitchell et al., 2000; Raynor et al., 2002).

Glanz et al. (1998) discovered that the only predictor for fruit and vegetable intake that was considered to be universally important was taste. Further information showed that the other factors investigated in this study (nutrition, cost, convenience, and weight) appear to be important in determining food consumption as long as the food is seen as tasting good. Investigators also concluded that there was a positive relationship between the importance of convenience and fast-food consumption versus the negative association between convenience and consumption of fruits and vegetables and breakfast cereals which suggests that people who believe fast food is more convenient than fruits, vegetables, and breakfast cereals will eat fast food more often.

Furthermore, research has shown that there appears to be differences in grocery store availability of fruits and vegetables related to low income groups/areas. Chung and Myers (1999), who conducted an empirical analysis of grocery store access and prices in communities within the Minneapolis and St. Paul metropolitan area, found that chain grocery stores were more likely to be located in non-poor zip code areas. The study showed that there is a clear relationship between less access to large grocery store chains where prices and selection tend to be lower. Additionally, researchers compared the revenues of these chain grocery stores with that of non-chain stores and discovered that those chain stores with excess of $10 million revenue were more likely

to be located in low-poverty rate areas versus small or non-chain stores. Cheadle et al. (1991) found significantly positive correlations in community and zip code levels between the availability of healthful products in grocery stores and the reported healthfulness of an individual's diet. Many studies discuss geographic-income areas as potential barriers to appropriate intake of fruits and vegetables.

Rose and Richards (2004) explored and ascertained that easy access to supermarket shopping appears to be correlated with increased household use of fruits. Since participants of this study sample were selected from the low-income groups that participated in the Food Stamp Programs, participants were particularly at risk for decreased access to supermarkets. This study specifically examined combined variables that corresponded to food access: car ownership, round trip distance traveled to the supermarket, and if their principle store was a supermarket. This study revealed that participants living greater than five miles away from their principle food store consumed 62 grams per day of fruit less than those participants who lived less than a mile away. Distance from home to food store was inversely associated with fruit use by households. Although not significant, similar patterns were seen with vegetable intake at 36 grams per day greater for those participants who lived less than one mile away than those who lived greater than five miles away.

Further research by Horowitz, Colson, Hebert, and Lancaster (2004) explored barriers to buying healthy food for individuals with diabetes. With store surveys, investigators compared the availability of food for diabetics (specifically low fat or

skim milk, diet soda, high fiber bread, low-carbohydrate bread or both high fiber and low carbohydrate bread, fresh fruits, and fresh vegetables) among two neighborhoods in New York that were adjacent to each other but differed vastly in income/economic status and race/ethnicity. The two neighborhoods where the study occurred were the Upper East Side and East Harlem. In the Upper East Side, where the median income was four times that of East Harlem, researchers found that stores located in the Upper East Side were 3.2 times more likely than East Harlem stores to be desirable by stocking all the food items noted above that investigators were looking for. As this particular study noted, convenience was a primary factor to non-whites (approximately 90 % of residents in East Harlem were either considered to be of black or Hispanic race/ethnicity). The Upper East Side was less diverse with 84 % of the residents being of white, non-Hispanic race/ethnicity. Consequently, East Harlem appeared to have significantly more small grocery stores or 'bodegas' which were far more unlikely to carry all five food items.

Race and poverty appear to correlate with access to healthy foods. For instance, one study concluded this with a survey of the St. Louis, Mo area in which 2000 census data were used to assess the racial distribution and percentage of people living below federal poverty with audits of community supermarkets and fast food restaurants (Baker, Schootman, Barnidge, & Kelly, 2006). Researchers discovered that high poverty areas regardless of race were less likely to have access to food outlets than residents in primarily white higher income communities (36 supermarkets

and 170 fast food restaurants in < 10% census tract in poverty versus 10 supermarkets and 28 fast food restaurants in >20% census tract in poverty) (p. 10). Similar findings were seen when supermarkets and fast food restaurants were assigned a rating for meeting dietary intake recommendations established by the USDA. There were more supermarkets and fast food restaurants with higher ratings located in higher income areas thus making lower income areas and the residents there incapable of making healthy food choices based on availability.

Cost Motivations

Cost has been depicted through various studies as a major barrier to healthy eating. Lower income women cited the high cost of fresh fruit and vegetables, their short shelf life, and limited storage space as major barriers to fruit and vegetable consumption (Giskes, Turrel, Patterson, and Newman, 2002; Reicks, Randall, and Haynes, 1994; Treiman et al., 1996). In a cross-sectional survey of Americans, Glanz et al. (1998) researched the associations of taste, nutrition, cost, convenience, and weight control on personal dietary choices. Cost of food was second only to taste regarding the influence it had on food choices.

Within the last 20 years, the Consumer Price Index for food at home has increased by 3 % per year, thus indicating moderately stable food prices over time (Leitbag, 2005). However, there are many facets to the variations in food cost. Store layout in these low income areas has also been shown to affect what individuals tend to buy. Leibtag discussed the impact of store formats and regional differences on

retail food prices in Amber Waves. It was reported that prices tend to vary by region up to approximately 11% due to production costs, transportation of food, consumer preferences, competition in the market, and USDA price regulation. Store formats can relate to increases seen in food prices due to their physical characteristics (i.e. services offered, operating practice, square footage, remodeling), products offered, business practices, and marketing strategies. Lower income areas and the families that live there may experience transportation problems and poor store formats which correspond to higher prices for food.

Drewnowski (2004) has brought more light to the situation regarding energy dense foods costing less thereby decreasing individuals' ability to include healthier food in their grocery store shopping. More specifically, items with added sugars and fats are easier to produce, process, transport, and store than meats, dairy products, or fresh produce. Interestingly, Putnam and colleagues discussed how the retail price of fresh fruit and vegetables increased by 118 % between 1985 and 2000; whereas there was only a 35 % price increase for fats and oils and a 20 % increase in the cost of carbonated soft drinks (Putnam et al., 2002).

Studies that investigated the cost of adopting healthy diets appear to have varying results from increases in food cost to decreases in food cost. Two separate studies, a United Kingdom cohort of women and a Danish children's hypercholesterolemia intervention study, reported that consuming a healthy diet was more expensive. The Danish hypercholesterolemia study concluded that decreasing

dietary fat from 35 % to 25 % of the total dietary energy would increase food cost approximately 10 % to 20 %. In particular, the cost of the lower fat diet increased with higher reported vegetable, fruit, and juice consumption. Between groups, fruits and vegetables comprised 24 % per 10 megajoules (MJ) of the hypercholesterolemia group versus 10 to 13 % per 10 MJ of the non-hypercholesterolemia group. However, results of this study did not state a conclusion that diet change over a longer period of time would result in similar economic consequences and that population demands may lead to varying price levels (Stender et al., 1993).

Additionally, the UK cohort of women compared the extreme healthy diet indicator groups. In this comparison, the highest healthy diet indicator groups spent 1.48 £ more per day than the lowest healthy diet indicator group. In this particular study, researchers discovered that fruit and vegetable expenditures were the primary items that made a healthier diet more expensive. For the healthiest diet indicator group, fruit and vegetable cost was 49 % of the food budget while the lowest healthy diet indicator group only spent 29 % of the food budget on fruits and vegetables. Interestingly, approximately 71 % of individuals in the healthiest diet indicator group and 60 % of those in the least healthy diet indicator group did not believe that following a healthier diet was more expensive (Cade, Upmeier, Calver, Greenwood, 1999).

Another study of freely chosen diets of French adults and the cost of replacing fats and sweets with vegetables and fruits showed that for every additional 100 grams

of fats and sweets consumed, there was an associated reduction in cost 0.05-0.40 Euros per day. Furthermore, for every additional 100 grams of fruit and vegetables consumed per day there was an associated 0.18-0.29 Euro increases per day (Drewnowski et al., 2004).

In contrast, a study assessing the average Italian food pattern and how it affected expenditure for food related to following the Recommended Dietary Allowance (RDA) cut-offs, determined that buying foods only to meet the RDA are minimal in cost. Researchers further concluded that most food expenditures, in regards to the Italian diet, are more related to taste and habits of consumption (Conforti & Amicis, 2000). An obesity intervention study and a Children's Health Project nutrition education intervention study conducted in the United States found that there were no significant effects of adopting a healthful or lower fat diet on food costs. In the Children's Health Project study, Mitchell et al. (2000) found that the consumption of a low-fat diet did not affect food cost. The intervention group appeared to have non-significant lower associated food costs. With the intervention group, diet recalls taken at baseline and twelve months showed a decreased average cost of $ 0.24 per day spent +/- $1.09 (p. 102). Yet, this particular study did not focus on increased or decreased fruit and vegetable intake over time, but rather the investigators focused on the changes made by participants to lower fat products.

Additionally, Raynor et al. (2002) reported that a diet of lower energy, nutrient dense foods did not increase dietary costs over time. Twenty-four hour diet recalls

taken at baseline, six months, and twelve months during the intervention showed that although there was no significant decrease in cost from baseline to six months, there was a significant decrease in cost at twelve months with respect to baseline (see Table 1). Cost per 1000 kcal did not change, and thus investigators concluded that the change from baseline to one year was a result of the decreased intake of nutrient dense foods (see Table 1). Additionally, this study merely separated the 24-hour recalled foods into three categories: green, yellow, and red foods by fat content rather than focusing solely on fruit and vegetables. Since this study was longitudinally done, researchers were able to compare the difference of cost over time and concluded that with time, food choices and cooking methods may be implemented to provide for lowering food costs while continuing a healthful diet. The amount of contradicting research done on vegetable and fruit intake with associated costs allows for further studies on the topic.

Table 1

Daily Dietary Costs

Total cost	
Baseline	6.77 +/- 2.41
6 months	6.38 +/- 2.42
12 months	5.04 +/- 1.80
Cost/1,000 kcals	
Baseline	3.69 +/- 1.44
6 months	4.58 +/- 1.86
12 months	4.11 +/- 2.21
Cost for red[a] food servings	
Baseline	4.31 +/- 2.20
6 months	3.18 +/- 2.69
12 months	2.44 +/- 1.39
Cost for green[b] food servings	
Baseline	1.63 +/- 1.29
6 months	2.34 +/- 1.62
12 months	2.02 +/- 1.63

Note. All cost represented in dollars. [a]red foods = > 5 grams fat/serving and/or are low in nutrient density. [b]green foods = nutrient dense foods with 0-1 gram of fat/serving.

Leitbag and Kaufman (2003) reported that low-income households appear to purchase 3.3 % less fruits and vegetables by weight than higher-income households. Yet, lower income households are paying 13 % less. Conclusively, researchers theorize that lower-income households are purchasing fruits and vegetables but this includes fruits and vegetables that are less expensive. Total fruit and vegetable purchasing in 1998 was approximately 41.45 pounds of fruit and 25.02 pounds of vegetables per person (see Table 2). Total expenditure in 1998 for fruit and vegetable per person was $49.10 (see Table 2). Taking into account the previous research indicating that individuals living in the United States are not reaching their recommended fruit and vegetable intakes, it must be assumed that approximately ten years later, these recommended dietary intake levels are still not being met and that fruit and vegetable costs per person could possibly increase to meet recommended levels or stay the same by placing the lower nutrient dense foods that are taking the place of fruit and vegetable intake.

Table 2

Income Comparison with Money Spent on Fruits and Vegetables

Product/income level	Expenditure/person[a]	Quantity/person[b]	Price/pound[c]
Random Weight Fruit			
Total	28.73	41.45	0.69
<$35,000	26.90	40.88	0.66
$35,000-$49,999	27.44	39.25	0.70
$50,000+	31.70	43.33	0.73
Random Weight Vegetable			
Total	20.47	25.02	0.82
<$35,000	20.06	25.90	0.77
$35,000-$49,999	17.96	21.72	0.83
$50,000+	22.31	25.70	0.87

Note. [a] Expenditure/person represented in dollars. [b]Quantity/person represented in pounds.

[c]Price/pounds represented in dollars

CHAPTER III

METHODS

Participants

Participant demographic and food intake data were obtained from a previous study of the reliability and validity of a food frequency questionnaire aimed at youth and adolescents (Cullen & Zakeri, 2004). Institutional review board (IRB) approval for this study was previously obtained by the Baylor College of Medicine. Forms for exempt from full IRB review were submitted to the Texas Woman's University IRB.

Demographics

The original study included 102 seventh and eighth graders from two predominately low income schools located in Houston, Texas. Income level was illustrated with 99 % and 74 % of students being eligible for free and/or reduced cost meals at the two schools. Informed consent forms were distributed and sent home to all students in five classes with approximately 30 students per class. There were a total of 102 informed consent forms returned. Student participants were given $30 compensation for completing the study.

Participant Procedures

The team of trained investigators visited the two schools six times within a period of three weeks during the home room period. During the first visit,

demographic questions and a baseline food frequency questionnaire was given to all participating students. The items on the questionnaire were read to each class. For the next four visits, a twenty four-hour food record listing the type and amount of food and beverages consumed for the previous day were recorded. One weekend food record was sent home with participants on a Friday to record daily food intake Friday through Sunday. On the following Monday, the 24-hour food records were reviewed and collected. Trained data collectors assisted and checked food records daily for missing data. A second food frequency questionnaire was completed on the sixth and final visit. In total, the study encompassed a 21 day time period and included two weekend days, four weekdays totaling a possibility of six 24 hour food records and two food frequency questionnaires.

Food Record Analysis

Food records were analyzed with the University of Minnesota Nutrient Data System Software (version 2.91, 1996, Food Database version 12a). Kilocalories, percent kilocalories from fat, and servings of fruit, 100% fruit juice, and regular and high fat vegetables were obtained. Any unavailable nutrient data were extrapolated based on nutrient content of other nutrients of the same food, with product ingredient lists, or they were estimated based on nutrients of similar foods. Any missing values were allowed if they were thought to be negligible, if the food eaten was usually in small amounts, or if there was unknown nutrient content because the food was unlike any other.

Food Cost Collection

Food costs were determined by the investigator. The distribution of individual fruit and vegetable intake was determined for the entire sample of students. Thirty records with the highest amount of fruits and vegetables, and 30 with the lowest amount of fruits and vegetables were selected based on the distribution of fruit and vegetable intake. Two separate grocery stores within the previous study area were selected to maintain socioeconomic and demographic similarities to the sample of the population studied. The investigator visited each store and recorded the lowest generic brand price and the lowest name brand price of each item listed on the food records. These food items included canned, fresh, and frozen versions of the food items. In addition to price, size or weight of the item, and brand name were recorded. Food items determined to be from fast food restaurants, theaters, and school a-la-carte and vending machines were collected separately in the corresponding place where they where purchased, close to the same demographic/socioeconomic area as the study population. School a-la-carte and vending machine items were priced according to the price list found on the Houston Independent School District website (HISD, 2007).

Food Cost Determination

Prices per portion of the items were determined for each food item listed. Food items which included mixed foods were included, and the amount of each was determined by the detailed food records provided. Standard determination of percent

yield was used when determining food items' portion size in which cooking would reduce the actual edible portion (Brown, 2004). The average over the two randomly selected grocery stores were taken for each food item separated by lowest generic price and lowest brand name price.

Pricing Methods

Prices were entered according to three varying costing methods. The first two pricing methods were calculated disregarding where the items for meals were made/bought to act as a baseline only inclusive of grocery store pricing and fast food items where the food places and prices were absolute. Lowest generic brand price average is a baseline of food items recorded on the single day food record for each individual. The second pricing method included the summation of each single day food record using the average of the two grocery stores' lowest brand name price. The last method which is termed 'alternate price', is inclusive of where these items were bought according to their single day food record. For example, items that were provided as 'school free lunch or breakfast' were given a total cost of zero whereas items that were bought at a theater, fast food restaurant, or school a-la-carte/vending machine were given their respective dollar amounts determined through price collection. All food items for each single day food record were summed individually and have three separate prices according to the previous methods mentioned.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS version 14.0) software. Hypotheses were tested using analysis of variance (ANOVA) and *t*-tests. The significance level was set at $p<0.05$.

CHAPTER IV

RESULTS

Data were analyzed for 60 participants (see Table 3). The sample population were approximately split in half regarding gender, with 31 (51.7%) male and 29 (48.3%) female participants. Variance among participants between grades were also similar with 29 seventh graders and 31 eight graders within the study population. Additionally, ethnic variation within the study population was defined as 40% African American, 26.7% Mexican American, and 33.3% White. Subjects were randomly selected for half of the participants (30) who consumed zero servings fruits and vegetable per day and the remaining half (30) who consumed four or more servings of fruits and vegetables per day. Of the 60 participant single day meals studied, 40 (66.7%) recorded eating zero restaurant meals, and 20 (33.3%) ate at least one restaurant meal. The majority of meals were recorded on weekdays versus weekends within the 60 single day meal records. No meals were recorded on a Wednesday.

Table 3

Demographics and Frequencies of Participants

Variable	Frequency	Percent (%)
Ethnic		
African American	24	40
Mexican American	16	26.7
White	20	33.3
Gender		
Male	31	51.7
Female	29	48.3
Grade		
7th	29	48.3
8th	31	51.7
Servings F/V[a] consumed		
0 F/V	30	50
≥4 F/V	30	50
Restaurant meals consumed		
0 meals	40	66.7
≥ 1 meals	20	33.3

Table 3 (continued)

Demographics and Frequencies of Participants

Variable	Frequency	Percent (%)
Day of the week		
Friday	9	15
Monday	9	15
Saturday	8	13.3
Sunday	7	11.7
Thursday	14	23.3
Tuesday	13	21.7

Note. $n = 60$; [a]F/V = fruits and vegetables

Summation of the study population, exhibited in Table 4, illustrates that the average servings of fruit and vegetables consumed were 2.48 servings *(SD* = 2.65). The number of meals per day consumed were 3.16 *(SD* = 0.69), and the restaurant meals consumed per day averaged approximately one third per participant *(SD* = 0.47). Total caloric intake averaged 2145 kilocalories *(SD* = 589) with 1.2 servings of fruits and vegetables per 1000 kilocalories *(SD* = 1.39). For the entire study population, mean costing per day using the baseline store value generic brand was $3.78 *(SD* = 2.08), while the baseline brand name costing per day was $5.10 *(SD* = 2.16). "Alternate" food cost prices per day averaged approximately $4.70 *(SD* = 2.96).

Table 4

Mean Characteristics of Fruit and Vegetable Consumption and Food Costs

Variable	Mean
Servings F/V[a] consumed	2.48 -/+ 2.66
Generic brand average food pricing ($)	3.79 -/+ 2.09
Brand name average food pricing ($)	5.11 -/+ 2.16
Alternate average food pricing ($)	4.71 -/+ 2.97
Total kilocalories consumed/meal	2145.10 -/+ 589.89
Servings F/V[a] consumed/1000 kilocalories	1.24 -/+ 1.39
Number meals/day	3.17 -/+ 0.69
Restaurant meals/day (0 vs. >/= 1)	0.33 -/+ 0.48

Note. [a] F/V = fruits and vegetables

The results for hypothesis one (daily food costs will not differ for adolescents based on daily food costs of store/generic name foods compared with name brand foods) are presented in Table 5. Using *t*-testing, significant differences were discovered between the food costs using generic brands versus name brand food items. Thus, hypothesis one is rejected ($p = 0.000$). The price of one days worth of food using generic brand items was significantly less ($3.78+/-2.08) than buying name brand food items ($5.10+/-2.16).

Table 5

Comparison of Generic Brand Costs and Name Brand Costs

Variable	Means -/+ *SD*	*p* (two tailed)	95% CI	
Generic brand average daily food pricing ($)	3.79 -/+ 2.09	0.000*	3.25	4.33
Name brand average daily food pricing ($)	5.11 -/+ 2.16	0.000*	4.55	5.66

Note. $n = 60$, *SD* = standard deviations, p = probability, *CI* = confidence interval, illustrated using lower to upper confidence limits. Using *t*-test, *Statistically significant p value < 0.001

The results for hypothesis two (daily food costs will not differ for adolescents consuming >/= four servings of fruits and vegetables compared with those consuming zero servings of fruits and vegetables based on various costing methods: generic brand average food costing, name brand average food costing, and 'alternate' average food costing) are illustrated in Table 6. The average daily food cost for participants with low fruit and vegetable intake (n = 30) was $4.05 for generic brands, $5.20 for name brands, and $4.37 for 'alternate' costs. Conversely, the average daily food cost for participants with high fruit and vegetable intake (n = 30) was $3.52 for generic brands, $5.01 for name brands, and $5.04 for 'alternate' costs. Using ANOVA, results showed no significant difference between high and low fruit and vegetable consumption groups and all three costing methods ($p = 0.337$, $p = 0.732$, $p = 0.384$). Therefore, hypothesis 2 was accepted or fails to be rejected.

Table 6

Comparison of Fruit & Vegetable Consumption and Daily Food Costs

Type of Pricing	Means -/+ *SD*	*p*	95% CI	
Generic brand average daily food costs				
0 F/V[a]	4.05 -/+ 2.50		3.12	4.98
≥4 F/V[b]	3.53 -/+ 1.58	0.337	2.94	4.12
Total	3.79 -/+ 2.09		3.25	4.33
Name brand average daily food costs				
0 F/V[a]	5.20 -/+ 2.32		4.34	6.07
≥4 F/V[b]	5.01 -/+ 2.02	0.732	4.26	5.76
Total	5.11 -/+ 2.16		4.55	5.67

Table 6 (continued)

Comparison of Fruit & Vegetable Consumption and Daily Food Costs

Type of Pricing	Means -/+ *SD*	*p*	95% CI	
'Alternate' average daily food costs				
0 F/V[a]	4.37 -/+ 2.84		3.31	5.43
≥4 F/V[b]	5.04 -/+ 3.10	0.384	3.88	6.20
Total	4.71 -/+ 2.97		3.94	5.47

Note. $n = 60$; *SD* = standard deviations, p = probability, *CI* = confidence interval, illustrated using lower to upper confidence limits. [a] 0 F/V = no fruits or vegetables consumed during single day diet recall. [b] ≥4 F/V = at least four fruits and vegetables consumed during single day diet recall. Using ANOVA, no significant differences were revealed.

Table 7 illustrates the results for hypothesis three using ANOVA (daily food costs will not differ for those adolescents that ate >/= one restaurant meal compared with those adolescents that ate zero restaurant meals based on generic brand average food costing, name brand average food costing, and 'alternate' food costing). There were significant differences in food costing for all three costing methods. Children who ate one or more restaurant/fast food meals had higher food costs compared with those who ate no restaurant/fast food meals within one day. For those participants that ate more than one restaurant meal per day, daily food costs averaged approximately $4.96 for generic brands, $5.98 for name brands, and $6.78 for 'alternate' costs. Participants who ate no restaurant meals per day, averaged daily food costs of $3.20

for generic brands, $4.70 for brand names, and $3.67 for 'alternate' costs. There was a significant difference in generic brand daily food costs between participants consuming no restaurant meals and those consuming >/= one restaurant meal per day ($p = 0.001$). Name brand average food costing between the groups was similarly significant with a p value < 0.05 ($p = 0.036$). Lastly, 'alternate' food costing showed a strong significant difference between the groups with a p value < 0.001 ($p = 0.000$). Thus hypothesis three was rejected.

Table 7

Comparison of Restaurant Meals and Daily Food Costs

Type of Pricing	Means -/+ *SD*	*p*	95% CI	
Generic brand average daily food costs				
0[a]	3.20 -/+ 1.38		2.76	3.64
≥1[b]	4.96 -/+ 2.72	0.001**	3.69	6.24
Total	3.79 -/+ 2.09		3.25	4.33

Table 7 (continued)

Comparison of Restaurant Meals and Daily Food Costs

Type of Pricing	Means -/+ *SD*	*p*	95% CI	
Name brand average daily food costs				
0[a]	4.70 -/+ 1.76		4.13	5.25
≥ 1[b]	5.93 -/+ 2.66	0.036*	4.68	7.17
Total	5.11 -/+ 2.16		4.55	5.66
"Alternate" average daily food costs				
0[a]	3.67 -/+ 2.51		2.87	4.47
≥1[b]	6.78 -/+ 2.77	0.000***	5.48	8.07
Total	4.71 -/+ 2.97		3.94	5.47

Note. [a]0 = no restaurant meals consumed for single day diet recall; [b]>/= 1 = one or more restaurant meals consumed for single day diet recall; Using ANOVA; *Statistically significant p value <0.05; **Statistically significant p value < 0.01; ***Statistically significant p value < 0.001.

CHAPTER V

DISCUSSION

Significantly higher food costs were found for adolescents when brand name foods were used in analysis rather than generic food costs, as evidence in the results of the first hypothesis. In the low income study area, it would be assumed that parents for these adolescents would be buying items generally known as less expensive. Consumerism and product marketing promotes brand name buying, however, those who are lower income often buy the generic brands due to the lower prices offered. Brand names are defined as:

> a customer experience represented by a collection of images and ideas; often, it refers to a symbol such as a name, logo, slogan, and design scheme. (Agnes, 2002, p. 177)

Whereas generic brands usually refer to merely the class/type of item regardless of company and marketing association. According to recently published articles by Consumer Reports and Dairy Foods in 2006, store brands or generic brands are becoming more and more popular to consumers. Recent research suggests that store's labels now account for between 17-20% of the products on grocery store shelves compared to approximately 1-2% 30 years ago (Anonymous, 2006; Phillips, 2006). Additionally, Phillips of Dairy Foods reported that total sales of store labels (generic brands) have grown to greater than 105 billion dollars with continued growth expected.

This is also observed with the 5% growth rate of store/generic brands compared with that of national brands at 2% (2006).

The research completed within this respective geographic area corresponds to the previous research that generic items are in fact less expensive than brand name items. Consumer Reports confirmed the study results in reporting that store brands, on average, are cheaper than national or name brands by 26-28% across all categories with similar quality comparisons (Anonymous, 2006).

Although the determined daily food costs were not significantly different between low and high fruit and vegetable consumption groups and food costing methods, illustrated with hypothesis number two, the fact that there is no difference is worth noting. General consumer consensus as well as research studies have reported that eating healthier is often times more expensive (Cade et al., 1999; Drewnowski et al., 2004; Stender et al., 1993). This usually refers to the cost of buying fresh produce. Foods provided as fresh produce in the grocery stores are also available in a variety of forms such as canned and frozen; as this was taken into account in this study. Thus, if daily food costs for adolescents who consume at least four servings of fruits and vegetables per day show no significant difference in cost compared to those adolescents who consume no servings of fruits and vegetables each day, then cost is no longer a barrier to higher fruit and vegetable consumption/healthy eating in adolescents. This contradicts what many previous studies have stated regarding the higher food costs of

consuming fruits and vegetables and thus the inability of low-income families to eat well balanced meals.

Variety in fruit and vegetable consumption among the high fruit and vegetable groups appeared limited to items including a few fresh fruit, canned fruit, 100% fruit juice, yams, potatoes, green beans, corn, cabbage, carrots, and salad. Individually, the vegetables that were most consumed were potatoes (40 servings), corn (22 servings), green beans (15 servings), cabbage (12 servings), and salad (14 servings). Eight individual servings of fresh fruit, 12 servings of 100% fruit juice, and one serving of canned fruits were recorded. Interestingly, the fresh fruit was largely provided by the school's after school snack program. Providing easy and free access to fresh fruits may have contributed to higher fruit consumption to individual adolescents that participate in the after school snack program. Reinaerts and colleagues tested programs to increase fruit and vegetable intake. Both a free fruit and vegetable distribution program and multi-component program were found to significantly increase fruit and vegetable consumption by 0.2 portions per day. The free fruit and vegetable distribution program was the most effective of the two tested programs and led to an increased 24 hour fruit/juice and vegetable intake among the youngest and eldest children (Reinaerts, de Nooijer, Candel, & de Vries, 2007). In contrast, snack items and sweetened beverages appear to overpower recorded servings of fruit and vegetable. Overall, over the 60 days, adolescents reported consuming 58 cans or bottles of soda or sweetened beverages, 26 servings of chips, 12 servings of candy, 5 servings of ice cream, and

approximately 40 servings of baked goods (including doughnuts, cake, brownies, and cookies).

Though many researchers point out that the cost of refined sugars appear to be on a continually decreasing trend over the last 20 years, thereby providing lower income groups a possible explanation for decreased fruit and vegetable consumption, the mean caloric intake of the entire group remains similar to that of the NHANES study data and recommended intake levels according to the Recommended Dietary Intake levels. Dietary recalls of individual adolescents in the study population revealed that average intakes (2145 +/- 589 kilocalories) were similar to NHANES data regarding average caloric intake at approximately 2200 kilocalories for females and 2400 kilocalories/day for males (Carlson, A., Lino, M., Juan, W-Y., Hanson, K., & Basiotis, P.P., 2007; United States Department of Agriculture, 2007). Decreased price of refined sugars may play a role in the way lower income groups shop for food; however, based on the dietary recalls of the adolescents in the study group that were able to record where items were from, at least one-third of the items aforementioned were bought from places with notoriously higher prices than grocery stores (where items may be bought in bulk) including vending machines, the a-la-carte line at the participating schools, and theaters.

Fruit and vegetable consumption of the study population averaged less than the recorded average consumption patterns in the U.S. according to the Department of Agriculture. While the current study's participants averaged approximately 2.4 +/- 2.6

servings of fruits and vegetables per day, the USDA reports the average daily fruit consumption for adolescents at 1.4 servings and vegetable consumption at 3.7 servings (Lietbag, 2005). Important to note, however, is that the current study participants were randomly selected based on zero servings of fruit and vegetable consumption versus greater than four servings of fruits and vegetables per day and thus there may be sampling discrimination.

The most recent Thrifty Food Plan (TFP) was established in 2006 to correspond to the new 2005 U.S. Dietary Guidelines and to appropriate adjustments for inflation. According to Carlson et al. (2007), the new TFP can meet the nutrient needs with minimal costs. The TFP is also the basis for which the U.S. Food Stamp Program determines allotment amounts that low-income families receive monthly for food costs. Although the participation in the Food Stamp Program was not recorded, it may have additional effects relating to direct costs of food.

As reported in the study, the average daily cost of food for both high and low fruit and vegetable consumption groups was $3.78 -/+ 2.08 based on generic brand pricing, of which it is assumed that low-income shoppers would largely buy products from. Through research of the maximum food stamp allotment in Texas, the standard family of four would receive about $506 per month (Texas Health & Human Services Commission, 2006). Remembering that the food stamp allotment is only meant to be supplemental to monthly food costs (providing ~70%), this would mean that the TFP is expecting a low-income family of four to spend approximately $722 per month,

$180.50 per person, and $5.93 per day per person. Accordingly, this price is actually higher than what was determined through food purchasing methods using generic brand food items of individual one day diet records. The mean price for meals per day using brand name food items for both groups was $5.10 -/+ 2.16. Interestingly, this is also below the daily per person average for which the TFP was set at. This may be explained by the fact that the TFP reports to include the use of convenience food items, waste, and spoilage.

This study determined that the average price corresponding to the 'alternate' pricing method was $4.70 -/+ 2.96. 'Alternate' method prices fell between the two mean pricing methods and illustrates how the place of purchase was taken into account rather than the items that just came from grocery stores or items from known fast food restaurants. It also illustrates and exemplifies the fact that the TFP is based on the preparation and cooking of foods at home. Foods that were recorded to be obtained by the school lunch line were priced at zero through the "alternate" pricing method with the basis that in this particular school, since the majority of the students attending were reported to be low-income, school lunches as well as breakfasts were free to all students. Interestingly, this does not prevent the students from buying their food from the a-la-carte line or their parents providing them with the funds to do so. Out of the 60 adolescents in the study population, only 14 (23.3%) reported participating in the school lunch or breakfast programs. From the study population, it seemed that there was limited effort to save money through the use of school free lunch and breakfast.

Intriguingly, fruit and vegetables provided through the school free lunch and breakfast programs did not seem to play as big a role in consumption patterns of this adolescent population.

In contradiction to this information, some research has stated that high costs of food in certain geographic areas affect the abilities of those households who receive foods stamps to make healthy food choices. Nord and Hopwood (2007) reported that food costs vary through geographic area and in Houston, Texas the cost of food is about 103% the national average, and thus the amount received by food stamps is slightly in the negative. This may be explained through the allocation of funds to food eaten away from home. Blisard and Stewart (2006) reported that the typical low income household spends about the same amount on total food as the overall TFP benchmark, but these households do not allocate these monies to the appropriate food groups corresponding to the TFP benchmark. They also discovered that the average low-income family allots approximately 20% of their TFP budget to eating outside the home (Blisard & Stewart, 2006). Similarly, competitions to the uses of the food dollar among low-income households reportedly are represented as: 26 cents of a food dollar spent on food away from home and 74 cents of a food dollar on items purchased at a grocery store. Furthermore, making up almost one-third of the grocery store items purchased (22 cents) were 'other foods' inclusive of frozen prepared meals, pre-packaged preparation foods, snacks, condiments, seasonings, sugar, sweets, fats, oils, and nonalcoholic beverages. Fruit and vegetables (12 cents) fell to third on the hierarchy of food dollar

allocation of the grocery store dollar. Through research, increases in income produces little increases in purchasing and resulting consumption of fruits and vegetables (Frazao, Andrews, Smallwood, & Prell, 2007).

According to Frazao and colleagues (2007), the main driver behind the pattern of increasing food expenditures is food eaten away from home. The results for hypothesis three in this study support this finding. Previous investigation across seven income categories found that food away from home makes up an estimated two-thirds of reported increases in food spending (Frazao et al., 2007). Reportedly, for the lowest income levels, food away from home accounted for one-fourth of the food budget. The strongest relationship found during the current research resulted in the cost difference of individuals who ate away from home (excluding meals provided at school under the National School Lunch/Breakfast Program). Meals eaten away from home came primarily from fast food establishments. Thus, across all pricing methods, eating at fast food establishments resulted in a more expensive daily food cost. This dispels the general consensus that fast food is generally regarded as less expensive. Fast food seems to appeal more to a factor of convenience and time.

Limitations

This study had several limitations. A primary limitation was the small sample size. Research including more participants and research will likely be necessary to accurately depict cost standards and patterns of adolescents in low-income households. Additionally, although there were trained personnel obtaining the dietary information

from the adolescents, there may be inconsistencies in the reported intake compared to that of actual intake. Furthermore, the study was limited to one geographic area, and thus generalizability is decreased.

CHAPTER VI

CONCLUSIONS AND FUTURE RESEARCH

Daily food cost analysis revealed that purchasing generic brands over name brands can decrease the price of meals inclusive of healthy eating with increased fruit and vegetable intake. Additional research has revealed that generic or store brands are becoming more available to consumers to take advantage of to help reduce daily food costs.

Additionally, as no significant differences were found in food cost comparatively between high fruit and vegetable consumption groups and low fruit and vegetable consumption groups, it can be assumed that in this specific geographical area the cost of buying healthier foods or increasing fruit and vegetable intake in adolescents should not be a relevant barrier to healthy eating. In comparison to the national guidelines of the Thrifty Food Plan, low-income households living in Houston, Texas should be able to afford appropriate nutritious meals with minimal costs or costs similar to those who consume no fruits and vegetables through corresponding budgeted shopping practices.

As more and more research indicates that restaurant meals or meals away from home correspond to higher fat and higher energy intake, the added cost of restaurant or meals away from home seem to work synergistically. Abstaining or limiting the amount of meals eaten away from home will not only allow for more

nutritious meals to be made at home and allow for more family sociability but it will also help decrease the daily food costs. If low-income families redirected their monies away from fast food meals predominately consisting of high sugar and high fat items, to purchasing more fruits and vegetables in any form, they may be able to reduce the potential risks associated with unhealthy dietary intake such as obesity and its corresponding co-morbidities.

In summary, accounting for the poor nutrient content of fast food/restaurant meals and their cost along with non significant difference in cost of varying levels of fruit and vegetable consumption; adolescents and families in low-income areas should be able to increase healthy eating habits without the fear of spending more than what the TFP states is appropriate. Food prices do not appear to play as large a role in fruit and vegetable consumption associated with healthful dietary habits. Factors that seem to effect consumption include, but are not limited to, taste and convenience. Pricing barriers seem to be easily overcome, especially when using cost effective shopping techniques such as shopping for generic brand versus brand name food items or taking advantage of National School Lunch/Breakfast Programs in schools to provide additional assistance in obtaining recommended fruit and vegetable intake levels in adolescents for zero to little additional costs. Increased fruit and vegetable consumption with decreased restaurant meal consumption could possibly lead to healthier dietary habits thereby possibly decreasing the incidence of obesity among these adolescents.

As obesity rates continue to rise, it is important to gather information regarding barriers to healthy eating and fruit and vegetable intakes in order to provide better nutrition education and programs. Such programs should target Food Stamp recipients in order to encourage, persuade, and educate low-income families on the economic realities for healthy eating habits. Educational messages on menu planning and grocery shopping may be needed to help families purchase and prepare the foods needed for healthful eating.

Further research will need to be done in differing geographic areas as many studies have poignantly described the price variation of foods among different areas of the country, the grocery store availability, and transportation issues associated therein to purchasing foods at grocery stores.

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APPENDIX

Institutional Review Board Approval Letters

TWU
TEXAS WOMAN'S UNIVERSITY
DENTON DALLAS HOUSTON

Office of Research
6700 Fannin Street
Houston, TX 77030-2343
713-794-2480 Fax 713-794-2488

July 25, 2007

Ms. Molly Wong
6700 Fannin Street
Houston, TX 77030

Dear Ms. Wong:

Re: Food cost analysis associated with fruit and vegetable intake

The above referenced study has been reviewed by the TWU Institutional Review Board (IRB) and was determined to be exempt from further review.

Any changes in the study must receive review and approval prior to implementation unless the change is necessary for the safety of subjects. In addition, you must inform the IRB of adverse events encountered during the study or of any new and significant information that may impact a research participant's safety or willingness to continue in your study.

Sincerely,

William P. Hanten

Dr. William P. Hanten, Chair
Institutional Review Board - Houston

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Karen W. Cullen, Dr.P.H.
Department Of Pediatrics-Nutrition
Mail Station: CNRC/2056
Baylor College of Medicine
Houston, Texas 77030

RE: **#H-9003 - VALIDATION OF THE YOUTH/ADOLESCENT QUESTIONNAIRE AND SAPAC PHYSICAL ACTIVITY QUESTIONNAIRE WITH A MULTIETHNIC ADOLESCENT POPULATION**

APPROVAL VALID FROM 7/11/00 TO 7/11/01

Dear Dr. Cullen:

The Institutional Review Board for Human Subject Research for Baylor College of Medicine and Affiliated Hospitals (BCM IRB) is pleased to inform you that your above referenced research protocol and consent form were approved according to institutional guidelines and provided they receive the unaltered approval of any other institutional committees in which your research is involved.

1. Continued review will be required
   - ( ) a. After each subject's exposure
   - ( ) b. Quarterly
   - ( ) c. Semi-annually
   - (X) d. Annually
   - (X) e. Change in Protocol
   - (X) f. Development of unexpected problems or unusual complications
   - ( ) g. Other

2. Method of Review
   - (X) a. IRB Renewal Form (IRB2)
   - ( ) b. New Protocol
   - ( ) c. Interview with principal investigator
   - ( ) d. Other

If a consent form is being used for this protocol, only the IRB approved (and stamped) version should be used for obtaining consent from potential study subjects.

Sincerely yours

Kathleen J. Motil, M.D., Ph.D., Vice-Chair
Institutional Review Board for Human Subject Research
for Baylor College of Medicine & Affiliated Hospitals

KJM:jdh

humanap