

Examination of the Food and Nutrient Content of School Lunch Menus of Two School Districts in Mississippi

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Abstract: This study examined the diet quality of the school meals in two Mississippi school districts and compared them to the national guidelines. We examined the lunch menus of the two school districts that participated in the National School Lunch Program and School Breakfast Program focusing on food quality and assessing both healthy and unhealthy foods and eating behaviors. This analysis was completed through a computerized review used to accurately determine the nutrient content. Both the standard and the alternative meals provided by the cafeterias in the two school districts exceeded the minimum requirement for calories for all grade levels. The meals from the urban schools cafeteria provide more calories than meals from the cafeteria in the rural school district. Although schools believe that they are making positive changes to children's diets, the programs are falling short of the nutrient recommendations. Poor nutrition and improper dietary practices are now regarded as important risk factors in the emerging problems of obesity, diabetes mellitus, hypertension and other chronic diseases, with excessive energy intake listed as a possible reason. Dietitians, school professionals and other health care practitioners need to accurately assess energy intake and adequately promote a dietary responsible lifestyle among children.

Keywords: Diet, food, nutrient intake, students, Mississippi

Introduction

Over the past 25 years, eating patterns have changed among children [1]. However, according to the American Dietetic Association, adopting appropriate eating habits should allow children to achieve optimal physical and cognitive development, attain a healthy weight, enjoy food, and reduce the risk of chronic disease. An increased number of childhood overweight conditions has driven dietitians to address children's over consumption of foods and beverages that are lacking in proper nutrients [2], and to highlight the need to improve their nutritional intake [3-5] because children's food choices very often result in poor nutrient intakes [6, 7]. Data from the Bogalusa Heart Study and the USDA showed an overall decline in the total amount of milk, vegetables, soups, breads, grains, and eggs consumed from 1973 to 1994 [7-11]. Researchers have also reported that approximately 68% to 75% of children exceed the current dietary recommendations for intake of total or saturated fats [12].

American schools that participate in the National School Lunch Program and School Breakfast Program have been given guidelines to encourage an improved quality of nutrient consumption among school children. Schools participating in the USDA's national school meals programs are required to serve meals during the course of the school week that adhere to the Dietary Guidelines for Americans [13].

This study sought to examine the diet quality of the school meals in two Mississippi school districts (one urban and one rural) and compare them to the national guidelines. The questions to be addressed were:

- (1) Are the mean nutrient contents in the meals significantly higher in the urban Jackson Public School District than in the rural Canton Public School District?
- (2) Are the nutrient contents found in the meals offered significantly different from those recommended in the nutrient requirements by grade level?

Two hypotheses were developed for examination:

- (1) There is no significant difference in the nutrient content of the meals served by the Jackson Public School District and Canton Public School District;

- (2) There is no significant difference in the nutrient contents of the meals offered by the schools and the recommended nutrient values.

Methods

We examined the school lunch menus of children in two school districts that participated in the USDA National School Lunch and School Breakfast Program focusing on food quality and assessing the types of foods prepared in the schools' cafeterias. Dietary practices were assessed by a review of the breakfast and lunch menus for the year 2005, provided by Jackson Public School (JPS), an urban school district in the capital city of Mississippi, and Canton Public Schools (CPS), a rural district. Students in both school districts are enrolled in grades K-12 and all children from pre-school, elementary, middle and high schools were served the same meals, regardless of age. The nutrition recommendations for children are listed in Table 1. The nutrient analysis of the school meals was conducted on the menus provided by the school districts under examination for five consecutive days.

The menu review was intended to ascertain the amount of calories (energy), grams of fat, grams of protein, milligrams of cholesterol, and grams of sodium found in the meals. This analysis of the menus for these schools was completed through a computerized review used to accurately determine the nutrient content of the meals through detailed food descriptions, detailed meal preparation methods, and various serving size descriptions. The Nutrition Data System V. 4.5 (NDS), a computer based menu planning system was used to analyze the contents of the meals served to the children in both school districts. NDS uses approved computer software to analyze the specific nutrient content of menu items. It is designed to assist menu planners in choosing food items that create nutritious meals and meet the nutrient standards.

Limitations and Assumptions

In review of the menus, the actual recipes used in food preparation, food preparation techniques, and food production records were not provided, and in some instances serving sizes were not provided. There was no way to ascertain whether everything that was on the menu was actually served to the children. As a result, some assumptions were made in order to analyze the meals. It was assumed by the researchers that the additives such as fat sodium, and sugar were added at moderate amounts. Also, there were some assumptions made concerning the meal design, such as the alternative meal, which is believed to be a healthier alternative to the regular meal. The alternative meal plan for Jackson Public Schools was simply a different meal option offered to the students that only included a change in the entrée, not the entire meal. As a result, the reviewer proceeded with the assumption that the only change

made to the meal plan was with the entrée and that the rest of the meal remained the same.

Statistical Analysis

This study analyzed the meals of the two schools and compared them with the dietary recommendations. NDS was used to analyze five days worth of food records and the Statistical Package for Social Sciences (SPSS) was used to compare them to the students' recommended nutrients based upon grade level. The researchers believed that a week's worth of analysis would provide a clear picture of the nutrient excesses and/or deficiencies. The meal menus were obtained for each day of the week and analyzed using; (1) the t-test to examine for differences between Jackson Public School District and Canton Public School District; (2) the one sample t-test was used to compare the two districts to the nutrient recommendations stratified by grade level. The one sample t-test was used to compare the means of each nutrient (energy, fat protein, cholesterol and sodium) against the National School Lunch Program (NSLP) recommendations as the specified constant; (3) the paired t-test was used to compare the regular lunch menu with the alternative menu.

Results

The School lunch menu of the Canton Public Schools was examined for a one week period and the average of the nutrients for all students from pre-school to 12th grade was taken and compared to the nutrient recommendations for school lunches as endorsed by the National School Lunch Program (NSLP) and other nutrition organizations as seen in Table 1.

Table 1: Nutrient recommendation for school children by grade level

<i>Nutrient</i>	<i>Pre-School</i>	<i>Grades K-6</i>	<i>Grades 7-12</i>
Protein (grams)	7.00	10.00	16.00
Sodium (mg)	1,350.00	1,350.00	1,350.00
Cholesterol (mg)	100.00	100.00	100.00
Total Fat (g)	22.00*	22.00*	22.00*
Calories	517.00	664.00	825.00

USDA/ARS Children's Nutrition Research Center

*Based on less than 30% of calories from fat.

For the regular school menu, the averages were as follows: Energy-977.20 kcal, fat-33.54g, protein-45.58g, cholesterol-97.62mg, and sodium-1548.00mg; for the alternative menu, the averages were; energy-698.80kcal, fat-33.54g, protein-45.58g, cholesterol-97.62mg, and sodium-1548.00mg (Table 2).

Table 2: Canton Public Schools' menu analysis for children in grades K-12

<i>Regular menu</i>	<i>Energy (Kcal)</i>	<i>Fat (g)</i>	<i>Protein (g)</i>	<i>Chol (mg)</i>	<i>Na (mg)</i>
Day 1	801.0	31.40	45.93	109.90	1,347.0
Day 2	1057.0	37.13	55.85	129.32	1,872.0
Day 3	1057.0	45.72	41.39	101.01	1,689.0
Day 4	1038.0	29.01	46.58	94.73	1,558.0
Day 5	933.0	24.42	38.15	53.15	1,274.0
<i>Average</i>	<i>977.2</i>	<i>33.54</i>	<i>45.58</i>	<i>97.62</i>	<i>1,548.0</i>
<i>Alternative menu</i>					
Day A1*	705.0	32.49	27.15	46.93	1,253.0
Day A2*	618.0	19.00	28.58	54.08	938.0
Day A3*	799.0	35.93	40.69	95.16	2,330.0
Day A4*	739.0	27.73	24.72	54.75	1,349.0
Day A5*	633.0	22.30	26.70	54.75	1,297.0
<i>Average</i>	<i>698.8</i>	<i>27.49</i>	<i>29.57</i>	<i>61.13</i>	<i>1,433.4</i>

*A1-A5 = Alternative Menus for Day 1 to Day 5

As seen in Table 3, students from all of the grade levels in Canton Public Schools from pre-school to 12th grade were served from a school lunch menu that contained less cholesterol than the recommended amount. In addition the students in grades 7-12 also had less energy than the recommended amount in their meals. With all of the other nutrients, the recommended levels were exceeded.

The average of the nutrients for all Jackson Public School students from pre-school to 12th grade was taken. For the regular school menu, the averages were as follows: Energy-1308.40 kcal, fat-50.56g, protein-56.51g, cholesterol-211.87mg, and sodium-2,232.20mg; for the alternative menu, the averages were; energy-1,142.60kcal, fat-43.56g, protein-48.73g, cholesterol-182.41mg, and sodium-2,025.60mg (Table 4).

Table 4: Jackson Public Schools' menu analysis for children in grades K-12

<i>Regular menu</i>	<i>Energy (Kcal)</i>	<i>Fat (g)</i>	<i>Protein (g)</i>	<i>Chol (mg)</i>	<i>Na (mg)</i>
Day 1	1718	64.03	74.56	187.76	2,652
Day 2	999	32.19	38.21	74.99	1,644
Day 3	1080	40.41	52.27	173.62	1,940
Day 4	1256	57.82	42.86	93.40	1,856
Day 5	1489	58.84	74.65	529.60	3,069
<i>Average</i>	<i>1308.40</i>	<i>50.66</i>	<i>56.51</i>	<i>211.87</i>	<i>2,232.2</i>
<i>Alternative menu</i>					
Day A1*	676	24.71	22.49	53.94	1,279
Day A2*	1094	42.05	52.27	173.62	1,377
Day A3*	1259	58.04	41.6	165.98	2,288
Day A4*	1170	41.04	60.61	72.59	1,977
Day A5*	1514	51.95	66.66	506.3	3,207
<i>Average</i>	<i>1142.60</i>	<i>43.56</i>	<i>48.73</i>	<i>182.41</i>	<i>2,025.6</i>

*A1-A5 = Alternative Menus for Day 1 to Day 5

Table 3: Comparison of the school lunch menus of Canton Public Schools with the recommended nutrients

Pre School					
<i>Menu</i>	<i>Energy (kcal)</i>	<i>Fat (g)</i>	<i>Protein (g)</i>	<i>Cholesterol (mg)</i>	<i>Sodium (mg)</i>
Average Regular Menu	977.20	33.54	45.58	97.62	1548.00
Recommended Menu	517.00	22.00	7.00	100.00	1350.00
Difference	+470	+11.54	+38.58	-2.38	+198.00
Average Alternative Menu	698.80	27.49	29.57	61.13	1433.40
Recommended Menu	517.00	22.00	7.00	100.00	1350.00
<i>Difference</i>	<i>+181.80</i>	<i>+5.49</i>	<i>+22.57</i>	<i>-38.87</i>	<i>+83.00</i>
Grades K-6					
Average Regular Menu	977.20	33.54	45.58	97.62	1548.00
Recommended Menu	664.00	22.00	10.00	100.00	1350.00
Difference	+33.32	+11.54	+35.58	-2.38	+198.00
Average Alternative Menu	698.80	27.49	29.57	61.13	1433.40
Recommended Menu	664.00	22.00	10.00	100.00	1350.00
<i>Difference</i>	<i>+34.80</i>	<i>+5.49</i>	<i>+19.57</i>	<i>-38.87</i>	<i>+83.40</i>
Grades 7-12					
Average Regular Menu	977.20	33.54	45.58	97.62	1548.00
Recommended Menu	825.00	22.00	16.00	100.00	1350.00
Difference	+15.22	+11.54	+29.58	-2.38	+198.00
Average Alternative Menu	698.80	27.49	29.57	61.13	1433.40
Recommended Menu	825.00	22.00	16.00	100.00	1350.00
<i>Difference</i>	<i>-126.20</i>	<i>+5.49</i>	<i>+13.57</i>	<i>-38.87</i>	<i>+83.40</i>

As seen in Table 5, students from all of the grade levels in Jackson Public Schools, from pre-school to 12th grade, were provided a school lunch menu that exceeded the recommended levels of all the nutrients examined. The regular menus of the two school districts were compared and significant differences were found in the levels of energy, fat and sodium.

Table 5: Comparison of the school lunch menus of Jackson Public Schools with the recommended nutrients for children

Pre School					
<i>Menu</i>	<i>Energy (kcal)</i>	<i>Fat (g)</i>	<i>Protein (g)</i>	<i>Cholesterol (mg)</i>	<i>Sodium (mg)</i>
Average Regular Menu	1308.40	50.66	56.51	211.87	2,232.20
Recommended Menu	517.00	22.00	7.00	100.00	1,350.00
<i>Difference</i>	+791.40	+28.66	+49.51	+111.87	+882.20
Average Alternative Menu	1142.60	43.56	48.73	182.41	2,025.60
Recommended Menu	517.00	22.00	7.00	100.00	1,350.00
<i>Difference</i>	+625.60	+21.56	+41.73	+82.41	+1124.40
Grades K-6					
Average Regular Menu	1308.40	50.66	56.51	211.87	2,232.20
Recommended Menu	664.00	22.00	10.00	100.00	1,350.00
<i>Difference</i>	+644.40	+28.66	+46.51	+111.87	+882.20
Average Alternative Menu	1142.60	43.56	48.73	182.41	2,025.60
Recommended Menu	664.00	22.00	10.00	100.00	1,350.00
<i>Difference</i>	+478.60	+21.56	+38.73	+82.41	+675.60
Grades 7-12					
Average Regular Menu	1308.40	50.66	56.51	211.87	2,232.20
Recommended Menu	825.00	22.00	16.00	100.00	1,350.00
<i>Difference</i>	+483.40	+28.66	+40.51	+111.87	+882.20
Average Alternative Menu	1142.60	43.56	48.73	182.41	2,025.60
Recommended Menu	825.00	22.00	16.00	100.00	1,350.00
<i>Difference</i>	+317.60	+21.56	+32.73	+82.41	+675.60

The lunch menu of the Jackson Public School had significantly higher levels of these nutrients than the lunch menu of the Canton Public Schools. An examination of the alternative menus of the two school districts revealed that the Jackson Public Schools had significantly higher levels of energy, fat and protein (Table 6).

The menus were also subjected to comparisons between the regular menus and the alternative menus. There was no significant difference found between the levels of nutrients in the regular menu of the Jackson Public Schools and the alternative menu. The Canton Public School regular and alternative menus showed significant differences in the energy levels and the protein levels (Table 7). No Significant difference was found in the other nutrients.

The meals offered to the pre-school children were examined and compared to the dietary recommendations. As seen in Table 8, the levels of energy, fat, protein and sodium significantly exceeded the levels that were recommended for Jackson Public Schools Pre-school children, and levels of energy, fat and protein exceeded the recommended levels for Canton Public Schools Pre-school children.

The meals offered to the children in grades K-6 were examined and compared to the dietary recommendations. The levels of energy, fat, protein and sodium significantly exceeded the levels that were recommended for Jackson Public Schools children in Grades K-6, and levels of energy, fat and protein exceeded the recommended levels for Canton Public Schools children in Grades K-6 (Table 9).

The meals offered to the children in Grades 7-12 were examined and compared to the dietary recommendations. The levels of energy, fat, protein and sodium significantly exceeded the levels that were recommended for Jackson Public Schools children in Grades 7-12, and levels of energy, fat and protein exceeded the recommended levels for Canton Public Schools children in Grades 7-12 (Table 10).

Discussion

This study found that the school lunches from Jackson Public Schools and Canton Public Schools were high in energy, fat, protein and sodium. The major difference noted between the Canton Public Schools Lunch menu and Jackson Public Schools is in the level of cholesterol in the meals. The Canton students were served meals with levels of cholesterol that are below the recommended levels. The levels of nutrients in the regular meals served by the Jackson Public Schools and the level of nutrients in the alternative meals were not found to be different. The alternative meals served by the Canton Public Schools appeared to be a healthier alternative to the regular meals served. The regular meals of both school districts exceeded the recommended levels of nutrients.

It is generally believed that a large number of students who qualify for free or reduced lunches through the NSLP program are also characterized as children at risk for developing diet-related chronic diseases caused by an over consumption of fats, cholesterol and sodium. These two school districts have a preponderance of students who qualify for free or reduced lunches provided by the NSLP program.

Table 6: Differences between nutrient intake between regular meals and alternative meals in Jackson and Canton Schools

Category	School	Mean	Mean Difference	95% CI of Difference	SD	T	Sig (2-tailed)
Regular Menu							
Energy (kcal)	JPS	1308.40	331.20	4.89-657.50	296.23	2.341	.047
	CPS	977.20			111.17		
Fat (g)	JPS	50.67	17.14	0.71-33.53	13.63	2.406	.043
	CPS	33.53			8.21		
Sodium (mg)	JPS	2232.20	682.20	13.19-1347.21	598.52	2.352	.047
	CPS	1548.00			245.17		
Alternative Menu							
Energy (kcal)	JPS	1142.60	443.80	119.78-767.81	305.08	3.158	.013
	CPS	698.80			75.09		
Fat (g)	JPS	43.56	16.07	1.12-31.00	12.69	2.480	.038
	CPS	27.49			6.99		
Protein (g)	JPS	48.73	19.16	.03-38.29	17.43	2.309	.050
	CPS	29.57			6.37		

JPS = Jackson Public Schools; CPS = Canton Public Schools

Table 7: Differences between nutrients in the regular menu and nutrients in the alternative menu of Canton Public Schools

Category	School	Mean Difference	95% CI of Difference	SD	T	Sig (2-tailed)
Energy in Regular Menu Energy in Alternative Menu	CPS	278.40 (kcal)	125.86-430.94	122.86	5.067	.007
Protein in Regular Menu Protein in Alternative Menu	CPS	16.01 (g)	3.23-28.79	10.29	3.478	.025

CPS = Canton Public Schools

Table 8: Differences between nutrients in the regular menu and the recommended intake of nutrients for pre-school children

Category/School	Mean	Mean Diff.	95% CI of Diff.	SD.	T	Sig (2-tailed)
JPS Pre-School						
Energy in Menu (kcal)	1308.40	791.40	423.57-1159.23	296.24	5.974	.004
Recommended Energy	517.00					
Fat in Menu (g)	50.66	28.66	11.73-45.58	13.63	4.701	.009
Recommended Total Fat	22.00					
Protein in Menu (g)	56.51	49.51	28.06-70.92	17.28	6.408	.003
Recommended Protein	7.00					
Sodium in Menu (mg)	2232.20	882.20	134.79-1629.61	601.95	3.277	.031
Recommended Sodium	1350.00					
CPS/Pre-School						
Energy in Menu (kcal)	977.20	460.20	322.17-598.23	111.17	9.257	.001
Recommended Energy	517.00					
Fat in Menu (g)	33.54	11.54	1.34 – 21.73	8.21	3.143	.035
Recommended Total Fat	22.00					
Protein in Menu (g)	45.58	38.58	30.27-46.89	17.28	12.883	.000
Recommended Protein	7.00					
Sodium in Menu (mg)	1548.00	198.00	-106.42-502.42	245.17	1.806	.145
Recommended Sodium	1350.00					

JPS = Jackson Public Schools; CPS = Canton Public Schools

Table 9: Differences between nutrients in the regular menu and the recommended intake of nutrients for Grades K-6

<i>Category/School</i>	<i>Mean</i>	<i>Mean Diff.</i>	<i>95% CI of Diff.</i>	<i>SD.</i>	<i>T</i>	<i>Sig (2-tailed)</i>
JPS Grades K-6						
Energy in Menu (kcal)	1308.40					
Recommended Energy	664.00	644.20	276.57-1012.23	296.24	4.864	.008
Fat in Menu (g)	50.66					
Recommended Total Fat	22.00	28.66	11.73-45.58	13.63	4.701	.009
Protein in Menu (g)	56.51					
Recommended Protein	10.00	46.51	25.06-67.93	17.28	6.019	.004
Sodium in Menu (mg)	2232.20					
Recommended Sodium	1350.00	882.20	134.79-1629.61	601.95	3.277	.031
CPS Grades K-6						
Energy in Menu (kcal)	977.20					
Recommended Energy	664.00	313.20	175.17-451.23	111.17	6.300	.003
Fat in Menu (g)	33.54					
Recommended Total Fat	22.00	11.54	1.34 – 21.73	8.21	3.143	.035
Protein in Menu (g)	45.58					
Recommended Protein	10.00	35.58	27.27-43.89	6.69	11.881	.000
Sodium in Menu (mg)	1548.00					
Recommended Sodium	1350.00	198.00	-106.42-502.42	245.17	1.806	.145

JPS = Jackson Public Schools; CPS = Canton Public Schools

Table 10: Differences between nutrients in the regular menu and the recommended intake of nutrients for grades 7-12

<i>Category/School</i>	<i>Mean</i>	<i>Mean Diff.</i>	<i>95% CI of Diff.</i>	<i>SD.</i>	<i>T</i>	<i>Sig (2-tailed)</i>
JPS Grades 7-12						
Energy in Menu (kcal)	1308.40					
Recommended Energy	825.00	483.40	115.57-851.23	296.24	3.649	.022
Fat in Menu (g)	50.66					
Recommended Total Fat	22.00	28.66	11.73-45.58	13.63	4.701	.009
Protein in Menu (g)	56.51					
Recommended Protein	16.00	40.51	19.06-61.96	17.28	5.243	.001
Sodium in Menu (mg)	2232.20					
Recommended Sodium	1350.00	882.20	134.79-1629.61	601.94	3.277	.031
CPS Grades 7-12						
Energy in Menu (kcal)	977.20					
Recommended Energy	825.00	152.20	14.17-290.23	111.17	3.061	.038
Fat in Menu (g)	33.54					
Recommended Total Fat	22.00	11.54	1.34 – 21.73	8.21	3.143	.035
Protein in Menu (g)	45.58					
Recommended Protein	16.00	29.28	21.7-37.89	6.70	9.878	.001
Sodium in Menu (mg)	1548.00					
Recommended Sodium	1350.00	198.00	-106.42-502.42	245.17	1.806	.145

JPS = Jackson Public Schools; CPS = Canton Public Schools

Many public health personnel believe that strategies to combat the development of diet-related chronic diseases must begin in childhood (14), and one of those strategies must be the exercise of dietary responsibility. The results of this study demonstrate that, although schools believe that they are making positive changes to children's diets, in fact, the programs are falling short of the nutrient recommendations. This information should be of interest, not only to dietitians, but to researchers of diet and obesity, as well as policy makers who may have an interest in changing behaviors to improve health.

One option for food service personnel to maintain acceptable levels of nutrients is to use more low-fat, low-sodium foods. However, many people searching for a healthier alternative realize that sodium chloride and fat are used in many instances for their flavor producing abilities, and other healthier, alternate flavoring ingredients are generally more expensive and must be used in greater quantities to derive the desired taste of the lower fat, lower sodium ingredients. That makes it a challenge to balance need for flavor and taste with appropriate, manageable costs. Another important school-based dietary recommendation would be for school dietary personnel to place more emphasis on the importance of age-appropriate portion sizes [15]. This is especially relevant in the case of these two schools where all children from Preschool to grade 12 were served the same menus.

Conclusions

This descriptive study examined the quality of school lunches in terms of nutrient content in two school districts. The question most food service directors face is how to improve the diets of the school children through the menus that are prepared daily, especially since researchers have previously reported that approximately 68% to 75% of US children exceed the current dietary recommendations for intake of total or saturated fats (12). The following is a summary of the major findings of this study:

Canton Public Schools

- (a) Preschool- (1)-the calories, fat, protein and sodium are above the recommended, while the cholesterol is less than the recommended levels.
- (b) Grades K-6- (2)-the calories, fat, protein and sodium are above the recommended levels, while the cholesterol is below the recommended levels.
- (c) Grades 7-12- (3)-the calories, fat, protein and sodium are above the recommended levels, while the cholesterol is below the recommended levels.

Jackson Public Schools

- (a) Preschool- (1)-the calories, fat, protein, cholesterol and sodium are above the recommended, while the cholesterol is less than the recommended levels.

- (b) Grades K-6- (2)-the calories, fat, protein, cholesterol and sodium are above the recommended levels, while the cholesterol is below the recommended levels.
- (c) Grades 7-12- (3)-the calories, fat, protein, cholesterol and sodium are above the recommended levels, while the cholesterol is below the recommended levels.

Conclusion

Further research is needed to analyze the relationship between lunch intake and student achievement. Research is also needed to determine if the results of this study are similar to schools with a lower percent of students who qualify for the free or reduced lunches. Further studies can also be conducted to determine if students in other geographical areas are served lunch menus with similar nutrient content.

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