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A Comparative Analysis of State School Food Preparation Practices in NJ, GA & KY, 2006 - 2012

Shanice Battle

ABSTRACT

A Comparative Analysis of State School Food Preparation Practices in NJ, GA & KY, 2006 - 2012

By

Shanice Battle

Background: Over the past decade, the U.S. has struggled to effectively address the childhood obesity epidemic. Healthy eating is paramount to child health, especially in terms of obesity prevention. The rate of obese adolescents in grades 9-12 between 2005 and 2013 remained about the same in Georgia, decreased in New Jersey, and increased in Kentucky. It is possible that school meals could be different amongst these states.

Methods: This study analyzed changes and differences in school food preparation practices between 3 selected states. These regions were chosen based on their relatively low (New Jersey), intermediate (Georgia), and high (Kentucky) obesity rates. Both SHPPS 2006 and 2012 nutrition services data was chosen for this analysis to look at changes in school food preparation practices in each state and in the overall sample over time using independent samples t-tests and one way ANOVA.

Results: Overall, statistically significant changes ($p<.05$) in food preparation practices were observed in seven out of 22 food preparation practice variables between 2006 and 2012. New Jersey and Georgia improved their food preparation practices between 2006 and 2012 while Kentucky improved in some areas and worsened in others. Between states comparisons showed Kentucky had several practices different from New Jersey and Georgia in 2006 but by 2012 there were very few differences between states.

Discussion: These states have improved in some areas of school food preparation practices while other areas still need improvement. The state with the highest adolescent obesity rate was the only state to show declines in the average use of healthier school food preparation practices. Public health efforts should seek to address barriers to providing healthy foods in schools for regions that show the need for intervention.

A Comparative Analysis of School Food Preparation Practices in New Jersey, Georgia and Kentucky 2006-2012

by

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Author's Statement Page

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Introduction

1.1 Background

Childhood obesity is a complex health issue caused by an amalgamation of several social and biological factors. Based on an analysis of National Health and Nutrition Examination Survey surveillance data by Ogden and colleagues (2014) about 32% of U.S. children ages 2-19 are obese or overweight with about 17% (12.7 million) being obese. Current rates are 3 times as high as they were in 1980 (Story, Kaphingst & French, 2006). Childhood obesity is a major component of the obesity epidemic that presents two main public health concerns. Children who are obese have several health risks and consequences and these children have higher chances of adulthood obesity.

Hence, the U.S. has struggled to effectively address the childhood obesity epidemic as American children and adolescents have suffered from the health consequences of obesity at increased rates over the past decade. While some states have seen reductions in overall adolescent overweight and obesity rates others have remained at an intermediate or increasingly high rate of adolescent obesity. For example, the rate of obese adolescents in grades 9-12 between 2005 and 2013 remained about the same in Georgia, decreased in New Jersey, and increased in Kentucky. While many factors may be attributing to these differences, it is possible that the school meal preparation differs amongst these states.

Healthy eating is paramount to child health, especially in terms of obesity prevention. Children with a healthy diet are less likely to become obese and are consequently less likely to develop diabetes, cardiovascular disease and cancer. The school environment is especially important in terms of combating the adolescent obesity epidemic in this country. Over 31 million children were served lunch at school each day in 2012 in addition to those who also ate breakfast

(Cullen, Chen, Dave, & Jensen, 2015). Also, it is estimated that children consume anywhere from 19-50% of their daily food at school (Story et al, 2006) provided through the National Student Lunch Program (NSLP) and School Breakfast Program (SBP). This places large responsibility on the NSLP to ensure children are served nutritious food in schools by utilizing healthy school food preparation practices. The NSLP and SBP nutrition policies have been revised several times in the past 50 years. Each revision was made out of increasing consciousness of how school food impacts adolescent health.

1.2 Research Aims

To date, no studies have directly evaluated the differences in school food preparation practices between states with variances in adolescent obesity. This study will analyze changes in school food preparation practices between 3 selected states. These regions were chosen based on their relatively low (New Jersey), intermediate (Georgia) and high (Kentucky) rates of adolescent obesity. Practices in 2006 will be compared to 2012 within each state to identify any changes that may indicate more or less obesogenic school food preparation practices. In addition, there will be a side-by-side comparison of each state's school food preparation practices within each year to understand differences that exist as a result of their differences in the utilization of unhealthy practices.

Literature Review

2.1 Childhood Obesity in the U.S.

Overweight and/or obese status is determined using body mass index (BMI) guidelines set by the Center for Disease Control and Prevention (CDC, 2015). Children who are overweight fall in the 85th BMI percentile and obese children fall in the 95th BMI percentile. In an analysis of 2003-2004 and 2011-2012 obesity surveillance data by Ogden, Carroll, Kit and Flegal (2014) childhood obesity rates for ages 2-19 were 17.1% and 16.9%, respectively. Amongst adolescents ages 12-19 the obesity rate was 17.4% in 2003-2004 and 20.5% in 2011-2012. The overall 2011-2012 statistics show no significant decrease in the obesity prevalence.

Adolescents who struggle with attaining a healthy weight experience immediate and long term consequences if the struggle persists. According to the CDC (2015), obesity is a risk factor for high blood pressure, high cholesterol, gastro-esophageal reflux and joint problems, which all can lead to more serious conditions such as cardiovascular disease and Type 2 Diabetes if left unresolved. Childhood obesity can also be associated with depression, low self-esteem and lack of social health (CDC, 2015). According to the CDC, recent study results showed at least one cardiovascular disease risk factor such as high blood pressure or high cholesterol in 70% of obese children while 39% had at least two (CDC, 2012). Obese children are also at increased risk for the development of type 2 diabetes. In addition, the impact of obesity on the adolescent body can lead to joint issues, muscoskeletal discomfort, heartburn, sleep apnea, and asthma (CDC, 2012). Previous studies have shown a predictive association between adolescent and adulthood obesity. The US National Longitudinal Study of Adolescent Health (Add Health) (The, Suchindran, North, Popkin & Gordon-Larsen, 2010) followed a cohort of individuals from 1996 to 2009 to record incident adulthood severe obesity to determine its relationship with adolescent weight status. The and colleagues (2010) observed a 7.9% incident adulthood obesity rate (95% CI, 7.4-8.5%). This group had higher adolescent body mass index (BMI) and were primarily minority (mainly non-Hispanic black women). In addition, less than 5% of adolescents who were not obese developed adulthood obesity. This prevalence remained stable after analyzing each racial/ethnic and sex category. Due to the almost 10 year stagnancy of U.S.

adolescent obesity rates and health implications of this condition it is imperative to continue to address every aspect of the current hindrances to obesity rate reduction.

2.2 The Cost of Childhood Obesity

The economic burden of childhood obesity characterizes this epidemic as one we cannot afford to ignore. Using data from the Medical Expenditure Panel Survey, Trasande and Chatterjee (2009) compared health care utilization, outpatient visit expenditures, prescription drug expenditures and emergency room expenditures between obese/overweight and normal/underweight adolescents age 6-19 years old over a two-year period. Over 40% of the sample were children who were either obese both years, overweight both years or obese 1 year and overweight the other. Compared to normal/underweight children, the children who were obese both years or obese one year and overweight for the other had combined 45.3% higher outpatient visit expenditures, 54.5% prescription drug expenditures and 29.5% higher emergency room expenditures. The overall additional medical cost for overweight and obese children projected in the U.S. was $14.1 billion.

Trasande and Chatterjee also reviewed differences in health care utilization. 6-19 year old obese subjects had 38.3% more outpatient appointments and 29.7% more prescriptions than their normal and underweight counterparts. In another study, overweight and obese children were found to have a combined additional $74,000 in medical costs for primary care and mental health visits (Estabrooks & Shetterly, 2007). In addition, the predicted lifetime increased medical costs for just obese children compared to normal weight children is estimated to be $12,000-$19,000 (Finkelstein, Wan Chen Kang, & Malhotra, 2014). The economic impact of adolescent obesity is well documented in the literature. With the known economic and racial disparities amongst the obese/overweight adolescent population in the U.S. combined with other costs associated with healthcare utilization such as parental time off of work for appointments and transportation expenses, weight status improvement would not only improve adolescent health but also relieve a considerable amount of financial burden.

2.3 Childhood Obesity in Selected States

Although there have been adolescent obesity interventions implemented on a national level the statistics in this population look completely different in each state. The aim of this analysis is to compare states with childhood obesity rates that are low, intermediate and high with respect to school food preparation practices. Based on differences in 2013 childhood obesity rates, New Jersey, Georgia and Kentucky were selected. Although there are states with adolescent obesity rates lower than New Jersey, The state of New Jersey [Figure 2] has seen much success in addressing the rate of childhood adolescent obesity. In 2005, the obesity rate for high school students was 11.3%. In 2011, only 10.0% of adolescents ages 10-17 were obese and in 2013 only 8.7% of high school students were obese. These statistics have placed New Jersey in the top 10% of all ranked states for adolescent obesity. New Jersey's childhood obesity prevention and reduction initiatives have been advantageous at making their childhood obesity rates among the lowest in the country.

Georgia [Figure 3] has seen a somewhat moderate level of success in addressing the obesity epidemic. The high school obesity rate has not changed much, ranging from 12.3% in 2005 to 12.7% in 2013. In 2011, Georgia's obesity rate for 10-17 year olds was 16.5%. Although these rates are not among the highest or lowest for adolescents in the U.S. it does not show any significant decreases. Kentucky, however, is among the states with high rates of adolescent obesity [Figure 4]. The percentage of adolescent obesity increased from 15.4% in 2005 to 18.0% in 2013 ranking this state as one of the U.S. states with the highest rate of obesity among high school students. In addition, 19.7% of 10-17 year old Kentucky children were found to be obese in 2011. With efforts to decrease adolescent obesity both nationally and within each state, key differences in the school food environment are likely.

2.4 Risk Factors for Childhood Obesity in the School Environment

There are several important factors relevant to childhood obesity in the school environment. First, there is the availability of nutritious foods at school. The United States Department of Agriculture (USDA) provides guidelines for school breakfast and lunch programs nationwide. Foods served through this program are to provide a nutritious meal for all students based on USDA standards and prevent hunger for students at risk (Gunderson, 2003). There are other foods sold in schools that are not a part of the USDA programs called competitive foods. These are sold in vending machines, during fundraisers, at school snack bars, in school stores and as a la carte options in cafeterias (Story et al, 2006). More recently, farm to school and school garden programs were initiated. Farm to school programs connect schools to locally grown ingredients and school garden programs allow students to experience planting, nurturing, harvesting and preparing their own foods (Story et al, 2006).

Second, there are curriculum related factors relevant to childhood obesity in schools. Obesity is a function of consuming and using calories, and to use enough calories to prevent obesity an adequate amount of physical activity is necessary (School Health Guidelines to Promote Healthy Eating and Physical Activity, 2011). Although the Federal government's daily recommendation for children and adolescents is at 60 minutes per day, each state has the authority to set a requirement for a minimum amount of physical activity to ensure each district meets this standard. In addition, extracurricular sports and activity programs help students remain active outside of school hours. School health education is also an important factor for childhood obesity. Teaching students about nutrition, exercise and weight management at early ages are important investments for healthy weight outcomes throughout life (Story et al, 2006).

Lastly, school health services are related to childhood obesity. Health professionals in elementary, middle and high schools are useful for routine screenings, disseminating health information and providing referrals to students who need them. Specifically, monitoring height, weight and BMI are crucial to characterizing obesity in school environments and assessing the need for interventions (Story et al, 2006).

2.5 The National Student Lunch Program

This analysis will focus specifically on food offered through USDA programs. The National School Lunch Program (NSLP) was initiated in 1946 as a way for U.S. schools to receive financial assistance from the federal government to provide meals to students. In 1966 the Child Nutrition Act established the School Breakfast Program as an addition to the NSLA in an effort to maximize student health (NSLP, 2014). Since its creation its purpose has expanded, and school food has the responsibility of concurrently ensuring nutrition is not a barrier to academic performance, alleviating hunger, reducing waste and mitigating childhood obesity amongst other roles (Disiena, 2015). There have been several changes to this program that range from adding food safety regulations to nutrition requirements all with regard to child health.

The Dietary Guidelines for Americans (DGFA) is a 5-year publication beginning in 1980. The DGFA includes specific recommendations for various aspects of diet such as controlling weight, which foods to decrease and increase for increased health, establishing beneficial eating practices and making healthy choices (DGFA, 2005). The Healthy Meals for Healthy Americans Act of 1994 required schools to meet the Dietary Guidelines for Americans (DGFA) when serving school meals (Abraham, Chattopadhyay, Sullivan, Mallory, Steiger & Daft, 2000). As a result of this act the School Meals Initiative (SMI) became one of the first amendments that set regulations for nutritional content of school meals for all children over the age of 2. This initiative recommended schools offer meals with less than 30% of calories from fat and less than 10% from saturated fat. In addition, at least one third of the daily allowances of dietary fiber, protein, vitamin A, vitamin C, calcium and iron each day during breakfast and lunch. The SMI also recommends sodium reduction (less than 600 mg for breakfast, less than 800 mg for lunch) and cholesterol (less than 75mg for breakfast, less than 100mg for lunch) (Abraham et al, 2000).

In 2009, out of growing concern for the quality and quantity of school meals to optimize child development, the Institute of Medicine (IOM) issued a report outlining recommendations for changes the USDA should make to the NSLP. The IOM outlined specific alterations such as increased access to fruits vegetables and whole grains, upper and lower calorie limits for school meals, and the need for increased focus on reducing saturated fat and reducing sodium. This report drew the attention of several school food decision makers, beginning with major food distribution companies. The three main companies serving as food providers for U.S. schools pledged to meet the IOM's standards by providing ingredients that met the fat, fruit, vegetable, sodium and whole grain recommendations (Front Matter, 2010)(IOM, 2013).

Following this declaration the President Obama signed the Healthy Hunger Free Kids Act of 2010 that required U.S. schools to meet the IOM recommendations by giving the USDA the opportunity to reform the school lunch and breakfast programs (School Meals, 2015). This was the first major legal revision of the NSLP since the student meals initiative of 1994. Also in 2010, the first lady launched the *Lets Move!* initiative that not only promoted increases in physical activity to combat childhood obesity but also encouraged schools to create healthier food environments by increasing food quality, partnering with local chefs and placing more salad bars in schools (Eat Healthy, 2015).

In 2012 the USDA officially released new school meal standards. These guidelines outlined the required components of school meals specifically focusing on fruits, vegetables, grains, meat, milk, calories, saturated fat, sodium and trans fat. Each component was described in terms of portioning by grade level, frequency of offerings (daily, weekly), which meals they must be a part of (lunch, breakfast) and even which food groups the foods offered must belong to. In addition, there were strict rules implemented for what types of foods can serve as substitutions for each category and a plan for monitoring and compliance was discussed in detail (Nutrition Standards in the National School Lunch and School Breakfast Programs, 2012).

How compliant are schools with set guidelines for meal nutrition? The periodic School Nutrition Dietary Assessment (SNDA) answers this question by analyzing school meals offered and served based on the SMI and DGFA. The 2004-2005 fiscal year SNDA found only 19% of schools served meals that met the total fat standard and only 28% of schools met the saturated fat standard. Gordon and colleagues also found there was an excessive amount of sodium served in schools meals – zero percent of schools met the sodium standard (the average sodium content was over 1,300mg per meal). Overall, less than 7% of all schools offered lunches that met all SMI nutritional content standards. The 2009-2010 SNDA showed some improvement. Fox and Colleagues (2012) found only 34% of schools met the total fat standard and 50% met the saturated fat standard. Sodium content was not included in the 2009-2010 report. In addition only 14% of schools offered meals that met all SMI standards. Fat and sodium consumption are both linked to obesity incidence. With so few schools meeting these standards in the past decade combined with the current state of the childhood obesity epidemic, further evaluation of school food is warranted.

2.6 School Food Preparation Practices

The Centers for Disease Control and Prevention conducts the School Health Policies and Practices Survey (SHPPS) every 6 years since 1994 as a measurement of the 8 components of school health (Kyle, Brener, Kann, Ross, Roberts, Lachan, Robb & McManus, 2006). These components - Health education, Physical education and activity, Health services, Mental health and social services, Nutrition services, Healthy and safe school environment, Faculty and staff health promotion and Family and community involvement- are measured across private and public elementary, high, and middle schools at the state, district, and classroom level (Kyle et al, 2006). The aims of the survey are to describe changes in policies and practices over time, the professionals responsible for implementing these policies and practices, and any collective efforts amongst staff and with outside institutions to ensure school health (Kyle et al, 2006).

School food preparation practices were analyzed based on SHPPS 2000 data and again for SHPPS 2006. Based on the results of the SHPPS 2000 analysis only about 36% (8/22) of the school food preparation techniques to reduce sugar, fat and salt were practiced always or almost always (Wechsler, Brener, Kuester & Miller, 2001). While the majority of institutions offered a variety of foods about 30% did not have a daily choice of 2 or more fruits, vegetables or entrees. In addition, according to Wechsler and colleagues, most milk in schools was high in fat and only about 20% of schools had both low and skim fat alternatives (2001). The SHPPS 2006 analysis by O'Toole, Anderson, Miller, and Guthrie (2007) also reviewed all nutrition services in schools. Most of all school districts (49.1% to 91.4%) always or almost always used techniques to reduce fat in meat preparation and vegetable preparation (48.4%-77.7%) depending on the technique (O’Toole et al, 2007). However, when reviewing sugar, fat and salt substitution and reduction there were some alarming practices directly related to the risk factors and complications of childhood obesity. An evaluation of the substitution of ingredients showed only 14.3% of school districts exchanged low sodium canned vegetables over regular vegetables and only 32.5% of U.S. school districts substituted salt in recipes. In addition, less than 30% of all districts used each method of fat, salt or sugar reduction always or almost always. These analyses were done as overall assessments of practices in the U.S. and no state comparisons were made.

These results illustrate the need for a review of district school food preparation practices in each state for two main reasons. First, although almost half of schools had satisfactory meat and vegetable practices it would be valuable to know if states with higher and lower childhood obesity rates differ in these categories. Second, salt, sugar and fat are of major concern in relation to adolescent obesity. It is crucial to evaluate if states with lower and higher obesity rates have healthier or unhealthier reduction and substitution techniques. As obesity rates follow alarmingly different trends in each state and school meals provide a substantial portion of the adolescent diet, it is important to investigate the nutritional quality of school food in states that struggle to address this epidemic and in those that do not. An observation of poor school food preparation practices in states with higher or lower adolescent obesity will be useful for justifying further examination of the NSLP and provide support for closer monitoring of school food preparation policy implementation.

Methods

3.1 Sampling

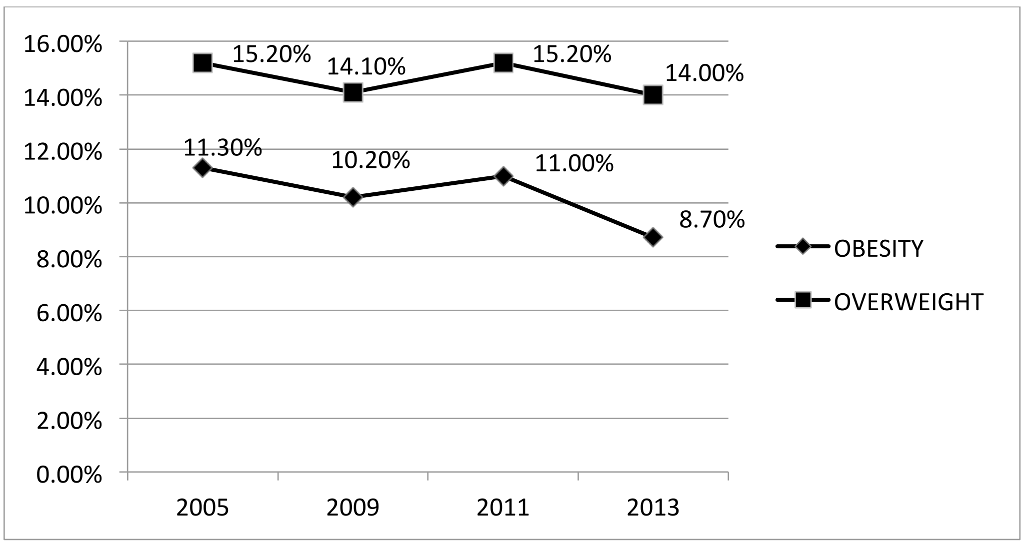
Data from the SHPPS 2006 and 2012 nutrition services data are chosen for this analysis to investigate changes in school food preparation practices in each state and in the overall sample over time. District level nutrition services data are selected to compare food preparation practices between states because this data is not collected at the state level. In SHPPS, a nationally representative sample of all elementary middle and high schools completed the survey. All public and private schools in all 50 states and the District of Columbia that receive only funding from a school board (with limited guidance) are eligible (Kyle et al, 2006). The SHPPS 2006 and 2012 surveys used mostly identical sampling techniques. Using census data, school districts were first separated into 4 strata by high/low poverty and rural/urban population. They were classified based on U.S. median percent living below the federal poverty level and U.S. median rural population. Then, geographic primary sampling units (PSUs) were created based on these strata. For the 2006 survey, 5520 PSUs were created based off the national sample resulting in 13, 694 total districts (Kyle et al, 2006). From this pool, 820 districts were selected, 104 were determined to be ineligible after sampling, 722 school districts were surveyed and 538 (74.5%) responded by completing at least one module of the survey (Kyle et al, 2006). For the 2012 survey, 5407 PSUs were created resulting in 12,784 total districts. From this pool, 1057 districts were selected, 9 were determined to be ineligible after sampling, 1048 school districts were surveyed and 804 (76.7%) responded by completing at least one module of the survey (Brener et al, 2012).

3.2 State Selection

The CDC uses 3 categories to classify states by childhood obesity rate by grouping states with less than 10%, 10-14%, and 15-19% together based on percentage of high school students who were obese (Adolescent and School Health, 2014). For the purposes of state selection these were determined to be low, intermediate and high rate groups. For the analyses, New Jersey, Georgia and Kentucky were randomly chosen and rates between 2005 and 2013 are graphed because they are the closest years of the YRBSS survey that can show trends corresponding with

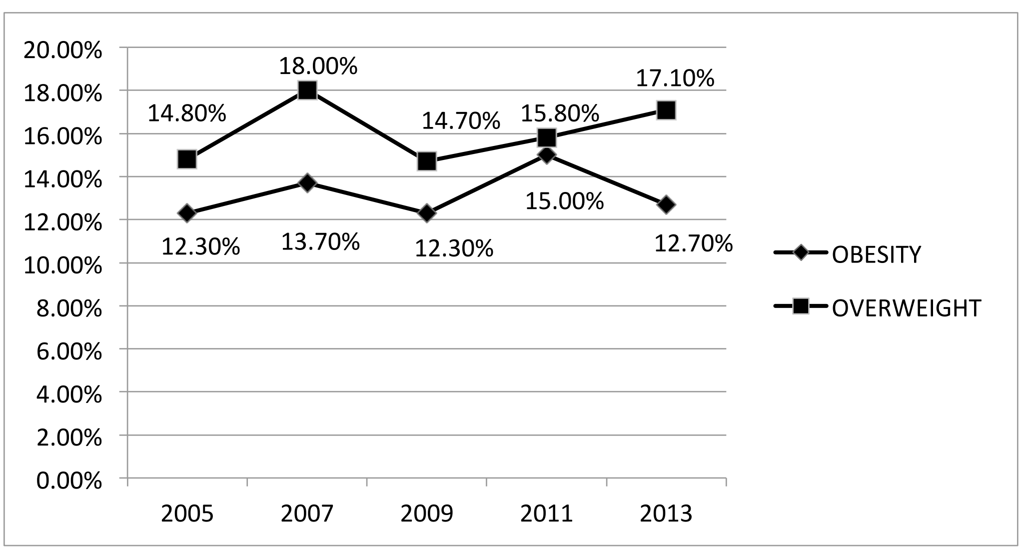
2006 and 2012 SHPPS data collection [Figures 1-3]. This information was obtained from Youth Risk Behavioral Surveillance System (YRBSS), which was developed in 1991 by the CDC to monitor the main causes of death and disease incidence among U.S. adolescents in grades 9-12 (CDC, 2013). A total of 89 districts (all from GA, KY and NJ) were selected. 16 districts were removed because they did not have primary responsibility for preparing food resulting in 73 districts (36 from 2006 and 37 from 2012 SHPPS) used for analysis.

Figure 1. Prevalence of Adolescent Obesity and Overweight in New Jersey, 2005-2013



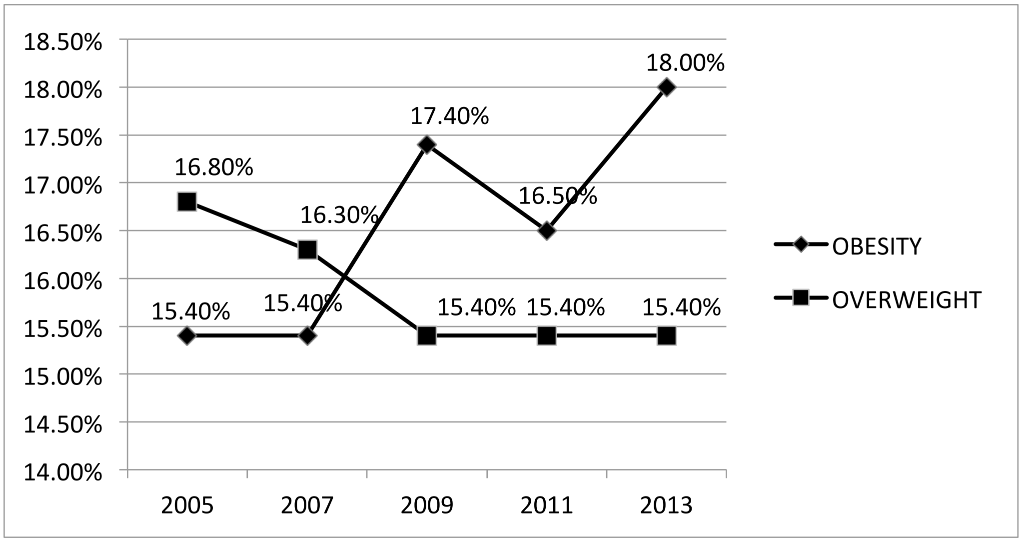
Percentages are based on prevalence of obesity among US high school students. Source: Youth Risk Behavior Surveillance System, CDC.

Figure 2. Prevalence of Adolescent Obesity and Overweight in Georgia, 2005-2013



Percentages are based on prevalence of obesity among US high school students. Source: Youth Risk Behavior Surveillance System, CDC.

Figure 3. Prevalence of Adolescent Obesity and Overweight in Kentucky, 2005-2013



Percentages are based on prevalence of obesity among US high school students. Source: Youth Risk Behavior Surveillance System, CDC.

Figure 4. Obese Youth Over Time (CDC, 2014)

0%-9%	10%-14%	15%-19%
Utah, 6	Alaska, 12	Alabama, 17
Montana, 9	Arizona, 11	Arkansas, 18
New Jersey, 9	Connecticut, 12	Kentucky, 18
	Delaware, 14	Mississippi, 15
	Florida, 12	Missouri, 15
	Georgia, 13	Tennessee, 17
	Hawaii, 13	Texas, 16
	Idaho, 10	West Virginia, 16
	Illinois, 12	
	Kansas, 13	
	Louisiana, 14	
	Maine, 12	
	Maryland, 11	
	Massachusetts, 10	
	Michigan, 13	
	Nebraska, 13	
	Nevada, 11	
	New Hampshire, 11	
	New Mexico, 13	
	New York, 11	
	North Carolina, 12	
	North Dakota, 14	
	Ohio, 13	
	Oklahoma, 12	
	Rhode Island, 11	
	South Carolina, 14	
	South Dakota, 12	
	Vermont, 13	
	Virginia, 12	
	Wisconsin, 12	
	Wyoming, 11	
	Not Available	
California	Iowa	Pennsylvania
Colorado	Minnesota	Washington
Indiana	Oregon	

Source: CDC YRBSS (Adolescent and School Health, 2014)

3.3 Variables of Interest

There are 23 food preparation variables measured in the SHPPS 2006 survey and 25 for the 2012 survey. These variables are separated into four categories: ingredient substitution, ingredient reduction, fat reduction during meat preparation and fat reduction during vegetable preparation. The ingredient substitution questions ask how often oil, meat, salt, canned vegetables butter, cheese, milk, yogurt, and other dairy products were substituted for healthier reduced fat options. The ingredient reduction items ask how often sugar fat and salt was reduced in a school food recipe. The fat reduction questions ask how often meats were roasted, boiled or baked instead of fried, how often was meat drained by roasting on a rack or manually drained, and how often fat was trimmed from meat. In addition, there are questions about how often skinless poultry was used, how often and solid fat was spooned from chilled meats and how often it was skimmed off warm broth. Finally, the vegetable preparation questions ask how often potatoes were boiled, mashed or baked instead of fried, how much other vegetables were steamed and how often they were prepared without the addition of butter margarine, cheese or cream. All answers are recorded on a likert scale with choices never, rarely, sometimes, and always or almost always. All questions ask how often each preparation or cooking practice was used in the past 30 days.

There are some differences in variables measured on the 2006 and 2012 survey. In the 2012 survey, the meat preparation questions have an additional answer to select if the responding district only uses precooked meat. This answer was coded to missing because there is no way to assess how the precooked ingredient was prepared. In addition, the ingredient substitution items on the SHPPS 2012 survey ask how often canned fruits and vegetables were substituted for fresh or frozen options. These two variables were only included in analysis when comparing 2012 practices between states and not when analyzing differences between 2006 and 2012 practices.

3.4 Response Rate

The SHPP surveys are sent for completion by the staff member who knows the most about each component (Kyle et al, 2006). For the nutrition services module the respondents had various titles and not all districts completed the module. Both the 2006 and 2012 food preparation practices section of the nutrition services questionnaires begin with the question “Does your district nutrition services program have primary responsibility for cooking foods for schools in your district, for example in a central kitchen?” (Nutrition Services District Questionnaire, 2012). A “No” answer to this question instructs the respondent to skip the nutrition services section. Twenty-two more questions about food preparation practices for a total of 23 food preparation variables used for analysis follow this. The overall response rate for the nutrition services module was almost identical for the 2006 (64.5%) (Kyle et al, 2006) and 2012 (63.0%) (Brener et al, 2012) surveys.

3.5 Data Analysis

Independent samples t –tests were used to compare mean responses to food preparation practices questions between 2006 and 2012 survey years. Independent samples t-tests were also used to compare mean responses to food preparation practices questions for New Jersey, Georgia and Kentucky separately between 2006 and 2012. One-way ANOVA tests were used to compare mean responses in Georgia, Kentucky, and New Jersey to one another for 2006 and 2012. Statistical significance was based on $p<.05$. For variables with $p= .000$ the independent samples t-tests or one-way ANOVA was repeated at the $p<.01$ significance level.

Results

4.1 Differences in Food Preparation Practices: 2006 versus 2012

The 2006 and 2012 SHPPS food preparation practices were compared in the entire sample. Statistically significant changes ($p<.05$) in food preparation practices were observed in seven food preparation practice variables. Results of this independent samples t-test are shown in [Table 1]. On average, in New Jersey, Georgia and Kentucky used healthier ingredient substitution practices for grease, oil, butter, shortening, margarine, cheese and whole milk more often in 2012 than 2006 (based on a statistically significant increased mean). In addition, these school districts used healthier food preparation practices for meat by roasting, baking, or broiling it rather than frying, draining fat from browned meat and spooning solid fat from chilled meat or poultry broth.

4.2 Differences in Food Preparation Practices: State Specific 2006 versus 2012

Study states showed significant differences in food preparation practices in 2006 versus 2012. In New Jersey, on average, whole milk was substituted more often for healthier low fat options and food preparation staff reduced fat during meat preparation by spooning off solid fat from chilled meat or poultry broth. There were no other significant changes in food preparation practices in the study period as shown in [Table 2]. Georgia also showed few statistically significant differences in food preparation between 2006 and 2012. On average, the amount of salt in recipes was reduced or low sodium canned vegetables were used more often in 2012 than 2006 [Table 3].

As for the high adolescent obesity state (KY), there were several statistically significant differences in food preparation practices for the study periods. In 2012, food preparation staff increased the average frequency of 5 ingredient substitution practices and decreased the average use of 4 substitution practices [Table 4]. Grease, oil, shortening, butter, margarine, cheese, whole milk and regular ground beef were all substituted for healthier options more often in 2012 than in 2006. In addition, fat was reduced more often during meat preparation by draining it from browned meat, trimming or skin removal. Meat, canned vegetables, salt, and mayonnaise were substituted for healthier options less often in 2012 than in 2006. This was the only state to have a significant change in vegetable preparation by frying potatoes slightly more frequently.

4.3 Differences in Food Preparation Practices: Between States in 2006 and 2012

In 2006 there were several significant differences in food preparation practices between the three selected states [Table 5]. The average frequency of fat and salt reduction in New Jersey was significantly different from GA and KY. The mean frequency of mayonnaise substitution in GA and KY was significantly different from NJ. Lastly, KY had 8 statistically significantly different ingredient substitution practices than GA and NJ. On average, these KY school districts substituted oil, butter, cheese, milk, beef, meat and canned vegetables less often than GA or NJ. KY removed skin from meat during preparation more frequently and fried potatoes less frequently than GA and NJ. In 2012 there were very few statistically significant differences in food preparation practices between the selected states [Table 6]. NJ substituted whole milk and salt on average more frequently than GA or KY.

Table 1. District School Food Preparation Practices in NJ, GA, and KY, 2006 versus 2012.

Variable	2006	2012	p-value
N	**36**	**37**	
SubOil	**3.08±.220**	**3.86±.069**	**.001**
SubButter	**2.61±.223**	**3.30±.168**	**.016**
SubCheese	**2.89±.202**	**3.57±.091**	**.003**
SubMilk	**2.89±.224**	**3.92±.045**	**.000**
SubBeef	2.89±.194	3.30±.115	.073
SubMeat	2.56±.185	2.22±.129	.129
SubCanVeg	2.63±.200	2.95±.128	.169
SubSalt	3.41±.120	3.36±.081	.725
SubCream	3.44±.135	3.24±.131	.296
RedSug	2.94±.163	2.89±.137	.806
RedFat	3.09±.133	3.14±.121	.790
RedSalt	3.03±.152	3.16±.113	.485
FatRedMeatFry	3.82±.066	3.82±.074	.983
FatRedMeatRack	3.09±.181	3.04±.210	.846
FatRedMeatDrain	**3.68±.117**	**3.97±.034**	**.031**
FatRedMeatTrim	3.67±.112	3.60±.163	.730
FatRedMeatSkin	3.06±.133	2.92±.214	.576
FatRedMeatSpoon	**3.24±.179**	**3.72±.102**	**.020**
FatRedMeatSkimOff	3.26±.186	3.57±.111	.157
FatRedVegPotFry	3.53±.087	3.57±.091	.764
FatRedVegSteamBake	3.79±.084	3.78±.069	.970
FatRedVegDairy	3.41±.134	3.41±.091	.968

Comparison of mean responses to questions about food preparation practices between 2006 and 2012 in all 3 states. The p-value is from independent samples t -test (means ± standard errors) differences across the two study time points. Statistically significant differences across the two time points are **bold**. SHPPS Responses are coded 1-Never 2-Rarely 3-Sometimes 4-Always or Almost Always.

Table 2. District School Food Preparation Practices in New Jersey in 2006 versus 2012.

Variable	2006	2012	p-value
N	**18**	**16**	
SubOil	3.78±.173	3.81±.136	.878
SubButter	3.22±.275	2.75±.310	.261
SubCheese	3.61±.118	3.75±.112	.403
SubMilk	**3.35±.242**	**4.00±.000**	**.014**
SubBeef	3.61±.118	3.31±.198	.194
SubMeat	2.11±.227	1.94±.193	.569
SubCanVeg	2.38±.287	3.06±.249	.081
SubSalt	3.39±.183	3.56±.128	.454
SubDairy	3.06±.206	3.19±.245	.681
RedSug	2.89±.267	2.80±.262	.815
RedFat	3.35±.147	3.07±.248	.316
RedSalt	3.41±.193	3.13±.221	.335
FatRedMeatFry	3.89±.076	3.70±.153	.226
FatRedMeatRack	3.22±.250	2.70±.423	.266
FatRedMeatDrain	3.72±.177	3.91±.091	.441
FatRedMeatTrim	3.67±.181	3.25±.412	.287
FatRedMeatSkin	3.17±.185	2.78±.364	.298
FatRedMeatSpoon	**2.83±.294**	**3.93±.067**	**.002**
FatRedMeatSkimOff	3.22±.275	3.73±.118	.121
FatRedVegPotFry	3.33±.114	3.63±.155	.134
FatRedVegSteamBake	3.82±.095	3.81±.101	.937
FatRedVegDairy	3.33±.214	3.63±.125	.263

Comparison of mean responses to questions about food preparation practices between 2006 and 2012 in NJ. The p-value is from independent samples t -test (means ± standard errors) differences across the two study time points. Statistically significant differences across the two time points are **bold**. SHPPS Responses are coded 1-Never 2-Rarely 3-Sometimes 4-Always or Almost Always.

Table 3. District School Food Preparation Practices in Georgia in 2006 versus 2012

Variable	**2006**	**2012**	**p-value**
N	**8**	**15**	
SubOil	3.88±.125	3.87±.091	.957
SubButter	3.13±.350	3.73±.153	.078
SubCheese	3.50±.189	3.47±.165	.901
SubMilk	4.00±.000	3.93±.067	.478
SubBeef	3.38±.183	3.40±.163	.925
SubMeat	2.25±.250	2.33±.211	.810
SubCanVeg	**2.00±.267**	**2.80±.175**	**.017**
SubSalt	3.13±.227	3.27±.118	.545
SubDairy	3.88±.125	3.40±.163	.064
RedSug	2.63±.263	2.87±.192	.466
RedFat	3.13±.227	3.20±.145	.774
RedSalt	**2.50±.189**	**3.27±.153**	**.006**
FatRedMeatFry	3.88±.125	3.85±.104	.863
FatRedMeatRack	2.29±.360	3.08±.265	.094
FatRedMeatDrain	4.00±.000	4.00±.000	*
FatRedMeatTrim	3.86±.143	3.69±.175	.537
FatRedMeatSkin	2.50±.267	2.86±.312	.448
FatRedMeatSpoon	3.50±.189	3.67±.126	.458
FatRedMeatSkimOff	3.50±.378	3.47±.133	.920
FatRedVegPotFry	3.63±.183	3.60±.131	.912
FatRedVegSteamBake	3.88±.125	3.73±.118	.456
FatRedVegDairy	3.63±.183	3.20±.145	.090

Comparison of mean responses to questions about food preparation practices between 2006 and 2012 in GA. The p-value is from independent samples t -test (means ± standard errors) differences across the two study time points. Statistically significant differences across the two time points are **bold**. SHPPS Responses are coded 1-Never 2-Rarely 3-Sometimes 4-Always or Almost Always.

Table 4. District School Food Preparation Practices in Kentucky in 2006 versus 2012.

Variable	2006	2012	p – value
N	10	6	
SubOil	**1.20±.133**	**4.00±.000**	**.000**
SubButter	**1.10±.100**	**3.67±.211**	**.000**
SubCheese	**1.10±.100**	**3.33±.211**	**.000**
SubMilk	**1.20±.133**	**3.67±.211**	**.000**
SubBeef	**1.20±.133**	**3.00±.258**	**.000**
SubMeat	**3.88±.125**	**2.67±.211**	**.001**
SubCanVeg	**3.75±.164**	**3.00±.000**	**.002**
SubSalt	**3.75±.164**	**3.00±.000**	**.004**
SubDairy	**3.88±.125**	**3.00±.258**	**.006**
RedSug	3.38±.183	3.17±.167	.433
RedFat	2.50±.327	3.17±.167	.128
RedSalt	2.71±.360	3.00±.000	.480
FatRedMeatFry	3.63±.183	4.00±.000	.139
FatRedMeatRack	3.50±.267	3.75±.250	.567
FatRedMeatDrain	**3.25±.250**	**4.00±.000**	**.040**
FatRedMeatTrim	3.50±.189	4.00±.000	.098
FatRedMeatSkin	3.38±.183	3.67±.333	.438
FatRedMeatSpoon	3.88±.125	3.33±.494	.249
FatRedMeatSkimOff	3.13±.350	3.40±.600	.678
FatRedVegPotFry	**3.88±.125**	**3.33±.211**	**.038**
FatRedVegSteamBake	3.63±.263	3.83±.167	.549
FatRedVegDairy	3.38±.263	3.33±.211	.909

Comparison of mean responses to questions about food preparation practices between 2006 and 2012 in KY. The p-value is from independent samples t -test (means ± standard errors) differences across the two study time points. Statistically significant differences across the two time points are **bold**. SHPPS Responses are coded 1-Never 2-Rarely 3-Sometimes 4-Always or Almost Always.

Table 5. Differences in food preparation practices in 2006 in NJ, GA and KY.

Variable	NJ	GA	KY	p-value
SubOil	**3.78±.173[a]**	**3.88±.125[a]**	**1.20±.133[b]**	**.000**
SubButter	**3.22±.275[a]**	**3.13±.350[a]**	**1.10±.100[b]**	**.000**
SubCheese	**3.61±.118[a]**	**3.50±.189[a]**	**1.10±.100[b]**	**.000**
SubMilk	**3.35±.242[a]**	**4.00±.000[a]**	**1.20±.133[b]**	**.000**
SubBeef	**3.81±.118[a]**	**3.38±.183[a]**	**1.20±.133[b]**	**.000**
SubMeat	**2.11±.227[a]**	**2.25±.250[a]**	**3.88±.125[b]**	**.000**
SubCanVeg	**2.38±.287[a]**	**2.00±.267[a]**	**3.75±.164[b]**	**.002**
SubSalt	3.39±.183[a]	3.13±.227[a]	3.75±.164[a]	.204
SubCream	**3.06±.206[a]**	**3.88±.125[b]**	**3.88±.125[b]**	**.006**
RedSug	2.89±.267[a]	2.63±.263[a]	3.38±.183[a]	.280
RedFat	**3.35±.147[a]**	**3.13±.227[b]**	**2.50±.327[b]**	**.028**
RedSalt	**3.41±.193[a]**	**2.50±.189[b]**	**2.71±.360[b]**	**.020**
FatRedMeatFry	3.89±.076[a]	3.88±.125[a]	3.63±.183[a]	.258
FatRedMeatRack	3.22±.250[a]	2.29±.360[a]	3.50±.267[b]	.053
FatRedMeatDrain	3.72±.177[a]	4.00±.000[b]	3.25±.250[a]	.079
FatRedMeatTrim	3.67±.181[a]	3.86±.143[a]	3.50±.189[a]	.580
FatRedMeatSkin	**3.17±.185[a]**	**2.50±.267[a]**	**3.38±.183[b]**	**.049**
FatRedMeatSpoon	**2.83±.294[a]**	**3.50±.189[a]**	**3.88±.125[a]**	**.041**
FatRedMeatSkimOff	3.22±.275[a]	3.50±.378[a]	3.13±.350[a]	.774
FatRedVegPotFry	**3.33±.114[a]**	**3.63±.183[a]**	**3.88±.125[b]**	**.030**
FatRedVegSteamBake	3.82±.095[a]	3.88±.125[a]	3.63±.263[a]	.549
FatRedVegDairy	3.33±.214[a]	3.63±.183[a]	3.38±.263[a]	.686

Values are mean responses (±standard error) for food preparation practice variables between all states and in 2006 based on one way ANOVA.[a] show mean responses with no differences between states in 2006.[b] show mean responses with differences between states in 2006. **Bold** text shows significance at $p < 0.05$. SHPPS Responses are coded 1-Never 2-Rarely 3-Sometimes 4-Always or Almost Always.

Table 6. Differences in food preparation practices in 2012 in NJ, GA and KY.

Variable	New Jersey	Georgia	Kentucky	p-value
SubOil	3.81±.136[a]	3.87±.091[a]	4.00±.000[a]	.659
SubButter	**2.75±.310**[a]	**3.73±.153**[a]	**3.67±.211**[a]	**.013**
SubCheese	3.75±.112[a]	3.47±.165[a]	3.33±.211[a]	.196
SubMilk	**4.00±.000**[b]	**3.93±.258**[a]	**3.67±.211**[a]	**.036**
SubBeef	3.31±.198[a]	3.40±.163[a]	3.00±.258[a]	.508
SubMeat	1.94±.193[a]	2.33±.211[a]	2.67±.211[a]	.114
SubCanVeg	3.06±.249[a]	2.80±.175[a]	3.00±.000[a]	.647
SubSalt	**3.56±.128**[b]	**3.27±.118**[a]	**3.00±.000**[a]	**.044**
SubFreshFruit	3.19±.101[a]	3.20±.145[a]	3.33±.211[a]	.814
SubFreshVeg	3.38±.125[a]	3.27±.118[a]	3.33±.211[a]	.825
SubCream	3.19±.245[a]	3.40±.163[a]	3.00±.258[a]	.556
RedSug	2.80±.262[a]	2.87±.192[a]	3.17±.167[a]	.659
RedFat	3.07±.248[a]	3.20±.145[a]	3.17±.167[a]	.882
RedSalt	3.13±.221[a]	3.27±.153[a]	3.00±.000[a]	.707
FatRedMeatFry	3.70±.153[a]	3.85±.104[a]	4.00±.000[a]	.369
FatRedMeatRack	2.70±.423[a]	3.08±.265[a]	3.75±.250[a]	.271
FatRedMeatDrain	3.91±.091[a]	4.00±.000[a]	4.00±.000[a]	.457
FatRedMeatTrim	3.25±.412[a]	3.69±.175[a]	4.00±.000[a]	.284
FatRedMeatSkin	2.78±.364[a]	2.86±.312[a]	3.67±.333[a]	.467
FatRedMeatSpoon	3.93±.067[a]	3.67±.126[a]	3.33±.494[a]	.115
FatRedMeatSkimOff	3.73±.118[a]	3.47±.133[a]	3.40±.600[a]	.452
FatRedVegPotFry	3.63±.155[a]	3.60±.131[a]	3.33±.211[a]	.537
FatRedVegSteamBake	3.81±.101[a]	3.73±.118[a]	3.83±.167[a]	.835
FatRedVegDairy	3.63±.125[a]	3.20±.145[a]	3.33±.211[a]	.091

Values are mean responses (±standard error) for food preparation practice variables across all states in 2012 based on one way ANOVA.[a] show mean responses with no differences between states in 2012.[b] show mean responses with differences between states in 2012.**Bold** text shows significance at $p < 0.05$. SHPPS Responses are coded 1-Never 2-Rarely 3-Sometimes 4-Always or Almost Always.

Discussion

5.1 Discussion of Findings

The goal of this study is to determine if there are any differences between states with varying rates of adolescent obesity due to no known existing analysis of this kind. To fill this gap in knowledge a comparison of school food preparation practices in New Jersey, Georgia and Kentucky between 2006 and 2012 was made. Overall, Kentucky had the most significant changes from 2006-2012. While some food preparation practices improved, this was the only state to have any negative changes between 2006 and 2012. When comparing 2006 to 2012 Kentucky improved their substitution of oil, butter, cheese and milk. On the contrary, this state did not improve their meat, canned vegetables, salt and dairy substitution practices. While some of Kentucky's practices positively changed during the study period to mirror other states its high level of obesity shows the need for progress. In Georgia, there were only improvements to canned vegetable and salt reduction techniques. While most of the means for GA preparation practices increased they were not significant. As for New Jersey, this state also had only two significant changes, their mean substitution of milk and removal of fat from warm broth increased.

This analysis also compared school food preparation practices between states in 2006 and 2012. School food preparation practices between these 3 states were dramatically different in 2006 but became very similar to one another by 2012. It was mainly Kentucky's food preparation practices that varied from the rest of the group. New Jersey and Georgia both had healthier oil, butter, cheese, milk, beef, meat and canned vegetable routines. New Jersey alone implemented better cream, fat and salt substitution methods in 2006 than Georgia and Kentucky. Surprisingly, the healthiest skin removal from meat and reduced fat potato preparation was observed in Kentucky. By 2012, there were only 2 significant differences between states; New Jersey had the best milk and salt substitution habits (even though the other states' means weren't very far off).

To date, this is the first analysis of school food preparation practices by state adolescent obesity trends based on SHPPS data. These results are consistent with the changes to school food preparation practices observed between 2000 and 2006. A nationwide analysis showed cheese and salt substitution practices improved. In addition, fat reduction practices (trimming fat from meat and preparing potatoes without deep-frying) were used more often. These results support an ongoing trend of improvements to school food preparation practices. These findings are not, however, consistent with IOM findings as a result of their 2008 evaluation of school lunches. Two of the main recommendations call for reduced fat consumption; implying student meal content was still too high. This was an overall analysis to initiate policy reform and did not include obesity data as a characteristic for comparison or account for specific policy implementation such as school food preparation practices (The Nutrition Standards, 2008). A state-by-state analysis with obesity and other population factors included is necessary to further conceptualize and strengthen the argument that there may be practices unique to low, intermediate or high adolescent obesity states and internal differences in school nutrition implementation.

Throughout the analysis there were some themes in observed modifications to school food preparation practices. Food preparation related to reducing fat consumption by altering milk, butter, oil and cheese and meat were consistently changed over time and within each state. Moreover, reducing salt consumption was also a reoccurring observation. These modifications are consistent with the evolution of school nutrition recommendations in the past decade. In

2004, the Institute of Medicine (IOM) released a report with plans to intervene in the childhood obesity epidemic by confronting nutrition in schools amongst other factors in society (Krisberg, 2004). Specifically, the IOM cited the need to control the consumption of unhealthy foods in school environments that are high in fat and salt content. In 2005, IOM recommendations were announced that continued to pinpoint the need for fat and salt reduction through policy changes to restrict competitive foods and urged school meals to meet the Dietary Guidelines for Americans (DGFA). The most recent 2009 recommendations sparked further investigation into the nutritional quality of NSLP meals. A 2011 survey of meals served in 75 U.S. schools revealed while most met the cholesterol and calorie limits less than 10 to around 20% of schools met saturated and trans fat suggestions (Smith and Chezem, 2011) while none of the schools surveyed met the sodium standard.

The DGFA have served as the underlying nutritional standard for school meals for several years. The variations in guidelines coinciding with the study period are consistent with observed alterations to school food preparation practices. The 2005 DGFA suggests reducing saturated fat intake by consuming low or fat free milk and lean poultry and meat, limiting the consumption of oils by choosing foods with reduced content and consuming as little trans fat as possible (USDA, 2005). The recommendations were pushed as 2005-2006 NHANES data showed cheese as the 2nd highest contributor of dietary saturated fat for Americans ages 2 and older. Also, 2006 legislation required food labels to indicate trans fat content (USDA, 2010). According to the 2010 DGFA Americans still struggled with fat consumption; few fat intake changes were observed from 1990-2006. On the other hand, trans fat consumption was shown to significantly decrease as a result of food labeling laws. The DGFA continued to recommend dietary changes and more specific suggestions such as removing fat from meat during preparation by trimming or skin removal were added (USDA, 2010).

Salt consumption has been another focus for reduction in the U.S. diet. According to the 2005 DGFA, only 12% of sodium in the U.S. diet is naturally occurring. This guideline suggests less than 2,300mg per day for people of all ages and proposed reduction during preparation and not adding salt at the table as the most effective methods. A 2005-2006 analysis of NHANES data showed children 12-19 consumed 3,000-4,500 mg per day (USDA, 2010). A 2008-2009 analysis showed no improvements in salt consumption among school-aged children and the highest consumption among high school students (Cogswell et. al. 2014). Since then the recommendation was updated to 1,500mg per day as of the 2010 DGFA in an effort to reduce high blood pressure amongst children and adults (USDA, 2010).

Fat and salt are two dietary components that impact multiple health outcomes if controlled. Reducing fat and salt consumption are associated with reduced risk of obesity, high blood pressure, atherosclerosis and cardiovascular disease. The replacement of whole and reduced fat milk with low and skim milk has the potential to significantly reduce saturated fat intake (Rehm et al, 2015). Salt substitution and reduction combined with increased fruit and vegetable consumption has the potential to stop hypertension and improve blood pressure control (Svetkey et al., 2004). In addition, positive association has been shown between salt and sugar sweetened beverage consumption, which is related to other negative health outcomes (Grimes et al, 2013). Undeterred by policy recommendations and evidence supporting the multiple benefits of reducing salt and fat intake, the U.S. diet still has many obstacles to overcome in adopting widespread habits that promote long-term health.

5.2 Policy and Practice Implications

The National Student Lunch program has served over 224 billion meals since its creation and continues to be a major contributor to the adolescent diet (Disiena, 2015). Several changes, additions, amendments and revisions have been enforced for this program all with the original purpose of maximizing child health in mind. In reality, creating a perfect NSLP is impossible. Even if a perfect program was created, perfect implementation is another impediment to ensuring our nations children only have access to healthy food in schools. There are, however, a few policy and practice implications for the findings described above.

The overall issue at hand is addressing the barriers to improved school food preparation practices. More stringent monitoring of districts that fail to utilize healthy food preparation practices could provide a necessary push to ensuring implementation but also requires the need for more legislation. A sanction for not meeting USDA standards comes to mind but may indirectly negatively impact the children the NSLP was created to serve. In addition, many steps in the process of food preparation could be modified. First, an assessment of resources is necessary to ensure district facilities, appliances, and foods are not obstacles to healthy preparation. Second, school food personnel may require additional training to properly utilize reduction and substitution techniques. Third, instead of relying on school food personnel to actively reduce and substitute ingredients it may be necessary to only offer and provide food and recipes that are already low in saturated fat and sodium, for example. This would remove the room for human error and ensure a certain level of consistency. Fourth, it is understood healthier practices may require better training, resources and focused intervention that may imply the need for increased fiscal support for the NSLP. Either way, increased focus on the creation of school food environments that promote healthy food access and choices is necessary.

5.4 Limitations

These findings are interpreted in the context of identified methodological limitations. First, there are several factors that contribute to obesity in the school environment and school food preparation practices are only a small piece of the overall picture. These results should not be interpreted as evidence supporting or refuting an association. Second, no matched demographic data was publicly available on the selected school districts so the results are presented without accounting for the social, economic and environmental risk factors that could further characterize each state and their capacity to implement healthy food preparation practices. Poverty and urbanicity data was available for each district but the sample size was too small to actually run an analysis based on these variables.

Third, there were an uneven amount of districts from each state included in the analysis. Combined with the lack of demographic data it is hard to understand how much of the adolescent population in each state is represented in the selected districts and how much food preparation practices in these districts reflect the entire state (even though these districts were chosen as part of a national sample and are presumed to be accurately representative of each state). Fourth, different personnel answered the SHPP surveys sent to each district. While most (60-80%) of respondents were food service or child nutrition managers, directors, supervisors, or coordinators some district surveys were completed by principals or superintendents who may not have been the most knowledgeable about district food preparation practices over the past 30 days. Fifth, when reporting practices related to obesity reduction such as school food preparation practices there may be some response bias given the recent increased cultural awareness and sensitivity to childhood obesity and its causes.

5.3 Conclusion

Overall, school food preparation practices are different in New Jersey, Georgia and Kentucky. Since 2006, New Jersey and Georgia have made improvements in school food preparation practices while Kentucky practices have both improved and worsened. By 2012, there were very few statistically significant differences in school food preparation practices between the three states. The state with the highest adolescent obesity rates was the only state to show declines in the average use of healthier school food preparation practices. Conducting an overall analysis of all states grouped by adolescent obesity trends could help tease out the true relationship between school food preparation practices and whether unhealthy practices are more common in states with certain demographic characteristics. The school food environment has seen some improvements in school food preparation practices and while some states are struggling to keep up, others are steadily headed in the right direction. Public health efforts should seek to address barriers to providing healthy foods in schools for regions that show the need for intervention.

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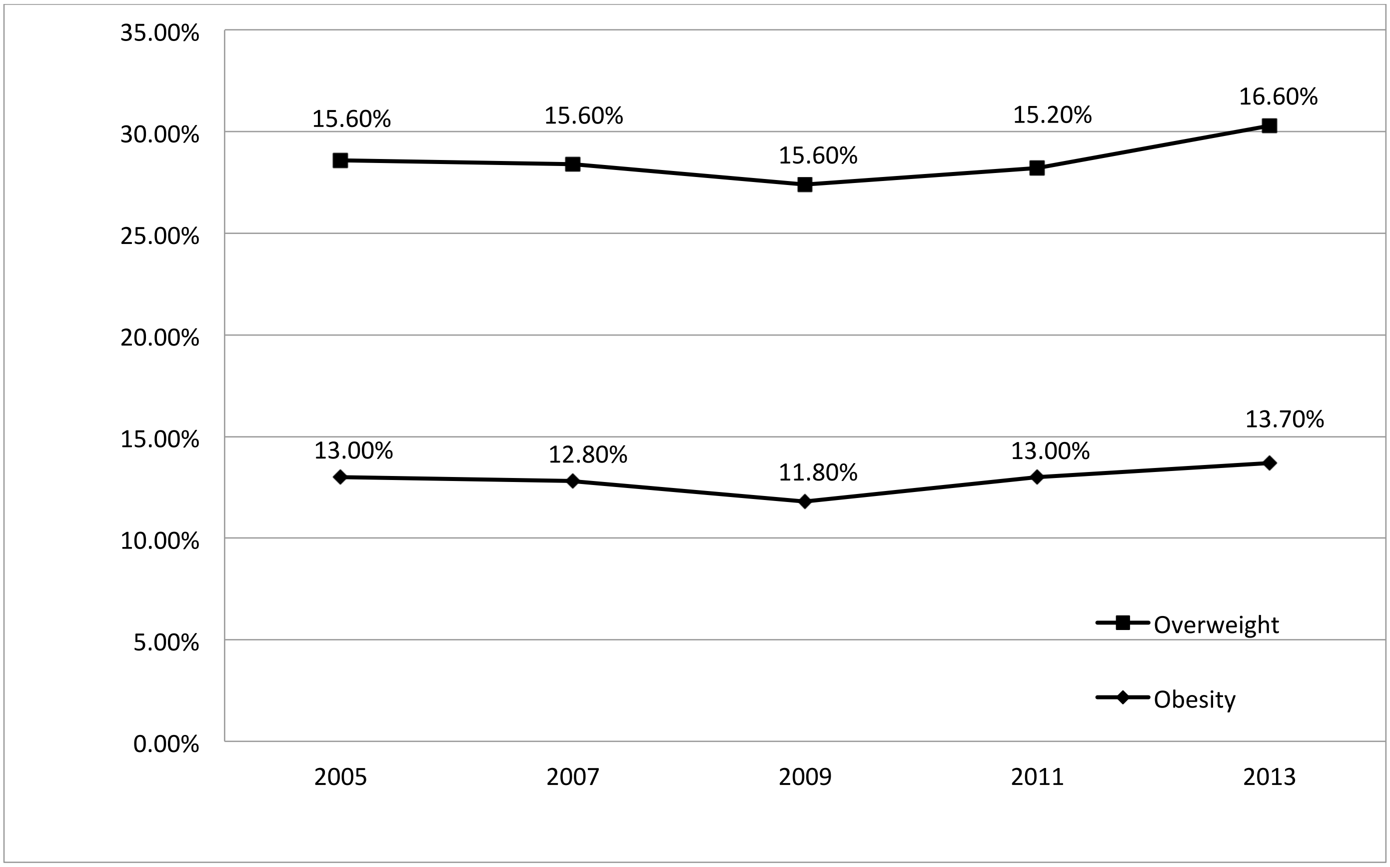
Appendix.

Figure 5. Prevalence of Adolescent Obesity and Overweight in the United States, 2005-2013



Percentages are based on prevalence of obesity among US high school students. Source: Youth Risk Behavior Surveillance System, CDC.