University of North Carolina at Asheville
Journal of Undergraduate Research
Asheville, North Carolina
May 2020

Brain Food?: An Assessment of School Lunches in Elementary and Middle Schools in Buncombe County, NC

Allison Walter
Department of Health and Wellness Promotion
University of North Carolina at Asheville
One University Heights
Asheville, North Carolina 28804 USA

Faculty Advisor: Dr. Ameena Batada

Abstract

Despite the progress of Asheville's tourism industry, social issues like food insecurity persist within Buncombe County. As of 2015, 21.8% of Buncombe County, North Carolina children lived in food insecure homes.[1]For children experiencing food insecurity, school lunches are integral to their health and development. Children need not only calories, but an appropriate amount of macronutrients to live healthy lives. This study aims to assess the nutritional quality of Buncombe County's elementary and middle school lunches through analysis of calories, protein, carbohydrates, total fat, saturated fat, dietary fiber and sodium in comparison to recognized standards for diets of children in their respective age groups. This study was assessed 2,915 possible combinations of school lunch items available for the week of October 7th-11th, 2019. Data were obtained from Buncombe County Schools website. Each meal was then compared to recommendations set by the US Department of Health and Human Services for calories, carbohydrates, protein, fats, dietary fiber and sodium. Of the meals studied, many had excess protein, carbohydrate, saturated fat and sodium content. Further research is needed, and could explore nutritional quality of Buncombe County high school lunches, which lunches are chosen by students, or student satisfaction with school lunches.

1. Introduction

1.1 Background

Children face serious risks to their growth and development and long term health problems without access to proper nutrition.[11] The US Department of Health and Human Services Dietary Guidelines for 2015-2020 posit that about 75% of the population has inadequate consumption of fruits and vegetables, while most Americans exceed recommendations for sugar, sodium, and saturated fat.[9] According to the CDC, in the years 2007-2010, only 1 in 10 children consumed adequate vegetables and only 4 in 10 children consumed adequate fruit.

The National School Lunch Program serves 29.5 million children a day in public schools.[2] However, in the past few decades, school lunches have been intensely scrutinized for their possible connection to the rise in childhood obesity.[3] Quality of school lunches has also been linked to academic performance.[4] The Healthy, Hunger Free Kids Act of 2010 changed the National School Lunch Program's nutritional standards drastically by increasing the availability of whole grains, fruits and vegetables, and reducing sodium content. Evidence suggests that school meals under the Healthy, Hunger Free Kids Act (HHFKA) are more nutritionally and energy dense.[6] The most recent publication of the School Nutrition Dietary Assessment Study, conducted from 2009-2010, which compared lunches from the National School Lunch Program to standards set by the School Meal Initiative found that over the course of a week, most schools offered and served lunches that met their standards for minimum levels of target nutrients. Most schools also offered and served lunches that met the minimum for caloric, total fat, and saturated fat needs. However, only 14% of schools offered lunches that satisfied all of the School Meal Initiative's standards.[5] Currently, the NSLP

follows nutritional standards set by the USDA.[6] Recently, the USDA started to rescind some of the standards set by the HHHFKA. Some of these changes include a decrease in the amount of fruit offered per day from 1 cup to ½ cup, a decrease in the variety of vegetables offered, and a repeal of the ban on trans fats in school lunches.[2]

1.2 Background: School Nutrition in Buncombe County

Despite being one of the most up and coming "foodie" towns in the south, Asheville faces an abundance of food insecurity. As of 2015, 21.8% of children in Asheville lived in food insecure homes and 10,600 children were eligible for free or reduced price lunch.[1] One of the reasons for the level of food assistance may be the lack of access to foods, as the city of Asheville has 9 food deserts, or areas that are more than 1 mile away from a grocery store in urban areas, or more than 10 miles away in rural areas.[7] In 2014 and 2015, ~85% of food insecure households with school age children participated in the National School Lunch Program.[8] Having access to healthy, nutrient dense school lunches is especially important for areas with high rates of food insecurity, as food insecure children often rely on school breakfast and lunch to meet their nutritional needs. Though there is national data on the quality of school lunches, information about the nutritional quality lunches served in the 45 schools that make up the Buncombe County School District is not available. Thus, the purpose of this research was to assess the nutritional quality of children's meals with Buncombe County school lunches.

2. Methodology

2.1 Introduction

This study is a crosssectional observational analysis of the nutritional quality of school lunches in Buncombe County elementary and middle schools. Data were obtained from Buncombe County school district's online menu.

2.2 Procedure and Sample

For this study, elementary and middle school meal combinations were derived from Buncombe County Schools' online lunch menu for each day of the week of October 7-11th, 2019. For elementary school, each day had 3-4 entree options, 3-4 sides, and 5 drink options. For middle school, each day had 12 entrees, 4-5 sides and 5 drinks. Along with each menu item, the website also listed the protein, carbohydrate, dietary fiber, total fat, saturated fat, sodium, calcium, iron, Vitamin A and Vitamin C content for each item. For both groups, one meal consisted of one entree, two sides, and one drink. One side had to be a fruit or a vegetable. In total, the website listed 19 possible fruit sides that could be available on any given day. These 19 fruit sides were averaged to create one "average fruit" that was included in the combinations as needed. Each individual item listed on Buncombe County's school lunch menu (and its respective nutritional content) for the week analyzed was entered into a spreadsheet based on the classification of the item (entree, side, or drink) and the day it was available. Then, all meal combinations were created for each day based on the requirements that meals consist of one entree, one drink, and two sides, one of which had to be a fruit or a vegetable. The total number of possible combinations for Buncombe County elementary schools during the week of October 7th-11th was 615. The total number of combinations for Buncombe County middle schools was 2,300, for a total of 2,915 meal combinations.

2.3 Analysis

The meal combinations for this study were compared to the US Department of Health and Human Services Dietary Guidelines for 2015-2020. Caloric needs for children ages 4-18 were listed for each individual year and divided by sex and activity level, as listed in Appendix 2 of the USDHHS Dietary Guidelines.[9] To estabilsh the caloric guidelines for elementary schoolers, moderately active male and female needs were averaged for ages 5-11 years old. This created a range of 467-667 calories, or an average of 633 calories, which was used as the final cutoff for determining whether a meal exceeded caloric needs. To get the caloric guideline for middle schoolers the same process was repeated for ages 11-14. This created a range of 600-800 calories and an average of 700 calories, which was used as the final cutoff.

For all macronutrients (carbohydrates, protein, and total fat) along with dietary fiber and sodium, recommendations were given in age groups of 4-8 years old, 9-13 years old, and 14-18 years old respectively. For elementary school, the recommendations for age groups 4-8 years old and 9-13 years old were averaged to make cutoffs for exceeding needs. For middle school, macronutrients, dietary fiber and sodium cutoffs were set by the 9-13 year old age group, as it was most encompassing of the typical years children are in middle school, though the age 14 is missing. The final cutoffs for elementary and middle school meals can be found in Tables 1 and 2.

Table 1: Elementary School Recommendations

Nutrient	**Cutoff**
Calories	633 kcals
Protein	11.3 grams
Carbohydrates	43.3 grams
Dietary Fiber	5.6 grams
Total Fat	Less than or equal to 35% of calories
Saturated Fat	Less than 10% calories
Sodium	683.3 milligrams

Table 2: Middle School Recommendations

Nutrient	**Cutoff**
Calories	700 kcals
Protein	11.3 grams
Carbohydrates	43.3 grams
Dietary Fiber	8.4 grams
Total Fat	Less than or equal to 35% of calories
Saturated Fat	Less than 10% calories
Sodium	733.3 milligrams

To understand the prevalence with which Buncombe County elementary and middle school lunches exceeded recommendations for nutritional needs, a frequency analysis was completed via Google Excel. Each of the possible 2,915 combinations were inserted into a spreadsheet, with nutrients separated by column and color coded by day. Each combination was then coded with formulas to calculate how many combinations exceeded the cutoff for all nutrients. Finally, at the end of each column, a sum formula was inserted to get the percentage of combinations that exceeded the cutoff.

3. Results

3.1 Elementary School Lunches

The results section reports on the school meal combinations that exceeded the cutoffs recommended by the USDHHS. For Buncombe County elementary school lunches, calorie, protein, carbohydrate, saturated fat, and sodium content are of particular interest.

Among assessed elementary school meals, 43.4%, (n=267) of the meal combinations exceeded the caloric cutoff of 633 calories per meal and 57% (n=348) met the caloric cutoff as shown in Figure 1.

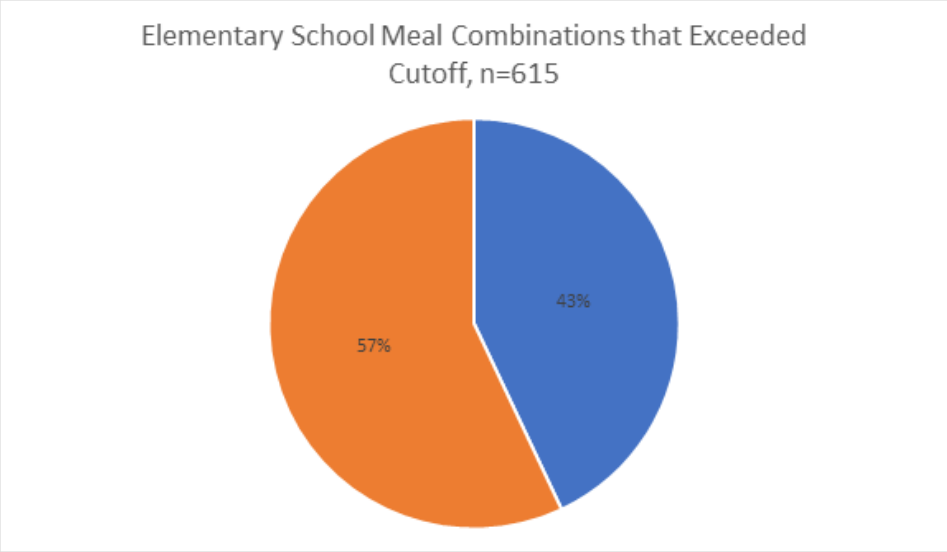

Figure 1. Bar chart that shows the percentage of elementary school meals that exceeded calorie cutoff.

Figure 2 shows that of the assessed elementary school meals, 100%, (n=615) of the meal combinations exceeded the protein cutoff of 11.3 grams per meal. 99.8% (n=614) of meal combinations exceeded the carbohydrate cutoff of 43.3 grams per meal.

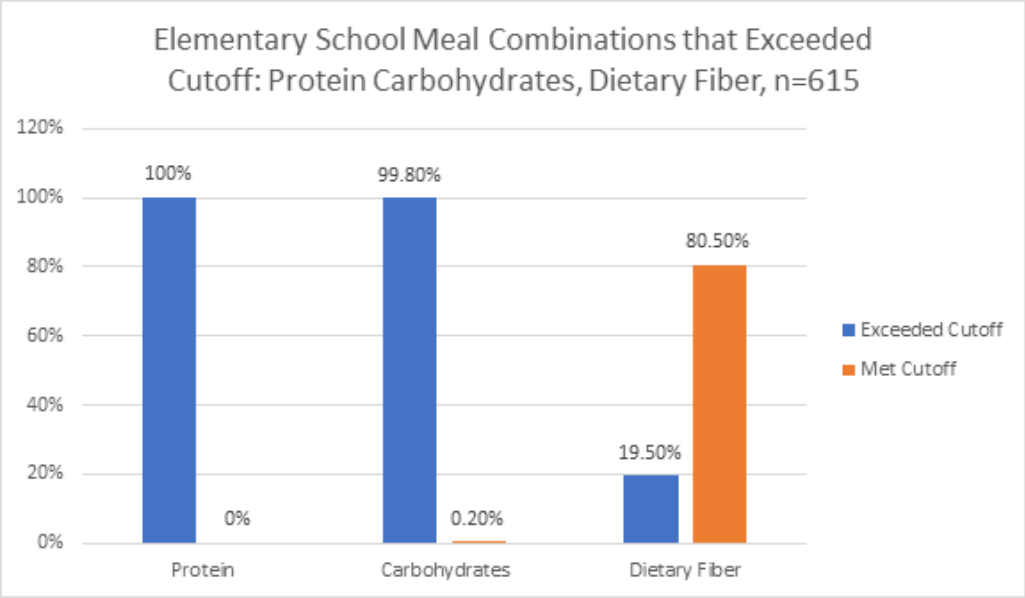

Figure 2. Bar chart that shows the percentages of elementary school meal combinations that exceeded protein, carbohydrate, and dietary fiber cutoffs.

Figure 3 shows that among assessed elementary school meals, 43.5% (n=268) exceeded the <10% of calories cutoff for saturated fat, while 56.5% (n=347) met the cutoff. 70.1% (n=431) exceeded the sodium cutoff of 683.3 milligrams per meal, while 29.9% (n=184) met the sodium cutoff.

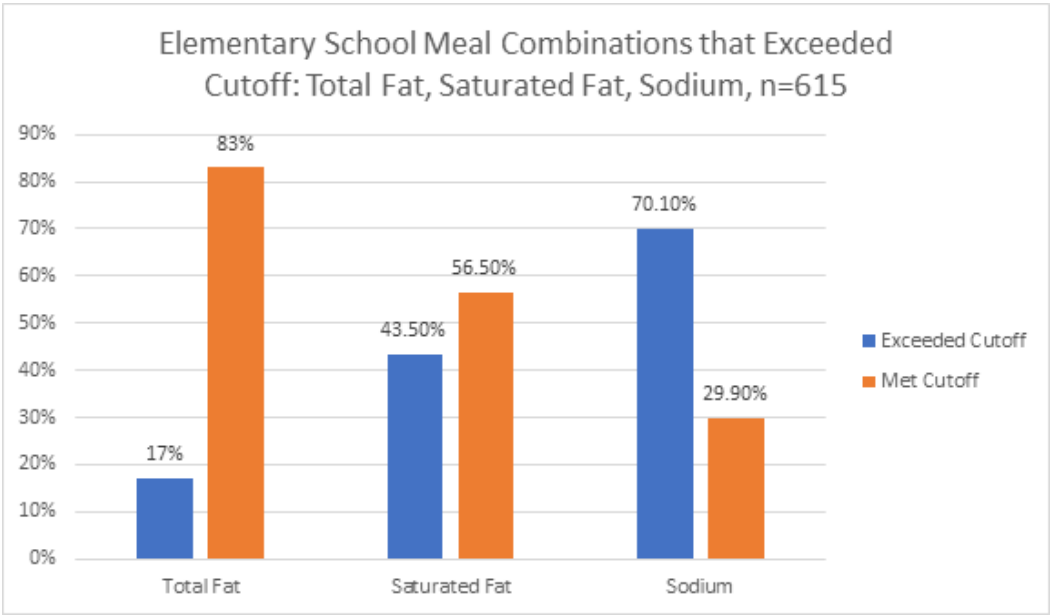

Figure 3. Bar chart that shows the percentages of elementary school meal combinations that exceeded total fat, saturated fat, and sodium cutoffs.

An example meal combination illustrates how for younger elementary school children, excess of protein, carbohydrates and sodium could be an issue (see Table 3). In this example, all three nutrients are 2-3x the recommendation of 11.3 grams, 43.3 grams, and 683.3 milligrams for protein, carbohydrates and sodium respectively.

Table 3. Example Meal for Elementary Schoolers on Thursday, October 10th, 2019

	Protein (g)	Carbohydrates (g)	Sodium (mg)
Arroz Con Pollo	24.2	44.8	1,305.7
Hot Buttered Golden Corn	2.1	16.1	16.6
Taco Fiesta Beans	5	19.9	468.5
Fruit Punch Juice	0	22	10
TOTAL:	31.3 grams	102.8 grams	1,800.8 milligrams

3.2 Middle School

The following figures show percentages of middle school meal combinations that exceeded the cutoffs recommended by the USDHHS. Protein, carbohydrates, saturated fat and sodium were also of concern for Buncombe County middle school lunches. A few entrees were especially problematic for Buncombe County middle schools: Arroz con Pollo, Grilled Chicken Quesadilla, Tex Mex Beef Tacos, and Baked Spaghetti. Among assessed middle school meals, 23% (n=539) exceeded the caloric cutoff of 700 calories, while 77% (n=1,761) met the caloric cutoff as shown in Figure 4.

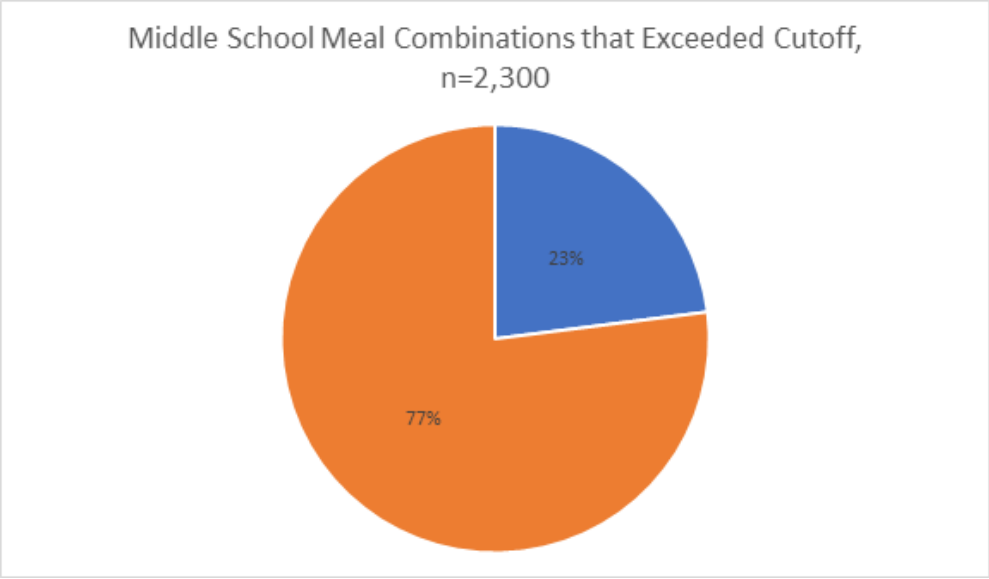

Figure 4. Bar chart that shows the percentage of middle school meals that exceeded caloric cutoff.

Among assessed middle school meals, 100% (n=2,300) exceeded the protein cutoff of 11.3 grams per meal. 99.9% (n=2,299) exceeded the carbohydrate cutoff of 43.3 grams per meal.

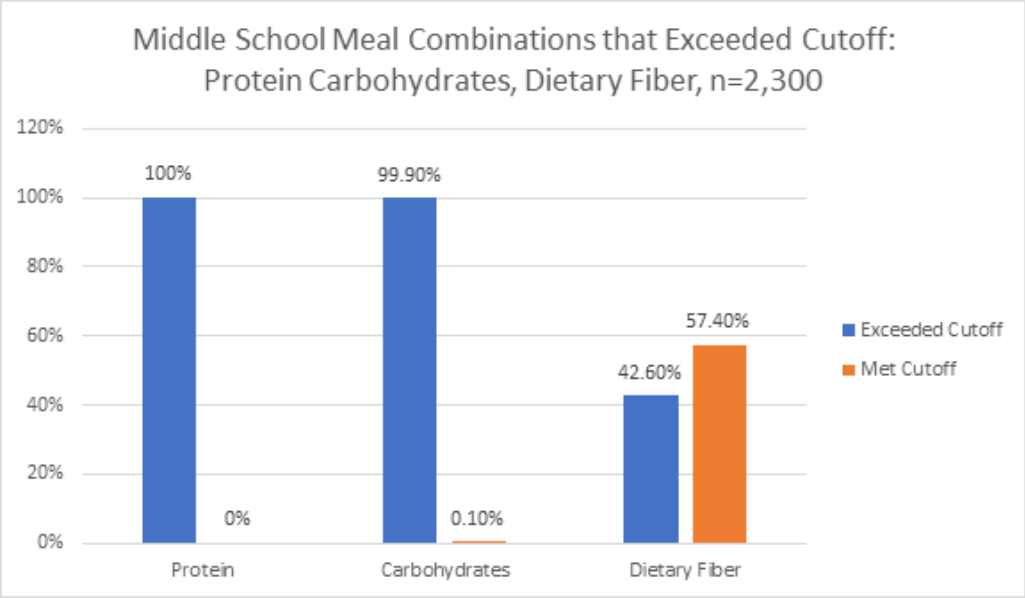

Figure 5. Bar chart that shows the percentage of middle school meals that exceeded the protein, carbohydrate, and dietary fiber cutoffs.

Figure 6 shows that of assessed middle school meals, 17%,(n=392) exceeded the recommendation of <35% of total fat, while 83% (n=1,908) met the cutoff. For saturated fat 44.8% (n=1,030) exceeded the recommendation of <10% of calories and 55.2% (n=1,270) met the cutoff.. 78.2% (n=1,799) exceeded the sodium cutoff of 733.33 milligrams, and 21.8% (n=501) met the cutoff..

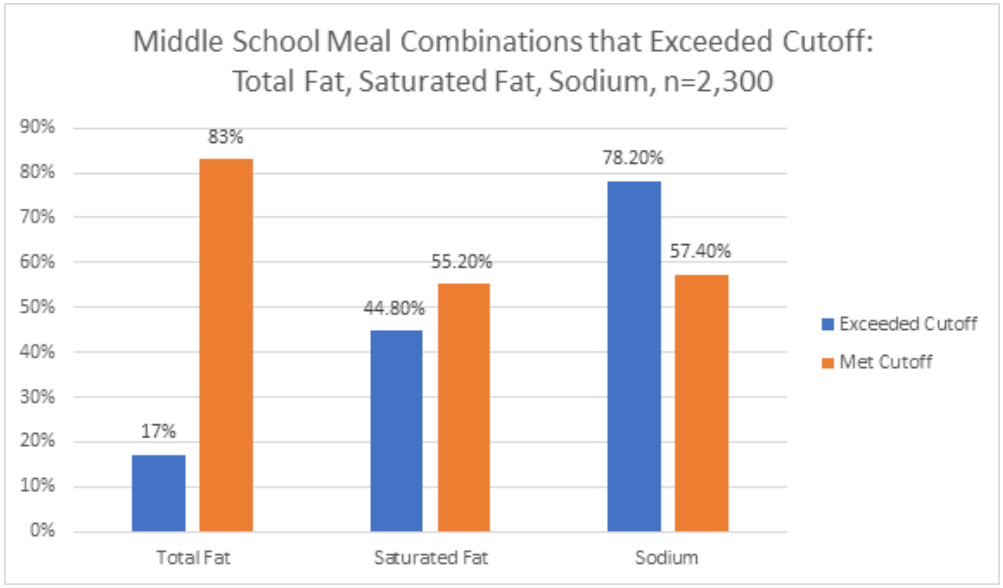

Figure 6. Bar chart that shows the percentages of middle school meals that exceeded the cutoff for total fat, saturated fat and sodium.

Table 4. Example Meal for Middle Schoolers on Tuesday October 8th, 2019

	Calories	Carbohydrates (g)	Sodium (mg)
Clux Delux Sandwich	359	43	1,047
Baked Parmesan and Herb Tomatoes	186.6	6.2	647.7
Creamy Mashed Potatoes	139.5	18.3	511.1
1% Milk	110	13	130
Total:	795.1 grams	80.5 grams	2,335.8 milligrams

Middle school lunches also included the options of entrees from Pizza Hut and Clux Delux, which tended to be higher in calories, carbohydrates and sodium.

4. Discussion

4.1 Practical and Policy Implications

As previously mentioned, the protein, carbohydrate, saturated fat and sodium content of the meals assessed exceeded cutoffs from the USDHHS. Unfortunately, within the context of similar research about the American diet, the results from this study are not surprising. The USDHHS asserts that at least half of Americans' diets exceed recommendations for proteins, carbohydrates, saturated fat and sodium.[9] Excess of these nutrients can lead to a variety of health risks.The results of this research also align with similar studies. For example, data collected as part of the 3rd School Nutrition Dietary Assessment found that 80% of public school children in the US had excessive intake of saturated fat while 90% had excessive intake of sodium.[10] As previously mentioned, the 4th School Nutrition Dietary Assessment Study analyzed school meals from the 2009-2010 school year against standards set by School Meal Initiatives. Most schools studied struggled with offering lunches that were within the standards for calories, total fat and saturated fat.[5]

Excess of calories, sodium and saturated fat were also found to be concerning within this study of Buncombe County elementary and middle schools. Additionally, SNDA IV showed that there were discrepancies in the content of what was offered vs served/chosen by students. Whereas about ⅔ of schools studied offered meals that were within the healthy caloric range, only about 39% of schools served meals that were within the healthy caloric range. In regards to meals meeting all of the standards set for SNDA IV, 14% offered meals that met standards whereas only 7% actually served those meals.[5]

Results from these studies may indicate that the standards for sodium and saturated fat in the Healthy Hunger Free Kids Act may need to be reviewed, and that qualitative data regarding which meals were actually chosen could be helpful in determining the nutritional reality for children participating in the NSLP. However, it is important to recognize the complexity that is faced in attempting to develop a menu for millions of children. The National School Lunch Program faces the challenging situation of feeding children from a variety of backgrounds, even within one particular school. Students have different nutritional needs based on age, sex, food security, and activity level. For a student who only eats at school, excess calories, protein, and carbohydrates would be helpful in keeping them satiated until the next day. On the other hand, for a student who has little activity and has three square meals a day as well as snacks, excess calories, protein, and carbohydrates could be harmful to their health. These results indicate that the calorie, protein, carbohydrate, saturated fat and sodium content of Buncombe County school lunches are of concern and need to be examined more closely through additional research.

4.2 Strengths and Limitations

Strengths of this research include the large sample size of almost 3,000 meals. The meals were also analyzed against scientifically based criteria that were applied quantitatively. Possible limitations to this study include the limited timeframe of the sample. Meals were only analyzed for one week out of an entire school year, and thus may not provide a representative sample of school lunches. The standards used are also a somewhat limited view of nutrition. For example, sugar content, vitamin and mineral content, and prevalence of whole foods were not considered when assessing meal quality. This study also does not take into account what meals or combinations of items were actually chosen by students. There is discrepancy in what is offered versus what students choose, and the difference in the two could lead to very different results concerning nutrition in schools.

4.3 Future Research Direction

Moving forward, research in this area could be continued in various ways. Nutritional content of Buncombe County school breakfasts could be studied. It would be worth exploring how Buncombe County high schools fare in comparison to the standards set by the US Department of Health and Human Services. It may also be worth exploring to analyze meals for a larger period of time, such as all meals during a one month period or one school year. Qualitative research could also be used to analyze which meals were chosen by students in order to get a better picture of average diets, or to get an idea of satisfaction levels for school lunches. On a broader scope, the food environment within Buncombe County schools, ie. vending machines, access to drinking water, food present at classroom celebrations/other school events, could also be studied, along with how much of this food was consumed.

5. Conclusion

It is critical that students who participate in the National School Lunch Program are served food that supports their health and wellbeing. This study indicates that protein, carbohydrate, saturated fat, and sodium content in Buncombe County elementary and middle school lunches are of concern. Too much protein, carbohydrate, saturated fat and sodium content could result in negative health consequences for children. For example, consuming too much sodium could eventually lead to high blood pressure, chronic kidney disease, osteoporosis, and even cancer in adults.[12] School meals that meet recommended levels of macronutrients and micronutrients would ensure that every child has at least one meal per day that contributes to their health, wellbeing, and ability to learn.Though more research is needed, the results of this study show that there is a need for improvement within the nutritional content of school lunches in Buncombe County.

6. Acknowledgments

The author wishes to express gratitude to Dr. Ameena Batada for guidance, resources, and background knowledge.

7. References

1. Berner, Maureen. “Food Insecurity Statistics in NC.” Food Insecurity Statistics in NC | Hunger Research, 2015, hunger-research.sog.unc.edu/content/2015-buncombe-county-nc.
2. Lott M, Miller L, Arm K, Story M. Rapid Health Impact Assessment on USDA Proposed Changes to School Nutrition Standards. Durham, NC: Healthy Eating Research; 2020. Available at https://healthyeatingresearch.org
3. Schanzenbach, Diane Whitmore. “Do School Lunches Contribute to Childhood Obesity? .” The Journal of Human Resources, vol. 44, no. 3, 2009.
4. Anderson, Michael, et al. “School Lunch Quality and Academic Performance .” 24 Jan. 2018.

5. Fox, Mary Kay, and Elizabeth Condon. “School Nutrition Dietary Assessment Study-IV : Summary of Findings.” Mathematica Policy Research , Nov. 2012.
6. Johnson, Donna B., et al. “Effect of the Healthy Hunger-Free Kids Act on the Nutritional Quality of Meals Selected by Students and School Lunch Participation Rates.” JAMA Pediatrics, vol. 170, no. 1, 2016, doi:10.1001/jamapediatrics.2015.3918.
7. Danielle, Erin. “Urban Renewal, Gentrification and Food Insecurity in Asheville’s Southside Neighborhood”. April 2016.
8.Ralston , Katherine, and Alisha Coleman Jensen. “USDA's National School Lunch Program Reduces Food Insecurity .” United States Department of Agriculture Economic Research Service , US Department of Agriculture , June 2017, https://www.ers.usda.gov/amber-waves/2017/august/usda-s-national-school-lunch-program-reduces-food-insecurity/
9. Olson, Richard. “Dietary Guidelines for Americans 2015–2020 8th Edition.” Edited by Anne Brown Rodgers, 2015-2020 Dietary Guidelines, US Department of Health and Human Services, 2015, https://health.gov/dietaryguidelines/2015/guidelines/.
10. Clark, Melissa A., and Mary Kay Fox. “Nutritional Quality of the Diets of US Public School Children and the Role of the School Meal Programs.” Journal of the American Dietetic Association, Elsevier, 21 Jan. 2009, www.sciencedirect.com/science/article/abs/pii/S0002822308020531.
11. Healthwise Staff. “Healthy Eating in Children: Problems Caused by Poor Nutrition.” *My Health Alberta* , 2018, myhealth.alberta.ca/Health/Pages/conditions.aspx?hwid=ug2061
12. “Salt and Sodium.” *The Nutrition Source*, Harvard T.H Chan School of Public Health, 16 Dec. 2019, www.hsph.harvard.edu/nutritionsource/salt-and-sodium/.