

5-2021

## ARE SCHOOL LUNCHES CONTRIBUTING TO THE OBESITY EPIDEMIC AMONG CHILDREN?

Luis Chavez  
*California State University - San Bernardino*

Follow this and additional works at: <https://scholarworks.lib.csusb.edu/etd>



Part of the [Maternal and Child Health Commons](#), and the [Other Public Health Commons](#)

---

### Recommended Citation

Chavez, Luis, "ARE SCHOOL LUNCHES CONTRIBUTING TO THE OBESITY EPIDEMIC AMONG CHILDREN?" (2021). *Electronic Theses, Projects, and Dissertations*. 1208.  
<https://scholarworks.lib.csusb.edu/etd/1208>

This Thesis is brought to you for free and open access by the Office of Graduate Studies at CSUSB ScholarWorks. It has been accepted for inclusion in Electronic Theses, Projects, and Dissertations by an authorized administrator of CSUSB ScholarWorks. For more information, please contact [scholarworks@csusb.edu](mailto:scholarworks@csusb.edu).

ARE SCHOOL LUNCHESES CONTRIBUTING TO THE OBESITY EPIDEMIC  
AMONG CHILDREN?

---

A Thesis  
Presented to the  
Faculty of  
California State University,  
San Bernardino

---

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Public Health

---

by  
Luis Chavez  
May 2021

ARE SCHOOL LUNCHESES CONTRIBUTING TO THE OBESITY EPIDEMIC  
AMONG CHILDREN?

---

A Thesis  
Presented to the  
Faculty of  
California State University,  
San Bernardino

---

by  
Luis Chavez  
May 2021

Approved by:

Neal Malik, Committee Chair, Health Science and Human Ecology

Salome Mshigeni, Committee Member, Health Science and Human Ecology

Kassandra Harding, Committee Member, Health Science and Human Ecology

© 2021 Luis Chavez

## ABSTRACT

**Background:** Childhood obesity is a major public health issue in the United States (U.S.) and recent data have shown that the incidence and prevalence have been increasing over the past 20 years. Poor dietary habits are often attributed to these increasing rates. The National School Lunch Program (NSLP) provides meals and snacks to over 30 million students. Therefore, determining whether an association exists between student participation in the NSLP, and their respective body mass index (BMI) is critical. Few studies have examined a family's economic stability and the child's race as potential moderating variables. This study aimed to investigate whether those students who participate in the National School Lunch Program (NSLP) have a higher BMI when compared to students who do not participate in the NSLP. An examination of the influence race and economic stability was included in the analyses, as well.

**Methods:** After a thorough literature review, secondary survey data collected by the U.S. Census and National Center for Education Statistics were analyzed. Data related to participation in free or reduced-price school meal programs as well as data regarding the race and economic stability of those participants were extracted. Kruskal-Wallis H tests were performed to determine whether an association existed between participation in the NSLP and the participants' BMI. In order to assess the potential influence of moderating variables, race and economic stability were also included in the analyses.

**Results:** A total of 15,136 responses were analyzed. Results revealed participation in the NSLP had a small, positive effect on students' BMI. Race and a family's economic stability also had small, positive effects on NSLP participants' BMI. Interestingly, those families reporting struggling very often economically did not appear to be associated with BMI.

**Conclusion:** Results suggest that participation in the NSLP is associated with participants' BMI. Race and a family's economic stability also appeared to have a small influence on BMI. While a cause-and-effect relationship has yet to be determined, these results are of particular importance given their potential to influence the long-term health of millions of students.

## ACKNOWLEDGEMENTS

I wish to acknowledge and express my gratitude to my parents and sister who have supported me throughout my academic career. I would also like to express my sincerest gratitude to my committee members Dr. Kassandra Harding, Dr. Salome Mshigeni, and my committee chair Dr. Neal Malik for the patience and guidance they provided during my research and growth. Thank you for believing in me and for your assistance whenever I had a question or concern no matter how trivial. Thank you.

## TABLE OF CONTENTS

|   |      |
|---|------|
| ABSTRACT.....                               | iii  |
| ACKNOWLEDGEMENTS.....                       | v    |
| LIST OF TABLES.....                         | viii |
| CHAPTER ONE: INTRODUCTION.....              | 1    |
| Problem Statement.....                      | 1    |
| Purpose of the Study.....                   | 3    |
| Significance to Public Health.....          | 4    |
| CHAPTER TWO: LITERATURE REVIEW.....         | 6    |
| Introduction.....                           | 6    |
| Why is Body Mass Index Important?.....      | 9    |
| The National School Lunch Program.....      | 10   |
| Race and Instability an Alternate Look..... | 13   |
| CHAPTER THREE: METHODS.....                 | 15   |
| Study Design.....                           | 15   |
| Participants/Recruitment.....               | 15   |
| Data Source/Collection.....                 | 16   |
| Analysis.....                               | 17   |
| CHAPTER FOUR: RESULTS.....                  | 19   |
| Characteristics of Participants.....        | 19   |
| Research Questions.....                     | 19   |
| CHAPTER FIVE: DISCUSSION.....               | 25   |

|                                    |    |
|------------------------------------|----|
| Significance to Public Health..... | 27 |
| Strengths and Limitations.....     | 28 |
| Recommendations.....               | 29 |
| Conclusion.....                    | 30 |
| REFERENCES.....                    | 31 |

## LIST OF TABLES

|  |    |
|--|----|
| Table 1. Participation in the National School Lunch Program and Body Mass Index.....                       | 20 |
| Table 2. Participation in the National School Lunch Program and Body Mass Index by Race.....               | 22 |
| Table 3. Participation in the National School Lunch Program and Body Mass Index by Economic Stability..... | 24 |

## CHAPTER ONE: INTRODUCTION

### Problem Statement

Over the past 50 years, the prevalence of overweight and obesity among children in the U.S. has increased significantly (Fryar, 2018). It has been estimated that instances of obesity amongst children have nearly tripled since the 1970's and continues to rise (Center for Disease Control, 2013). Body Mass Index (BMI) is considered an important health indicator and is often used to assess future risk of chronic diseases, such as heart disease and Type 2 diabetes (Reilly & Kelly, 2011). As a child's BMI increases, the risk for chronic diseases increases as well regardless of age, race, or sex. Commonly this risk is much greater in children with a BMI of 30.0 kg/m<sup>2</sup> or greater but risks still exist for those who are overweight with a BMI of 25.0 to 29.9 kg/m<sup>2</sup> (CDC, 2020). The increase in BMI among children is a multifactorial issue that can include numerous factors ranging from the community in which the child lives to social influences, like friends and family (Perpich et al., 2011). Many researchers and advocates have begun to focus on the National School Lunch Program (NSLP) and its possible impact on children's diets.

The NSLP is part of the daily lives of many children throughout the country. Approximately 52.11% of children in the United States are eligible to participate (Digest of Education Statistics, 2017). It has been reported that NSLP participants typically have a higher BMI (Li & Hooker, 2010). Additionally,

children attending public schools have a much higher BMI than those attending private schools (Li & Hooker, 2010). Residential childcare institutions, public, and private schools can participate in the program as long as the institutions meet federal meal pattern requirements and provide the service to eligible children. Around 95.6% of all public schools participate in the NSLP and around 18.8% of all private schools participate in the program (National Center for Education Statistics, 2020). While school lunches meet the nutrition guidelines as outlined by the United States Department of Agriculture (USDA, 2012), critics of the NSLP point to the excess amounts of sugar and salts in the meals and snacks provided (United States General Accounting Office (GAO), 2015; Dillard, 2008). These foods have been linked to an increased likelihood of weight gain in children (Perpich et al., 2011).

It has been reported that foods containing higher levels of fat, sodium, calories, and sugar may be more appealing to students, which increases the likelihood of purchasing and consuming the item (Nardocci et al., 2018; Bauer et al., 2004). Less appealing foods such as simple salads or bruised fruit, tend to be purchased less frequently even though these foods may be more nutritious. Additionally, foods supplied to the NSLP are often surpluses of products from the USDA and can include high-fat meats and highly processed, shelf-stable foods which are often high in salt and sugar (Mortazavi, 2014; Rouse, 2018).

Additionally, gaps in the literature persist. For example, the effects of race and economic stability on the relationship between NSLP participation and BMI

have not been widely cited. Culture, which is often linked with an individual's race, has also not been adequately studied despite its potential effect on BMI. Access to culturally appropriate foods, eating patterns that result in poor nutrition, or a child's perception of body weight may be associated with BMI (Bauer et al., 2004). Income may also be associated with obesity risk as it can limit food purchasing, often resulting in the purchase of cheaper, less nutritious foods such as pizza as opposed to more costly freshly made salads (Perpich et al, 2011).

However, family income levels alone do not determine how or where money is being spent. A large percentage of a family's income may be earmarked for expenses unrelated to a child's needs. Therefore, economic stability - defined as the ability to provide for an individual's family at the family's current income - may provide important insights beyond simply examining a household's income level (United States Census Bureau, 2018). It is plausible that economic stability may affect a student's nutritional intake if a large percentage of the household's income is spent on non-food-related items, such as medical care, living expenses, and insurance. This can be especially concerning for low-income families as purchasing nutritious foods may be less of a priority as less nutritious foods may be affordable (Perpich et al, 2011).

### Purpose of Study

The purpose of this study is to investigate whether those students who participate in the National School Lunch Program (NSLP) have a higher BMI when compared to students who do not participate in the NSLP. An examination

of the influence race and economic stability may have will be included in the analyses, as well.

Research Questions:

- Is there an association between a student's participation in NSLP and the student's BMI?
- Among students who participate in the NSLP, is there an association between the student's race and BMI outcome?
- Among students who participate in the NSLP, is there an association between family economic stability and BMI outcome?

To answer these questions, I will conduct a secondary analysis using data from the 2018 National Survey of Children's Health.

#### Significance to Public Health

The World Health Organization (WHO) recently stated that childhood and adolescent obesity is one of the most significant public health challenges of the 21<sup>st</sup> century, particularly because obese children are likely to stay obese into adulthood (World Health Organization). This study will investigate whether the NSLP impacts the BMI of school-aged children. Additionally, to my knowledge, no other study has examined economic stability and race in relation to NSLP participation and BMI. Results of this study may influence policy changes and modifications to the foods provided by the NSLP. Additionally, examining a child's race and their respective household's economic stability may help target

at-risk groups. In turn, this too may influence policy change and provide valuable information for targeted awareness campaigns.

## CHAPTER TWO: LITERATURE REVIEW

### Introduction

In the U.S., overweight and obesity have become a major public health issue due to the increase in recent years and its detrimental impact on the health of those afflicted by it. To be classified as overweight one must have a body mass index (BMI) of 25 kg/m<sup>2</sup> to 29.9 kg/m<sup>2</sup>, whereas obesity is defined as having a BMI of 30.0 kg/m<sup>2</sup> or greater (Ward et al., 2019). While it has been predicted that rates of overweight will decline, it is believed that one in two U.S. adults will be obese by 2030 (Ward et al., 2019). Therefore, a reduction in the prevalence of overweight may simply mean more adults will become obese in the near future.

Children are of particular interest given that the incidence of overweight and obesity among those between the ages of 2 and 17 has more than tripled in recent decades, increasing from 5.2% to 18.5% (Fryar, 2018). Prospective studies have found that those with high BMIs during childhood tend to have a high BMI in adulthood and maybe at a greater risk of developing health issues associated with obesity (Reilly & Kelly, 2011). Additionally, it is estimated that obese children are 1.4 to 2.9 times more likely to die prematurely in adulthood.

The National School Lunch Program (NSLP) is being examined as a possible contributor to the increased incidence of overweight and obesity in children by the U.S. Government Accountability Office (GAO, 2015). Given the

program provides lunches to approximately 30,000,000 children in the United States 180 days out of the year or more (Digest of Education Statistics, 2017).

Meals served by the NSLP meet the minimum nutritional guidelines outlined by the USDA (USDA, 2012), but many of the limitations set to protect children against the overconsumption of certain foods have not been fully implemented. Recently the federal government has loosened restrictions. For example, a reduction of the sodium content of NSLP foods was proposed (United States Department of Agriculture Food and Nutrition Service, 2019) yet these were delayed. Therefore, children continue to consume over 60% of the recommended daily value of sodium during lunch (USDA-FNS, 2019). This delay also allowed flavored milk, which is known to be a major source of added sugar, to remain as an NSLP offering (USDA-FNS, 2019). In fact, the program has said that there are no plans to limit total sugar beyond limiting added sugar in certain foods (USDA-FNS, 2019). As a result, students receiving meals from the NSLP are usually consuming more sugars and salts than students who are not participating (Connelly et al., 2020). The USDA's guidelines are quite broad and are split by K-12 grades, usually grouped as grades K-5, 6-8, and 9-12, to ensure children of varying ages obtain the appropriate nutrition guidelines (USDA, 2012). The overarching NSLP guidelines require schools to provide servings of whole grains, fluid milk, fruits, and vegetables in the meals provided to students. In order for the schools to receive meal reimbursements, students must select an entrée, fruit or vegetable, and a drink. However, students may not

always consume the required items and may simply dispose of them even if the foods were healthier resulting in food waste (U.S. Government Accountability Office, 2015; Zhao et al., 2019). However, heavily processed can meet the NSLP guidelines as long as foods do not exceed the imposed nutrient limitations. According to the 2015–2020 Dietary Guidelines for Americans, upon which many of the NSLP restrictions are based, salt intake should be limited to less than 1,900 milligrams (mg) per day for children between the ages of 4-8 years, 2,200 mg (mg) per day for those between 9-13 years, and 2,300 (mg) per day for those between the ages 14-18 years. Fat intake should be limited to 25-35% of a child's daily calorie intake, while added sugars should not surpass 10% of their daily caloric intake (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015).

The NSLP relies on the availability of processed foods due to the ease of storage and preparation (Rouse, 2018). However, highly processed foods are often energy-dense, high in sugar, total fat, and salt while low in nutrients (Nardocci et al., 2018). In fact, Li and Hooker (2010) discovered that students who receive meals from the NSLP had a higher BMI when compared with those that did not. Connelly et al. (2020) also discovered that NSLP students have higher intakes of sugars and salt than non-NSLP participants. The purpose of this review will be to summarize the relationship between childhood overweight and obesity and food access.

## What is Body Mass Index and Why is it Important?:

As mentioned previously, BMI is a health indicator that measures individuals' body fat and is often used to assess disease risk (Petrich et al., 2011). However, BMI has come under some criticism. BMI does not reveal information between fat and fat-free mass, and therefore may not be a reliable method for assessing the body fat of individuals (Petrich et al., 2011; Brambilla et al., 2013). BMI is also considered to be a less accurate measure of fat mass in children and adolescents. BMI is calculated based on an individual's height and weight, therefore rapid changes in either variable can lead to BMI classification errors (Himes, 2009). Children and adolescents may be especially prone to these errors given their day-to-day variations in hydration, posture, and the occurrence of growth spurts (Himes, 2009; Reilly & Kelly, 2005). Therefore, BMI may need to be used in conjunction with other body fat assessment methods such as electronic measurement tools, health history, and a complete health screening to accurately evaluate body weight and health status (Perpich et al, 2011). Even so, BMI is still considered an assessment tool for populations. Studies have reported a higher BMI is correlated with socioeconomic status, sedentary lifestyle, unhealthy eating patterns, and living environment such as the neighborhood in which individuals reside (Perpich et al., 2011). As a result, identifying a single cause of the childhood obesity epidemic has been difficult due to its many contributing factors.

## The National School Lunch Program

The NSLP was created in 1946 with the signing of the National School Lunch Act (NSLA) by President Harry S. Truman (USDA-FNS, 2017). The program emerged after World War II to address the issue of malnutrition in men as approximately 33% of men who entered the draft were disqualified due to malnutrition (Dillard, 2008). The program ultimately expanded to ensure the health and wellbeing of children and encourage the consumption of excess produce grown by U.S. farmers (Ralston et al., 2008). In 2012, a major change occurred as the 2010 Healthy, Hunger-Free Kids Act was officially enacted into law which had a major impact on the NSLP. The act targeted the program in an attempt to make school lunches healthier for students and ensure that the food provided to them did not cause harm. The act has had a positive impact on the program as nutritional standards have risen and children's health has improved (Vaudrin et al., 2018). Yet, caution must be taken as recent exemptions have allowed some improvements to be delayed or removed (USDA-FNS, 2019). Other changes, such as the Child Nutrition Act of 1966 expanded and strengthened the NSLP by increasing its funding, merging it with the Special Milk Program, including nonfood assistance to buy equipment, and by making the USDA the main authority (Gunderson, 2008).

To qualify for the NSLP a child's family must meet one of a few criteria set forth by the USDA-FNS (2017). These include participation in certain Federal Assistance Programs, such as the Supplemental Nutrition Assistance Program or

the Temporary Assistance for Needy Families program. Others pertain to the child's living status, such as those who are homeless, migrants, runaways, or part of a foster family. If a child's living status meets any of these criteria, they are automatically eligible for participation in the NSLP (USDA-FNS, 2017).

Additionally, if the family's yearly income level is at or below 130% of the Federal Poverty Level for free meals or between 130 and 185 percent for reduced price meals, the child may qualify (USDA-ERS, 2020). Currently, the NSLP consists of low-income students many of whom would be classified as minorities (Digest of Education Statistics, 2017). Both public and private schools can participate along with residential childcare institutions as long as the schools meet federal meal pattern requirements and provide the service to eligible children.

Along with the NSLP, other school-based programs provide meals to children. One such program is the School Breakfast Program (SBP) which is similar to the NSLP, but instead serves breakfast to children before the start of the school day (USDA-FNS). Another is the Summer Food Service Program which focuses on providing meals to qualifying students during the summer months when school is no longer in session (USDA-FNS). However, the NSLP remains one of the longest-serving and second-largest food and nutritional assistance programs in the U.S. (United States Department of Agriculture Economic Research Service, 2020).

The NSLP is an essential part of the USDA's assisted meals program as it feeds over 30 million children a year (USDA-ERS, 2020). Given its coverage, the

program has the potential to greatly impact children's diets. According to a study published in the Journal of School Health, students who attend public schools and who qualified for the NSLP have a higher BMI when compared with students who did not qualify (Li, & Hooker, 2010). Interestingly, children attending public schools have a higher BMI than those attending private schools regardless of the student's socioeconomic status (Li, & Hooker, 2010).

Within the NSLP, a food's appeal and quality may also need to be assessed given its potential role in consumption behavior and food waste (Zhao et al., 2019; Smith et al., 2015). Unappealing foods, for example those that look to be of poor quality or have poor palatability, may be ignored by the students resulting in a missed meal or possible disposal of the food prior to consumption (Zhao et al., 2019). As reported by Zhao et al., (2019) one major cause of lunch waste was the unappealing nature of the foods along with a lack of options. (Zhao et al., 2019; Smith et al., 2015). These findings appear to contradict previously published studies that found that students may prefer unhealthy foods (Dillard, 2008). However, Smith et al., (2015) found that aroma and visual appeal were strong predictors of food consumption, However, it should be noted that focus groups were used to collect these data. Caution must be taken when interpreting these results given social desirability bias.

The layout of the cafeteria may also influence the students' food selection. For example, making foods more prominent or providing self-service options may increase student appeal (Huang et al., 2013). This may also lead to students

ignoring those foods that are placed less prominently, such as more nutritious options. In fact, modifying the placement of more nutritious foods has been found to encourage the selection of healthier options such as a chicken salad or low-fat yogurt (Huang et al., 2013).

### Race and Instability an Alternate Look

Race and economic instability may offer additional insights into the cultural influence of food choices, food preferences, and the proportion of a household's income spent on a child's welfare. Racial background can also influence the views and preferences some children may have due to how they were brought up and what foods they were exposed to. While not a completely straightforward interpretation, economic instability may provide information regarding whether a household struggles to provide for the children present such as the inability to purchase nutritious foods or the lack of a safe place.

Race is a variable that many researchers use to classify and sort participants, but it can also be a way to glimpse into the lives of the participants. In fact, Race has been shown to be a major factor in diet quality in the United States (Hiza et al., 2013). Race and subsequently culture also have a great impact on the food preference children develop due to the exposure and access to the foods that may be present in a culture than those that are not (Bruss et al., 2007). This can lead to them opting to avoid or dispose of foods that they may not have experience with which can happen to children who participate in the NSLP.

In a study published in the Social Service Review, it was found that economic stability may be a factor in health disparities amongst children who experience instability and can also impact their food security as a result (Wolf & Morrissey, 2017). This shows that economic instability is an issue, though in the Wolf & Morrissey study only children ages 3-5 were involved. Despite this limit, other studies have shown that economic instability can also affect a child's life regardless of age, such as parental involvement due to work schedule and government assistance such as SNAP as instability puts such involvement in flux as they may qualify in one time period and then not qualify in another (Hill et al., 2017). Economic instability is something that is difficult to measure, but as the study has seen it can have a great impact on the lives and health of children inside their home and possibly outside.

The composition of foods provided by the NSLP is possibly associated with overweight and obesity in school-aged children and needs to be examined further. Additionally, race and economic instability need to be included in these analyses to determine the possible impact they may have on a child's body weight. In this study, I hope to add to the literature regarding the NSLP's impact on the BMI of school-aged children while incorporating the child's race and economic instability to provide a more thorough analysis.

## CHAPTER THREE:

### METHODS

#### Study Design

The study used secondary quantitative data obtained from the U.S. Census Bureau to examine the possible relationship between participation in free- or reduced-price meals in school (NSLP) and children's BMI. Race and economic stability were also assessed to determine if they influence the relationship between participation in the NSLP and children's BMI. The data were downloaded, labeled according to the Topic Variable List provided by the U.S. Census, and checked for any errors to ensure accuracy.

#### Participants/Recruitment

The 2018 National Survey of Children's Health was conducted by the U.S. Census and funded primarily by the United States Department of Health and Human Services (HHS), Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB) (U.S. Census Bureau, 2019). The questions centered around the child's health status and access to healthcare. (U.S. Census Bureau, 2019).

The survey targeted parents or guardians living with children under the age of 18 who resided in the United States and had a mailing address listed (U.S. Census Bureau, 2019). If more than one child resided within the home, parents and guardians were instructed to select one child and respond to

questions with this single child in mind. The data were collected using questionnaires that were mailed to selected families and collected by the U.S. Census through the mail or online.

Intentional oversampling occurred to account for those children with special care needs and those between 0-5 years (U.S. Census Bureau, 2019). Those with special health care needs, such as children with autism or muscular dystrophy, were of particular interest. Additionally, oversampling of children ages between 0-5 occurred due to the underrepresentation of this age group and because of a possible age bias from sampling those with special needs (Aschner et al., 2019; Van Dyck et al., 2004; U.S. Census Bureau, 2019).

To recruit subjects for the study, the U.S. Census distributed a preliminary survey to randomly selected addresses across the United States to determine eligibility. If eligible, respondents had the option to respond to the survey online or by mail (U.S. Census Bureau, 2019). For non-responders, three follow-up attempts were made and if participants remained unresponsive, the household was no longer eligible to participate. Approximately 29,950 questionnaires were collected and analyzed, with each state collecting between 520 and 769 completed surveys.

#### Data Source/Collection

To ensure that the available data were appropriate for this study, background information such as the study purpose, participants sampled, and survey questions were reviewed using information available from the U.S.

Census. The Topical Variable List, a codebook containing all questions and answers from the original questionnaire, was reviewed and specific research questions and hypotheses were created. Test variables were then identified.

### Analysis

The data were analyzed using SPSS Version 27 (IBM, Armonk, NY). To ensure accuracy, data were obtained directly from the census website and downloaded in .spv format. The dataset was then manually checked to ensure that each variable was properly formatted. The Topical Variable List was used to label those variables with missing names.

#### Research Question 1

The primary research question examined the relationship between children who receive free- or reduced-price meals in school, which included both breakfast and lunch (K11Q62: 1=Yes, 2=No), and their Body Mass Index (BMICLASS: 1=underweight, 2=normal weight, 3=overweight, 4= obese). A Kruskal-Wallis H test was performed to assess the possibility that students who receive free- or reduced-price meals in school are more likely to have a BMI classification of 3 or above (Overweight or obese).

#### Research Question 2

The second research question examined the correlation between race (categories: 1=White alone, 2=Black or African American alone, 3=American Indian or Alaska Native alone, 4=Asian alone, 5=Native Hawaiian/Other Pacific Islander alone, 6=Some Other Race alone, 7=Two or More Races), and the

possible relationship between a student's participation NSLP and the child's BMI. Data were first grouped by their race and then analyzed using a Kruskal-Wallis H test to see if race influenced the association between free- or reduced-price meals and BMI.

### Research Question 3

The final research question examined the correlation between family economic stability, which was defined as a family's difficulty in providing basic necessities to the child, (categories, 1=Never, 2=Rarely, 3=Somewhat often, 4=Very often), and the possible relationships between participation in the NSLP and the child's BMI. The dataset was also grouped based on students' family economic stability. A Kruskal-Wallis H test was then performed to see if family economic stability influenced the association between free- or reduced-price meals and BMI.

## CHAPTER FOUR:

### RESULTS

#### Characteristics of Participants

A total of 30,530 individuals took part in the National Survey of Children's Health 2018 (U.S. Census Bureau, 2019). Of those, 15,977 (52.3%) identified as male and 14,533 (47.7%) identified as female. Along with this 23,465 (76.9%) of those surveyed identified themselves as White, 2,316 (7.6%) as Two or More Races, 2,080 (6.8%) as African American, 1,498 (4.9%) as Asian alone, 834 (2.7%) as Some Other Race alone, 259 (.8%) as Native American, and 78 (.3%) as Native Hawaiian/Pacific Islander.

#### Research Questions

##### Research Question 1

The first research question examined the relationship between children who receive free- or reduced-price meals in school (participation in the NSLP), which included both breakfast and lunch (K11Q62: 1=Yes, 2=No), and their Body Mass Index (BMICLASS: 1=underweight, 2=normal weight, 3=overweight, 4=obese). When asked, "At any time *during the past 12 months*, even for one month, did anyone in your family receive free- or reduced-price breakfast or lunches at school?" 6,229 (20.9%) answered "Yes" and 26,641 (79.1%) answered "No". Of those who responded to K11Q62 Approximately 15,136 (49.5%) responded with their BMI which was categorized in BMICLASS. Of those

who responded, 984 (6.5%) were classified as being underweight (having a BMI under the 5th percentile), 9,953 (65.8%) normal weight (having a BMI between the 5th and 85th percentile), 2,211 (14.6%) overweight (having a BMI between the 85th and 95th percentile), and 1,988 (13.1%) were classified as obese (having a BMI equal to or greater than the 95th percentile). A Kruskal-Wallis Test was used to determine the relationship between participation in the NSLP and participants' BMI classification (BMICLASS). It was discovered that participation in the NSLP was positively associated with the respondents' BMI classification ( $\chi^2(1) = .02, p < 0.001$ ) (See Table 1), therefore the null hypothesis is rejected.

Table 1. Participation in the National School Lunch Program and Body Mass Index

|                            | Free or Reduced-Price Meals - Past 12 Months | N     | Mean Rank | $\chi^2$ | Effect size (Chi/n-2) | P     |
|----------------------------|--|-------|-----------|----------|-----------------------|-------|
| Body Mass Index Percentile | Yes  | 3404  | 8466.37   | 261.170  | .017                  | <.001 |
|                            | No   | 11732 | 7307.99   |          |                       |       |
|                            | Total  | 15136 |           |          |                       |       |

### Research Question 2

The second research question examined the association between NSLP participation and participants' BMI by race. All participants (100%) who

responded to K11Q62 also responded to the question identifying their race SC\_RACE\_R (categories: 1=White alone (78.4%), 2=Black or African American alone (6.7%), 3=American Indian or Alaska Native alone (1%), 4=Asian alone (5%), 5=Native Hawaiian/Other Pacific Islander alone (.3%), 6=Some Other Race alone (2.8%), 7=Two or More Races (6.4%)). Race distribution among respondents was noted above. Data were grouped based on the respondent's race then a Kruskal-Wallis test was performed and revealed the following: identifying as White had a small influence on BMI among those who participate in the NSLP ( $\chi^2(1) = .133, p < .001$ ). Similarly, identifying as African American had a small influence on BMI ( $\chi^2(1) = .011, p = .001$ ). Identifying as American Indian or Alaskan native also had a small influence on BMI among NSLP participants ( $\chi^2(1) = .054, p = .007$ ). Finally, those who identified with Two or More Races experienced a small effect on their BMI ( $\chi^2(1) = .023, p < .001$ ). Those who identified as Asian alone, Native Hawaiian/other Pacific Islander, or a Some Other Race alone than those listed were not statistically significant (see Table 2). Therefore, race did appear to have a small but significant, positive association on BMI among NSLP participants, therefore the null hypothesis can be rejected.

Table 2. Participation in the National School Lunch Program and Body Mass Index by Race

| Race of Selected Child                        |                            | Free or Reduced-Price Meals - Past 12 Months | N     | Mean Rank | X <sup>2</sup> | Effect size (Chi/n-2) | P     |
|---|----------------------------|--|-------|-----------|----------------|-----------------------|-------|
| White alone                                   | Body Mass Index Percentile | Yes  | 2250  | 6611.02   | 157.413        | .133                  | <.001 |
|   |                            | No   | 9612  | 5772.44   |                |                       |       |
|   |                            | Total  | 11862 |           |                |                       |       |
| Black or African American alone               | Body Mass Index Percentile | Yes  | 514   | 526.84    | 10.800         | .011                  | .001  |
|   |                            | No   | 486   | 472.65    |                |                       |       |
|   |                            | Total  | 1000  |           |                |                       |       |
| American Indian or Alaskan Native alone       | Body Mass Index Percentile | Yes  | 66    | 76.33     | 7.244          | .054                  | .007  |
|   |                            | No   | 69    | 60.04     |                |                       |       |
|   |                            | Total  | 135   |           |                |                       |       |
| Asian alone                                   | Body Mass Index Percentile | Yes  | 110   | 366.41    | 1.214          | .002                  | .271  |
|   |                            | No   | 590   | 347.53    |                |                       |       |
|   |                            | Total  | 700   |           |                |                       |       |
| Native Hawaiian /other Pacific Islander alone | Body Mass Index Percentile | Yes  | 20    | 25.40     | 1.435          | .003                  | .231  |
|   |                            | No   | 24    | 21.08     |                |                       |       |
|   |                            | Total  | 45    |           |                |                       |       |
| Some Other Race alone                         | Body Mass Index Percentile | Yes  | 181   | 225.27    | 3.391          | .008                  | .066  |
|   |                            | No   | 246   | 205.71    |                |                       |       |
|   |                            | Total  | 427   |           |                |                       |       |
| Two or More Races                             | Body Mass Index Percentile | Yes  | 263   | 550.29    | 27.770         | .023                  | <.001 |
|   |                            | No   | 704   | 459.23    |                |                       |       |
|   |                            | Total  | 967   |           |                |                       |       |

### Research Question 3

The third research question examined the association between participation in the NSLP and the participants' BMI by economic stability (ACE1 categories, 1=Never, 2=Rarely, 3=Somewhat often, 4=Very often). A majority of the participants who responded to K11Q62 responded to this ACE1 with a total of 15,098 (100%) responding and 38 missing. Of those who responded, 7,873 (52.1%) indicated they never had a hard time providing basic necessities, 5,244 (34.7%) responded "rarely", 1,617 (10.7%) "somewhat often", and 364 (2.45%) indicated they struggled very often. The data was then grouped by family economic stability then a Kruskal Wallis test was conducted, and it revealed that those who indicated they never had a hard time covering their child's basic necessities were found to have a small, statistically significant influence on NSLP respondents' BMI ( $\chi^2(1) = .012$ ,  $p < .001$ ). Similarly, those that indicated they rarely had a hard time covering their child's basic necessities had a small, statistically significant influence on NSLP respondents' BMI ( $\chi^2(1) = .012$ ,  $p < .001$ ). Those who indicated that they somewhat often had a hard time covering their child's basic necessities had a small, statistically significant influence on respondents' BMI ( $\chi^2(1) = .006$ ,  $p = .001$ ). Finally, those who indicated that they very often had a hard time revealed no statistical significance (see Table 3). Therefore, a degree of economic stability appears to positively influence the BMI

of those who participate in the NSLP. This result shows that the null hypothesis can be rejected.

Table 3. Participation in the National School Lunch Program and Body Mass Index by Economic Stability

| Frequency in Which Families Identified Difficulty Affording Basics Like Food or Housing |                            | Free or Reduced-Price Meals - Past 12 Months | N    | Mean Rank | $\chi^2$ | Effect size (Chi/n-2) | P     |
|---|----------------------------|--|------|-----------|----------|-----------------------|-------|
| Never   | Body Mass Index Percentile | Yes  | 932  | 4482.19   | 92.379   | .012                  | <.001 |
|   |                            | No   | 6941 | 3863.79   |          |                       |       |
|   |                            | Total  | 7873 |           |          |                       |       |
| Rarely  | Body Mass Index Percentile | Yes  | 1439 | 2857.11   | 64.225   | .012                  | <.001 |
|   |                            | No   | 3805 | 2533.77   |          |                       |       |
|   |                            | Total  | 5244 |           |          |                       |       |
| Somewhat often  | Body Mass Index Percentile | Yes  | 787  | 842.96    | 10.440   | .006                  | .001  |
|   |                            | No   | 830  | 776.80    |          |                       |       |
|   |                            | Total  | 1617 |           |          |                       |       |
| Very often  | Body Mass Index Percentile | Yes  | 233  | 189.04    | 2.918    | .008                  | .088  |
|   |                            | No   | 131  | 170.86    |          |                       |       |
|   |                            | Total  | 364  |           |          |                       |       |

\*38 respondents missing.

## CHAPTER FIVE: DISCUSSION

The purpose of this study was to investigate the National School Lunch Program's (NSLP) impact on the BMI of participating students. Two variables of interest were examined: race and economic stability to determine if they were associated with the possible relationship between NSLP participation and BMI. The NSLP is a significant food source in the daily lives of many U.S. children (USDA-ERS, 2020). Therefore, the foods served as part of the NSLP play a major role in children's short-term and long-term health and wellbeing. The NSLP is such an important program that if a relationship between NSLP participation and BMI exists, it must be addressed to ensure that it is not detrimental to the health of the children.

This topic was explored using relevant, recent literature. In this study, findings suggest that participation in the NSLP is associated with the BMI of participating children. Those who participated in the NSLP tended to have a significantly higher mean BMI than students who were not enrolled in the program. This aligns with a study conducted by Li & Hooker (2010) which found that students' NSLP participation was positively correlated with students' BMI. It should be noted, however, data for this study were collected after the changes to the NSLP program were made in 2012.

In general, the study found that race and economic stability had a statistically significant influence on the association between participation in the

NSLP and the participants' BMI. Notably, the relationship between NSLP and BMI was not significant among those who identified as Asian alone, Native Hawaiian/other Pacific Islander alone, and Some Other Race. It should be noted that the number of those identified as belonging to American Indian or Alaskan Native alone and Some Other Race was quite small which may have led to a lack of statistical power. A lack of economic stability (indicated by those families that identified as struggling *Very Often*) did not influence BMI among those students participating in the NSLP. In economic stability, *Very Often* was the only option that had a small number of responses in relation with the others which can weaken its statistical power.

These results suggest that there is a significant positive relationship between NSLP participation and BMI of participating students. This is a public health concern because a higher BMI places a child at an increased risk for developing long-term health issues like cardiovascular disease, particularly if their BMI is between the 85th and 95th percentile or above the 95<sup>th</sup> percentile (Perpich et al., 2011). While this study does not determine a cause-and-effect relationship between these variables, it may be worthwhile to consider reexamining the quality of foods served in the NSLP. As stated previously, children's BMI may also be influenced by factors beyond the NSLP such as a child's activity levels. A study conducted by Daly et al. (2017) found activity level to be a major factor in children's weight status, with higher activity levels associated with lower BMI and more sedentary time was associated with a higher

BMI. Prior studies have found racial differences in obesity rates in children. For example, Haas et al. (2003) found that Latinos and Asian/Pacific Islanders experience a higher prevalence of overweight in adolescence than other races. Akhabue et al. (2018) found that Black and Hispanic children tend to have a higher BMI than white children with a more distinct difference emerging after the age of 12. It should be noted that studies examining the influence race may have on the association between NSLP participation on BMI appear to be lacking and to our knowledge, this is one of the first to examine these relationships.

With regard to economic stability, previously published studies have found that those families with lower incomes, defined as an income below 185% of the federal poverty limit, tend to raise children with a higher BMI than families above the limit (Demment & Margaret, 2014; Jo, 2014). It has been proposed that the reason for this is due to low-income children's increased intake of energy-dense, low nutrient foods and limited physical activity (Jo, 2014).

#### Significance to Public Health

Childhood and adolescent obesity are one of the most prevalent public health issues of the 21st century and it is not something that will go away on its own (WHO, 2020). This issue can have a lifelong impact on the health of children, particularly because obese children are likely to stay obese into adulthood which can lead to various health issues like cardiovascular disease (WHO). This study investigated whether the NSLP impacts the BMI of school-aged children and the results showed that it does have a positive relationship. The grouping variables,

the participants' race and economic stability were also found to have a positive relationship, with some exceptions. The results of this study may be used to influence policy changes and modifications to the foods provided by the NSLP or to encourage more research into the issue. Additionally, the examination of the grouping may help identify at-risk groups which may also influence policy change and provide valuable information for targeted awareness campaigns.

#### Strengths and Limitations:

Study strengths include the use of recent data, collected in the past 3 years. The data acquired was from a large data set which may increase the generalizability of these results. Data used in these analyses were collected by the U.S. Census Bureau and processed by the Data Resource Center for Child and Adolescent Health (DRC) which ensures that the collection was done with a high level of expertise and professionalism which ensured the data were cleaned accurately before being obtained. Families were also randomly sampled from across the country which also allows for greater generalizability of these results.

However, it should be noted that the study has limitations as the questionnaire had not been tested for validity or reliability. Another major limitation is regarding the unknown quality of students' meals. The NSLP provides nutritious foods as options to students, however, it is not known whether students are, in fact, selecting fruits and vegetables, low-fat dairy or more processed foods. The data also lacked information regarding meal consumption patterns: students may select nutritious foods but may not actually eat them. The

data also had limited responses for some of the questions which led to limited statistical power. Finally, social desirability bias may have also influenced the results, particularly for those reporting economic stability. Reporting low economic stability may be seen by participants as undesirable leading them to modify their responses accordingly.

### Recommendations

The prevalence of childhood obesity is a major concern within the U.S. since it may influence the long-term health and wellbeing of children. One practical recommendation to address this issue is to begin transitioning school lunch programs away from heavily processed food and begin serving foods containing less sodium, fat, and added sugars. A closer examination of sales data from schools may also be worthwhile to identify what popular foods may be harmful or what can be phased out. Finally, allocating more funding to the NSLP to allow for more nutritious meal options or offer incentives for schools to adopt a healthier meal standard may be beneficial.

Future research should consider examining sales data to examine the nutritional density of items in the NSLP that are most often selected by students. Larger samples within each of these groups may be needed to determine whether a true association exists. Along with this, researchers should determine which foods are consumed most often as well as those that are purchased yet discarded. Future research should also consider controlling for confounding variables such as meals consumed outside of school to determine whether a

cause-and-effect relationship between participation in the NSLP and participants' BMI exists in order to ensure the validity of the research.

### Conclusion

The results of this study suggest that participation in the NSLP does influence the BMI of participating students. Additionally, when a grouping variable was used such as a child's race and their family's economic stability it was determined that certain racial groups and those families that did not struggle *Very Often* economically appeared to be positively associated with the respective children's BMI. More research is needed though as the study cannot currently establish what causes these associations with our present findings. Finally, while a cause-and-effect relationship cannot be determined between NSLP participation and participants' BMI, these results have reinforced the existing literature that suggests that a relationship between NSLP participation and BMI among school children exists. These results are of particular importance given their potential to influence the long-term health of millions of current and future children.

## REFERENCES

- Akhabue, E., Perak, A. M., Chan, C., Greenland, P., & Allen, N. B. (2018). Racial differences in rates of change of childhood body mass index and blood pressure percentiles. *The Journal of Pediatrics*, *202*, 98-105.e6. <https://doi.org/10.1016/j.jpeds.2018.07.023>
- Aschner, J. L., Raphael, J. L., & Wong, S. L. (2019). The 2020 Census and the child undercount: A threat to pediatric research and the health and wellbeing of children. *Pediatric Research*, *86*(3), 289–290. <https://doi.org/10.1038/s41390-019-0477-6>
- Bauer, K. W., Yang, Y. W., & Austin, S. B. (2004). “How can we stay healthy when you’re throwing all of this in front of us?” Findings from focus groups and interviews in middle schools on environmental influences on nutrition and physical activity. *Health Education & Behavior*, *31*(1), 34–46. <https://doi.org/10.1177/1090198103255372>
- Brambilla, P., Bedogni, G., Heo, M., & Pietrobelli, A. (2013). Waist circumference-to-height ratio predicts adiposity better than body mass index in children and adolescents. *International Journal of Obesity* (2005), *37*(7), 943–946. <https://doi.org/10.1038/ijo.2013.32>
- Bruss, M. B., Applegate, B., Quitugua, J., Palacios, R. T., & Morris, J. R. (2007). Ethnicity and diet of children: development of culturally sensitive

measures. *Health Education & Behavior*, 34(5), 735–747.

<https://doi.org/10.1177/1090198106294648>

Center for Disease Control. (2013) Obesity—United States, 1999–2010.

Retrieved April 12, 2021, from

<https://www.cdc.gov/mmwr/preview/mmwrhtml/su6203a20.html>

Center for Disease Control. (2020, September 2). Causes and Consequences of Childhood Obesity. Centers for Disease Control and Prevention. Retrieved

April 14, 2021, from <https://www.cdc.gov/obesity/childhood/causes.html>

Connelly, J., Palacios, C., Campa, A., Gonzalez, N., De La Torre, K., &

Panchana, X. (2020). Sodium and sugar intake comparison among participants of the USDA National School Lunch Program versus non-participants based on 2015–2016 NHANES Survey. *Current*

*Developments in Nutrition*, 4(Supplement\_2), 172–172.

[https://doi.org/10.1093/cdn/nzaa043\\_023](https://doi.org/10.1093/cdn/nzaa043_023)

Daly, C. M., Foote, S. J., & Wadsworth, D. D. (2017). Physical activity, sedentary behavior, fruit and vegetable consumption and access: what influences obesity in rural children? *Journal of Community Health*, 42(5), 968–973.

<https://doi.org/10.1007/s10900-017-0343-6>

Digest of Education Statistics. (2017). Number and percentage distribution of public-school students, by percentage of students in school who are

eligible for free or reduced-price lunch, school level, locale, and student race: fall 2015 [Data Table].

[https://nces.ed.gov/programs/digest/d17/tables/dt17\\_216.60.asp](https://nces.ed.gov/programs/digest/d17/tables/dt17_216.60.asp)

Dillard, J. A. (2008). Sloppy joe, slop, sloppy joe: how USDA commodities dumping ruined the National School Lunch Program. *Oregon Law Review*, 87(1). <https://scholarsbank.uoregon.edu/xmlui/handle/1794/8364>

Fryar, C. D. (2018). Prevalence of overweight, obesity, and severe obesity among children and adolescents aged 2–19 years: United States, 1963–1965 through 2015–2016. 6. *Health E-Stats*  
<https://www.cdc.gov/nchs/data/hestat/obesity-child-17-18/obesity-child.htm>

Gunderson, G. W. (2003). The National School Lunch Program: background and development. *Nova Science Publishers*. <https://fns-prod.azureedge.net/sites/default/files/resource-files/NSLP-Program%20History.pdf>

Haas, J. S., Lee, L. B., Kaplan, C. P., Sonneborn, D., Phillips, K. A., & Liang, S.-Y. (2003). The association of race, socioeconomic status, and health insurance status with the prevalence of overweight among children and adolescents. *American Journal of Public Health*, 93(12), 2105–2110.  
<https://doi.org/10.2105/AJPH.93.12.2105>

- Hill, H. D., Romich, J., Mattingly, M. J., Shamsuddin, S., & Wething, H. (2017). An introduction to household economic instability and social policy. *The Social Service Review, 91*(3), 371–389. <https://doi.org/10.1086/694110>
- Himes, J. H. (2009). Challenges of accurately measuring and using BMI and other indicators of obesity in children. *Pediatrics, 124*(Supplement 1), s3–s22. <https://doi.org/10.1542/peds.2008-3586D>
- Hiza, H. A. B., Casavale, K. O., Guenther, P. M., & Davis, C. A. (2013). Diet quality of Americans differs by age, sex, race/ethnicity, income, and education level. *Journal of the Academy of Nutrition and Dietetics, 113*(2), 297–306. <https://doi.org/10.1016/j.jand.2012.08.011>
- Huang, T. T.-K., Sorensen, D., Davis, S., Frerichs, L., Brittin, J., Celentano, J., Callahan, K., & Trowbridge, M. J. (2013). Healthy eating design guidelines for school architecture. *Preventing Chronic Disease, 10*, E27. <https://doi.org/10.5888/pcd10.120084>
- Li, J., & Hooker, N. H. (2010). Childhood obesity and schools: evidence from the National Survey of Children’s Health. *Journal of School Health, 80*(2), 96–103. <https://doi.org/10.1111/j.1746-1561.2009.00471.x>
- Mortazavi, M. (2014). Consuming identities: law, school lunches, and what it means to be American. *Cornell Journal of Law and Public Policy, 24*(1), 1–46. <https://scholarship.law.cornell.edu/cjlpp/vol24/iss1/1/>

- National Center for Education Statistics. (2020). National Teacher and Principal Survey (NTPS). Retrieved September 26, 2020, from [https://nces.ed.gov/surveys/ntps/tables/ntps1718\\_2019082301\\_s12n.asp](https://nces.ed.gov/surveys/ntps/tables/ntps1718_2019082301_s12n.asp)
- Nardocci, M., Leclerc, B.-S., Louzada, M.-L., Monteiro, C. A., Batal, M., & Moubarac, J.-C. (2018). Consumption of ultra-processed foods and obesity in Canada. *Canadian Journal of Public Health = Revue Canadienne de Santé Publique*, 110(1), 4–14. <https://doi.org/10.17269/s41997-018-0130-x>
- Perpich, K., Russ, R., Rizzolo, D., & Sedrak, M. (2011). Childhood obesity: Understanding the causes, beginning the discussion. *Journal of the American Academy of Physician Assistants*, 24(12), 30–34.
- Ralston, K., Newman, C., Clauson, A., Guthrie, J., & Buzby, J. (2008). National School Lunch Program: Background, trends, and issues.
- Reilly, J. J., & Kelly, J. (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: Systematic review. *International Journal of Obesity*, 35(7), 891–898. <https://doi.org/10.1038/ijo.2010.222>
- Rouse, S. (2018). Renewing the Healthy, Hunger Free Kids Act and strengthening the farm to school program. *Journal of Law & Education*, 47(1), 177–187.

Smith, S., Cunningham-Sabo, L., & Auld, G. (2015). *Satisfaction of middle school lunch program participants and non- participants with the school lunch experience. The Journal of Child Nutrition and Management, 39(2)*,  
[https://schoolnutrition.org/uploadedFiles/5\\_News\\_and\\_Publications/4\\_The\\_Journal\\_of\\_Child\\_Nutrition\\_and\\_Management/Fall\\_2015/SatisfactionofMiddleSchoolLunchProgramParticipantsandNonParticipantswiththeSchoolLunchExperience.pdf](https://schoolnutrition.org/uploadedFiles/5_News_and_Publications/4_The_Journal_of_Child_Nutrition_and_Management/Fall_2015/SatisfactionofMiddleSchoolLunchProgramParticipantsandNonParticipantswiththeSchoolLunchExperience.pdf)

United States Census Bureau (2018). 2018 NSCH Data Release [Datafile and Code Book].

<https://www.census.gov/data/datasets/2018/demo/nsch/nsch2018.html>

United States Census Bureau (2019) Data Users: Frequently Asked Questions.

[Text]. Retrieved February 13, 2021, from

<https://mchb.hrsa.gov/data/national-surveys/data-user>

United States Department of Agriculture (2012). Nutrition standards in the National School Lunch and School Breakfast Programs; *Final Rule*.

*Federal Register, 77*. <https://www.govinfo.gov/content/pkg/FR-2012-01-26/pdf/2012-1010.pdf>

United States Department of Agriculture Food and Nutrition Service. (2017, November). The National School Lunch Program. Retrieved April 13,

2021, from <https://fns-prod.azureedge.net/sites/default/files/resource-files/NSLPFactSheet.pdf>

United States Department of Agriculture Economic Research Service (2020).

National School Lunch Program. Retrieved September 12, 2020, from <https://www.ers.usda.gov/topics/food-nutrition-assistance/child-nutrition-programs/national-school-lunch-program.aspx>

United States Department of Agriculture Food and Nutrition Service (2019). Final

rule: child nutrition program flexibilities for milk, whole grains, and sodium requirements | USDA-FNS. Retrieved February 21, 2021, from <https://www.fns.usda.gov/cn/fr-121218>

United States Department of Agriculture Food and Nutrition Service (n.d.) Child

nutrition programs | USDA-FNS. Retrieved February 23, 2021, from <https://www.fns.usda.gov/cn>

United States Department of Health and Human Services and U.S. Department

of Agriculture. (2015) 2015 – 2020 Dietary guidelines for Americans. 8th Edition. <https://health.gov/our-work/food-nutrition/previous-dietary-guidelines/2015>.

United States Government Accountability Office (2015). School nutrition: USDA

has efforts underway to help address ongoing challenges implementing changes in nutrition standards. Retrieved from <https://www.gao.gov/products/GAO-15-656>

- Van Dyck, P. C., Kogan, M. D., McPherson, M. G., Weissman, G. R., & Newacheck, P. W. (2004). Prevalence and characteristics of children with special health care needs. *Archives of Pediatrics & Adolescent Medicine*, *158*(9), 884. <https://doi.org/10.1001/archpedi.158.9.884>
- Vaudrin, N., Lloyd, K., Yedidia, M. J., Todd, M., & Ohri-Vachaspati, P. (2018). Impact of the 2010 US Healthy, Hunger-Free Kids Act on school breakfast and lunch participation rates between 2008 and 2015. *American Journal of Public Health*, *108*(1), 84–86. <https://doi.org/10.2105/AJPH.2017.304102>
- Ward, Z. J., Bleich, S. N., Cradock, A. L., Barrett, J. L., Giles, C. M., Flax, C., Long, M. W., & Gortmaker, S. L. (2019). Projected U.S. state-level prevalence of adult obesity and severe obesity. *New England Journal of Medicine*, *381*(25), 2440–2450. <https://doi.org/10.1056/NEJMsa1909301>
- Wolf, S., & Morrissey, T. (2017). Economic instability, food insecurity, and child health in the wake of the great recession. *Social Service Review*, *91*, 534–570. <https://doi.org/10.1086/694111>
- World Health Organization (2020). Noncommunicable diseases: Childhood overweight and obesity. Retrieved February 21, 2021, from <https://www.who.int/news-room/q-a-detail/noncommunicable-diseases-childhood-overweight-and-obesity>

Zhao, C., Panizza, C., Fox, K., Boushey, C. J., Byker Shanks, C., Ahmed, S., Chen, S., Serrano, E. L., Zee, J., Fialkowski, M. K., & Banna, J. (2019). Plate waste in school lunch: Barriers, motivators, and perspectives of SNAP-eligible early adolescents in the US. *Journal of Nutrition Education and Behavior*, 51(8), 967–975. <https://doi.org/10.1016/j.jneb.2019.05.590>