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Impacts of Diets and Weight on Cognitive Decline Diseases Among the Middle-aged Populations in Louisiana

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2024

Abstract

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MS, Western Governors University, 2018

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Cognitive decline is a public health concern since people are living longer, but little is known regarding how to prevent the progression of this condition; furthermore, current treatment options are not always effective after diagnosis. Previous research indicated obesity was associated with diminishing cognitive health, but most studies were conducted on individuals over the age of 65. The purpose of the study was to determine if there is a statistical correlation between cognitive decline and body mass index (BMI) among those between the ages of 40 and 64 years. Data from the 2015-2020 Behavioral Risk Factor Surveillance System Alzheimer's Disease and Healthy Aging dataset for Louisiana citizens were used. Louisiana was chosen due to high rates of obesity and lack of research among this population. Bronfenbrenner's ecological model served as the conceptual framework. Logistic regression was used to test the relationship between BMI and cognitive decline while controlling for race, gender, income, and education level. No statical relationship was found between cognitive decline and BMI nor cognitive decline and daily fruit intake. However, there was a statistically significant relationship between cognitive decline and daily vegetable intake. Implications for positive social change include emphasizing increased vegetable intake as this could improve cognitive disease outcomes and perhaps prevent or mitigate actual cognitive decline later in life.

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Dedication

I would like to dedicate this doctoral study to my parents. They have supported me in furthering my education every step of the way. I would further like to dedicate this study to my husband who ensured that this process would be completed even on days where I did not think it was possible. Lastly, I would like to dedicate this study to my great-great-aunt, Mary Dorman, who was the inspiration for the research question, itself. It is my fervent hope that this research may help to improve longevity and prevent cognitive decline in others.

Acknowledgments

I would like to acknowledge the members of the committee, Dr. Claire Robb, and Dr. Daniel Li. Dr. Robb was truly invaluable while completing this entire process—from noticing the tiniest of details to large aspects of this paper. Furthermore, Dr. Daniel Li pushed me to explore statistical studies and to become more comfortable with SPSS. From the bottom of my heart, I thank both of them.

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Section 1: Foundation of the Study and Literature Review

Because people are living significantly longer lives, cognitive decline has become a subject of great concern since elderly adults may suffer from debilitating loss of memory and reasoning. The Centers for Disease Control and Prevention (CDC, 2018) noted a drastic increase in the number of cognitive decline disease cases since 2014. Subjective cognitive decline (SCD) involves confusion and forgetfulness, and these symptoms are often not reported; this is concerning since these small occurrences may be harbingers of fully developed cognitive diseases like Alzheimer's disease (AD; CDC, 2018). Several studies have demonstrated the impact that obesity has on cognitive decline disease development and progression. By studying impacts of dietary habits and obesity on cognitive decline, such risk factors can be addressed at a much younger age. Researchers can improve detection of cognitive decline by offering choices to prevent these diseases at a younger age, especially since most medications do not adequately treat cognitive decline (Bhatti et al., 2017).

Recent studies have reviewed how various diets associated with obesity can possibly lead to cognitive decline diseases later in one's life. Dye et al. (2017) claimed obesity is associated with brain atrophy. While these researchers recommend further research into the topic, it is important to consider that people are living longer, and most cognitive decline issues are not diagnosed until later in one's life. Therefore, noting risk factors like obesity can motivate physicians to look for biomarkers within at-risk individuals and start treatments earlier to prevent or mitigate the progression of these debilitating diseases. For these reasons, I focused on 40- to 64-year-olds. This population is less studied when discussing cognitive decline. However, issue must be addressed earlier so considerations can be taken to change clinical outcomes through early detection and treatment.

Discussing how dietary habits and choices that lead to obesity earlier in life as well as how those factors can lead to cognitive decline later in life requires a multifactorial approach within the state of Louisiana, a state that is rooted heavily in culture that is centered around food, regardless of one's race, ethnicity, or religion. Much of the Louisiana culinary scene does not include a large amounts of fruits and vegetables. According to the America's Health Rankings (AHR, 2021), 6.9% of adults within the state consumed fruits and vegetables on a daily basis in 2020. Food is not just a personal issue, but is part of the population's social-environment risks since food is the center of social events. Those same food choices are handed down through generations, making healthy food consumption problematic for the entire state.

Addressing the impact of dietary habits leading to obesity and possibility of those practices leading to cognitive decline is important where people practice unhealthy eating habits on a regular basis. While this study could impact the population of Louisiana, findings could also motivate clinicians to change their overall approach to treating these diseases by incorporating earlier interventions and testing. Ultimately, goals are to educate healthcare professionals regarding how to detect risks sooner and educate the population about what they can do differently to lower risks of possibly developing a debilitating cognitive disease later on in life. This study will have a significant impact not only on Louisiana, but potentially other regions with similar social practices by addressing these issues sooner rather than later.

Problem Statement

I focused on citizens of Louisiana, where little research has been done on cognitive abilities. In Louisiana, 44.9% of adults over 45 have discussed signs of SCD with their doctors (CDC, 2018); however, numbers could be undercounted due to lack of reporting. With the high prevalence of obesity in Louisiana, the problem is possibly associated with dietary choices due to local cultural practices. Eating diets that are high in saturated fats is a common practice at social gatherings within the state. Therefore, the issue of increasing SCD could result from dietary practices within the state that lead to obesity. To combat this problem, clinical practices can be adjusted to help diagnose early signs of SCD.

Current screenings conducted by primary care physicians are completed on individuals over the age of 65. One of the most common tools, the Dementia Screening Indicator, does include body mass index (BMI), but it lacks consideration of other environmental factors. Earlier screening should take place for people with certain health indicators related to obesity and biomarkers potentially related to SCD in combination with obesity. Diet, biomarkers, and SCD can be studied within specific populations to see if individuals in certain areas could benefit from earlier interventions for SCD as well as education and assistance to change their dietary practices. For example, diets like the Mediterranean and dietary approaches to stop hypertension (DASH) diets promote consumption of fruits and vegetables and are associated with lower risks of cognitive decline (van den Brink, et al., 2019). Therefore, people with biomarkers related to SCD at the age of 50 could be educated on benefits of these diets to help lower their risks of developing cognitive diseases, which would lower overall rates of these diseases and negative health effects. This issue was examined by determining if there were associations between obesity, fruit and vegetable consumption, and cognitive status within Louisiana. I assessed 40 to 64-year-olds since cognitive studies are rarely performed with this group. This will benefit the study in terms of ways to diagnose these diseases earlier in order to mitigate negative effects associated with cognitive decline.

There are few studies related to obesity and SCD for adults between 40 and 64. Analysis of this age group can aid in detecting and treating these SCD cases earlier in patients' lives. This would ultimately lower risks of developing severe cognitive disorders later in life.

Purpose of the Study

The purpose of this study is to examine if there are correlations between dietary choices (daily fruit and vegetable intake) and cognitive decline. Since eating food that is high in saturated fats and carbohydrates is a common in Louisiana, race was controlled for. Middle-aged individuals were the focus of this study to determine if SCD can be diagnosed and prevented via dietary habits and biomarkers to slow rates of cognitive decline within the state. Gender was also controlled, since SCD and cognitive diseases have been documented for both men and women. Since obesity is a concern across the state, education level and income were variables.

Research Questions and Hypotheses

RQ1: Is there a association between obesity and cognitive decline among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender?

$H_0$1: There is no association between obesity and cognitive status among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender.

H_a1: There is a association between obesity and cognitive status among citizens of Louisiana between 40 and 64 when controlling for education, income, race and gender.

RQ2: Is there an association between fruit and vegetable intake and people with cognitive decline among citizens of Louisiana between 40 and 64 years when controlling for education, income, race, and gender?

$H_0$2: There is no association between fruit and vegetable intake and cognitive decline among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender.

H_a2: There is an association between fruit and vegetable intake and cognitive decline among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender.

Theoretical Foundation

The ecological model (EM) by Bronfenbrenner was chosen for this study. The EM combines components of a person's self, relationships, community, and society that shape one's habits and daily life (Bronfenbrenner, 1996). At the individual level of the

EM are genetic, biological, and personal components. The relationship level involves family relationships that lead to negative or positive influences on behaviors. Workplaces and neighborhoods comprise the community level, while pervasive culture influences what actions are normalized for larger populations.

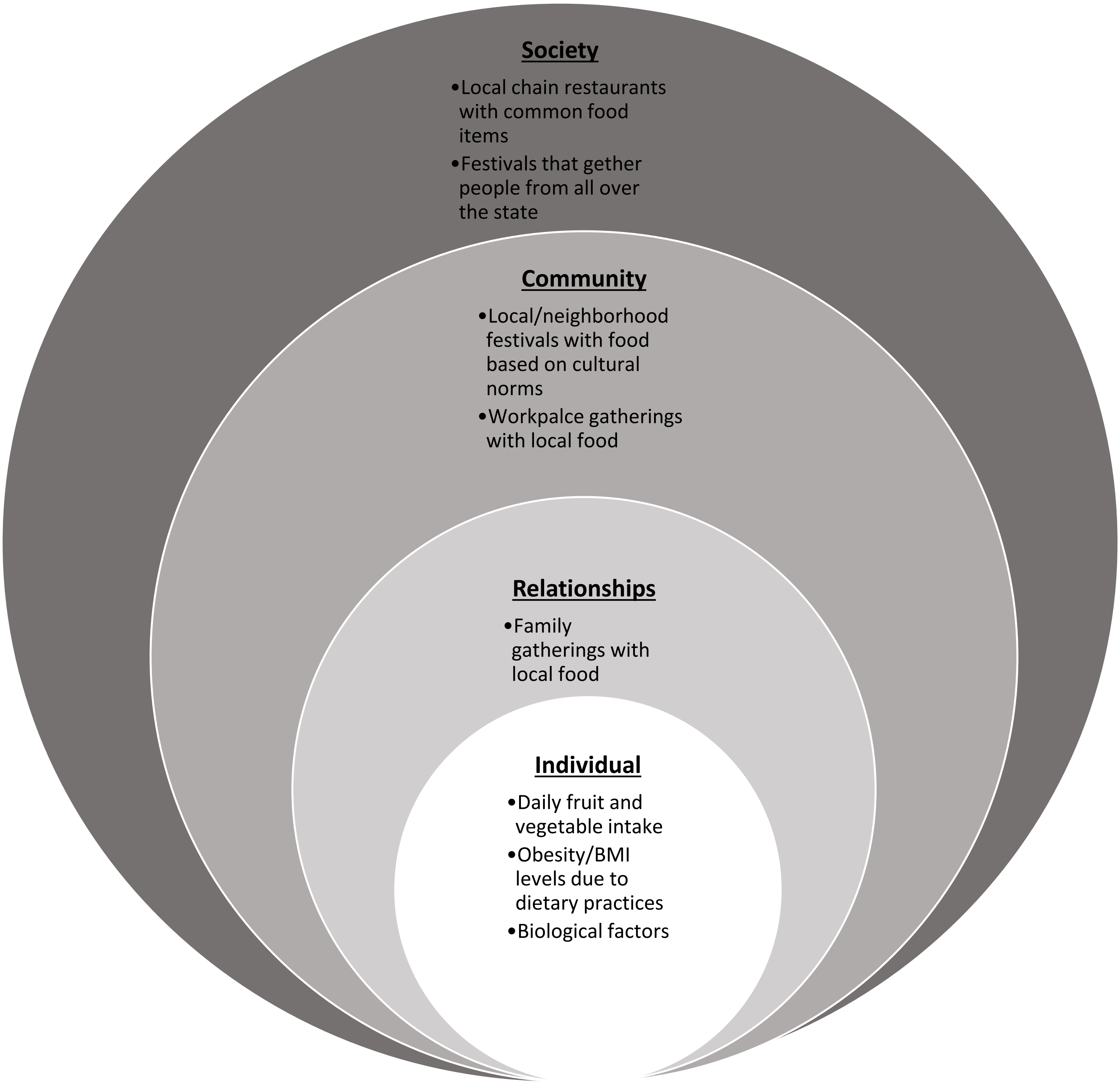
Within the target population, cultural dietary practices can be influenced by normalized practices across Louisiana. Communities are influenced by dietary norms due to family practices, leading to health issues for a majority of the population.

This study was focused on data that were collected at the individual level as well as influence of relationship, community, and societal factors (see Figure 1). Healthy behaviors that prevent obesity at the individual level include healthy eating habits and physical activity; both are essential to maintaining a healthy body weight. Biological factors can also contribute to obesity at the individual level, but genes respond to environmental stimuli which may increase hunger, which in turn increases one’s food intake. Thus, environmental stimuli such as family diet or relationship stress are inextricably linked to individual influences on health issues. Family history may also determine if someone is more likely to become obese. Such traits manifest throughout bloodlines as shared diseases and respective comorbidities (CDC, 2021b). For this study, I analyzed daily fruit and vegetable intake and obesity. These two variables were tested to determine if there were any effects on cognition; this can lead to the discovery of other biological factors in order to diagnose cognitive decline diseases.

Relationships with family members can impact dietary habits in terms of traditional family cooking practices (see Figure 1). Relationships can impact one’s dietary choices just as much as community and society. The ubiquity of cultural dishes and their impact on obesity and dietary choices is outside the scope of this study; however, the influence of these factors on individuals in terms of developing healthy eating habits cannot be ignored.

Figure 1

Application of the EM in Terms of Obesity and Dietary Practices in Louisiana



Nature of the Study

This quantitative retrospective cross-sectional study was conducted using secondary data to determine possible associations between cognitive decline and obesity among those between 40 and 64 in Louisiana. The Behavioral Risk Factor Surveillance System (BRFSS) AD and Healthy Aging dataset provided by the CDC was used to establish if daily intake of fruits and vegetables impacted rates of cognitive decline within the chosen population and whether gender played a significant role. From these data, the following variables were used: cognitive decline (dependent variable), obesity (independent variable), gender (control variable), education (control variable), income (control variable), race (control variable), fruit intake (independent variable), vegetable intake (independent variable), and age (independent variable). This study may increase awareness regarding addressing dietary habits and obesity as regular at-risk signs for cognitive decline that can lead to development of earlier treatment options. Additionally, sharing findings could help educate population and make them aware of possible consequences of their choices that could lead to different social practices.

Literature Search Strategy

A review of literature included conducting a general search for cognitive decline rates on Google. Studies published by the CDC were reviewed to establish a foundation for this study. Further research was done using the Walden University Library. Using EBSCOHost and PubMed, studies involving dietary habits, obesity, and rates of cognitive decline were found using the following key words: *cognitive disorders, obesity*, *Mediterranean diet*, *high saturated fat diets*, and *diet.* Additionally, all sources were published between 2014 and 2021. CDC studies regarding cognitive decline and obesity within Louisiana were reviewed to establish connections between cognitive decline and dietary habits in this state.

Literature Review Based on Key Variables

Impact of Obesity Globally, Nationally, and in Louisiana

Obesity levels have increased, and obesity is now considered a global epidemic that is linked to higher healthcare costs and comorbidities like hypertension, diabetes, stroke, sleep apnea, high cholesterol, heart disease, liver disease, and cancer (Falcon, 2016). As obesity rates have tripled since 1975, more people now die from being obese instead of being undernourished worldwide; furthermore, this issue is causing life expectancies to drop while disability cases increase, causing further economic hardship among those who support these individuals (World Health Organization [WHO], 2021).

The prevalence of obesity throughout the United States and territories varies due to location; however, every state and territory has an adult prevalence of at least 20% (CDC, 2021c). The areas of greatest concern are the Midwest and South with adult obesity prevalence rates of 34.1% (CDC, 2021d). While percentages of obesity cases for both males (33%) and females (36%) are relatively close in the United States, obesity among adults between 40 and 59 was the highest of any group at 40% (Falcon, 2016). Falcon (2016) claimed geographical location, environmental factors, and behavioral influences were more important than genetics.

Louisiana has the highest obesity rate in the U.S. in connection to other comorbidities (Brantley et al., 2020). In 2016, Louisiana was ranked fourth in the nation with an adult obesity rate of 34.9% (Falcon, 2016). Little has improved since the adult prevalence of obesity in Louisiana as of 2018 was still the fourth highest in the nation at 36.8% (Holston et al., 2020). Obesity is significantly higher in rural populations since six of the rural populated parishes in Louisiana had an obesity prevalence of 40% or higher. Higher prevalence in rural parishes was due to lower diet quality and nutrition-related chronic diseases due to local nutrition practices combined with low physical activity rates (Holston et. al., 2020). While prevalence of obesity had been increasing, the prevalence of obese adults in Louisiana dropped to 35.9% in 2019 (Louisiana Department of Health [LDH], 2020).

Impact of Cognitive Decline Globally, Nationally, and in Louisiana

The WHO (2021c) documented 55 million cases of dementia worldwide with an approximate annual new case total of 10 million. Dementia due to Alzheimer's accounts for 60-70% of these cases. Dementia is also the seventh leading cause of death globally (WHO, 2021c). With growing life expectancies all over the world, it is important to address the rise in cognitive cases that will result from individuals living longer. While not every person does develop such diseases, most cases are found later in life, and with projected increases in life expectancies, cases will likely increase for the next few decades. As a result, increased medical spending will result in order to treat these patients properly. Additionally, government spending would also increase since government-funded insurance plans will have to cover costs of treating patients with cognitive diseases (Dye et al., 2017).

Within the United States, having other chronic diseases leads to increase likelihood of developing SCD or other cognitive impairments. Among all states and territories, 20.4% of adults over 45 with one or more chronic diseases reported having SCD; but there are 20 states, Washington D.C. and Puerto Rico which all had percentages over 20.4%. These values rise when patients have three or more chronic diseases. Overall, 25.6% of adults over 45 with three or more chronic diseases reported issues related to SCD. Washington D.C., Puerto Rico, and 26 other states had prevalence percentages over 25.6% (CDC, 2020). Louisiana is above the national percentage for patients with one chronic illness and patients with three more chronic illnesses. Among the population of those over 45 with one or two chronic illnesses, 24.2% reported issues with SCD. This increased to 26.4% when individuals had three or more chronic diseases (CDC, 2020). However, 13.6% of the population over 45 exhibit SCD symptoms without having any other reported chronic illnesses (Alzheimer's Association, 2022). Additionally, The CDC (2021a) reported one in seven people over 45 in Louisiana experienced symptoms of SCD, 50% of individuals with SCD had to alter or give up their daily activities, almost 50% of individuals with SCD reported issues at work or social events, less than half of SCD patients shared their symptoms with healthcare professionals, and 44% of SCD patients needed help around their homes with household tasks.

92,000 individuals over 65 years old have AD in Louisiana, leading to a $765 million annual burden on Louisiana's Medicaid program for AD-related costs alone. In addition, 203,000 residents act as caregivers to family members with cognitive decline-related diseases resulting in $3.8 billion in unpaid care to these individuals (Alzheimer's Association, 2022). The Louisiana Department of Health conducted training for supervisors within this department in order for them to have necessary tools to share with their workers regarding how to enhance their awareness of signs of cognitive diseases and how to appropriately treat and care for them. However, this is recognized as a beginning step and beyond this, little is being done about increasing rates of cognitive diseases within the state to the extent that no cognitive disorders are mentioned in the Louisiana Health Report Card.

Impact of Dietary Habits on Cognitive Decline

Various diets have been studied to help determine possible links between cognitive decline and dietary habits that people adhere to.

MD

In countries like Greece where the Mediterranean diet was prevalent and widely adhered to, there were lower risks of cognitive impairment among men when compared to women, while only memory and language were less impaired among individuals from northern European and Puerto Rico who moderately adhered to the MD. Less adherence to this diet by individuals in China, the U.S., and Australia did not lead to reduced chances of developing cognitive disorders; therefore, the MD was successful in terms of lowering risks of dementia and AD, especially when closely adhered to (van den Brink et al., 2019).

High adherence to the MD showed slower aging within the Chianti region of Italy (Tanaka et al., 2018). Medium adherence to the MD led to slight health improvements in comparison to low adherence. High adherence to the MD can slow down the aging process and impact cognition positively (Tanaka et al., 2018).

Davies (2019) noted lack of adherence to the MD can be geographically, socially, and culturally impacted depending on local practices regarding food. People in Mediterranean areas demonstrate a higher adherence to this diet since it is a lifestyle, and freshly-prepared meals that are healthy are a part of societal norms and cultural practices; citizens of these areas therefore engage in healthier eating options since it is what is known and passed down from generation to generation as well as practiced in social settings (Davies, 2019). Other cultures may place higher value on different types of meals for similar reasons, but these actions could impact their cognitive function later in life. Furthermore, higher adherence to the MD slowed down the progression of biomarkers linked to AD among middle-aged adults (Berti et al., 2018).

DASH Diet

According to van den Brink (2019), the DASH dietary plan was “developed to prevent and treat hypertension and has been shown to improve cardiovascular disease (CVD) risk factors, including systolic and diastolic blood pressure and total cholesterol” (p. 1041). The DASH diet is similar to the MD in that less saturated fatty acids, sodium, and cholesterol are consumed in favor of plant-based consumption. More specifically, this diet was created to treat and prevent hypertension and cardiovascular diseases related to blood pressure and total cholesterol. Within the United States, adherence to the DASH diet improved verbal memory, but not visual memory or processing time. Overall long-term improvements in terms of episodic and semantic memory were observed. Higher adherence to this diet and addition of weight management techniques showed strongest results. The combination of the DASH diet and weight management techniques led to improvements in terms of executive function, memory, and learning (van den Brink et al., 2019).

MIND Diet

According to Pearson (2017), the MIND diet is a dietary approach used "to reduce dementia and the decline in brain health that often occurs as people get older" (paras. 2). Strongest associations between lowering risks of cognitive decline diseases were found among patients who strongly adhered to the MIND diet. The MIND diet led to better cognitive function and lowered risks of negative cognitive performance. In the United States, there were long-term improvements in terms of episodic and semantic memory, working memory, perceptual speed, and visuospatial ability (van den Brink et al., 2019).

Dietary Habits of Louisiana

Louisiana is known for unique blending of cultures and the that has flourished as a result of cultural blending for the past 300 years. Foods are celebrated within homes and publicly through festivals. However, differences arise when culturally-specific foods are practiced within families, and some people take traditional Louisiana cuisine and alter it to better fit their cultural norms. One example of a traditional food item in Louisiana is gumbo. Gumbo has roots in African, Native American, and European cultures. Blending of these cultures resulted in a staple dish that is served in restaurants and homes throughout the state. Individual cultural influence can be seen based on the color of the roux or the items placed in the gumbo that may differ throughout Louisiana. Regardless of how the gumbo is made, it is still a dish that is meant to be celebrated with groups large or small (Owens, 2000).

Fergus et al. (2021) studied dietary habits within rural, low-income parishes across Louisiana, mostly among African American single mothers. They addressed lack of accessibility to readily obtain healthy foods, lack of steady funding to promote healthier lifestyles, and taste of healthier food options compared to staple foods. Participants claimed their family members positively impacted them by either limiting the number of sweet items or offering advice on how to make healthier food choices. Other family members mentioned some people would refuse to eat fruits and vegetables due to taste even when they had easy access to healthier foods. In addition, restaurants advertise unhealthy foods, making them look more appealing and desirable to this audience when targeted directly. Participants admitted to adding unhealthy meats and seasonings to vegetables to make them taste better, but they recognized this was unhealthy and could be an area of change to form healthier eating lifestyles. Others mentioned the need to find healthier preparation processes. For example, frying food could be replaced with baking in order to use less fats and breading materials. This would help save on calories and fat intake that leads to obesity (Fergus et al., 2021).

The issue of healthy diets in Louisiana is a result of multiple factors. Low income and accessibility of healthy food are key to changing dietary practices, but education regarding how to eat healthier and benefits are equally important to those who have access to healthier food choices. Changing these perceptions can help in terms of adjusting dietary habits that can overall impact obesity and cognitive decline.

Biomarkers That are Linked to Obesity and Cognitive Decline

Bhatti et al. (2017) studied connections between early signs of cognitive decline and obesity by monitoring how obesity impacts individual oxidative stress, mitochondrial dysfunction, and ATP production, which are common causes of cognitive impairments. There was a statically significant relationship between obesity, oxidative stress, and mitochondrial dysfunction and roles these factors play in terms of increasing cognitive decline symptoms and diseases. Bhatti et al. (2020) found diet and calorie restriction led to positive modifications and suggested the MD as a possible solution to rates of cognitive decline diseases like AD. Tan and Norhaizan (2019) concluded oxidative stress in addition to diets that are high in saturated fats increased chances of developing cognitive impairments.

Duffy et al. (2019) studied the possibility of increased risks of cognitive decline due to diets high in saturated fats. Their notions were based on studies completed with rats that showed signs of the inability to produce orexin, which is a component that improves cognitive function in mice. With this information, these researchers focused on how obesity impacts orexin and how high fat diets can contribute to neuroinflammation. Their conclusions were that orexin loss can lead to memory loss, and the same is true about high fat diets; it should also be noted that high fat diets increase hippocampus learning defects (Duffy et al., 2019). Therefore, high fat diets were documented as a possible reason for memory loss and that neuroinflammation that can lead to cognitive disorders were also higher in obese individuals.

Another biomarker linked to cognitive decline rates is adiponectin, "a protein synthesized and secreted predominantly by adipocytes into the peripheral blood" (Kishida, 2013). This biomarker is especially present in individuals with increased accumulation of visceral fat. Higher adiponectin levels have been linked to several diseases, but these levels can also serve as predictors of cognitive decline in both males and females (Ganguli et al., 2020). In addition to their findings on adiponectin, Ganguli et al. concluded that resistin and glucagon-like peptide-1 are linked to obesity and can serve as potential biomarkers linked to a wide variety of health detriments including cognitive decline diseases (2020).

Hawkins et al. (2021) designed a study around multiple hypotheses to connect the negative impacts of waist circumference with indicators for physiological dysregulation (cognitive decline). Their results concluded that excess weight in the waist area or adiposity was positively related to increased physiological dysregulation and these adults experienced higher fasting insulin and glucose levels, increased insulin resistance, and chronic hyperglycemia.

Hawkins et al. (2021) confirmed that IL-6 and hs-CRP were strong indicators of negative health results compared to TNF-α since these markers for inflammatory were able to predict mortality when TNF-α could not. This study concluded that central obesity with the presence of visceral fat was more consistent with

Furthermore, their results suggest that central adiposity is also positively correlated to inflammatory biomarkers which may increase risk of cognitive decline. Within a similar population, increased BMI instability or changes resulted in faster progression of cognitive decline symptoms. While the study was also based on an African American population in Louisiana, the findings were generalized for gender as men and women exhibited the same progression of symptoms when BMI fluctuated (Aiken-Morgan, et al., 2020).

Definitions

Adiponectin: According to Achari and Jain (2017), "the most abundant peptide secreted by adipocytes, whose reduction plays a central role in obesity-related diseases, including insulin resistance/type 2 diabetes and cardiovascular disease" (paras. 1).

Alzheimer's Disease (AD): a disease that causes the brain to shrink/ atrophy and death of brain cells (Mayo Clinic, n.d.). According to Jessen et al., 2014, AD involves the occurrence of SCD, but the symptoms are not to clinical levels; however, SCD is not a preclinical diagnosis of AD, but it could possibly be.

Biomarkers: biological markers, "cellular, biochemical or molecular alterations that are measurable in biological media such as human tissues, cells, or fluids" (Mayeux, 2004).

Cognitive: includes all components of the cognitive domain including memory and executive functions like speech impairments (Jessen et al., 2014).

Cognitive Decline: "reduction in one or more cognitive abilities, such as memory, awareness, judgement, and mental acuity, across the adult lifespan" (APA Dictionary of Psychology, n.d.a).

Decline: the subjective awareness of experiences that show the worsening of cognitive capabilities and events that occur through the aging process (Jessen et al., 2014).

Dementia: "a generalized, pervasive deterioration of memory and at least one other cognitive function, such as language and an executive function, due to a variety of causes. The loss of intellectual abilities is severe enough to interfere with an individual's daily functioning and social occupational activity" (APA Dictionary of Psychology, n.d.b).

Dietary Approaches to Stop Hypertension (DASH) Diet: dietary plan "developed to prevent and treat hypertension and has been shown to improve cardiovascular disease (CVD) risk factors, including systolic and diastolic blood pressure and total cholesterol" (van den Brink, 2019).

Dietary/Nutrition Habits/Practices: personal food preferences that can be connected to health status, culture, socioeconomic background, and education (Krause, 2015).

Elderly Adults: over 65 years old.

Episodic Memory: "a neurocognitive (brain/mind) system, uniquely different from other memory systems, that enables human beings to remember past experiences" (Tulving, 2002).

Mediterranean Diet (MD): "is a generic term based on the traditional eating habits in the countries bordering the Mediterranean Sea. Eating styles vary among these countries and even among regions within each country because of differences in culture, ethnic background, religion, economy, geography and agricultural production. However, there are some common factors" (American Heart Association, n.d.). These factors include a focus on fruits, vegetables, grains, beans, fish, and poultry over red meat consumption (American Heart Association, n.d.).

Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND): a dietary approach used "to reduce dementia and the decline in brain health that often occurs as people get older" (Pearson, 2017).

Middle Aged: mid-life, adults 40-64 years old.

Neuroinflammation: inflammation in the brain and/or spinal cord; "a complex response to brain injury involving the activation of glia, release of inflammatory mediators, such as cytokines and chemokines, and generation of reactive oxygen and nitrogen species" (Milatovic et al., 2017).

Obesity: a BMI over 30 kg/m^2 due to excessive fat gathering that causes negative health impacts (World Health Organization, 2021b). Normal body weight is classified as a BMI between 18.5-24.9 kg/m^2. A BMI of 25-29.9 kg/m^2 is considered overweight, while individuals with a BMI between 30-34.99 kg/m^2 are placed in class 1 obesity and people between 35-39.9 kg/m^2 are grouped as class 2 obesity. If a patient has a BMI over 40 kg/m^2, then they are considered morbidly or extremely obese (Falcon, 2016).

Orexin: "any of a group of proteins, expressed in the lateral hypothalamus, that trigger feeding and have also been implicated in narcolepsy" (APA Dictionary of Psychology, n.d.c).

Oxidative Stress: "an imbalance between free radicals and antioxidants in your body. Free radicals are oxygen-containing molecules with an uneven number of electrons. The uneven number allows them to easily react with other molecules. Free radicals can cause large chain chemical reactions in your body because they react so easily with other molecules" (Legg, 2018).

Perceptual Speed: or primary ability, "any of the seven unitary factors revealed by factor analysis to be essential components of intelligence: verbal ability (V), word fluency (WF), numerical ability (N), spatial intelligence (S), memory (M), perceptual speed (P), and reasoning (R)" (APA Dictionary of Psychology, n.d.d).

Semantic Memory: "memory for general factual knowledge and concepts, of the kind that endows information with meaning and ultimately allows people to engage in such complex cognitive processes as recognizing objects and using language" (APA Dictionary of Psychology, n.d.e).

Subjective: one's self-perception of their cognitive performance without regard to medical testing (Jessen et al., 2014).

Subjective Cognitive Decline (SCD): self-perceived cognitive decline before any confirmation from medical testing is observed (Jessen et al., 2014).

Visceral Fat: a type of body fat that's stored within the abdominal cavity. It's located near several vital organs, including the: liver, stomach, and intestines (Gotter, 2021).

Visuospatial Ability: "a person's capability to identify visual and spatial relationships among objects…. is measured in terms of the ability to imagine objects, to make global shapes by locating small components, or to understand the difference and similarities between objects" (NeuRA, 2021).

Working Memory: "the retention of a small amount of information in a readily accessible form. It facilitates planning, comprehension, reasoning, and problem-solving" (Cowan, 2014).

Assumptions

The data for this research was collected via a telephone survey. Therefore, there is the assumption that the participants answered the questions truthfully and fully. Some participants are unwilling to answer personal questions over the phone, therefore limiting the population variance. On the other hand, the population could have also been expanded since it is easier to reach people via phone rather than having individuals fill out a survey by paper. Furthermore, it is the assumption that their answers where then properly recorded by the health professional. Lastly, it is assumed that BMI calculations provided for the obesity variable as percentages were calculated properly and then recorded correctly in the data set.

Scope and Delimitations

This study focused on the connection between dietary habits and obesity to possible cognitive decline symptoms. Louisiana was chosen since America's Health Rankings (2021) documented the state as the least healthy. In addition, this population was chosen since all cultures, races, and ethnicities within the state share a common connection: food. For this reason, race was not assessed in this study and this variable was controlled for. However, this could possibly allow the findings of this study to be used in other similar populations where food is the center of the social practices and where food is not as specific to certain subdivisions of the population. The decision to focus on the 40 to 64-year-old population was chosen since most cognitive decline studies reviewed were on populations over 65, and this does not benefit the cause of trying to lower the overall rates of cognitive decline or to form treatment options earlier on in the progression stages of these diseases. Therefore, the sample population was reduced to 1,009 to accommodate for only this portion of respondents. Focusing on a younger population than other studies would benefit clinical practice and increase awareness of these risk factors in order to adjust current treatment or prevention methods.

Significance, Summary, and Conclusions

This study is significant in terms of understanding how to make lifestyle modifications through diet to lower risks of developing cognitive diseases, while also considering biological factors that may lead to earlier diagnosis. Most studies and screenings for these diseases are completed on elderly individuals over 65. However, although much is known about how diets, obesity, and biomarkers can impact cognitive health, those in middle age are still not screened for such diseases (Duffy et al., 2018). Subsequently, studying impacts of obesity and dietary habits on biomarkers at an earlier age could help individuals make necessary changes earlier in their lives to ward off SCD and further development of detrimental cognitive diseases later in their lives. Diagnosing these diseases earlier could possibly lower rising case rates and could possibly lead to better quality of life for patients with SCD or similar cases. While this study could impact the population of Louisiana, findings could also motivate clinicians to change their overall approaches to treating these diseases by incorporating earlier interventions and testing.

Within Louisiana, this study has the potential to educate people about how social practices that have been normalized for generations can impact health and lower quality of life due to factors related to obesity. Social change can occur in terms of how food is prepared and celebrated across the state that can lead to obesity and the possibility of developing cognitive diseases. Studying the 40 to 64-year-old age range is important to determine if current biomarkers can be indicated for these diseases. These at-risk individuals can make changes sooner to lower their possibility of developing life-altering diseases. Educating and intervening with this age group could change relationship practices with families that could also improve individual thinking about personal dietary practices and how to make changes for their children. In Section 2, this study’s research design and methodology are discussed.

Section 2: Research Design and Data Collection

The purpose of this study is to determine if there were associations between obesity, daily fruit and vegetable intake, and cognitive status among people between 40 and 64 in Louisiana. Race, income, education, and gender were control variables in this study. By including these control variables, it can be determined if there are patterns of cognitive decline among such patients across the state regardless of these factors, placing a stronger emphasis on common dietary practices. Section 2 includes a description of the research design and rationale for the methodology (population, sampling procedures, sample size calculations and power, and data analysis), as well as threats to validity and ethical procedures.

Research Design and Rationale

This study involved using a retrospective cross-sectional design with secondary data that were from the BRFSS data between 2015 and 2020. I addressed cognitive status (dependent variable), fruit intake (independent variable), vegetable intake (independent variable), obesity (independent variable), age (independent variable), income (control variable), education (control variable), race (control variable), and gender (control variable). This particular data set was chosen since it contained information on cognitive status, obesity, and fruit and vegetable intake in order to answer questions about possible links between lack of nutritional food intake and cognitive decline within the selected population. Since data were collected as a random telephone survey, I explored a different age group than most studies on this topic. I used the retrospective design to focus on the desired population without conducting lengthy research to obtain information. This allowed new connections to form between variables that were unexplored in relation to each other. Random sampling was used to represent how food intake and obesity relate to cognitive status in terms of education, income, race, and gender. Findings can be related to citizens of Louisiana.

Methodology

Population

The population for this study was taken from the 2015-2020 BRFSS Alzheimer's Disease and Healthy Aging dataset. I focused on nutritional practices causing obesity in Louisiana. Therefore, only participants from this state were chosen as part of the study. Then, the desired age range was chosen. This study aims to benefit early detection of cognitive diseases and most studies are done on individuals over the age of 65. The 40–64-year-old population was specifically chosen for this study. After selecting this group, the study included 3,035 participants.

Sampling Procedures Used by Original Creators of the Dataset

The 2015-2020 BRFSS AD and Healthy Aging dataset was made publicly available by the CDC in May 2016 and has continued to be updated since its first publication. To collect this data, the BRFSS conducted a phone survey using random digit dialing (RDD) for cellphones and landlines. Anyone over the age of 18 was asked to participate in the survey, but they were not compensated. Interviews conducted within each state vary based on size of regions, health districts, and funding. Some questions on the questionnaire are fixed and are asked every year, but others are rotating questions that states pick from a list based on need of the area. The dataset is available online through the CDC for public use. This data set included every variable that was needed to determine potential risk factors for cognitive decline, particularly among a rarely studied age range. Randomized sampling of respondents increases validity of the study.

Sample Size and Power Calculation

Louisiana's total population in 2020 was 4,657,757 and 76.7% were over the age of 18 (U.S. Census Bureau, 2021). The estimated population range was determined using data from the U.S. Census Bureau. The U.S. Census Bureau (2020) estimated545,998 people in Louisiana were between 40 and 49 (11.7%), 595,034 were between 50 and 59 (12.8%), and 544,674 were between 60 and 69 (11.7%). Using these numbers, the estimated number of people in Louisiana between 40 and 64 years in 2020 was 1,413,369 (calculated by dividing the number of people between 60 and 69 by two and then adding values for the other two age ranges). This represented 30.34% of the population in 2022.

Based on the number of people who answered the cognitive-decline related question and were between 40 and 64 according to the 2015-2020 BRFSS AD and Healthy Aging dataset, the sample size was 3,035. The power based on this sample size was calculated via G*Power version 3.1.9.7 for Windows. To minimize the risk of type I errors, a p-value of 0.05 was selected to detect a statistically significant correlation using logistic regression. Due to the small effect size (1.68), this study required a population of 151 participants to achieve a power of 80%. Bujang et al. (2018) found 500 participants is the minimum sample size that observational studies using logistic regression would require when considering large populations.

Instrumentation and Operationalization of Constructs

I used variables from the 2015-2020 BRFSS AD and Healthy Aging dataset that was first published by the CDC in 2016. This dataset was chosen since to address statistical connections between obesity, fruit and vegetable intake, and cognitive status. Data were collected randomly. Study findings could be generalized to larger populations in Louisiana.

The BRFSS survey is collected with the goal of identifying "health-related risk behaviors, chronic health conditions, and use of preventative services" (CDC, 2018, paras. 1). Esser et al. (2020) argued information in BRFSS datasets was valid and reliable in terms of "measuring several health conditions and health risks at both the state and national levels" (paras. 11).

Dependent Variable

Answers to questions regarding frequency of experiencing confusion or memory loss were reported as yes (1), no (2), don't know/not sure (7), or refused (9).

Independent Variables

Age was the first independent variable selected in order to determine the possibility of a statistical correlation between middle-aged adults and early warning signs of SCD. Therefore, this study focused on the 40–64-year-old population provided. This categorical variable was coded as Imputed age in six groups. The six groups used to report the data are Age 18 to 24 (1), Age 25 to 34 (2), Age 35 to 44 (3), Age 45 to 54 (4), Age 55 to 64 (5), and Age 65 or older (6).

The second categorical, independent variable chosen, computed body mass index categories, was selected to determine if there was a statistically significant relationship between obesity and SCD. This variable was reported in categories for four different weight classes. All participants' weights were reported as Underweight (1), Normal Weight (2), Overweight (3), or Obese (4).

Two independent variables were chosen from the Fruits & Vegetables category to determine if food practices are significantly correlated to signs of SCD. The first variable chosen was Fruits & Vegetables: How many times did you eat fruit? Researchers asked participants "Not including juices, how often did you eat fruit?" All answers were recorded in categorical and ordinal groups and then organized into the following categories: Days (101-199), Weeks (201-299), Less than once a month (300), Month/Year (301-399), Never (555), Don't know/ Not sure (777), and Refused (999).

The second independent variable chosen from the Fruits & Vegetables section was Fruits & Vegetables: How many times did you eat dark green vegetables? Respondents were asked to answer the following question: "How often did you eat a green leafy or lettuce salad, with or without other vegetables?" Ordinal and categorical answers were provided for this variable. Respondent responses were recorded as Days (101-199), Weeks (201-299), Less than once a month (300), Month/Year (301-399), Never (555), Don't know/ Not sure (777), and Refused (999).

Control Variables

In order to extrapolate the findings to a broader population across the state, imputed race/ethnicity value, computed gender, education level, and income level were chosen as control variables. Imputed race/ethnicity value was the first control variable chosen. The researchers did not document the question asked to obtain this information. For this categorical variable, participants' answers were recorded as White/Non-Hispanic (1), Black/Non-Hispanic (2), Asian, Non-Hispanic (3), American Indian/ Alaskan Native, Non-Hispanic (4), Hispanic (5), or Other race, Non-Hispanic (6).

The second chosen control variable chosen was computed gender. There is no documented question on file for what the participants were asked in order to answer this question. This categorical variable is also categorical and respondent answers were categorized as: Male (1) or Female (2).

Education level was determined by asking participants "What is the highest grade or year of school you completed?" Their responses were reported using these categorical and ordinal labels: Never attended school or only kindergarten (1), Grades 1 through 8 (Elementary) (2), Grades 9 through 11 (Some high school) (3), Grade 12 or GED (High school graduate) (4), College 1 year to 3 years (Some college or technical school) (5), College 4 years or more (College graduate) (6).

The last control variable chosen was income level. Respondents were asked "Is your annual household income from all sources [insert value]?" The following categorical and ordinal codes were used: Less than $10,000 (1), Less than $15,000 ($10,000-$15,000) (2), Less than $20,000 ($15,000 to $20,000) (3), Less than $25,000 ($20,000-$25,000) (4), Less than $35,000 ($25,000 to $35,000) (5), Less than $50,000 ($35,000 to $50,000) (6), Less than $75,000 ($50,000-$75,000) (7), $75,000 or more (8), Don't know/Not sure (77), or Refused (99).

Table 1

Operational Information for Dependent, Independent, and Control Variables

Variable Name	Type of Variable	Question Asked	How it was reported
Cognitive Decline: Have you experienced confusion or memory loss that is happening more often or is getting worse?	Dependent Variable, Binary/Nominal	During the past 12 months, have you experienced confusion or memory loss that is happening more often or is getting worse?	Yes (1), No (2), Don't know/Not sure (7), Refused (9)
Imputed age in six groups	Independent Variable, Categorical/ Ordinal	N/a	Age 18 to 24 (1), Age 25 to 34 (2), Age 35 to 44 (3), Age 45 to 54 (4), Age 55 to 64 (5), Age 65 or older (6)
Computed body mass index categories	Independent Variable, Categorical/ Ordinal	N/a	Underweight (1), Normal Weight (2), Overweight (3), Obese (4)
Fruits & Vegetables: How many times did you eat fruit?	Independent Variable, Categorical/ Nominal	Not including juices, how often did you eat fruit?	Days (101-199), Weeks (201-299), Less than once a month (300), Month/Year (301-399), Never (555), Don't know/ Not sure (777), Refused (999)
Fruits & Vegetables: How many times did you eat dark green vegetables?	Independent Variable, Categorical/ Nominal	How often did you eat a green leafy or lettuce salad, with or without other vegetables?	Days (101-199), Weeks (201-299), Less than once a month (300), Month/Year (301-399), Never (555), Don't know/ Not sure (777), Refused (999)
Imputed race/ethnicity value	Control Variable, Ordinal/ Categorical	N/a	White/Non-Hispanic (1), Black/Non-Hispanic (2), Asian, Non-Hispanic

			(3), American Indian/ Alaskan Native, Non-Hispanic (4), Hispanic (5), Other race, Non-Hispanic (6)
Imputed Gender	Control Variable, Categorical/ Dichotomous/Nominal	N/a	Male (1), Female (2)
Education Level	Control Variable, Categorical/ Ordinal	What is the highest grade or year of school you completed?	Never attended school or only kindergarten (1), Grades 1 through 8 (Elementary) (2), Grades 9 through 11 (Some high school) (3), Grade 12 or GED (High school graduate) (4), College 1 year to 3 years (Some college or technical school) (5), College 4 years or more (College graduate) (6)
Income Level	Control Variable, Categorical/ Ordinal	Is your annual household income from all sources [insert value]?	Less than $10,000 (1), Less than $15,000 ($10,000-$15,000) (2), Less than $20,000 ($15,000 to $20,000) (3), Less than $25,000 ($20,000-$25,000) (4), Less than $35,000 ($25,000 to $35,000) (5), Less than $50,000 ($35,000 to $50,000) (6), Less than $75,000 ($50,000-$75,000) (7), $75,000 or more (8), Don’t know/Not sure (77), Refused (99)
State FIPS Code	Categorical	N/a	Louisiana (22)

Note. CDC Data Source, 2015-2020 BRFSS Alzheimer’s Disease and Healthy Aging Dataset

Data Analysis Plan

This study employed the 27th version of IBM's SPSS to conduct statistical analysis for the variables chosen. The following analyses were conducted to answer the research questions listed below:

RQ1: Is there a significant association between obesity and cognitive decline among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender?

$H_0$1: There is no significant association between obesity and cognitive status among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender.

H_a1: There is a significant association between obesity and cognitive status among citizens of Louisiana between 40 and 64 when controlling for education, income, race and gender.

Logistic Regression was conducted in SPSS to answer research question one. This test was chosen in order to determine if there is a statistically significant relationship between this study's independent variables and the dependent variable.

RQ2: Is there an association between fruit and vegetable intake and people with cognitive decline among citizens of Louisiana between 40 and 64 years when controlling for education, income, race, and gender?

$H_0 2$: There is no association between fruit and vegetable intake and cognitive decline among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender.

$H_a 2$: There is an association between fruit and vegetable intake and cognitive decline among citizens of Louisiana between 40 and 64 when controlling for education, income, race, and gender.

Logistic Regression Analysis was conducted to compare the dependent variable (Cognitive Decline: Have you experienced confusion or memory loss that is happening more often or is getting worse?), with each of the independent variables (Imputed age in six groups, computed body mass index categories, "Fruits & Vegetables: How many times did you eat fruit?" "Fruits & Vegetables: How many times did you eat dark green vegetables?"); while a regression analysis was performed to determine if there was a statistically significant relationship between all of the above variables. Based on the statistical results, the null hypothesis would be rejected if $p < 0.05$. Since these variables are nominal and ordinal. A Chi-Square Test of Independence was also conducted to determine if the variables are statistically related or not.

Threats to Validity

The very nature of the data collection methods could decrease the validity of the study. Since it was a telephone survey, there is no way to verify the truthfulness of the respondents, nor was there necessarily an objective way to assess their responses. Data is limited to Louisiana residents only and may not be applicable to others in the United States (let alone the international community at large); therefore, decreasing external validity. Additionally, the estimated population for the age group being studied proved that the sample size is rather small in comparison to the amount of people living in the state between that age range. An odds ratio, however, was calculated to measure the association between the dependent and independent variables to verify the effect size and validity of the results. Therefore, generalizing the findings for that population clinically may be challenging even if statistical significance was reached.

Ethical Procedures

Concerning the data extracted from the 2015-2020 BRFSS Alzheimer's Disease and Healthy Aging Dataset, only information pertaining to the chosen variables was observed and no other variables and data were viewed. The dataset was available to the public, but no personal information about the participants was provided and none was observed while conducting this study. The data for the selected variables was saved to a password protected computer and this information will only be kept for 3 years.

Summary

For this study, connections between obesity, cognitive decline, and fruit and vegetable intake were studied to determine if statistical correlations existed for those between 40 and 64 within Louisiana. These variables were measured using the 2015-2020 BRFSS AD and Healthy Aging dataset via the CDC. Logistic regression tests were conducted to determine if these variables were statistically significant. Section 3 includes a discussion of results of these efforts.

Section 3: Presentation of the Results and Findings

The purpose of this study is to detect correlations between BMI and fruit and vegetable intake and SCD. Diets that are high in fat and carbohydrates can lead to altered biomarkers within the body that have been linked to obesity. In order to assist with earlier diagnosis of cognitive decline diseases, middle-aged populations were the focus of this study. Race, gender, income, and education level were control variables in order to generalize the study across Louisiana. This section includes results and findings based on the data analysis plan in Section 2.

Assessing the Data Set for Secondary Analysis

I used data that were collected between 2015 and 2020 by CDC researchers and reported via the BRFSS AD and Healthy Aging dataset. I selected 40 to 64-year-olds living in Louisiana. Furthermore, I focused on those in Louisiana who documented SCD. Descriptive statistics were conducted for the entire documented Louisiana population (24,592) and the specific focus group for this study (3,035); this was done in order to generalize findings.

Data and Variable Discrepancies Management

The first discrepancy involved the age variable. Section 2 outlined imputed age in six categories. This variable was divided into five-year increments. This was originally an independent variable. Additionally, no participants between 40 and 44 answered cognitive decline questions; therefore, the population of the study was between 45 and 64 rather than 40 to 64.

Gender was not reported consistently throughout the study. Gender was determined by asking whether participants considered themselves to be male or female or transgender. More specifics regarding transgender types were included in the surveys after 2016. The same procedures were used in 2017 and 2018 as in 2016. The national codebook for 2019 and 2020 reported gender as SEXVAR for sexes of respondents as male or female. Due to this discrepancy, available data points were merged and the imputed gender control variable name was changed to respondent sex (see Table 2).

Table 2

Final List of Variables Used for Logistic Regression

Variable Name	Variable Code	Type of Variable
Have You Experienced Confusion or Memory Loss That is Happening More Often or is Getting Worse?	CIMEMLOS	Dependent Variable
Reported Age in Five-year Age Categories Calculated	_AGEG5YR	Filter/Exclusion Variable
Computed Body Mass Index Categories	_BMI5CAT	Independent Variable
Imputed Race/Ethnicity Value	_IMPRACE	Control Variable
Respondents Sex	SEX	Control Variable
Education Level	EDUCA	Control Variable
Income Level	INCOME2	Control Variable
Consume Fruit One or More Times Per Day	(_FRTLT1)*	Independent Variable
Consume Vegetable One or More Times Per Day	(_VEGLT1)*	Independent Variable

Missing Data Procedures

I did not include participants who were not between 40 and 64. Then, prior to running any statistical tests, missing data points for cognitive decline were removed; this step was completed in order to form a bivariate categorical variable for logistic regression. These missing data points included participants who refused to answer questions. This reduced the population to only those individuals who answered cognitive decline questions and were between 40 and 64. For all other variables, any participants who did not answer questions or were not asked questions were coded as missing in the system. Those missing cases for individual variables were not deleted since SPSS was used to exclude those data points automatically for logistic regression. For RQ2 where logistic regression was performed, pairwise deletion was performed for missing values for control variables regarding fruits and vegetables.

Descriptive Analyses of Total Population

Cognitive Decline

Of the 24,592 Louisianans who were surveyed, only 5,668 participants answered the question: Have you experienced confusion or memory loss that is happening more often or is getting worse? Therefore, the missing data total for this section is 18,924. Those who answered yes (option 1) totaled 756 (3.1%) and those who answered no for option 2 totaled 4,861 (19.8%). Additionally, 51 (0.2%) participants were unsure if they experienced these events (option 7).

Table 3

Experiences with Confusion and Memory Loss

Experienced confusion or memory loss		N	%
Yes		756	3.1%
No		4861	19.8%
Not Sure		51	0.2%
Missing	System	18924	77.0%
Total		24592	100.0%

Reported Age in Five-year Age Categories

Age categories were separated into 5-year increments (see Table 4).

Table 4

Reported Age in Five-Year Age Categories

Age Categories	N	%
18 to 24	1498	6.1%
25 to 29	1305	5.3%
30 to 34	1491	6.1%
35 to 39	1497	6.1%
40 to 44	1465	6.0%
45 to 49	1690	6.9%
50 to 54	2167	8.8%
55 to 59	2613	10.6%
60 to 64	2786	11.3%
65 to 69	2635	10.7%
70 to 74	2048	8.3%
75 to 79	1471	6.0%
80 and over	1629	6.6%
Missing (Refused to Answer/Don’t Know)	297	1.2%

Computed BMI Categories

Of the 24,592 participants, 22,623 answered the question related to BMI; this resulted in a missing data total of 1,970 (see Table 5).

Table 5

Computed BMI Categories

Computed BMI categories	N	%
Underweight	386	1.6%
Normal Weight	6156	25.0%
Overweight	7756	31.5%
Obese	8324	33.8%
Missing	1970	8.0%
Total	24592	100.0%

Fruits and Vegetables

For both fruit and vegetable intake, participants were separated into three categories: consumed one or more times per day (Category1), consumed less than one time per day (Category 2), or don’t know/refused/missing values (Category 9). Category 9 was labeled as missing data in the dataset. The values obtained from the 2015, 2017, and 2019 studies were combined in order to run descriptives for the entire population of Louisiana that participated in this study.

2,147 (8.7%) people consumed fruits one or more times a day (Category 1), while 1,978 (8.0%) individuals did not consume fruit less than one time per day (Category 2). Category 9 was comprised of the missing data points, so the data point was merged with the missing data for this variable. 20,467 (83.2%) data points were missing for this variable.

Table 6

Daily Fruit Consumption

Daily fruit consumption	N	%
Consumed 1 or more per day	2147	8.7%
Consumed less than one time per day	1978	8.0%
Missing	20467	83.2%
Total	24592	100.0%

Category 1 for vegetable intake was comprised of people who consumed vegetables one or more times per day. This group consisted of 2,841 (11.6%) individuals. Category 2 contained 1,197 (4.9%) participants who consumed vegetables less than one time per day. Category 9 and the rest of the missing data totaled 20,554 (83.6%) of the data points were missing due to the lack of being asked the question, or if the person refused to answer the question.

Table 7

Daily Vegetable Consumption

Daily vegetable consumption	N	%
Consumed 1 or more per day	2841	11.6%
Consumed less than one time per day	1197	4.9%
Missing	20554	83.6%
Total	24592	100.0%

Imputed Race/Ethnicity

Race and ethnicity were documented in six categories. The first category, White Non-Hispanic, consisted of 16,655 or 67.7% of the participating population. The second option, Black Non-Hispanic, made up 24.9% (6,126) of the participants. The third group, Asian Non-Hispanic, consisted of 170 people (0.7%). The American Indian or Alaskan Native Non-Hispanic participants consisted of 1.4% (332) of the population screened (option 4). Option 5 involved the population that identified as Hispanic. For this option, 665 or 2.7% of the population classified themselves as Hispanic. For option six, 644 (2.6%) of participants selected Other Race, Non-Hispanic. All 24,592 Louisianians answered this question and no missing data resulted.

Table 8

Imputed Race/Ethnicity

Imputed race/ethnicity	N	%
White Non-Hispanic	16655	67.7%
Black Non-Hispanic	6126	24.9%
Asian Non-Hispanic	170	0.7%
American Indian or Alaskan Native Non-Hispanic	332	1.4%
Hispanic	665	2.7%
Other Race, Non-Hispanic	644	2.6%

Respondents' Sex

24,592 participants responded to the question on gender; only one participant did not answer the question. Category 1 consisted of 10,090 (41.0%) male participants and category 2 consisted of 14,476 (58.9%) women. 15 (0.1%) data points were missing in the system. Group 7 (11 participants, 0.0%) did not know or were not sure how to answer the question.

Table 9

Respondents' Sex

Respondents sex	N	%
Male	10090	41.0%

Female	14476	58.9%
Did not know/Not sure	11	0.0%
Missing	15	0.1%
Total	24592	100.0%

Education Level

For all the Louisiana responses reported, 24,592 participants offered their education level to the researchers. Of this population, 12 (0.0%) participants noted that they never attended school (option 1), 664 or 2.7 stated they finished elementary school up to 8th grade (option 2), 1,914 (7.8%) obtained some high school training from 9th to 11th grade (option 3), and 7,883 or 32.1% completed high school or an equivalent program (option 4). Additionally, 6,373 or 25.9% of participants went to college or technical school for 1-3 years (option 5), while 7,684 or 31.2% graduated from a college program (option 6). 62 (0.3%) participants refused to answer this question (option 9) or were considered missing from the data set.

Table 10

Education Level

Education level	N	%
Never attended school	12	0.0%
Finished elementary up to 8th grade	664	2.7%
Obtained some high school training from 9th to 11th grade	1914	7.8%
Completed high school or an equivalent program	7883	32.1%
College or technical school for 1-3 years	6373	25.9%
Graduated from a college program	7684	31.2%
Missing	62	0.3%

Total	24592	100.0%

Income Level

For income level, 24,231 responses were documented since 361 (1.5%) responses were missing from the system. For the remaining portion of the population, the following responses were documented for annual household income: 1,536 (6.2%) participants fell under option 1 (less than $10,000), 1,368 (5.6%) of the population made between $10,000 to less than $15,000 (option 2), 1,897 (7.7%) earned between $15,000 to less than $20,000 (option 3), 2,011 (8.2%) made anywhere from $20,000 to less than $25,000 (option 4), 2,102 (8.5%) reported earning between $25,000 to less than $35,000 (option 5), 2,663 (10.8%) earned between $35,000 to no more than $50,000 (option 6), 2,856 (11.6%) made $50,000 to $75,000 (option 7), 5,902 (24.0%) made a combined $75,000 or more (option 8). Option 77 included 1,971 (8.0%) participants that were unsure of their income, while Category 99 was for participants who refused to answer the question. Categories 77 and 99 were calculated as missing data, and the study had a total of 4,257 (17.3%) missing answers in the system.

Table 11

Income Level

Income level	N	%
Less than $10,000	1536	6.2%
$10,000 to less than $15,000	1368	5.6%
$15,000 to less than $20,000	1897	7.7%
$20,000 to less than $25,000	2011	8.2%
$25,000 to less than $35,000	2102	8.5%

$35,000 to no more than $50,000	2663	10.8%
$50,000 to $75,000	2856	11.6%
Combined $75,000 or more	5902	24.0%
Missing	4257	17.3%
Total	24592	100.0%

Descriptive Analyses of Study Population

The number of participants within the 40-64 age range within Louisiana surveyed was 12,693. This population number was further reduced to only consider 3,035 since that is the number of people who answered yes or no to the cognitive decline questions. The descriptives for the population provided below are based on 3,035 since the goal is to look at the 40-to-64-year-old population in relation to cognitive decline.

Cognitive Decline

The portion of the population that answered yes or no to the cognitive decline question "Have You Experienced Confusion or Memory Loss That is Happening More Often or is Getting Worse?" was isolated for this portion of descriptive statistics. Of the 3,035 individuals, 393 (12.9%) reported yes and 2,642 (87.1%) reported no.

Reported Age

This variable was used to reduce the overall population to the population chosen as the focus of this study; however, none of the participants in category 5 aged 40-44 years old answered the cognitive decline questions. Therefore, the true population study is from 45-64 years old. Category 6 (545, 18.0 %) contained participants between the ages of 45-49 years old, while category 7 (698, 23.0%) was comprised of the 50–54-year-old members. Category 8 contained 885 (29.2%) respondents between the ages of 55 to

59, and category 9 had 907 (29.9%) individuals between the ages of 60 and 64. This variable did not have any missing data points.

Computed BMI

Due to the 157 missing data points, 2,878 (94.8%) responses were documented out of the 3,035 participants studied. Of these participants, 33 (1.1%) were underweight (category 1), 675 (22.2%) were normal weight (category 2), 951 (31.3%) were overweight, and 1,219 (40.2%) were obese.

Fruits and Vegetables

Category 1(716, 23.6%) was designated for the individuals who did consume fruit 1 or more times per day. The second category (770, 25.4%) was comprised of participants that did not eat fruits at least once per day. 1,549 (51.0%) of the participants did not answer the question, or they were not asked the questions depending on the year of the survey.

1,030 (33.9%) study participants consumed vegetables one or more times per day. For category 2, 458 (15.1%) did not consume vegetables at least once per day. The large number of missing responses is due to the individuals not answering the question, or not being asked the question depending on the year they were surveyed.

Imputed Race/Ethnicity

All 3,035 participants reported their race and ethnicity. Category 1 consisted of 2,058 (67.8%) White/Non-Hispanic participants, while category 2 consisted of 797

(26.3%) Black/Non-Hispanic individuals. Only 10 (0.3%) of the population were Asian, Non-Hispanic (Category 3), and 35 (1.2%) were of American Indian/Alaskan Native, Non-Hispanic descent (Category 4). Both category 5 (Hispanic) and category 6 (Other Race, Non-Hispanic) contained 66 participants of 2.3% of the population studied.

Respondents' Sex

All 3,035 respondents stated they were either male or female. This study consisted of 1,259 (41.5%) male (option 1) and 1,776 (58.5%) female participants.

Education Level

Of the 3,035 participants, 1 never attended school or only kindergarten (Category 1) and 89 (2.9%) completed grades 1 through 8 (Elementary, Category 2). Category 3 (Grades 9 through 11-Some high school) consisted of 245 (8.1%) of the population studied, while 990 (32.6%) finished Grade 12 or received a GED to graduate from high school (Category 4). If someone completed 1-3 years of college or technical training, they were placed in Category 5. This category consisted of 769 (25.3%) of the target population. Participants (940, 31.0%) in Category 6 finished college, and 1 person refused to answer the question (Category 9).

Income Level

This variable was reported as annual household income from all sources. Of the 3,035 data points for income level, 236 (7.8%) were under Option 1 for less than

$10,000. Additionally, 155 (5.1%) of the population made between $10,000 to less than $15,000 (option 2), 213 (7.0%) earned between $15,000 to less than $20,000 (option 3), 216 (7.1%) made anywhere from $20,000 to less than $25,000 (option 4), 205 (6.8%) reported earning between $25,000 to less than $35,000 (option 5), 312 (10.3%) earned between $35,000 to no more than $50,000 (option 6), 369 (12.2%) made $50,000 to $75,000 (option 7), 917 (30.2%) made a combined $75,000 or more (option 8). Option 77 included 177 (5.8%) participants that were unsure of their income, while 237 (7.8%) participants refused to answer the question (option 99).

Proportionality of Total Population Versus Study Population

Of the 24,592 participants from Louisiana who participated in this study, 3,035 participants were observed for this study. By eliminating most of the participants to focus on the middle-aged population who answered the cognitive decline questions, the study population was 12.34% proportional or representative of the entire population sample.

Results for RQ1

Logistic Regression and Odds Ratio

For RQ1**,** binary logistic regression was performed in SPSS to determine if there was a statistically significant relationship between the dependent variable (cognitive decline) and the independent variable (computed BMI). Education level, income, gender, and race/ethnicity were used as control variables; age was already controlled through exclusion. The confidence interval was set at 95% and the Hosmer-Lemeshow goodness-of-fit test was selected.

According to table 21 shown below, an odds ratio of 0.941 (CI 0.807, 1.097, *P*= 0.435) was calculated for the cognitive decline dependent variable and the independent variable BMI when controlled for education, gender, income level, race/ethnicity, and respondent sex. The same was found for control variables education (OR 1022, CI 0.899, 1.162, *P*=0.743) and sex (OR 1.199, CI 0.920, 1.562, *P*=0.179). When analyzing race/ethnicity, most of the categories listed did not have a statistically significant relationship with subjective cognitive decline (Black: OR 0.276, CI 0.038, 1.994, *P*=0.202; Asian: OR 1.969, CI 0.247, 15.673, *P*=0.522; American Indian/Alaskan Native: OR 1.261, CI 0.433, 3.668, *P*=0.671; Hispanic of any race: OR 1.506, CI 0.573, 3.960, *P*=0.406). The White race, however, did have a statistically significant relationship with subjective cognitive decline with an OR of 1.647 (CI: 1.208, 2.247, P=0.002). Furthermore, income also showed a statistically significant relationship with subjective cognitive decline (OR 1.275, CI 1.195, 1.360, *P*<0.001).

Table 21

Variables in the Equation for RQ1

Variables in the Equation

								95% C.I. for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	COMPUTED BODY MASS INDEX CATEGORIES	-.061	.078	.609	1	.435	.941	.807	1.097

EDUCATION LEVEL	.021	.066	.107	1	.743	1.022	.899	1.162
WHITE NON-HISPANIC			12.642	5	.027			
BLACK NON-HISPANIC	.499	.158	9.935	1	.002	1.647	1.208	2.247
ASIAN NON-HISPANIC	-1.289	1.010	1.629	1	.202	.276	.038	1.994
AMERICAN INDIAN/ALASKA NATIVE NON-HISPANIC	.678	1.058	.410	1	.522	1.969	.247	15.673
HISPANIC	.232	.545	.180	1	.671	1.261	.433	3.668
OTHER NON-HISPANIC	.409	.493	.689	1	.406	1.506	.573	3.960
INCOME LEVEL	.243	.033	54.079	1	.000	1.275	1.195	1.360
RESPONDENTS SEX(1)	.181	.135	1.803	1	.179	1.199	.920	1.562
Constant	.497	.390	1.622	1	.203	1.643		

a. Variable(s) entered on step 1: COMPUTED BODY MASS INDEX CATEGORIES, EDUCATION LEVEL, IMPUTED RACE/ETHNICITY VALUE, INCOME LEVEL, RESPONDENTS SEX.

Results for RQ2

Logistic Regression

Tables 22 displays the results of logistic regression for the dependent variable Subjective Cognitive Decline and independent variables CONSUME FRUIT 1 OR MORE TIMES PER DAY and CONSUME VEGETABLES 1 OR MORE TIMES PER DAY. Table 22 further elaborates on the significance of the control variables: respondent sex, education level, income level, imputed race/ethnicity, and computed BMI. The p-value for daily fruit intake was 0.352 which indicates no statistically significant relationship between cognitive decline and daily fruit intake. There was not a statistically significant relationship between cognitive decline and daily vegetable intake since p=0.439 which is greater than the necessary p-value of 0.05. Among the control variables, income level had a statistically significant relationship to cognitive decline since p<0.001.

Table 22

Variables in the Equation for RQ2

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	Upper
Step 1[a]	CONSUME FRUIT 1 OR MORE TIMES PER DAY	-.122	.131	.868	1	.352	.885	.685	1.144
	CONSUME VEGETABLES 1 OR MORE TIMES PER DAY	-.112	.144	.599	1	.439	.894	.674	1.187
	RESPONDENTS SEX(1)	-.180	.134	1.811	1	.178	.835	.642	1.086
	EDUCATION LEVEL	-.008	.065	.014	1	.907	.992	.874	1.127
	INCOME LEVEL	.249	.032	59.481	1	.000	1.283	1.204	1.367
	IMPUTED RACE/ETHNICITY VALUE			13.634	5	.018			
	White/Non-Hispanic	-.405	.494	.674	1	.412	.667	.253	1.755
	Black/Non-Hispanic	.115	.506	.052	1	.820	1.122	.416	3.025
	Asian, Non-Hispanic	-1.718	1.122	2.347	1	.126	.179	.020	1.616

American Indian/Alaskan Native, Non-Hispanic	.277	1.163	.057	1	.812	1.319	.135	12.885
Hispanic	-.133	.728	.034	1	.855	.875	.210	3.644
Constant	1.325	.620	4.570	1	.033	3.763		

a. Variable(s) entered on step 1: CONSUME FRUIT 1 OR MORE TIMES PER DAY, CONSUME VEGETABLES 1 OR MORE TIMES PER DAY, RESPONDENTS SEX, EDUCATION LEVEL, INCOME LEVEL, IMPUTED RACE/ETHNICITY VALUE.

Chi-Square Test of Independence

A Chi-Square Test of Independence was conducted with dependent variable Subjective Cognitive Decline and independent variable CONSUME FRUIT 1 OR MORE TIMES PER DAY. The p-value=0.217 for the two variables shown in Table 23. Since this value is greater than 0.05, there is no statistically significant relationship between Cognitive Delcine and Daily Fruit Intake. However, the Chi-Square Test of Independence output shown by Table 24 displays a significance of 0.035 between dependent variable Cognitive Decline and independent variable CONSUME VEGETABLES 1 OR MORE TIMES PER DAY. Therefore, since the p-value is less than 0.05, there is a statistically significant relationship between these two variables. For both tests, respondent sex, education level, income level, imputed race/ethnicity, and computed BMI served as control variables.

Table 23

Chi-Square Tests For Fruits

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.643[a]	1	.200		
Continuity Correction[b]	1.489	1	.222		
Likelihood Ratio	1.640	1	.200		
Fisher's Exact Test				.217	.111
Linear-by-Linear Association	1.643	1	.200		
N of Valid Cases	2252				

Note. a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 142.61.

b. Computed only for a 2x2 table

Table 24

Chi-Square Tests for Vegetables

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.625[a]	1	.032		
Continuity Correction[b]	4.338	1	.037		
Likelihood Ratio	4.502	1	.034		
Fisher's Exact Test				.035	.020
Linear-by-Linear Association	4.623	1	.032		
N of Valid Cases	2252				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 88.17.

b. Computed only for a 2x2 table

Summary

After conducting logistic regression, I concluded there was no statistically significant correlation between cognitive decline and BMI. Logistic regression tests for cognitive decline and daily fruit consumption also resulted in a relationship that was not statistically significant; however, this test showed a statically significant relationship between cognitive decline and daily vegetable intake. The alternative hypotheses for RQ1 was rejected due to not finding a statistically significant relationship. The chi-square test of independence confirmed the statistical significance between cognitive decline and daily vegetable intake as well as the nonstatistically significant relationship between cognitive decline and daily fruit intake. In addition, findings of this study may change current practices and furthermore lead to social change.

Section 4: Application to Professional Practice and Implications for Social Change

This study was conducted in order to determine if there was a statistically significant correlation between cognitive decline and BMI, daily fruit intake, and daily vegetable intake among those between 40 and 64 in Louisiana. For RQ1, logistic regression was conducted with cognitive decline as the dependent variable and BMI as the independent variable while education, income, level, race/ethnicity, and gender were controlled for. This relationship was not statistically significant; therefore, the alternative hypothesis was rejected. While controlling for education, income level, race/ethnicity, and gender, logistic regression and chi-square tests were conducted with cognitive decline as the dependent variable and fruit intake and vegetable intake as independent variables. These statistical tests did not result in a statistically significant relationship between cognitive decline and daily fruit intake, but the test did show a significant relationship between cognitive decline and vegetable intake.

Interpretation of the Findings

While other studies have found links between obesity and cognitive decline, the null hypothesis was accepted for this study. There was, however, a statistically significant relationship between subjective cognitive decline and vegetable intake. Most studies on cognitive decline were completed on populations that were over 65 years of age. I attempted to determine if there was a statistically significant relationship between middle age and SCD in order to see if that could change the way clinicians screen for cognitive diseases. Obesity has shown impacts on cognitive decline among populations over 65, but not for those between 40 and 64. This study contributed to overall knowledge of factors that should be explored in terms of consumption of vegetables and patient income level.

Limitations of the Study

A significant limitation of the study was the fact that not every participant was asked about their fruit and vegetable intake. In 2015, 2017, and 2019, consumption of fruits and vegetables was documented; however, these variables were excluded from 2016, 2018, and 2020 reports. This is an additional limitation to findings of this study since a small portion of the study population was asked this question. In order to run data for these variables, data from 2015, 2017, and 2019 studies were merged into one before any analyses were completed.

Some variables were not reported the same way across all years of the study. As stated earlier, the respondent sex variable was changed, though this may not have significantly affected responses.

Because the BRFSS is a survey, responses may not accurately reflect experiences of respondents before answering the survey. Unless respondents accurately knew such measurements as height and weight as well as documented food intake, there is a possibility that false information could have been provided inadvertently. Additionally, many people may define fruit and vegetable intake differently. Furthermore, those who did not respond may have contributed different answers that could potentially skew data in a different direction.

Recommendations

Future studies should look at larger populations within the same age group to better determine if obesity, diet as a whole, and cognitive decline can be assessed in a larger context across the country rather than an individual state. Having a larger sample population could aid in determining if risk factors linking subjective cognitive decline to obesity and whole diet can be found within younger and more generalized populations. Future research should also involve vegetable intake and income as early indicators of cognitive decline since I did find a significant relationship between cognitive decline and these two factors. These recommendations should be explored to help early detection of cognitive diseases where people are living longer and become more susceptible to these types of ailments.

Implications for Professional Practice and Social Change

Since vegetable intake and income level showed the most significant statistical relationship, churches and local social clubs can partner with colleges and universities to aid populations in opening opportunities to improve income by earning additional credentials (such as certificates, vocational licenses, or other microcredentials) and qualifying for better paying jobs. Local community colleges offer free classes for students to prepare for high school equivalency exams. Social networking through churches and Mardi Gras Krewes can help individuals without high school diplomas obtain them within a reasonable time frame. This could also extend to medical practices. Physicians and local hospitals can not only recommend such programs to patients who need high school diplomas, but also offer services to their employees who wish to go back to school. Emphasis should be placed on finding positions that can maximize income and improving ability to access better care earlier in life and purchasing high quality food to consume, particularly fresh vegetables.

Healthcare professionals can improve their dialogue with their patients regarding these conversations. Since obesity in old age is associated with developing cognitive diseases, physicians can start conversations early with middle-aged adults about these possibilities. They can offer best practices for patients in their middle age to lose weight, potentially decreasing risks of experiencing cognitive-related complications. Physicians and other healthcare providers should emphasize increasing vegetable intake as this could improve SCD and perhaps prevent or mitigate actual cognitive decline later in life.

Additionally, the Louisiana Department of Health can offer cost effective and healthy recipes or variations of traditional Louisiana dishes. This would lead to modifying both dietary habits that are shared among most of the population and give people who normally feel they cannot afford to eat healthier options in order to determine feasibility. Other government agencies can help since they would be able to connect with people who are most impacted by monetary constraints. Emphasis should especially be based on plant-forward cuisine as this may increase vegetable intake which could improve rates of subjective cognitive decline. Lastly, festivals and social gatherings should be incentivized to provide healthier food options. The goal would be to expose as many people to these options as possible to have the greatest possible impact on subjective cognitive decline rates.

Conclusion

Even though obesity was not found to have any statistically significant relationship with SCD, there was a statistically significant relationship between SCD and vegetable intake. With people living longer than ever, clinicians and health departments need to be proactive about detecting cognitive diseases earlier in their existence in order to prevent harmful and debilitating symptoms. Further research with Louisiana populations can be conducted in a more methodical way to ensure all necessary questions are asked in order to determine if dietary practices are contributing to these factors or not. This must be done due to confirm findings.

References

Achari, A. E., & Jain, S. K. (2017). Adiponectin, a therapeutic target for obesity, diabetes, and endothelial dysfunction. *International Journal of Molecular Sciences*, *18*(6), 1321. https://doi.org/10.3390/ijms18061321

Aiken-Morgan, A. T., Capuano, A. W., Arvanitakis, Z., & Barnes, L. L. (2020). Changes in body mass index are related to faster cognitive decline among African American older adults. *Journal of the American Geriatrics Society*, *68*(11), 2662–2667. https://doi-org.ezp.waldenulibrary.org/10.1111/jgs.16814

Alzheimer's Association (2022). *Louisiana*. https://www.alz.org/professionals/public-health/state-overview/louisiana

America's Health Rankings (2021). *Social and economic factors*. United Health Foundation. https://www.americashealthrankings.org/explore/annual/measure/social_economic/state/LA

American Heart Association (n.d.). *What is the Mediterranean diet?* https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/nutrition-basics/mediterranean-diet

American Psychological Association. (n.d.a). *Cognitive decline.* https://dictionary.apa.org/cognitive-decline

American Psychological Association. (n.d.b). *Dementia.* https://dictionary.apa.org/dementia

American Psychological Association. (n.d.c). *Orexin*. https://dictionary.apa.org/orexin

American Psychological Association. (n.d.d). *Primary access*. https://dictionary.apa.org/primary-ability

American Psychological Association. (n.d.e). *Semantic memory*. https://dictionary.apa.org/semantic-memory

Berti, V., Walters, M., Sterling, J., Quinn, C. G., Logue, M., Andrews, R., Matthews, D. C., Osorio, R. S., Pupi, A., Vallabhajosula, S., Isaacson, R. S., de Leon, M. J., & Mosconi, L. (2018). Mediterranean diet and 3-year Alzheimer brain biomarker changes in middle-aged adults. *Neurology, 90*(20), e1789–e1798. https://doi.org/10.1212/WNL.0000000000005527

Brantley, P. J., Guan, W., Brock, R., Zhang, D., & Hu, G. (2020). Heads up: Design and methods of a Louisiana state-funded surgical and non-surgical weight loss program. *International Journal of Environmental Research and Public Health*, *17*(9). https://doi.org/10.3390/ijerph17092999

Bronfenbrenner, U., & Evans, G. W. (2000). Developmental science in the 21st century: Emerging questions, theoretical models, research designs and empirical findings. *Social Development*, *9*(1), 115–125. https://doi.org/10.1111/1467-9507.00114

Bujang, M. A., Sa'at, N., Sidik, T. M. I. T. A. B., & Joo, L. C. (2018). Sample size guidelines for logistic regression from observational studies with large population: Emphasis on the accuracy between statistics and parameters based on real life clinical data. *Malaysian Journal of Medical Sciences*, *25*(4), 122–130. https://doi.org/10.21315/mjms2018.25.4.12

Centers for Disease Control and Prevention (2018). *BRFSS frequently asked questions (FAQs)*. https://www.cdc.gov/brfss/about/brfss_faq.htm

Centers for Disease Control and Prevention (2020). *Chronic diseases and cognitive decline- A public health issue*. https://www.cdc.gov/aging/publications/chronic-diseases-brief.html

Centers for Disease Control and Prevention (2021a). *Louisiana subjective cognitive decline*. https://www.cdc.gov/aging/data/infographic/2019/pdfs/louisiana-h.pdf

Centers for Disease Control and Prevention (2021b). *The social-ecological model: A framework for prevention*. https://www.cdc.gov/violenceprevention/about/social-ecologicalmodel.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fviolenceprevention%2Fpublichealthissue%2Fsocial-ecologicalmodel.html

Centers for Disease Control and Prevention (2021c). *Adult obesity causes & consequences*. https://www.cdc.gov/obesity/adult/causes.html

Centers for Disease Control and Prevention (2021d). *Adult obesity and prevalence maps*. https://www.cdc.gov/obesity/data/prevalence-maps.html

Chen, H. Cohen, P. & Chen, S. (2010). How big is a big odds ratio? Interpreting the magnitude of odds ratios in epidemiological studies. *Communication in Statistics-Simulation and Computation, 39*(4), 860-864. https://doi.org/10.1080/03610911003650383

Cowan N. (2014). Working memory underpins cognitive development, learning, and education. *Educational Psychology Review*, *26*(2), 197–223. https://doi.org/10.1007/s10648-013-9246-y

Cremers, L., Huizinga, W., Niessen, W. J., Krestin, G. P., Poot, D., Ikram, M. A., Lötjönen, J., Klein, S., & Vernooij, M. W. (2020). Predicting global cognitive decline in the general population using the disease state index. *Frontiers in Aging Neuroscience*, *11*, 379. https://doi.org/10.3389/fnagi.2019.00379

Davies, R. (2019). Cognitive decline: Can diet be a preventive or treatment option? *Nursing Older People*, *31*(2), 26–30. https://doi org.ezp.waldenulibrary.org/10.7748/nop.2019.e1145

Duffy, C. M., Hofmeister, J. J., Nixon, J. P., & Butterick, T. A. (2019). High fat diet increases cognitive decline and neuroinflammation in a model of orexin loss. *Neurobiology of Learning and Memory*, *157*, 41–47. https://doi.org/10.1016/j.nlm.2018.11.008

Dye, L., Boyle, N. B., Champ, C., & Lawton, C. (2017). The relationship between obesity and cognitive health and decline. *The Proceedings of the Nutrition Society*, *76*(4), 443–454. https://doi.org/10.1017/S0029665117002014

Esser, M. B., Sacks, J. J., Sherk, A., Karriker-Jaffe, K. J., Greenfield, T. K., Pierannunzi, C., & Brewer, R. D. (2020). Distribution of Drinks Consumed by U.S. Adults by Average Daily Alcohol Consumption: A Comparison of 2 Nationwide Surveys. *American Journal of Preventive Medicine*, *59*(5), 669–677. https://doi.org/10.1016/j.amepre.2020.04.018

Falcon, L. M. (2016, June 29). *The epidemic of obesity*. The Baton Rouge Clinic AMC. https://batonrougeclinic.com/the-epidemic-of-obesity/

Fergus, L., Roberts, R., & Holston, D. (2021). Healthy eating in low-income rural Louisiana parishes: Formative research for future social marketing campaigns. *International Journal of Environmental Research and Public Health*, *18*(9), 4745. https://doi.org/10.3390/ijerph18094745

Fortune, N. C., Harville, E. W., Guralnik, J. M., Gustat, J., Chen, W., Qi, L., & Bazzano, L. A. (2019). Dietary intake and cognitive function: Evidence from the Bogalusa Heart Study. *The American Journal of Clinical Nutrition*, *109*(6), 1656–1663. https://doi.org/10.1093/ajcn/nqz026

Gotter, A. (2021, January 31). *Visceral fat*. Healthline. https://www.healthline.com/health/visceral-fat

Hawkins, M., Keirns, N. G., Baraldi, A. N., Layman, H. M., Stout, M. E., Smith, C. E., Gunstad, J., Hildebrand, D. A., Vohs, K. D., & Lovallo, W. R. (2021). Baseline associations between biomarkers, cognitive function, and self-regulation indices in the cognitive and self-regulatory mechanisms of obesity study. *Obesity Science & Practice*, *7*(6), 669–681. https://doi.org/10.1002/osp4.537

Holston, D., Stroope, J., Cater, M., Kendall, M., & Broyles, S. (2020). Implementing policy, systems, and environmental change through community coalitions and extension partnerships to address obesity in rural Louisiana. *Preventing Chronic Disease*, *17*, E18. https://doi-org.ezp.waldenulibrary.org/10.5888/pcd17.190284

Jessen, F., Amariglio, R. E., van Boxtel, M., Breteler, M., Ceccaldi, M., Chételat, G., Dubois, B., Dufouil, C., Ellis, K. A., van der Flier, W. M., Glodzik, L., van Harten, A. C., de Leon, M. J., McHugh, P., Mielke, M. M., Molinuevo, J. L., Mosconi, L., Osorio, R. S., Perrotin, A., Petersen, R. C., … (2014). Subjective cognitive decline initiative (SCD-I) working group. A conceptual framework for research on subjective cognitive decline in preclinical Alzheimer's disease. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, *10*(6), 844–852. https://doi.org/10.1016/j.jalz.2014.01.001

Kishida, K., Funahashi, T., & Shimomura, I. (2014). Adiponectin as a routine clinical biomarker. *Best Practice & Research. Clinical Endocrinology & Metabolism*, *28*(1), 119–130. https://doi.org/10.1016/j.beem.2013.08.006

Krause, D., Margetts, C. & Roupas, P. (2015). *Chapter 24 - Whole of diet approaches: Evaluating the evidence for healthy policy guidelines, the Mediterranean, vegetarian, paleolithic, Okinawa, ketogenic, and caloric-restrictive diets on the onset of Alzheimer's disease.* Science Direct. https://www.sciencedirect.com/science/article/pii/B9780124078246000240

Legg, T.J. (2018, September 29). *Everything you should know about oxidative stress*. Healthline. https://www.healthline.com/health/oxidative-stress

Louisiana Department of Health (2021). *2021 Louisiana health report card*. https://ldh.la.gov/assets/oph/Center-PHI/2021_Health_Report_Card.pdf

Louisiana: 2020 Census (2021, August 25). *Louisiana's population was 4,657, 757 in 2020.* https://www.census.gov/library/stories/state-by-state/louisiana-population-change-between-census-decade.html

Louisiana Destinations (n.d.). *Louisiana festivals and events*. https://www.louisiana-destinations.com/louisiana-festivals-events-2022.htm

Mayeux R. (2004). Biomarkers: potential uses and limitations. *NeuroRx: The Journal of the American Society for Experimental NeuroTherapeutics*, *1*(2), 182–188. https://doi.org/10.1602/neurorx.1.2.182

Mayo Clinic (n.d.). *Alzheimer's disease*. https://www.mayoclinic.org/diseases-conditions/alzheimers-disease/symptoms-causes/syc-20350447

Milatovic, D., Zaja-Milatovic, S., Breyer, R.M., Aschner, M., & Montine, T.J. (2017). Chapter 55- Neuroinflammation and oxidative injury in developmental neurotoxicity. *Reproductive and Developmental Toxicology 2,* 1051-1061. https://doi.org/10.1016/B978-0-12-804239-7.00055-X

National Institute on Aging (2021, March 23). *Assessing cognitive impairment in older patients*. https://www.nia.nih.gov/health/assessing-cognitive-impairment-older-patients#when

NeuRA (2021, July 27). *Visuospatial ability*. https://library.neura.edu.au/schizophrenia/signs-and-symptoms/cognition/visuospatial-ability/#:~:text=Visuospatial%20ability%20refers%20to%20a,differences%20and%20similarities%20between%20objects.

Owens, M. (2000). *Louisiana's food traditions: An insider's guide*. https://www.louisianafolklife.org/LT/CSE/creole_food_trad.html

Pearson, K. (2017, July 30). *The MIND diet: A detailed guide for beginners*. Healthline. https://www.healthline.com/nutrition/mind-diet

Tanaka, T., Talegawkar, S. A., Jin, Y., Colpo, M., Ferrucci, L., & Bandinelli, S. (2018). Adherence to a Mediterranean diet protects from cognitive decline in the Invecchiare in Chianti study of aging. *Nutrients*, *10*(12), 2007. https://doi.org/10.3390/nu10122007

Tulving E. (2002). Episodic memory: From mind to brain. *Annual Review of Psychology*, *53*, 1–25. https://doi.org/10.1146/annurev.psych.53.100901.135114

U.S. Census Bureau (2020). *American Community Survey 5-year estimates. Census Reporter Profile page for Louisiana*. http://censusreporter.org/profiles/04000US22-louisiana

van den Brink, A. C., Brouwer-Brolsma, E. M., Berendsen, A. A. M., van, de R. O., van den Brink, A. C., & van de Rest, O. (2019). The Mediterranean, dietary approaches to stop hypertension (dash), and Mediterranean-dash intervention for neurodegenerative delay (mind) diets are associated with less cognitive decline and a lower risk of Alzheimer's disease-a review. *Advances in Nutrition*, *10*(6), 1040–1065. https://doi-org.ezp.waldenulibrary.org/10.1093/advances/nmz054

World Health Organization (2021a). *Obesity and overweight*. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

World Health Organization (2021b). *Obesity*. https://www.who.int/health-topics/obesity#tab=tab_1

World Health Organization (2021c). *Dementia*. https://www.who.int/news-room/fact-sheets/detail/dementia