

THE COST AND CALORIE CONTENT OF A LA CARTE FOOD ITEMS
PURCHASED BY STUDENTS DURING SCHOOL LUNCH

A THESIS

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DEPARTMENT OF NUTRITION AND FOOD SCIENCES
COLLEGE OF HEALTH SCIENCES

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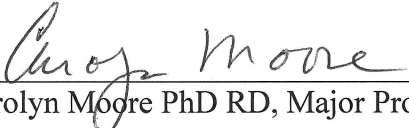
MAY 2016

TEXAS WOMAN'S UNIVERSITY
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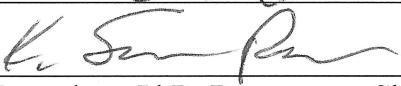
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To the Dean of the Graduate School:

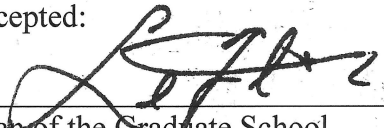
I am submitting herewith a thesis written by Betsy Ramirez entitled "The Cost and content of a la carte food items purchased by students during school lunch." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science with a major in Nutrition.


Carolyn Moore PhD RD, Major Professor

We have read this thesis and recommend its acceptance:




K. Broughton PhD, Department Chair

Accepted:


Dean of the Graduate School

ABSTRACT

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THE COSTS AND CALORIE CONTENT OF A LA CARTE FOOD ITEMS PURCHASED BY STUDENTS DURING SCHOOL LUNCH

MAY 2016

The cost and calories of a la carte/competitive food purchased by elementary and intermediate school students were examined. Data was provided by a school district in Houston for student transactions during the 2012-2013 school year. The amount of money spent on competitive foods, the number of calories per food item, the student grade level, and the socioeconomic status of the school were assessed. Differences in cost and calories of purchased competitive foods were analyzed using analysis of covariance (ANCOVA) and p value <0.001 determined whether results were statistically significant. Students in intermediate schools spent \$1.51 more on a la carte foods ($p<0.001$) and consumed a greater amount of calories (291.5 calories) ($p<0.001$) in comparison to elementary school students, regardless of socioeconomic status.

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CHAPTER I

INTRODUCTION

In the last 30 years, the prevalence of childhood obesity in the United States has doubled and quadrupled in children and adolescents, respectively. The Centers for Disease Control and Prevention (CDC) reports the percentage of obese children ages six to eleven years increased from 7% in 1980 to almost 18% in 2012, and from 5% to nearly 21% for adolescents ages 12-19 years over the same period of time (CDC, Childhood Obesity Facts). The increasing number of obese children and adolescents is of major concern because obesity at a younger age predisposes a child to short-term and long-term health effects and compromises overall well-being. Children who are obese or overweight are more likely to develop risk factors for cardiovascular disease (CVD), diabetes, osteoarthritis, and many types of cancers. In addition, obese or overweight children are more likely to experience social and psychological problems such as discrimination, prejudice and poor self-esteem (Park, Sappenfield, Huang, Sherry, & Bensyl, 2010).

Lifestyle habits such as consuming a healthful diet and engaging in physical activity can reduce the potential to become obese or overweight. The years of growth from childhood into adolescence are crucial as eating behaviors change, and energy intake may increase along with reduced energy expenditure (Templeton, Marlette, & Panemangalore, 2005). For children and adolescents, the school environment plays an

important role in the development and formation of dietary habits. Because children spend much of their time in school, consuming approximately one-third of their daily calories in a school environment, school wellness policies have been developed and implemented at the federal, state and district level (Briefel, Crepinsek, Cabili, Wilson, & Gleason, 2009). Changes in school food policies may have a positive impact on children's dietary habits and obesity prevention by providing more healthful foods and limiting the availability of low-nutrient, energy-dense food products. The Healthy Hunger-Free Kids Act signed into law in 2010 gave the United States Department of Agriculture (USDA) the authority to set standards foods sold in the schools (Turner & Chaloupka, 2012).

CHAPTER II

REVIEW OF LITERATURE

Childhood Obesity

Childhood obesity is one of the most serious public health challenges in the United States. The CDC defines overweight children as having a body mass index (BMI) at or above the 85th percentile for the corresponding age and sex while children with a BMI at or above the 95th percentile for children of the same age and sex are considered to be obese (CDC, 2014). Over the last 30 years, the prevalence of childhood obesity has increased dramatically, doubling for children six to eleven years old and quadrupling in adolescents 12-19 years old (CDC, 2014). Obesity can be caused by many different complex factors related to health, although the primary cause is energy imbalance: more calories consumed than expended through normal lifestyle and intentional physical activities. Briefel et al., (2009) reported that most children in the United States do not meet the daily dietary and physical activity recommendations, both of which may increase risk of children becoming overweight or obese.

Being obese or overweight at a young age predisposes an individual to be obese or overweight as an adult. If an individual is overweight in adolescence, they have a 70% chance of developing into an overweight or obese adult (Rogers et al., 2015). Being overweight or obese at a young age increases individual risk for health problems

associated with obesity at an even younger age than the current adult generation. Daniels (2006) states that childhood obesity not only has a negative impact on the quality of life but also may result in an overall shorter life span. In addition, the obesity epidemic impacts society as a whole, inducing a considerable economic burden. Treatment of the health issues related to the obesity epidemic exceeds \$14 billion annually (Briefel et al., 2009).

The accumulation of excess weight may be attributable to a person's daily caloric intake exceeding caloric expenditure through metabolic processes and daily physical activity. However, there are several factors, both modifiable and non-modifiable, which may lead a child or an adolescent to become overweight or obese. Factors a child or adolescent can control to a certain extent include their physical activity level and caloric intake. Uncontrollable predisposing factors for obesity include genetic makeup, as well as pre and post-natal influences (Vos and Welsh, 2010). Race or ethnicity are well known genetic factors that play a role in an individual's likelihood of being overweight or obese. The National Health and Nutrition Examination Surveys (NHANES) documented a higher prevalence of obesity in Hispanic/Hispanic/Latino and African American children from 1999 to 2008 (Madsen, Weedn, & Crawford, 2010). According to a recent report, 20% of African American children, 22% of Hispanic/Latino children, and 14% of White children are classified as obese. In recent years, obesity rates have plateaued or declined for some racial or ethnic groups; however, this has not been the case for Hispanic/Latino and African Americans. According to Nanney and Davey (2008), obesity rates increased

10% for children from racial or ethnic minority groups in comparison to white children. Children and adolescents of Hispanic/Latino and African American descent have higher levels of obesity development than their White counterparts (The State of Obesity, 2014).

Aside from genetic differences between races or ethnicities, reasons for obesity racial disparities may be associated with food insecurity which is the lack of access to affordable, low calorie nutrient-dense foods. Families with a low socioeconomic status (SES) are more likely to experience food insecurity as a result of limited financial resources available to purchase healthy foods. Nanney and Davey (2008) reported that 20% of children or adolescents in households with an income less than or equal to 130% of the poverty threshold were overweight or obese but only 16% of youth from families with higher incomes were overweight or obese. Furthermore, the prevalence of obesity was increased by 23-33% in children with multiple factors of low SES status, lower education levels, and higher rates of unemployment (Rogers et al. 2015). A strong association between a school district's low income status and the prevalence of overweight or obese youth was also reported in Massachusetts (Rogers et al., 2015).

The surrounding environment plays an important role in forming lifestyle and dietary habits in children and adults alike. School based programs implemented in school districts with high risk populations, such as African Americans and Hispanic/Latinos, have resulted in improved weight status of children and adolescents in these communities (Madsen, Weedn, & Crawford, 2010). Reducing the rates of obesity for all youth,

including at-risk children and adolescents, may require nationwide policies and programs which focus on changing the current obesogenic environment.

School Food Environment and Policies

Schools may significantly impact the formation of the dietary habits of more than 95% of children and adolescents enrolled in school. There is no other institution with such a long continuous contact over the first two decades of life (Story, Nannery, & Schwartz, 2009). The Institute of Medicine (IOM) (2005) recognized the crucial importance of schools in the implementation of programs to help lower or prevent the prevalence of overweight and obesity in this age group. Foods available in schools may influence children and adolescents' consumption habits, establishing their eating patterns at home or consumption habits outside of school (Templeton et al., 2005).

The National School Lunch Program (NSLP) was established in 1946 under the National School Lunch Act. This program was established to provide nutritious meals to all public, nonprofit, and private school students at a reduced price or free of cost, depending on the child's eligibility. In its initial stages, 7.1 million children participated in the federally funded program. By 1980, the number of students served by the NSLP had nearly quadrupled to 27 million children. In 2012, the NSLP provided reduced price or free lunches to more than 31 million children each day. The cost of implementing the NSLP was \$70 million and \$3.2 billion in 1947 and 1980, respectively. In 2012, the NSLP cost \$11.6 billion (National School Lunch Program Fact Sheet).

Twenty years after the establishment of the NSLP, the school breakfast program (SBP) was created as a pilot program to provide the first meal of the day for students, especially for those who lived in poor areas or areas at great distances from their designated schools (School Breakfast Program History). After success and need for expansion of the SBP was determined, the program received permanent authorization in 1975. Since then, the SBP has continued to provide adequate nutrition for all school aged children.

All students enrolled in U.S. schools can obtain meals through the federally funded meal programs. Children from families with incomes at or below 130 percent of the poverty level receive free meals while children whose families are between 130 percent and 185 percent poverty level can purchase meals at a reduced price, paying no more than 40 cents per meal. Students from families with an annual income above 185 percent poverty level pay full price for the meal. In 2012, approximately 68% of meals provided to students through the NSLP were offered for free or at a reduced price. Approximately eight percent of the 12.8 million children participating in the SBP received their meals for free or a lower cost in 2012, costing the federal government an estimated \$3 billion per year (Ishdorj, Crepinsek, and Jensen, 2013).

In addition to providing school meals via the federally regulated NSLP and the SBP, a la carte items are also available in venues such as vending machines or snack bars (Story et al., 2009). This a la carte category is also referred to as competitive foods, which include cookies, chips, and sugar-sweetened beverages (SSBs), because they

compete with the school meal program. Competitive foods found in a la carte venues were not federally regulated until 2014. These foods are usually low-nutrition, energy-dense, meaning they are low in nutrient content and high in calories. Studies report that students with access to a la carte food items consume more SSBs and french fries, and fewer fruit and vegetables than students who did not have access to these foods (Cullen & Zakeri, 2004). The School Nutrition and Dietary Assessment study (SNDA-III) found that students consumed more than 150 calories each day from these low-nutrient, energy-dense foods and the availability of snacks and sugar-sweetened beverages in the schools could contribute to an increase in body weight (Templeton et al., 2005). Competitive foods in the SNDA-III study provided an average of 634 kcals per day, while meals not including competitive food items contributed about 530 kcals per day (Templeton et al., 2005).

Before the passing of the Healthy Hunger-Free Kids Act in 2010, the federal government had legal authority to regulate only food items sold as part of the NSLP and SBP. Before 2010, regulations were minimal unless those foods were sold during scheduled meal times. Thus, standards for selling competitive foods in schools were determined at a state or district level. The Child Nutrition and WIC Reauthorization Act of 2004 required local education agencies participating in the NSLP and SBP to develop school wellness policies and implement the new policies by the 2006-2007 school year. These policies were required to include nutrition education and physical activity goals, as well as nutrition guidelines for all food items sold at schools during school hours.

However, the new policies were generally weak and non-specific, and inconsistent across grade levels, allowing students continued to have access to competitive foods and beverages in schools.

The State of California instituted food availability regulations that were fully implemented during the 2009-2010 school year (Samuels, Hutchinson, Craypo, Barry, & Bullock, 2010). The regulations limited the calories, fat, saturated fat, and sugar in competitive foods sold to students in vending machines, school stores, and cafeteria lines. To assess the impact of the new regulations, researchers used 24-hour recalls to determine consumption of nutrients from competitive foods. As a result of the new regulations, students in California schools consumed less fat, sugar and fewer calories in the school environment in comparison to states without regulations (Taber, Chriqui, Chaloupka, 2012). In addition, California students did not increase their intake of food at home or elsewhere to compensate for a reduced intake during the school day. Researchers also compared the results of the new policies on intake in students of different races. The decrease in intake of energy-dense, low-nutrient foods was greater among Hispanic/Hispanic/Latino students than students of other races or ethnicities. This finding was encouraging due to the high prevalence of obesity in the Hispanic/Hispanic/Latino communities of California (Taber, Chriqui, & Chaloupka, 2012).

Texas enacted a school food policy for the 2004-2005 school year, limiting the size of sugar sweetened beverages to 12-oz., with high-fat, sweet, and salty foods only made available in small, single-serving packages. In a study conducted by Cullen and

Thompson (2005), policies reducing the intake amount of competitive, a la carte food items had the potential to decrease energy intake by an average of 63 calories per meal, or 47 calories per student each day. This small reduction would be equivalent to an 8,460 calorie deficit over the 180-day school year and could reduce gradual weight accumulation. After the implementation of the Texas Public School Nutrition Policy, student intake of calories from fat decreased and consumption of protein, fiber, vitamin A, vitamin C, and calcium increased. Additionally, intake of vegetables and milk increased. Furthermore, the percentage of nutrients consumed from foods obtained through the snack bar and vending machines decreased, reducing the percentage of calories from saturated fats, iron, calcium, and sodium. The decreased availability of less nutritious foods and beverages sold in the schools allowed middle school students to choose healthier foods available through the NSLP meal (Cullen, Watson, & Zakeri, 2008).

Taber, Chriqui, Perna, Powell, and Chaloupka (2012) reported that states enacting laws regulating competitive foods had students with lower BMIs, and students were less likely to become overweight or obese than in states with no regulatory laws. Furthermore, it was found that students in states with non-specific food policy language or food regulatory laws had a slightly lower BMI compared to students attending schools with no regulatory laws. This difference was doubled in schools with very specific and clear standards when compared to states with no laws implemented to regulate school foods.

The Healthy, Hunger-Free Kids Act (HHFKA) of 2010 was the first federal, nationwide law with the purpose of setting standards for competitive food items sold in schools participating in federal reimbursable school meal programs. The new regulations aligned with the 2010 Dietary Guidelines for Americans (DGA). The HHFKA required the USDA to set specific nutrition standards for all competitive foods sold in schools coupled with an increased availability of whole-grains, fruits, vegetables, and fat-free or low-fat milk. In addition, sodium, trans- and saturated fat content of meals had to be reduced in meals starting with the 2012-2013 school year for NSLP and in the 2013-2014 school year for SBP. Through the implementation of this new policy, the USDA enforced guidelines for a la carte/competitive foods starting in the 2014-15 school year.

The Food and Nutrition Service (FNS) of the USDA established patterns for both breakfast and lunch meals. These are called meal patterns and are specific to grade level (Table 1). Overall, students in grade levels K-5 are allowed a lower amount of calories, sodium, grains, and meat or meat equivalents per meal than students in grades 6-8. Fruits and vegetables offered to students may be frozen, canned or fresh and should be prepared without adding solid fats, sugars, sodium, or refined starches. Meats or meat alternatives offered to students should be low in fat and preferably a low or reduced sodium option. At least half of grain based food items also should be whole grain (USDA Nutrition Standards for School Meals).

Table 1

Meal Pattern Specifications for Grades K-5 and Grades 6-8

	Breakfast Meal Pattern		Lunch Meal Pattern	
	Grades K-5	Grades 6-8	Grades K-5	Grades 6-8
Meal Pattern	Amount of Food per Week (Minimum Per Day)			
Fruits (cups)	5 (1)	5 (1)	2 ½ (1/2)	2 ½ (1/2)
Vegetables (cups)	0	0	3 ¾ (3/4)	3 ¾ (3/4)
Dark Green	0	0	½	½
Red/Orange	0	0	¾	¾
Beans/Peas (Legumes)	0	0	½	½
Starchy	0	0	½	½
Other	0	0	½	½
Additional Vegetables to Reach Total	0	0	1	1
Grains (ounces)	7-10 (1)	8-10 (1)	8-9 (1)	8-10 (1)
Meats/Meat Equivalent (ounces)	0	0	8-10 (1)	9-10 (1)
Fluid Milk (Cups)	5 (1)	5 (1)	5 (1)	5 (1)
Other Specifications: Daily Amount based on the Average for a 5-Day Week				
Calories	350-500	400-550	550-650	600-700
Saturated Fat (% of total calories)	<10	<10	<10	<10
Sodium (mg)	≤430	≤470	≤640	≤710
Trans fat	0	0	0	0

Modifications to existing recipes or food item purchases were needed in order to meet the new requirements. Certain foods not compliant with the new guidelines, such as SSBs and regular chips, were eliminated. In order to help meet the sodium restriction, schools could choose reduced or low sodium food items and the caloric content of meals

could be reduced by preparing foods with less added fats and sugar. In addition, at least half of all offered grains were to be whole grain for the NSLP by the 2012-2013 school year, whereas the SBP was given until the following school year to meet this requirement. However, by the 2014-2015 school year, all grains offered through the NSLP and the SBP were to be whole grains. All milk made available to students was to be low fat or fat free, regardless of whether the milk was flavored or not. In comparison to the newly established guidelines, the previous meal requirements were minimal and non-specific.

In recent years, these guidelines triggered nationwide school nutrition policy revisions with the potential to increase intake of fruits, vegetables, and whole grains in school aged children. Because financial resources available to address the increasing childhood obesity rates are limited, funds must be used wisely. A study conducted by Gortaker et al. (2015) compared seven obesity interventions targeted at reducing childhood obesity to determine which of these interventions were more cost effective. Some of the compared interventions focused on primary prevention, such as early education and establishment of nutrition policies in the schools. According to Gortmaker et al. (2015), nutrition policies implemented in schools had the greatest potential to decrease the rates of obesity when compared to all other interventions. Setting nutrition standards for meals offered to students could result in the prevention of an estimated 345,000 cases of childhood obesity, while saving approximately \$4.56 per dollar spent to implement the intervention. In comparison, interventions such as bariatric surgery, while

life-changing, would have a limited population reach and be more costly (Gortmaker et al., 2015).

Students in intermediate grade levels consume a greater amount of excess calories per week than students in elementary schools and while it may not seem a significant amount, small excesses in caloric intake may result in the slow accumulation of weight. Gortmaker et al. (2015) explains that for small children, ages two to five years, consuming an extra 33 calories per day would result in undesirable weight gain. For adolescents, weight change may be the result of an intake of 200 extra calories per day with weight gains early in life increasing the risk of a child or adolescent becoming an obese adult. Obesity and the health issues associated with the condition have a major impact on the economy of the United States. In 2008, the medical care costs of obesity were approximately \$147 billion. Interventions such as taxes on SSBs, setting nutrition standards for foods sold in the schools, and elimination of tax subsidies for unhealthy food advertisements targeting children, helping to reduce health related costs by reducing the rates of obesity (Gortmaker et al., 2015).

Hypotheses

There are no data on the costs associated with students purchasing a la carte/competitive foods, and limited data on the calories provided by these foods. Whether calories and costs of a la carte/competitive differ by grade level (elementary versus intermediate) is also unknown. Therefore, this study assessed cost and calories of

a la carte/competitive foods purchased by elementary and intermediate school students.

This study had two hypotheses:

- 1) There are no grade level differences in the costs of a la carte items purchased per meal by students during school meals, controlling for low income school status
- 2) There are no grade level differences in the calories provided per meal by a la carte items purchased by students during school meals, controlling for low income school status.

CHAPTER III

METHODS

Data were provided by a school district in the Houston area for 10 schools during the 2012-2013 school year. All lunch transactions in the cafeteria were entered into Point-of-Service (POS) software by the cashiers. The following information was included in text files: transaction date and identification (ID) number, whether it was a reimbursable lunch meal, the name of each of the individual components selected (fruit #1, fruit #2, entrée name, milk, vegetable name), and purchased a la carte items (chips, cookies). Data was obtained from six elementary schools and four intermediate schools (Table 1). The average number of students enrolled in the schools was 734 and 912 for elementary and intermediate schools, respectively. Students in the elementary schools were 6.6% African American, 37.6% Hispanic/Latino, 49.3% White, and 6.6% were identified as “Other.” The percentage of elementary school students who participated in free or reduced priced meals was 39.6%. The intermediate school student population was composed of 10.9% African Americans, 28.8% Hispanic/Latinos, 45.8% White, and 14.5% identified as “Other.” Participation in free or reduced priced meals (FRP) in the schools was 31.0% of total enrolled students.

The school district data manager retrieved the daily transaction data for each school for the 2012-2013 school year and saved each as a text file. A separate excel file was created with the calories and cost for every a la carte item available in the schools.

This information was obtained from the Child Nutrition Department of the district. The school text files were merged with the calorie and cost information of each food item.

Table 2

Student Demographics at Participating Schools

	Elementary Schools (n=6)	Intermediate Schools (n=4)
Average number of Students	734	912
Student Ethnicity (%)		
African American	6.6	10.9
Hispanic/Hispanic/Latino	37.6	28.8
White	49.3	45.8
Other	6.6	14.5
% Free/reduced priced meals	39.6	31.0

The resulting data file was aggregated by transaction ID, school, date, and transaction number and calories and cost for each transaction was summed. This resulted in a data file with one transaction per student which included the amount of money spent on a la carte items and the number of calories of those items, whether the student attended an elementary or intermediate school, and whether the school was a low income school (based on percent of FRP meals). Student gender was not included in the data sent from the district. First, the number of items within each food category was calculated. Then, differences in the number of students purchasing a la carte items by grade level and school FRP by grade level were calculated with chi-square analysis. Finally, analysis of covariance (ANCOVA) assessed differences in cost and calories of a la carte foods purchased by grade level (elementary or intermediate) by week, controlling

for FRP status as a covariate. Analysis was conducted using the Statistical Analysis Software (SAS) (version 9.4, SAS Institute Inc, Cary, NC, 2010-2012). Two analyses were conducted; one including all transaction data and one including a la carte purchases. The level of significance was set as $p < 0.05$.

This research study was approved by Baylor College of Medicine and Texas Woman's University. Refer to the Appendix for a copy of the approval letters.

CHAPTER IV

RESULTS

The frequency of purchases of a la carte foods by elementary and intermediate school students are summarized in Table 3 and Table 4. The competitive foods purchased with more frequency by elementary school students were chips (34.5% of all purchases), followed by Rice Krispies Treats (15.7%) and Goldfish Crackers (6.5%) (Table 3). For students in the intermediate schools, baked chips contributed to 17.5% of the total purchases made by intermediate school students, followed by Gatorade at 13.4%, and chocolate chip cookies 13.3% (Table 4).

Table 3

The Frequency and Percentage of Total Purchases Made in Elementary Schools

Food Name	Frequency	%
Chips	76,267	34.5
Rice Krispies Treat	34,857	15.7
A La Carte Main Dish	23,512	10.6
A La Carte Fruit	17,872	8.1
Bottled Water	16,079	7.3
Goldfish Crackers	14,479	6.5
A La Carte Milk	11,040	5.0
Yogurt Cup	8,918	4.0
Pretzels	7,729	3.5
Pickle, Whole	6,752	3.1
A La Carte Vegetable	3,185	1.4
Animal Crackers	646	0.3
Yogurt Parfait	3	0.0
A La Carte Garden Salad	1	0.0
Yogurt Cup	1	0.0
Chips	1	0.0
Tea	1	0.0
Total	221,343	100.0

Table 4

The Frequency and Percentage of Total Purchases Made in Intermediate Schools

Food Name	Frequency	%
Baked Chips	127,569	17.5
Gatorade	97,511	13.4
Chocolate Chip Cookie	96,568	13.3
Pizza Slice	67,362	9.2
Slush	35,815	4.9
Tea	25,721	3.5
Mozzarella Sticks with Marinara	21,363	2.9
Bottled Water	20,922	2.9
V-8	20,232	2.8
Condiment	20,208	2.8
Cheese Pizza	19,839	2.7
Chicken Tenders	19,778	2.7
Ice Cream	18,642	2.6
Brownie	18,026	2.5
Rice Krispies Treat	17,084	2.3
A La Carte Main Dish	16,661	2.3
A La Carte Milk	14,081	1.9
Pretzels	13,161	1.8
Freshetta 3 Meat	10,670	1.5
Curly Fries	7,916	1.1
Freshetta Buffalo Chicken	7,533	1.0
Chicken Sandwich	5,812	0.8
Crispitos	3,792	0.5
Fresh Fruit	3,302	0.5
A La Carte Fruit	2,754	0.4
Cheeseburger	2,705	0.4
Pickle, Whole	2,073	0.3
A La Carte Vegetable	2,072	0.3
Chips	2,064	0.3
Foot Long Corn Dog	1,961	0.3

(continued)

Food Name	Frequency	%
Half Sub	1,138	0.2
Yogurt Cup	947	0.1
Hamburger	795	0.1
Chicken Caesar Salad	779	0.1
Country Style Ranch Salad	519	0.1
Granola Bar	470	0.1
Goldfish Crackers	406	0.1
Mozzarella String Cheese	175	0.0
Spinach Harvest Salad	144	0.0
Marinara Cup	6	0.0
Salad Dressing	3	0.0
Yogurt Parfait	3	0.0
Animal Crackers	2	0.0
Total	728,584	100.0

More intermediate school students (71.51%) purchased a la carte foods than elementary school students (28.49%) ($p < 0.001$). Additionally, there was a significant difference in the amount of a la carte food items purchased by students by grade level and by socioeconomic status (SES) within grade level ($p < 0.001$) (Table 5). The number of students in lower SES elementary (33.63%) and intermediate schools (35.07%) who purchased a la carte foods was significantly lower than the number of elementary (66.37%) and intermediate school students (64.93%) in higher SES schools who purchased competitive food items ($p < 0.001$) (Table 5).

Table 5

*Frequency of A La Carte Food Purchase Transactions by Grade Level, School**Free/Reduced-Price (FRP) Meal Eligibility, and FRP Eligibility by Grade Level*

	Not purchased		Purchased		p
	n	%	N	%	
Grade Level*					
Elementary	269,267	69.9	153,219	28.5	<0.001
Intermediate	116,210	30.2	38,4541	71.5	<0.001
Elementary School*					
Low SES	181,998	67.6	51,535	33.6	<0.001
Not low SES	87,269	32.4	101,684	66.4	<0.001
Intermediate School*					
Low SES	62,936	54.2	134,864	35.1	<0.001
Not low SES	53,274	45.8	249,677	64.9	<0.001

*p<0.001

There were significant differences in the costs and calories purchased by grade level in the analysis using all student transactions, including transactions with no a la carte food item purchase (Table 6). Students in elementary schools spent significantly less each week (\$0.33) on a la carte food items compared with intermediate school students (\$1.84) ($p<0.001$). A la carte food items purchased by intermediate school students provided significantly more calories on a weekly basis (291.5 calories) per week than those purchased by elementary school students (49.1 calories) per week ($p<0.001$).

Table 6

Average Weekly Cost and Calories of A La Carte Foods Purchased From All Transactions by Grade Level¹

	Elementary Schools		Intermediate Schools		p
	Mean	SE	Mean	SE	
Cost (\$) *	0.33	0.07	1.84	0.08	<0.001
Calories* (kcal/week)	49.1	9.6	291.5	11.8	<0.001

¹ANCOVA with school FRP meal eligibility as a covariate

*p<0.001

The results of analyses comparing cost and calories of a la carte foods purchased from transactions including only an a la carte item (Table 7) were similar to those accounting for all transactions by grade level (Table 6). However, the costs and the amount of calories were higher for students in all grade levels; elementary school students spent an average of \$0.84 per week and intermediate school students spent \$2.43 per week (p<0.001). Students in the elementary grade level purchased an average of 132.8 calories from a la carte foods per week, while students in the intermediate grade level purchased an average of 390.2 calories from a la carte foods per week (Table 7) (p<0.001).

Table 7

*Average Weekly Cost and Calories of A La Carte Foods Purchased From Transactions
Including Only an A La Carte Item by Grade Level¹*

	Elementary Schools		Intermediate Schools		p
	Mean	SE	Mean	SE	
Cost (\$) *	0.84	0.06	2.43	0.07	<0.001
Calories*	132.8	7.37	390.2	9.0	<0.001

¹ANCOVA with school FRP meal eligibility as a covariate

*p<0.001

CHAPTER V

DISCUSSION

The significant differences in the cost and amount of calories in competitive foods purchased by the elementary and intermediates school students in this study may be due to several factors. The intermediate schools not only had a greater selection of entrees available to students, but also offered a larger variety of competitive foods. Analysis of the data also showed that the SES status of students in the schools played a role in the purchase of competitive foods. Previously, research by Finkelstein, Hill, and Whitaker (2008) concluded that as students move to higher grade levels, their food environment in the schools becomes less healthy, regardless of the school's predominant SES status. Similar to this study, a negative association was found by Finkelstein, Hill, and Whitaker (2008) between total daily intake of fruits and vegetables, and the availability of a la carte foods. The more low nutrient, energy dense foods were available for consumption, the higher the percentage of calories from fats and saturated fats (Finkelstein, Hill, & Whitaker, 2008).

Elementary schools offered fewer items than intermediate schools, and the only beverages were bottled water and milk (1%, skim, chocolate and strawberry milk). In a study by Cullen and Zakeri (2004), fifth grade students in middle schools who had access to more competitive foods consumed less milk, fruits, and non-fried vegetables, and more SSBs in comparison to fourth grade students in elementary schools where snack bars

were not available. Another study demonstrated that when competitive foods were available there was a lower intake of healthful foods such as fruits and vegetables and a higher consumption of total and saturated fats (Kubik, Lytle, Hannan, Perry, & Story, 2003). These dietary habits could be detrimental to the health of children if continued for an extended period of time.

The HEALTHY study, conducted in middle schools over the course of three years, aimed to improve the choices available to students in the school food environment (Hartstein, Cullen, Virus, Ghormli, Volpe, Staten, Bridgma, Stadler, Gillis, McCormick, & Mobley, 2011). The two main goals of the study were to serve dessert and snack foods providing a maximum of 200 kilocalories per single serving package, to eliminate 100% fruit juices and beverages with added sugars and to increase fruits, vegetables, high-fiber grain-based foods and legumes offered. A la carte food improvements in intervention schools included the removal of high fat and high sugar foods with lower fat and lower sugar items. As a result of the HEALTHY study intervention there was an improvement in the foods offered to students (Mobley, Stadler, Staten, Ghormli, Gillis, Hartstein, Siega-Riz, Virus, 2012). Thus, the Healthy Study demonstrated that removing low-nutrient, energy-dense foods and replacing them with more healthful options is feasible in lower income schools.

As found in this study, food choices differ between students in lower and higher grades. A comparison of choices and dietary intake patterns between 4th, 8th, and 11th grade students demonstrated that students in the higher grades consumed more high-fat

foods and more SSBs than students in lower grades, accompanied by a lower consumption of healthful foods such as fruit, milk, and yogurt (Perez, Holesher, Brown, and Kelder, 2007). Researchers attributed these results to the school meal environment and the increased presence of competitive foods. In addition, other factors such as decreased parental monitoring, social norms or ideology about food intake, and greater independence contribute to different food choices of students in higher grades. These factors may lead to an increased consumption of competitive foods among intermediate school students.

The SES of students in the school may also help explain the differences found in the cost of and calories provided by purchased foods. In a report by the USDA Economic Research Service (2013), it was found that during the 2002-2003 school year, 12% of food service revenues were obtained from the sale of competitive foods. During this period, few nutrition restrictions were in place for competitive foods. However, the higher percentage of revenue from the sale of these food items was found more often in districts with students of higher SES. These schools also had fewer students receiving free or reduced-price meals (USDA Economic Research Service, 2013).

The elimination of competitive foods from vending machines or a la carte lunch lines reduces the competition for student food purchases, allowing the schools to offer higher quality foods which met the national guidelines and are appealing to students. Cullen, Watson, and Fithian (2009) investigated the relationship between school SES and student dietary behaviors in the year before and then after the implementation of a state

wide school nutrition policy. Lower SES students consumed less high-fat foods, SSBs, and candy than students in schools with a middle SES. The low SES school students may not have been able to afford the additional cost of competitive foods sold a la carte, and instead selected more of the healthy food items that were part of the NSLP meal, available at no additional cost with the implementation of the nationwide school nutrition policy. Because the selection of competitive foods was limited, students in the middle SES schools made more healthful food choices, suggesting that available choices may influence daily energy intake of students.

Another factor influencing the differences seen in competitive food purchases made by elementary versus intermediate school students was the amount of disposable money available. A greater percentage of elementary school students (39.6%) participated in the FRP meal program compared to intermediate school students (31%). This finding may suggest that families of the intermediate school students had higher incomes than families whose children attended elementary schools. Intermediate school families were likely able to provide intermediate school students with more disposable income to purchase competitive foods. Greater access to disposable income, accompanied by decreased parental monitoring and increased independence in making food decisions may have resulted in more frequent purchases of competitive foods.

Schools participating in the national school meals programs receive federal reimbursement dependent on the rate of student participation in the NSLP and SBP. While participation in these meals programs provides financial support for the food

service departments of participating schools, operating costs are not completely covered by federal reimbursement. Many schools participating in the national school meal programs rely on the revenue from the sale of competitive foods for revenue (Terry-McElrath, O'Malley, & Johnston, 2015). This revenue covers any additional costs acquired by the food service department which are not covered by reimbursements from the NSLP and the SBP. In some of the nation's large school districts, food service directors have reported using competitive food revenue to cover the cost of federally mandated reimbursable meals (Nollen, Kimminau, & Nazir, 2011). Peterson (2011) reported the sale of a la carte foods and other non-reimbursable food items accounting for up to 16% of total food service revenue. Legislation to limit or eliminate the sale of competitive foods has been met with protest from School Food Authorities who argue that lost revenue makes it more difficult to support the cost of federal school meals programs (Peterson, 2011).

Recently a study was conducted in California school districts to measure the impact of new California school food policies on food service revenue. After implementation of new nutritional standards, school food service revenue increased due to greater participation in the reimbursable meal program and the decreased availability of a la carte foods (Woodward-Lopez, Gosliner, Samuels, Craypo, Kao, & Crawford, 2010). A similar result was found in a Connecticut study (Long, Luedicke, Dorsey, Fiore, and Henderson 2013). Schools with reduced availability of competitive foods had an increase in NSLP and SBP participation which in turn resulted in schools receiving more

revenue from the federally funded school programs. Furthermore, competitive foods in the Connecticut school were sold at a loss while meals meeting nutrition standards produced a revenue of 15%. In 2013, the USDA Economic Research Service report encouraged schools to: 1) provide more appealing alternatives to food items currently sold which still meet newly established nutrient guidelines, and 2) increase student participation in the school meal programs.

Limitations

Limitations of this study include human error in data entry into the POS which would have an effect on the reported cost and calories provided by a la carte food items. Students might have purchased items for other students. In addition, whether or not students consumed the purchased a la carte items was not assessed. Finally, this study was conducted in 10 schools in one school district in southeast Texas. Therefore, these results may not be generalized to other areas of the country.

CHAPTER VI

CONCLUSION AND IMPLICATIONS FOR FUTURE RESEARCH

In response to the increasing number of children and adolescents who are overweight or obese, the Institute of Medicine released the Report on Nutrition Standards in Schools, recommending guidelines be set in place to increase the availability of more healthful foods and to regulate competitive foods previously not regulated by federal policies, to be consistent with the latest Dietary Guidelines for Americans (Cullen, Chen, Dave, Jensen, 2015). The 2010, Healthy Hunger Free Kids Act joined in efforts to impact childhood obesity by mandating new guidelines for school meal patterns and competitive foods be implemented beginning in the 2012-2013 school year (Cullen, et al., 2015). The goal of the policies implemented as a result of these new rules was to improve student dietary intake at school and help prevent childhood obesity

It is important to note, however, that the consumption of “empty calories” provided by competitive foods is not limited to the school environment. While schools may provide more than a third of a child’s total daily food consumption (Ishdorj, Crepinsek, & Jensen 2013), there is no control over the amount or type of foods consumed outside the school. Students who participated in the NSLP consumed more fruits and vegetables at school when compared to students who did not receive NSLP meals (Ishdorj et al., 2013). Nevertheless, NSLP participants consumed fewer vegetables

outside of the school environment, which suggests a food substitution effect. Positive changes achieved via school meals may be nullified by the child's dietary habits at home and elsewhere. School policies may not have any control over foods brought by students from home. However, research indicated that NSLP participants consume more fruits and vegetables overall in comparison to nonparticipants (Ishdorj et al., 2013).

The financial resources available to purchase nutritious foods may be limited in lower SES families. Children from families of low SES standing may experience food insecurity, or unreliable access to adequate amounts of nutritious foods. The factors affecting the nutrition quality of foods obtained for consumption were collected over a 30-year time frame (Kant and Graubard 2013). The researchers hypothesized that available financial resources for food purchases would be inversely associated with the quality of the foods bought. While this is a logical hypothesis, analysis of the data led researchers to conclude that income or SES status was not independently associated with the types of foods purchased. Instead, the family's nutrition knowledge played a larger role in the selection of food than income (Kant and Graubard, 2013). This finding highlights the importance of nutrition education, not only for students but also for parents and other household members. According to the authors, the impact of increased nutrition knowledge on current dietary behaviors was also important. Future research is needed to determine whether school nutrition policies, in conjunction with nutrition education for the parents of school aged children, are effective interventions to improve diet and decrease the prevalent rates of obesity in children and adolescents. Furthermore, due to

the existing racial disparities in obesity, it would be interesting to see how the new policies would affect children from African American and Hispanic/Latino families and whether tailoring school based interventions to the culture and norms of this community would have a greater impact.

To date, there are a limited number of studies determining the calorie intake from a la carte foods available in schools provide by different grade levels. No data on the cost of a la carte food items purchased in the schools has been previously reported. This study has documented significant grade level differences in the costs of purchased a la carte items as well as significant differences in the calories provided per meal by these competitive food items. Further research is needed to determine whether the new competitive food rules in schools have resulted in more healthful dietary habits of all public school students.

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APPENDIX A

IRB Exemption Letter



Institutional Review Board
Office of Research
6700 Fannin, Houston, TX 77030
713-794-2480
mjackson3@twu.edu
<http://www.twu.edu/irb.html>

DATE: October 20, 2014

TO: Ms. Betsy Ramirez
Department of Nutrition & Food Sciences - Houston

FROM: Institutional Review Board - Houston

Re: *Exemption for The costs and calorie content of a la carte food items purchased by students during school lunch (Protocol #: 17883)*

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

If applicable, agency approval letters must be submitted to the IRB upon receipt PRIOR to any data collection at that agency. Because a signed consent form is not required for exempt studies, the filing of signatures of participants with the TWU IRB is not necessary.

Although your protocol has been exempted from further IRB review and your protocol file has been closed, any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any adverse events or unanticipated problems. All forms are located on the IRB website. If you have any questions, please contact the TWU IRB.

cc. Ms. Rose Bush, Department of Nutrition & Food Sciences - Houston
Carolyn Moore, PhD, Department of Nutrition & Food Sciences - Houston
Graduate School

APPENDIX B

Baylor College of Medicine Letter of Approval

August 16, 2012

KAREN W CULLEN
BAYLOR COLLEGE OF MEDICINE
PEDIATRICS: NUTRITION



Baylor College of Medicine
Office of Research
One Baylor Plaza, 600D
Houston, Texas 77030
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H-28086 - REVISED FEDERAL SCHOOL MEAL GUIDELINES: IMPACT ON STUDENT FOOD INTAKE AND COSTS

APPROVAL VALID FROM 8/16/2012 TO 8/15/2013

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 the research protocol and consent form(s) named above were approved.

The study may not continue after the approval period without additional IRB review and approval for continuation. You will receive an email renewal reminder notice prior to study expiration; however, it is your responsibility to assure that this study is not conducted beyond the expiration date.

Please be aware that only IRB-approved informed consent forms may be used when written informed consent is required.

Any changes in study or informed consent procedure 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 participants' safety or willingness to continue in your study.

The BCM IRB is organized, operates, and is registered with the United States Office for Human Research Protections according to the regulations codified in the United States Code of Federal Regulations at 45 CFR 46 and 21 CFR 56. The BCM IRB operates under the BCM Federal Wide Assurance No. 00000286, as well as those of hospitals and institutions affiliated with the College.

Sincerely yours,

A handwritten signature in black ink, appearing to read "V. Sutton", is written over a horizontal line.

VERNON R SUTTON, M.D., B.S.
Institutional Review Board for Baylor College of Medicine and Affiliated Hospitals



APPENDIX C

Permission for Use of Data Without Personal Qualifiers




**CHILDREN'S NUTRITION
RESEARCH CENTER**
Department of Pediatrics
1100 BATES STREET
HOUSTON, TX 77030-2600
(713) 798-7000
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www.kidnutrition.org

MEMORANDUM

Date: September 2, 2014

To: Betsy Ramirez

From: Karen Weber Cullen, DrPH, RD 
Professor of Pediatrics-Nutrition
Children's Nutrition Research Center
1100 Bates St.
Houston, TX 77030
713.798.6764
kcullen@bcm.edu

RE: PERMISSION FOR USE OF DATA WITHOUT PERSONAL QUALIFIERS

Title: The costs and calorie content of a la carte food items purchased by students during school lunch.

Betsy Ramirez has my permission to the costs and calorie content of a la carte food items purchased by students during school lunch in the school year 2012-2013. The data are from text files saved in Point-of-service machine software in 12 school cafeterias. There are no personal identifiers.

The study was approved by the IRB at Baylor College of Medicine (H-28086).