

THE IMPACT OF THE NEW UNITED STATES DEPARTMENT OF AGRICULTURE
(USDA) MEAL PATTERNS ON STUDENT FOOD SELECTION AND
CONSUMPTION AT BREAKFAST

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ABSTRACT

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This study examined the effect of the new USDA School Breakfast Program (SBP) guidelines on student fruit selection and consumption. Observations of breakfast selection and consumption were obtained from 120 students in Kindergarten through 8th grade in a Texas school district in the fall of 2011. Of the 37,000 students, 26% qualified for free/reduced price meals (FRP). Four low (49-79% FRP) and four middle-income elementary schools (7-18% FRP), and two low (34% FRP) and two middle-income (20% FRP) intermediate schools participated. Schools were matched on grade level and FRP. Schools were allowed selection of two fruit servings (intervention) or one fruit serving (control) at breakfast. Compared to control schools, more intervention students selected two fruit servings ($p=0.007$). However, the mean amount of fruit consumed did not differ. The results suggest the increase in SBP fruit servings does not necessarily result in an increase in student fruit selection and consumption.

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CHAPTER I

INTRODUCTION

National School Breakfast Program

Breakfast is frequently touted as the most important meal of the day, especially among children and adolescents (Rampersaud, Pereira, Girard, & Metzl, 2005). In an effort to provide nutritious breakfast meals to school children, the National School Breakfast Program (SBP) was created. The SBP is a federally funded meal assistance program that independent school districts and individual schools can participate in to help serve free and reduced priced (FRP) breakfast meals to children in low-income families (USDA, 2013a). The program began as a pilot project in 1966 and provided grants to public schools in order to provide breakfast to “nutritional needy” children (USDA, 2013b). The program eventually became a permanent program in 1975 and still exists to this day (USDA, 2013b).

Participant school districts receive cash subsidies from the United States Department of Agriculture (USDA) for each breakfast meal served, depending on family income levels (USDA, 2013b). Children from families with an income level at or below 130 percent of the federal poverty level are eligible for free meals (USDA, 2013b). Children from families with an income level between 130 and 185 percent of the federal poverty level are eligible for reduced-priced meals. In order to receive the subsidies, the participating school districts and schools must meet the nutritional guidelines established

by the USDA for the SBP and National School Lunch Program (NSLP) (USDA, 2013b). Students that meet eligibility criteria can participate in the SBP by completing an application provided by the school district (FRAC, n.d.). If students live in households that participate in the Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), Head Start, or the Food Distribution Program on Indian Reservations (FDPIR), they are automatically eligible to participate in the SBP or NSLP (FRAC, n.d.). Foster, migrant, homeless, or runaway children are also automatically eligible for participation (FRAC, n.d.).

Revised Federal School Meal Requirements

The most recent nutritional standards for the SBP (and the NSLP) were written in January of 2012 with compliance of the new standards to begin initiation on July 1, 2012 (“Nutrition Standards”, 2012). The standards were written to align school meal patterns with the Dietary Guidelines for Americans and were largely based on recommendations made by the Institute of Medicine of the National Academies in order to improve the composition of breakfast and lunch meals served in schools (“Nutrition Standards”, 2012). Overall, the new guidelines required meals to meet specific calorie ranges by grade level, aimed at reducing sodium and total fat content of meals, and increased the amount and variety of vegetables, whole grains, and fruits served at meals (“Nutrition Standards”, 2012).

Regarding caloric ranges, the new standards (which began in the 2013-2014 school year) require schools to serve meals within minimum and maximum caloric ranges

for specific age groups (“Nutrition Standards”, 2012; School Nutrition Association, 2012). Under the previous guidelines, traditional menu planning required a maximum of 554 calories at breakfast for grades Kindergarten through grade 12 (School Nutrition Association, 2012). Under the new guidelines, grades Kindergarten through grade 5 must meet a caloric range of 350-500, grades 6-8 must meet a caloric range of 400-550, and grades 9-12 must meet a caloric range of 450-600 calories at breakfast, averaged over a week (School Nutrition Association, 2012). This standard helps provide nutritionally appropriate meals to students at all age levels. The new guidelines also limit the amount of saturated fat and sodium served weekly in the NSLP and SBP (“Nutrition Standards”, 2012). Meals in both programs must serve on average no more than 10 percent of total calories from saturated fat and zero grams of trans fat per serving, both of which have not changed from the previous guidelines (“Nutrition Standards”, 2012; School Nutrition Association, 2012). Previously, the guidelines for sodium were to simply reduce sodium although no standard levels were set (School Nutrition Association, 2012). Under the new guidelines, maximum sodium levels were set for each age group (Kindergarten-grade 5, grades 6-8, grades 9-12) over the course of the week with final sodium target levels to be met in the 2022-2023 school year (“Nutrition Standards”, 2012; School Nutrition Association, 2012). The breakfast sodium target levels for the 2014-2015 school year (target year 1) are less than 540 milligrams (mg) for Kindergarten-grade 5, less than 600 mg for grades 6-8, and less than 640 mg for grades 9-12 (School Nutrition Association, 2012).

The new NSLP and SBP nutritional guidelines also addressed food group requirements. Schools are now required to serve at least one serving of grains daily at breakfast and lunch (“Nutrition Standards”, 2012). Daily and weekly minimum ranges were established for grains with 1 ounce required daily for all grades at breakfast and lunch in addition to the following weekly ranges: 8-9 ounces at lunch and 7-10 ounces at breakfast for Kindergarten-grade 5; 8-10 ounces at lunch and 8-10 ounces at breakfast for grades 6-8; and 10-12 ounces at lunch and 9-10 ounces at breakfast for grades 9-12 (School Nutrition Association, 2012). Initially, at least half of the servings of grains must be whole grain rich with a transition to only serving whole grains two years after implementation of this new standard (“Nutrition Standards”, 2012). In regards to fruits and vegetables, previous guidelines required one half to three fourths of a cup for combined fruit and vegetables per day at lunch and one half of a cup per day at breakfast for Kindergarten-grade 12 (School Nutrition Association, 2012). The new guidelines require three fourths to one cup of vegetables and one half to one cup of fruit per day at lunch as well as one cup of fruit at breakfast per day for Kindergarten-grade 12 (School Nutrition Association, 2012). The new guidelines added vegetable subgroup specifications: dark green, red/orange, bean/peas (legumes), starchy, and other vegetables as defined by the 2010 dietary guidelines (School Nutrition Association, 2012). Vegetables must be offered as a separate item at lunch and the amount of legumes and dark green and orange vegetables served increased while the amount of starchy vegetables served decreased (“Nutrition Standards”, 2012). It should be noted that

vegetables can be partly or fully substituted for fruit servings at breakfast; however, the first two servings of vegetable substitutions per week must be from the dark green, red/orange, beans, peas or other subgroups (“Nutrition Standards”, 2012). After at least 2 cups of non-starchy vegetables have been served in a week, starchy vegetables can also act as fruit substitutes (“Nutrition Standards”, 2012).

Fruit Requirements at Breakfast

As previously mentioned, the minimum quantity of fruit required to be served at breakfast was doubled from half a cup to one cup under the new standards (“Nutrition Standards”, 2012). Fruit can be served in the form of fresh, frozen without added sugar, dried, or canned (in fruit juice, water, or light syrup) fruit (“Nutrition Standards”, 2012). Schools will be required to meet this rule beginning in the 2014-2015 school year (“Nutrition Standards”, 2012). Schools may serve 100 percent fruit juice; however, at least half of the fruit requirement per meal must be met by a non-juice form of fruit as juice lacks dietary fiber and is also elevated in calories (“Nutrition Standards”, 2012). To minimize the potential of wasted fruit, the new standards allow students to select half a cup of fruit for a reimbursable meal under offer versus serve (OVS) at breakfast (“Nutrition Standards”, 2012). With OVS, students can decline no more than one food item at breakfast but still must choose a serving of fruit or vegetables (“Nutrition Standards”, 2012). The proposed standards for fruit consumption at breakfast intend to help increase fruit consumption at breakfast and overall in adolescents who participate in the SBP.

Statement of the Problem

With recent implementation of the guidelines, little research has been conducted to examine student consumption under the new requirements. More specifically, no previous research to our knowledge has been conducted to examine the effect of the guidelines on student fruit consumption at breakfast in SPBs. Under the previous guidelines, it was reported that fruit consumption among SBP participants was relatively low, however this has yet to be found under the new guidelines (Bruening et al., 2012). It is not clear if the new fruit requirements will actually increase student fruit consumption or rather contribute to increased plate waste. With a doubling in required fruit servings to one cup for SBP participants, the effect of the new guidelines should be evaluated.

Purpose of the Study

The purpose of this study is to examine the effect of the new USDA guidelines for the SBP on student consumption, particularly fruit consumption, at breakfast, while controlling for gender and school free/reduced priced meals (FRP). The amount of fruit consumed as well as caloric and food group intake will be compared between students following the previous USDA guidelines and the new USDA guidelines.

Hypotheses

The null hypotheses are: (1) there will be no difference in the proportion of students selecting two fruit servings at breakfast in the intervention group compared to the students in the control group, controlling for gender and school FRP; (2) there will be no difference in the mean amount of fruit servings selected by students in the intervention

group compared to the students in the control group, controlling for gender and school FRP; (3) there will be no difference in the mean amount of fruit servings consumed by students in the intervention group compared to the students in the control group, controlling for gender and school FRP.

CHAPTER II

REVIEW OF LITERATURE

General Trends in Breakfast Consumption

Much research involving breakfast consumption in children and adolescents has been conducted to examine the benefits of a regular breakfast meal. However, while many benefits to breakfast consumption have been proposed, 12-35% of adolescents and youth do not regularly consume a breakfast meal (Pereira et al., 2010). Many children and parents claim lack of time or not feeling hungry enough in the morning as primary barriers to consuming an adequate breakfast meal (Shaw, 1998; Bruening, Larson, Story, Neumark-Sztainer, & Hannan, 2011). Weight concerns and body image dissatisfaction have also been found to be predicting factors of breakfast consumption as some adolescents skip breakfast as a means of weight loss, especially females (Shaw, 1998; Bruening et al., 2011).

Demographics may also be contributing factors to adolescent breakfast consumption. In fact, low-income adolescents are less likely to consume breakfast than adolescents from families in higher socioeconomic classes (Bruening et al., 2011; Merten, Williams, & Shriver, 2009). Furthermore, non-white adolescents, particularly African American and Hispanic adolescents are more likely to skip breakfast (Bruening et al., 2011; Merten et al., 2009; Rampersaud et al., 2005). In addition to socioeconomic

status and race, gender and age appear to be factors that contribute to the frequency of breakfast consumption among adolescents. Studies have shown that female adolescents, especially teenage girls, are more likely to skip breakfast than their male counterparts (Shaw, 1998; Rampersaud et al., 2005; Lien, 2007; Sandercock, Voss, & Dye, 2010). Of the female adolescents who do consume breakfast, the quality of the breakfast they eat may be significantly less than the quality of breakfast consumed by males (O'Sullivan et al., 2009). Breakfast consumption may even track over time; therefore, as adolescents grow older, breakfast consumption tends to decrease especially as they approach secondary school (Bruening et al., 2011; Rampersaud et al., 2005; Merten et al., 2009; Utter et al., 2007). In fact, adolescent regular breakfast consumption may be a predictor of young adult breakfast consumption (Merten et al., 2009). When considering demographics and age in tandem, Utter, Scragg, Mhurchu, & Schaaf (2007) reported that older children with the most socioeconomic deprivation may be more likely to skip breakfast than others.

Body Mass Index Correlation with Breakfast Consumption

Consistent intake of a breakfast meal may help children establish healthy body mass index (BMI) values, which are inversely related to developing multiple risk factors and adulthood obesity later in life (Sandercock et al., 2010; Barton et al., 2005; Rampersaud et al., 2005; Leidy, 2012; Merten et al., 2009; Freedman, Mei, Srinivasan, Berenson & Dietz, 2007). However, the practice of skipping breakfast is more frequently observed in children with higher body mass index (BMI) and waste circumference values

than their counterparts who regularly consume breakfast (Rampersaud et al., 2005). In fact, as the frequency of breakfast consumption among children with normal BMI values decreases, the risk for becoming overweight increases (Croezen, Visscher, Bogt, Veling & Haveman-Nies, 2009; Rampersaud et al., 2005). On the contrary, adolescents who regularly consume breakfast may have higher energy intake, yet lower BMI values than their peers who skip breakfast (Rampersaud et al., 2005; Sandercock et al., 2010; Chitra & Reddy, 2006; Nicklas, Reger, Myers & O'Neil, 2000). According to Sandercock et al. (2010), breakfast skipping may also be positively correlated with increased frequency of snacking, increased unhealthy food choices throughout the day, and increased energy intake later in the day, which could all contribute to increased BMI values. Additionally, they found that increased physical activity is frequently observed in breakfast consumers. This may help explain lower BMI values despite the fact that breakfast consumers may have higher daily caloric intakes (Rampersaud et al., 2005).

The combination of decreased physical activity and an increased likelihood of unhealthy food choices and habits among breakfast skippers may lead to a positive daily energy balance and ultimately contribute to weight gain (Rampersaud et al., 2005; Albertson et al., 2007). Furthermore, since adolescents who eat breakfast are more likely to eat breakfast as an adult, breakfast eaters may be less likely to become chronically overweight or obese than adolescents who never eat breakfast or only ate breakfast during one developmental period leading up to adulthood (Merten et al., 2009; Timlin & Pereira, 2007; Leidy, 2012). With decreased risks of adulthood obesity, risk factors

associated with obesity may also decrease, including the risk of developing type 2 diabetes mellitus (Leidy, 2012). Overall, multiple studies reveal consistent intake of a breakfast meal may help children establish healthy weights (Rampersaud et al., 2005; Sandercock et al., 2010).

Nutrient Intake and Breakfast Consumption

Breakfast consumption may also contribute to increased favorable nutrient intake (Barton et al., 2005, Rampersaud et al., 2005, Ruxton & Kirk, 1997; Timlin & Pereira, 2007; Nicklaus et al., 2007; Chitra & Reddy, 2006). Barton et al. (2005) researched nutrient intake associated with breakfast consumption in girls aged 9-19 years old and found that eating breakfast was associated with higher calcium and fiber intake in the study participants. Furthermore, the participants that consumed cereal for breakfast had increased intakes of fiber, calcium, iron, folic acid, vitamin C, and zinc in addition to lower intakes of fat and cholesterol compared to breakfast skipping participants. An additional study by Nicklas et al. (2000) revealed increased adolescent intake of protein, B vitamins, vitamin A, vitamin C, vitamin D, iron, and zinc in correlation with breakfast consumption. In addition to having overall higher micronutrient intakes, they reported that breakfast consumers may consume less total daily fat. Studies such as these also reveal that students who skip breakfast may not be meeting the Recommended Dietary Allowance (RDA) of many nutrients that are necessary during adolescence. Ruxton and Kirk (1997) reported an overall higher micronutrient intake and lower fat intake among breakfast consumers. They suggested that decreased fat intake could be the result of

typical breakfast foods being higher in carbohydrates and fiber while being low in fat. The correlation between fat and carbohydrate intake was documented in an additional study with 711 fifteen year olds (Nicklas et al., 2000). Participants who skipped breakfast had a higher percentage of total daily energy intakes from fat and a lower percentage from carbohydrates when compared to participants who consumed breakfast. Therefore, it is not surprising that irregular breakfast consumers have been shown to have a lower frequency of fruit and vegetable consumption, and fat free foods containing carbohydrates and fiber (Lazzeri et al., 2013; Utter et al., 2007).

Breakfast and Cognition

In addition to weight and nutrient contributions, breakfast consumption has been shown in both acute and long-term breakfast studies to have positive effects on cognitive performance and function (Cooper, Bandelow, & Nevill, 2011; Hoyland, Dye, & Lawton, 2009; Rampersaud et al., 2005; Maffeis et al., 2012). When students consume breakfast, cognitive functions related to memory, academic performance, and school attendance may improve (Rampersaud et al., 2005). In a study of 1,386 children aged 6-16, four cognitive tasks were measured and compared between breakfast consumers and breakfast skippers (Wesnes, Pincock, & Scholey, 2012). In the study, the power of attention, a score that measures the ability to focus and avoid distractions, was reduced by 7% in participants who did not consume breakfast. Breakfast skipping participants also scored lower in sustained attention, correctly identifying pictures, and response and recognition speeds. Therefore, the ability of students to devote attention, avoid distractions, and have

adequate visual memory performance may be enhanced when a breakfast meal is consumed (Wesnes et al., 2012; Maffeis et al., 2012).

In addition to possibly enhancing cognitive function, breakfast consumption may also improve mental health (O'Sullivan et al., 2009). In one study, eating foods from at least three food groups correlated with a 10% decrease in a child behavior checklist, a mental health test with higher scores representing poorer behavior (O'Sullivan et al., 2009). Students have even reported higher energy and fullness and lower tiredness and hunger with breakfast consumption, which could both affect mental health (Cooper et al., 2011; Leidy, 2012). As mental distress decreases and mental health therefore improves, academic performance may increase (O'Sullivan et al., 2009).

National School Breakfast Program Participation

In the most recent Food Research and Action Center (FRAC) School Breakfast Scorecard for the 2012-2013 school year, SBP participation grew in the overall number of children participating (FRAC, 2014). The report card also revealed a greater increase in the number of low-income children participating in the SBP compared to those participating in the NSLP. In the 2012-2013 school year, 10.8 million low income students participated in the SBP on average, an increase of almost 311,000 students from the previous school year (FRAC, 2014). Additionally, 51.9 low-income students participated in the SBP for every 100 low-income students who participated in the NSLP, an increase from 50.4 students (FRAC, 2014). The report card shows that in total, 36 states had increased ratios of low-income students participating in the SBP in comparison

to the NSLP (FRAC, 2014). Texas had a student SBP participation rate of 60.1% in the 2012-2013 school year, higher than the national average rates (Texas Hunger Initiative, 2014; FRAC, 2014). However, only 1,951,786 of the 3,189,192 eligible Texas school children participated in the SBP in the 2012-2013 school year (Texas Hunger Initiative, 2014).

Despite efforts to increase SBP participation, about half of all eligible SBP students are not taking advantage of the program (FRAC, 2014). However, as previously noted and demonstrated by the FRAC report card, participation in SBP is slowly increasing. FRAC (2014) reports many of the increases in SBP participation can be attributed to strategies that moved breakfast out of the cafeteria and into the classrooms. Strategies such as breakfast in the classroom, grab and go breakfast options, second chance breakfast options, and the Community Eligibility Provision, are proving to be effective strategies that FRAC recommends implementing to further increase SBP participation. The Community Eligibility Provision is a federal provision that allows high-poverty schools to offer free breakfast and lunch to all students regardless of individual student family poverty levels (FRAC, 2014). This provision was implemented by seven states in the 2012-2013 school year and had 5% higher participation rates than other states (FRAC, 2014). In the 2013-2014 school year, the federal provision was available nationwide and could dramatically increase SBP participation rates (FRAC, 2014). Increasing and continuing programs and strategies that move breakfast out of the classroom may also help improve SBP participation rates.

Many adolescents have reported that the main barriers to eating breakfast are not having enough time before leaving for school or not feeling hungry before school (Peraiera et al., 2010; Shaw, 1998; Sandercock et al., 2010; Bruening et al., 2011; Deshmukh-Taskar, Nicklas, O'Neil, Keast, Radcliffe, & Cho, 2010; Olsta, 2013). Additionally, in a recent study with parent and student focus groups, both students and parents reported social stigma associated with participation in the SBP (Bailey-Davis, Virus, McCoy, Wojtanowski, Vander Veur, & Foster, 2013). Participants reported being called names by their peers and would rather eat before school or go hungry. However, despite estimates of 12-35% of adolescents skipping breakfast, parents and students believed breakfast is important for learning, maintaining focus, having energy, and avoiding fatigue, hunger, and mental distress in the morning (Pereira et al., 2010; Sandercock et al., 2010; Shaw, 1998; Deshmukh-Taskar et al., 2010; Olsta, 2013; Bailey-Davis et al., 2013). One Midwestern high school with a student population of 2,560, extended breakfast cafeteria hours and provided a mobile cart that served a full breakfast meal during study hall hours in an effort to increase school breakfast participation (Olsta, 2013). By the end of the school year, SPB participation at this school had increased more than 400%. Although overall SBP participation rates are increasing, further program and tactics such as those mentioned may further increase SBP participation.

Importance of Child and Adolescent Fruit Intake

Many benefits of fruit consumption for all ages have been studied and proposed (Van Duyn & Pivonka, 2000; Ruel et al., 2014). In an overview of the health benefits of

fruits and vegetables from epidemiologic studies by Van Duyn and Pivonka (2000), associations between fruit consumption and decreased risks of cancer, coronary heart disease, hypertension, diverticulosis, stroke, and chronic obstructive pulmonary disease were found. Although these disease conditions may not be common in children, unhealthy dietary habits formed during adolescence may lead to chronic disease developing later in life. In a recent study, Ruel et al. (2014) examined the importance of nutrition, including fruit intake, on the evolution of multimorbidity and found similar results. The results of this study showed that participants in the healthy group (those with no chronic disease conditions) reported the highest fruit consumption compared to participants in the other groups (those with one or more chronic disease conditions). They proposed that their results may be due to the presence of phytochemicals and micronutrients in fruits.

Despite evidence supporting the benefit of fruit intake, overall fruit intake in children and adolescents in the United States is below recommendations (Lorson, Melgar-Quinonez, & Taylor, 2009). Recently, the Center for Disease Control (CDC) recently reported that the amount of whole fruit consumed daily by children (age 2-18) daily increased by 67% from 2003-2010, although 60% of children did not consume enough fruit from 2007-2010 to meet recommendations of fruit intake (2014). Additionally, fruit juice consumption among children decreased by 30% as whole fruit replaced fruit juice as the main contributor to children's fruit intake. They note that in 2003-2004, children ate 0.24 cups of whole fruit per 1000 calories (recommendations are

age-based but range from 1-2 cups of fruit daily). In 2009-2010, children ate 0.40 cups of whole fruit per 1,000 calories. Although recommended fruit intakes for children are not being met, the fact that children are consuming more fruits is encouraging.

In a study by Lorson et al. (2009) examining factors affecting fruit and vegetable intake in U.S. individuals aged 2-18, not only were mean fruit intakes below recommended levels, but sex, age, and household income levels were factors affecting intake. In fact, they found that boys, older adolescents, overweight children and adolescents, and those living in households between 130-350% of the federal poverty level were more likely than others to not meet the recommended intake guidelines. A review article documented that age, gender, socio-economic position, preferences, parental intake, and home availability and accessibility were factors that influenced fruit and vegetable intakes among children and adolescents (Rasmussen, Krolner, Klepp, Lytle, Brug, Bere, & Due, 2006). Girls and younger children tended to have higher or more frequent fruit intakes than others.

School Breakfast Program Student Fruit Consumption

As previously noted, most children and adolescents do not meet recommended intake levels of fruits. Therefore, breakfast meals with fruit components provided through the SBP can greatly contribute to students' fruit intake. O'Brien, Burgess-Champoux, Haines, Hannan, and Neumark-Sztainer (2010) studied the proportion of fruits and vegetables consumed from school meal programs by 103 fourth grade to sixth grade low-income boys and girls. They found that on average, the participants consumed 2.1

servings of fruit daily, with 64% of daily fruit intake being consumed at school. Although the study did not specify the amount of fruit consumed at school breakfast meals, school meals appeared to greatly impact fruit intake among study participants. Despite the fact that school meals contribute to overall fruit intake, there is concern that with the initiation of the new fruit requirements, students will not consume one cup of fruit at breakfast, thereby increasing waste (“Nutrition Standards”, 2012). In fact, in a study of 2,314 students grade Kindergarten-grade 12 examining student school breakfast and lunch consumption, few study participants consumed fruit in a form other than fruit juice (Condon, Crepinsek, & Fox, 2009). Overall, 56% of participants in the SBP consumed 100% fruit juice compared to 6% who consumed canned fruit and 5% who consumed fresh fruit. Although SBP study participants consumed on average double the amount of fruit and fruit juice compared to non-SBP study participants, most students would not have met the new guidelines requiring at least half of the fruit servings to be in a non-juice form. In a more recent study of more than 2,000 adolescents, the average daily intake of fruit was 1.3 servings (Bruening, Eisenberg, MacLehose, Nanney, Story, & Neumark-Sztainer, 2012). The new guidelines will eventually require at least 1 cup of fruit at breakfast and half a cup (Kindergarten-grade 8) or 1 cup (grade 9-12) of fruit at lunch, far more than 1.3 servings of fruit a day (“Nutrition Standards” 2012).

CHAPTER III

METHODS

Participants

Observations of breakfast selection and consumption were obtained from 140 students in Kindergarten through 8th grade in a school district in the Houston, Texas area in the fall of 2011. Specific ethnic distribution of the study participants was not known; however, the actual schools district (37,000 students) was comprised of 21% Hispanic, 10% African American, 10% Asian, and 59% white students. The director of child nutrition selected 12 schools based on eligible participants for free/reduced priced (FRP) meals. Four low and four middle-income elementary schools (kindergarten-grade 5) were selected in which 49-79% and 7-18% of students that attended these schools were eligible for FRP meals. Additionally, two low and two middle-income intermediate schools (grade 6-8) were selected in which approximately 34% and 20% of students that attended these schools were eligible for FRP meals. Once the schools were selected, the schools were then matched on grade level and FRP and then randomized to the intervention or control groups. The observation data collected during the fall semester of 2011 from the original pilot study, “Revised Federal Meal School Guidelines: Impact on Student Food Intake and Costs” was used for this study and was approved by the Institutional Review Board (IRB) at the Baylor College of Medicine and was also approved for exemption by the Texas

Woman's University IRB (Appendix B). Consent forms were not required since the study data were collected based on anonymous observations of student food selection and consumption in the school cafeterias.

Menu Changes

The participating school district developed a 2-week cycle menu that met the new NSLP guidelines prior to the guidelines being published. The new menu included almost all whole grains and either 1% white milk or skim flavored milk. A fresh or canned fruit plus 100% fruit juice was available every morning for breakfast. Students in the intervention group were allowed to select two fruit servings (1 cup total), two grain servings (or 1 grain and 1 protein), and a milk for the FRP breakfast meal. Students in the control group were allowed to select only one serving of fruit (one half cup total) and similar servings of grain, protein and dairy foods as in the intervention group. The offer versus serve (OVS) option was allowed by the district. Therefore, students were allowed to select fewer meal components as long as the total meal met a specified minimum. It should be noted that this study was conducted before the new guidelines were implemented, and therefore the students were not required to take at least one serving for the meal to qualify as a reimbursable meal.

Letters which explained the menu changes were sent home, in both English and Spanish, to all parents and guardians of students in the intervention schools. Additionally, teachers were provided with information on the new menu patterns to post in their classrooms. To help students select proper meal components, easels were set up at the

entrance of each intervention cafeteria serving line with a display of color photos of the foods being served for the day. In addition to the correct number of servings to select under each food group category was presented. A small sign was also placed on the serving line that identified one fruit and two vegetable servings that could be selected for each FRP breakfast meal.

Cafeteria Observation Procedures

Student selection and consumption data were collected based on direct, anonymous observations by trained research staff. One research staff member attended a three-hour training session. Additionally, each observer conducted 2-4 practice observations with the research coordinator who was also recording student consumption. Quality control checks were conducted once a month by a trained observer.

A research observer visited each school once every ten days during the study duration for one semester. The observer obtained the cafeteria seating arrangements for breakfast and used the arrangements to establish weekly data collection rotations for each school. The observer developed a table rotation plan so that all cafeteria tables would be observed in a systematic method over the course of the study. In the elementary schools, each classroom was assigned a specific cafeteria table. Each observer used this information to ensure that equal numbers of students from each grade level were observed over the semester. Grade level was recorded only in the intermediate schools on the observation sheets since these schools did not have grade specific lunch periods.

Each data collector selected and observed, unobtrusively from a distance, three to four students who selected an NSLP breakfast meal each day.

Research staff members were provided with an observation checklist that listed all cafeteria foods provided on the menus in addition to foods sold as a la carte. The staff recorded the foods the students selected in the cafeteria line, foods obtained from other sources (home, a la carte, friend, etc.), and whether food was given away, spilled or obtained (e.g. purchase or trade) using columns on the observation checklist. The amount of each meal item consumed by a student in addition to the student's gender and grade level was recorded on the checklist.

Analysis of Nutrient Intake and Food Groups

Trained dietitians entered the recorded foods selected and consumed on each student lunch observation form into separate Nutrition Data System for Research (NDSR) files (version 21, Nutrition Coordinating Center, University of Minnesota). The recipes and nutrient information for the school menu items were obtained in order to create NDSR specific data files. This allowed data collection on student intake of calories and food groups. The food groups used were fruit, 100% fruit juice, vegetables (total, dark green, red-orange, starchy [white potatoes, corn, peas], other, legumes, high fat vegetables), grains, protein foods, snack chips, sugar sweetened beverages, desserts, and milk.

Statistical Methods

This study compared student food selection and consumption between the intervention group (students who were allowed to select two fruit servings, two grain servings, and a milk) and the control group (students could select only one serving of fruit and similar servings of grain, protein and dairy foods) for the FRP breakfast meal. Therefore, statistical analyses were conducted to determine any relationships between the intervention group and control group in the number of fruit servings (two vs. one) selected at each breakfast meal (yes or no). In the file for student food selection, a variable was created for students who selected two fruit servings at each breakfast meal (yes/no). Chi-square tests (Cochran-Mantel-Haenszel statistics) were used to test the difference in numbers of students selecting two fruit servings at breakfast in the intervention and control groups, controlling for student gender and school FRP (low/middle income) for both the elementary and intermediate schools, as well as grade in the elementary schools. Separate analyses of covariance (ANCOVA) compared the mean amounts of calories and food groups consumed, with intervention or control school membership as the between group factor. However, only students who selected the foods in the analyzed food groups were included. ANCOVA was also used to compare the percentage of food groups selected and consumed between the intervention and control groups. Again, only students who selected the foods in the analyzed food groups were included. Both ANCOVA analyses were adjusted for student gender and school FRP for both elementary and intermediate school student data as well as for grade for elementary

school data. Finally, the adjusted outcome means for each food component for the intervention and control groups were reported. All analyses were performed using SAS (version 9.3, 2011, SAS Institute Inc.) with $\alpha = 0.05$.

CHAPTER IV

RESULTS

One hundred and twenty students (120), 60 boys and 60 girls, from a Texas school district completed the study (see Table 1). Eighty-four (84) of the participants were elementary school students while 36 were middle school students (Table 1). The amount of boys and girls participating in both the intervention and control groups was approximately equal (Table 1). Likewise, the number of students in the low income and middle income schools were similar between groups (Table 1).

The proportion of participants in each group that selected two fruit servings at breakfast between intervention and control groups is summarized (Table 2). A significant difference was found between the two study groups for the number of participants who selected two fruit servings at breakfast ($p=0.007$). Six (6) participants in the intervention group (11.1%) and no participants (0%) in the control group selected 2 fruit servings at their breakfast meal. There was no significant difference in the mean amount of total calories consumed by participants who selected the foods in the intervention and control groups (Table 3). There also was no significant difference in the percentage of students selecting the food groups between the two groups. Very few participants, 14.8% intervention participants and 18.2% control participants, selected fruit

Table 1

Participants' Demographic Characteristics

	Elementary (n=84)				Middle (n=36)			
	Intervention (n=38)		Control (n=46)		Intervention (n=16)		Control (n=20)	
	n	%	n	%	n	%	n	%
Gender								
Boy	19	50	22	47.8	8	50	11	55
Girl	19	50	24	52.2	8	50	9	45
SES								
Middle	20	52.6	22	47.8	8	50	10	50
Low	18	47.4	24	52.2	8	50	10	50

only. On the other hand, 68.5% of intervention participants and 57.9% of control participants selected only juice as their fruit serving at breakfast meals.

There was no significant difference in the mean amount of total calories consumed by participants in the intervention and control groups at breakfast (Table 4). Participants in the control group consumed an average of 348 calories while participants in the intervention group consumed an average of 357 calories. There was also no significant difference in the mean amounts and percent of foods consumed between the two groups. In the intervention group, approximately 78.4% of fruit juice was consumed among participants selecting only fruit juice as their fruit component, compared to 75.4% in the control group (Table 4). Of students consuming fruit only, the intervention students actually consumed only 43.4% and control students consumed 36.6% of fruit selected.

Table 2

Proportion of Students Selecting Two Fruit Servings per Breakfast Meal¹

	Intervention Group	Control Group	Total
Selected 0-1 Fruit Servings	48 (88.9%)	66 (100%)	114
Selected 2 Fruit Servings ²	6 (11.1%)	0 (0%)	6

¹ Chi-Square Test (Cochran-Mantel-Haenszel Statistics) controlling for gender, grade, and school SES to test for differences in fruit selection between intervention and control groups.

²p-value=0.007

Table 3

*Total Calories Selected and Percent of Students Selecting Each Food per Breakfast**Meal^{1,2}*

	Intervention Group n=54	Control Group n=66
Calories (total selected)	425	422
Type of Food Selected (%)		
<u>Fruits (Servings)</u>		
Total Fruit and/or Fruit Juice	72.2	75.8
Fruit Only	14.8	18.2
Fruit Juice Only	68.5	57.6
<u>Vegetables (Servings)</u>		
Total Vegetables	5.6	7.6
Dark Green Vegetables	0	0
Red Orange Vegetables	5.6	7.6
Starchy Vegetables	0	0
Other Vegetables	0	0
Legumes	0	0
High Fat Vegetables	0	0
<u>Grains (Servings)</u>		
Total Grains	100	100
Whole Grains	25.9	22.7
Other Grains	77.8	80.3
<u>Protein Foods (Servings)</u>		
Total Meat, Yogurt, and Cheese	81.5	92.4
Total Milk	92.6	90.9

¹No significant differences between the intervention and control group² ANCOVA test controlling for gender, grade, and school SES

Table 4

Total Calories Consumed and Mean Food Group Servings and Percentage of Foods Consumed by Students per Breakfast Meal^{1,2,3}

	Consumed Amount ⁴		Percent Consumed (%) ⁵	
	Intervention	Control	Intervention	Control
Total Calories Consumed	357 ± 17.0	348 ± 15.1	83.6 ± 2.5	80.8 ± 2.3
Type of Food Consumed				
<u>Fruit (Servings)</u>				
Total Fruit and/or Fruit Juice	0.8 ± 0.1	0.7 ± 0.1	74.7 ± 7.1	65.8 ± 6.4
Fruit Only	0.5 ± 0.2	0.5 ± 0.2	43.4 ± 16.1	36.6 ± 13.5
Fruit Juice Only	0.8 ± 0.1	0.8 ± 0.1	78.4 ± 7.1	75.4 ± 7.1
<u>Vegetables (Servings)</u>				
Total Vegetables	0.2 ± 0	0.2 ± 0	100 ± 0	100 ± 0
Dark Green Vegetables	-	-	-	-
Red Orange Vegetables	0.2 ± 0	0.2 ± 0	100 ± 0	100 ± 0
Starchy Vegetables	-	-	-	-
Other Vegetables	-	-	-	-
Legumes	-	-	-	-
High Fat Vegetables	-	-	-	-
<u>Grains (Servings)</u>				
Total Grains	1.4 ± 0.1	1.4 ± 0.1	91 ± 4.3	83.8 ± 4.0
Whole Grains	0.7 ± 0.1	0.8 ± 0.1	88.2 ± 7.1	94.9 ± 7.4
Other Grains	1.6 ± 0.2	1.5 ± 0.2	90.1 ± 5.3	81.6 ± 4.7
<u>Protein Foods (Ounce Equivalents)</u>				
Total Meat, Yogurt, Cheese	0.6 ± 0.1	0.6 ± 0.1	75.4 ± 6.7	76.6 ± 5.8
Total Milk (Ounces)	7.2 ± 0.4	7.1 ± 0.3	87.0 ± 4.0	82.7 ± 3.7

¹No significant differences between the intervention and control group.

²ANCOVA Test controlling for gender, grade, and school SES.

³Only students who selected the foods in the analyzed food groups were included

⁴Mean amounts ± SEM

⁵Percentages ± SEM

CHAPTER V

DISCUSSION

To our knowledge, this is the first study examining the effect of the new USDA meal guidelines on student food selection and consumption at breakfast. More students in the intervention schools (11.1%) selected 2 fruit servings than students in the control schools (0%). Additionally, 88.9% of intervention group students and 100% control group students selected one fruit serving for breakfast. While fruit intake provides many benefits and research has shown that a majority of child and adolescent fruit intake comes from school meals, our study indicated that the majority of intervention students (89%) did not select two fruit servings when permitted (Van Duyn & Pivonka, 2000; Ruel et al., 2014; O'Brien et al., 2010). In fact, the mean amounts of fruit group servings selected and consumed by the student participants did not differ between groups. With the new guidelines requiring two fruit servings at SBP meals, these results suggest that interventions are needed to promote the opportunity for children to select and consume fruit for breakfast.

A recent study by Cohen, Richardson, Parker, Catalano, and Rimm (2014) also examined the effect of the new USDA nutrition standards on student lunch food selection and consumption before and after implementation of the new guidelines in the fall of 2011 and the fall of 2012. They reported that the percentage of students selecting a fruit

at lunch after the new standards were initiated significantly increased by 23.0% (52.7% vs. 75.5%) compared to the pre-implementation of the standards. However, there were no significant differences in the percentage or quantity of fruit consumed after the new standards were implemented. The researchers did note that there was no increase in fruit waste because there was no change in the percentage of fruit consumed by the students post-implementation. Therefore, they conclude that the new standards resulted in more students consuming fruits. Cohen et al. (2014) did note concern that students discarded about 40% of the fruits they selected from their trays.

The implications of the results of our study and that of Cohen et al. (2014) should be further examined, particularly the effect the new guidelines have on student fruit consumption and subsequent plate waste. Interventions that educate children, parents, and faculty on the importance of fruit consumption as well as the different types of fruit may be useful in increasing intake. If students are unfamiliar with certain fruits, they may not select or consume them. Therefore allowing students an opportunity to taste test fruits could be very beneficial. Schools should also focus on marketing and presentation to increase the appeal. Interventions and strategies such as those mentioned should be considered to increase overall fruit intake by children and adolescents.

Limitations

A total of twelve schools with 120 students from one school district in the Houston area were studied. Therefore, this study was limited in its sample size and lack of a diverse sample population. Studying student fruit selection and consumption in a

larger sample size may strengthen findings. Additionally, examining student fruit selection and consumption in other school districts not only in Texas, but also nationally, may provide a better picture of the effects of the new USDA nutrition standards and guidelines on U.S. school children. Although all U.S. school districts that participate in the SBP have to meet the same guidelines, they do not all serve the same foods or prepare foods the same way. Therefore, expanding this study to other districts could provide useful data. It should be noted that although the study included only one school district, the schools selected to participate in the study were both low and middle-income schools with different percentages of students eligible for FRP meals. Furthermore, results were controlled for school socioeconomic status. However, further studies should examine student fruit selection and consumption in higher income schools. Finally, this study examined fruit selection and consumption in students grade Kindergarten through grade 8. Therefore, future research should evaluate and examine the effect of the new guidelines on fruit selection and consumption in older students in grades 9-12. Especially as research shows a negative correlation between age and frequency of breakfast consumption (Rasmussen et al., 2006; Lorson et al., 2009; Rampersaud et al., 2005; Bruening et al., 2011; Merten et al., 2009).

A strength of this study is that objective data on foods selected and consumed were collected by trained researchers. However, whether the observers might have influenced student selection and consumption is unknown.

CHAPTER VI

CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

This study found a significant difference in the proportion of students selecting two fruit servings when allowed in a pilot test of the new USDA *Nutrition Standards in the National School Lunch and Breakfast Program* compared with students who could only select 1 serving as in the previous guidelines. Therefore the first null hypothesis is rejected. However, no significant differences were found in the mean amounts and percentages of fruit consumed between the two study groups. Therefore, the second and third null hypotheses were accepted. Fruit provides many nutrients necessary for children and adolescents and are therefore an important part of their diet. The new USDA guidelines aim at increasing fruit intakes in students; however, further methods and interventions to increase student fruit intake may be needed. For instance, interventions that educate children, parents, and faculty on the importance of fruit consumption as well as the different types of fruit may be useful in increasing intake. If students are unfamiliar with certain fruits, they may not select or consume them. Therefore allowing students an opportunity to taste fruits could be very beneficial. Schools should also focus on marketing and presentation to increase the appeal. Interventions and strategies such as those mentioned should be considered to increase overall fruit intake by children and adolescents.

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APPENDIX A

School District Breakfast Menu

School District Breakfast Menu				
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
<u>Breakfast Pizza</u>	<u>Whole Grain Pancake on a Stick</u>	<u>Scrambled Eggs, Turkey Sausage Patty & Whole Grain Toast</u>	<u>French Toast Sticks</u>	<u>Whole Grain Sausage Kolache</u>
OR	OR	OR	OR	OR
<u>Low Fat Yogurt w/Choice of:</u>	<u>Low Fat Yogurt w/Choice of:</u>	<u>Low Fat Yogurt w/Choice of:</u>	<u>Low Fat Yogurt w/Choice of:</u>	<u>Low Fat Yogurt w/Choice of:</u>
Granola Kellogg's Graham Cracker Gripz Low Fat Banana Nut Muffin Froot loops or Rice Krispies Cereal	Granola Kellogg's Graham Cracker Gripz Low Fat Banana Nut Muffin Froot loops or Rice Krispies Cereal	Granola Kellogg's Graham Cracker Gripz Low Fat Banana Nut Muffin Froot loops or Rice Krispies Cereal	Granola Kellogg's Graham Cracker Gripz Low Fat Banana Nut Muffin Froot loops or Rice Krispies Cereal	Granola Kellogg's Graham Cracker Gripz Low Fat Banana Nut Muffin Froot loops or Rice Krispies Cereal
Seasonal Fruit	Seasonal Fruit	Seasonal Fruit	Seasonal Fruit	Seasonal Fruit
100% Fruit Juice Low Fat or Fat Free Milk	100% Fruit Juice Low Fat or Fat Free Milk	100% Fruit Juice Low Fat or Fat Free Milk	100% Fruit Juice Low Fat or Fat Free Milk	100% Fruit Juice Low Fat or Fat Free Milk

APPENDIX B

IRB Approval Letters



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

March 21, 2014

Ms. Aubrey Dimas
Nutrition & Food Sciences
6700 Fannin Street
Houston, TX 77030

Dear Ms. Dimas:

Re: The impact of the new United States Department of Agriculture (USDA) meal patterns on student food selection and consumption at breakfast (Protocol #: 17613)

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

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 unanticipated incidents. If you have any questions, please contact the TWU IRB.

Sincerely,

Jan Foster, PhD, APRN, CNS
Institutional Review Board - Houston

cc. Ms. Rose Bush, Department of Nutrition & Food Sciences - Houston
John Radcliffe, PhD, RD, Department of Nutrition & Food Sciences - Houston
Graduate School

December 22, 2010

KAREN W CULLEN
BAYLOR COLLEGE OF MEDICINE
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H-28086 - REVISED FEDERAL SCHOOL MEAL GUIDELINES: IMPACT ON STUDENT FOOD INTAKE AND COSTS

APPROVAL VALID FROM 12/22/2010 TO 12/7/2011

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 named above was 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 dark ink, appearing to read "Julie P. Katkin, MD".

JULIE PAMELA KATKIN, M.D.
Institutional Review Board for Baylor College of Medicine and Affiliated Hospitals



APPENDIX C

Researcher Observation Data Collection Tool

NDSR ID: _____

On line today	Breakfast Menu Items	Start	Add	Gave/ Lost	Left	EATEN	Date:
Meats/Grains							Directions: Check food items selected by student. Circle specific item if group. If needed, write in item not on list. Check items added. Check items traded/lost. Mark amount left. Total amount eaten. Write notes if needed.
	Breakfast Pizza						
	Breakfast Sandwich						
	French Toast Sticks						
	Scrambled Eggs, Sausage Patty & Toast						
	Sausage Kolache						
	Whole Grain Pancake on a Stick						
	Cereal (assorted)						
	Low-fat yogurt with granola						
	Low-fat yogurt with graham cracker gripz						School: _____
	Low-fat muffin						
Fruit							Observer: _____
	100% Grape Juice						
	Fruit (seasonal)						Table#: _____
Milk							
	Chocolate (fat-free)						Start time: _____:_____ AM/PM End time: _____:_____ AM/PM Grade level (if known): _____
	Strawberry (fat-free)						
	Unflavored (1%)						Boy: _____ Girl: _____
Condiments							
	Syrup Packet						Measurement scale: _____ 0, 1/8, 1/4, 1/2, 3/4, all
	Ketchup						
							Food source codes: 1 = home 2 = a la carte 3 = reimbursable school meal 4 = friend (for items obtained from friend) 5 = vending (Victory Lakes has a vending machine in cafeteria) 6 = fresh fruit Friday 7 = from teacher 8 = from lunch room monitor 9 = unknown 10 = cafeteria water (free)

Notes: