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Association of Dietary Intake With Suicidal Ideation or Suicide Attempts in Adolescents

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Walden University
2018

Abstract

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by

Zenobia Bryant

BS, Emory University, 2009

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health—Epidemiology

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Abstract

Suicide is among the leading cause of adolescent deaths worldwide and thus a significant public health concern. Risk factors for suicidal behavior include drinking alcohol, smoking, and engaging in risky sexual behaviors. One area of concern is dietary patterns and their association with depressive symptoms and suicidal ideation. Bandura's social cognitive theory emphasizes the assumption that one can perform specific actions to bring about desired outcomes. The primary research questions for this quantitative, retrospective, cross-sectional study concerned whether there is a statistically significant interaction between fruit and vegetable intake and suicidal ideation or suicide attempts. Data from 71,776 adolescents in the Centers for Disease Control's Youth Risk Behavioral Surveillance Survey were analyzed using complex samples binominal logistic regression. The dependent variable was suicidal ideation or suicide attempts, and the independent variable was intake of fruits and vegetables. Suicidal ideation was significantly, positively correlated with fruit and vegetable intake. Even after controlling for age, sex, race, and depression, there was a significant, positive correlation with fruit and vegetable intake. Suicide attempt was significantly, positively correlated with fruit and vegetable intake even after controlling for age, sex, race, and depression. Although the results of this study were contrary to previous findings, these results do support the claim that sugary foods and fast foods have a dopaminergic "reward effect". The findings may foster positive social change by identifying the relationship between fruit and vegetable intake and suicidal ideation or suicide attempts in adolescents.

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Dedication

I dedicate this dissertation to my grandmothers, Cora Mae Johnson and Annie Mae Bryant, both of whom transitioned while I was pursuing my degree. The encouraging words and unconditional love they shared continues to inspire me. I also dedicate this dissertation to my loving parents, Dr. Irvin Eugene Bryant and Dr. Geraldine Johnson Bryant, and to my brother Zakeem Bryant. Without their patience, understanding, encouragement, and love, the completion of this work would not have been possible.

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I would like to express my deepest gratitude and thanks to God, who is the source of my strength. Without Him I am nothing! I would like to acknowledge my extended family and circle of friends who have always supported me and encouraged me throughout this process. I would like to thank my pastor, Kenneth Chism for his prayers and guidance! I would also like to thank my mentors Dr. Tiara N. Rosemond, Dr. Karen Carter, and Crystal Pleasant for so graciously walking this journey with me. Their words of encouragement and advice has helped push me towards greatness. Lastly, I would like to express my sincerest gratitude to my committee for their wonderful support and guidance! Without them, I would have not made it this far!

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Chapter 1: Introduction to the Study

Background

Adolescence is a critical developmental period as children transition to adulthood. It is during this period that individuals establish lifelong habits (Cavadini, Siega-Riz, & Popkin, 2000; Yim, 2015). Additionally, this period is one in which there are multiple rapid changes occurring physically, psychologically, and socially. This period also coincides with the onset of psychiatric illness, as vulnerability to mental illness increases tremendously (Jacka et al., 2010; Kim, Choi, Lee, & Park, 2015). About 50% of lifetime mental disorders start by the age of 14 (Kim et al., 2015). Progression through the adolescent period is associated with an increased incidence of suicidal ideation, suicide attempt, and completed suicide (McLoughlin, Gould, & Malone, 2015; Miranda, Ortin, Scott, & Shaffer, 2014). What is startling is that first-time attempters commit over half of reported suicides (Miranda et al., 2014; Ordaz, Goyer, Ho, Singh, & Gotlib, 2018). Interventions must focus on behaviors placing adolescents at risk to prevent suicide rates from increasing.

One behavior placing adolescents at risk for suicidal ideation or suicide attempts is following poor dietary habits. Researchers have established that diet and nutrition play a significant role in modulating the pathophysiological factors underpinning depressive illness (Jacka et al., 2010). For example, the dietary pattern associated with Western countries increases the odds of self- reported depression. On the other hand, the consumption of fruits and vegetables decreases behavioral problems (Jacka et al., 2010). In fact, the consistent intake of one to three servings of fruit and the consumption of

green vegetables is significant in decreasing the risk of depression (Kim et al., 2015). Fruit and vegetables are important sources of fiber and other nutrients that are essential to growth and healthy development. Unfortunately, very few adolescents consume the recommended amount of fruit and vegetables (Farvid et al., 2016; Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). Correcting dietary intake is possible because diet is a modifiable habit. Once someone modifies his or her dietary intake, a healthy eating pattern should remain across the entire lifespan (U.S. Department of Health and Human Services [HHS] & U.S. Department of Agriculture [USDA], 2015). For initiatives targeting dietary intake to be successful, it is necessary to understand the complex interactions occurring between the individual, the culture, and society (Murakami & Sasaki, 2010). One relationship of interest is the relationship between dietary components and mental health.

Mental health issues, left untreated, can lead to suicidal ideation or suicide attempts. The prevalence of suicidal ideation in adolescents is approximately 15-25%, depending on the severity of ideation. The severity of suicidal ideation ranges from passive thoughts of death to specific intents or plans for committing suicide (Bridge, Goldstein, & Brent, 2006). The prevalence of suicide attempts is 1.3-3.8% among adolescent males and 1.5-10.1% among adolescent females. Women are more likely to attempt suicide, whereas men are more likely to complete suicide (Gould, Greenberg, Velting, & Shalfer, 2003; McLoughlin et al., 2015). The actual numbers for suicidal ideation and attempt among adolescents may be higher because many youths may not have access to proper treatment (Bridge et al., 2006). Lack of appropriate treatment

presents an issue because suicidal ideation and suicide attempts are a significant risk factor for future completed suicide. Further, the rate of suicide increases steadily as children transition from childhood to adulthood (Bridge et al., 2006; McLoughlin et al., 2015). The rate may be increasing because as children grow through the adolescent period, cognitively they become more capable of planning and completing suicide than their younger counterparts (Bridge et al., 2006). Researchers have identified the leading methods of suicide among adolescents in the United States as firearms, hanging, and poisoning (McLoughlin et al., 2015). Suicidal ideation has become increasingly examined along with suicide attempts. The more frequent and severe the level of suicidal ideation an individual experiences, the more likely he or she is to transition from suicidal ideation to suicide attempt (Bridge et al., 2006; Milos, Spindler, Hepp, & Schnyder, 2004; Ordaz et al., 2018). Moreover, prior suicide attempts put adolescents at a higher risk for completing suicide. In fact, the risk of an adolescent attempting suicide multiple times is highest in the first 3 to 6 months after the first attempt. The risk remains elevated for at least 24 months (Bridge et al., 2006; Gould et al., 2003; Lowry, Crosby, Brener, & Kann, 2014; McLoughlin et al., 2015; Miranda et al., 2014). Approximately one-third of adolescents who experience suicidal ideation will physically develop a plan for suicide, and 60% of adolescents will attempt suicide within the first year of experiencing suicidal ideation (McLoughlin et al., 2015). The high rates of suicidal ideation and suicide attempt support the need for public health research in this area.

Problem Statement

Death by suicide is among the leading causes of adolescent deaths worldwide and thus a significant public health concern. Teenagers living in Southeast Asia and Eastern Europe have the highest prevalence of adolescent suicide, and suicide is the second leading cause of death for adolescents between the ages of 15 and 19 in the United States (McLoughlin et al., 2015). Researchers have identified multiple risk factors for suicidal behavior, which include drinking alcohol, smoking, and engaging in risky sexual behaviors (Kim & Kim, 2010). One area of concern is dietary patterns and their association with depressive symptoms and suicidal ideation (Li, Zhang, & McKeown, 2009). Forrest et al. (2016) found that in adults a poor diet may intensify vulnerability to depression, which may lead to suicidal ideation or suicide attempts, but little is known about whether this is true for adolescents. Lack of fruit and vegetable intake characterizes poor dietary habits. Approximately 75% of the U.S. population fails to consume the recommended amount of fruit, and about 87% fails to consume the recommended amount of vegetables (Moore, Thompson, & Demissie, 2016). The recommended daily intake of fruits and vegetables for adolescents is 1 to 2 cups of fruit and 1 to 3 cups of vegetables (Moore et al., 2016). Unfortunately, less than 10% of high school students consume the recommended intake of fruits, and only approximately 2% consume the recommended intake of vegetables. It seems that as adolescents age, their fruit and vegetable intake decreases (Moore et al., 2016). The problem is that adolescent suicide in the United States continues to be a significant cause of death and an increasingly important public health issue because the effect of poor dietary habits upon

suicidal ideation and suicide attempts is not well understood. If inadequate dietary intake is a risk factor for suicidal ideation in adolescents, then interventions and mental health practitioners may need to focus on building healthy eating habits early in life so that positive eating behaviors will continue into adulthood.

Purpose of the Study

The purpose of this quantitative, retrospective, cross-sectional study was to determine whether fruit and vegetable intake influences suicidal ideation or suicide attempts in adolescents. This study adds to knowledge in this area by evaluating the interaction of fruit and vegetable consumption with suicidal ideation or suicide attempts. Suicide is among the top 10 causes of death in the United States, and approximately 5,000 adolescent deaths per year are the result of suicide (Gould et al., 2003; Lowry et al., 2014; Ordaz et al., 2018). Researchers have estimated that about 9% of U.S. adolescents have attempted suicide (Bridge et al., 2006; Gould et al., 2003). Further, out of every five teens, at least one will attempt suicide (Bridge et al., 2006; Gould et al., 2003). As suicide rates have increased among adolescents over the past decade, dietary intake has shifted to include more fatty and sugary foods (Moore et al., 2016). Less than 10% of adolescents consume the recommended intake of fruits and vegetables (Birch & Fisher, 1997; Moore et al., 2016; Kranz, Brauchla, Slavin, & Miller, 2012). Because mental health and nutrition are important public health concerns, it is imperative to examine a possible link between them. To accomplish the quantitative evaluation, the Youth Risk Behavioral Surveillance Survey (YRBSS) was used. YRBSS is a national quantitative survey conducted by the Centers for Disease Control and Prevention (CDC).

The YRBSS is used to obtain information about specific health behaviors of adolescents and is representative of U.S. adolescents because a stratified random sampling strategy is used to acquire a nationally representative sample of U.S. high school students. The YRBSS includes questions on race, sex, depressive feelings, suicidal ideation, suicide attempts, and dietary intake of fruits and vegetables. These variables were necessary to test the hypotheses of this study.

Research Questions and Hypotheses

RQ1: Is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

$H_0$1: There is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

H_A1: There is a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

RQ2: Is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

$H_0$2: There is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

H_A2: There is a relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

RQ3: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

$H_0$3: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

H_A3: Controlling for age, sex, race, and depression, there is a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

RQ4: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

$H_0$4: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

H_A4: Controlling for age, sex, race, and depression, there is a relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

For all research questions, the dependent variable was suicidal ideation or suicide attempts, and the independent variable was the intake of fruits and vegetables. Age, sex, race, and depression were controlled for in analyses for Research Questions 3 and 4. Suicidal ideation was coded [Yes] if the participant reported having seriously considered attempting suicide or having made plans to attempt suicide in the past 12 months. How many times the participant reported attempting suicide in the past 12 months equaled suicide attempts. Suicide attempts was converted into a dichotomous variable by

separating the responses into two groups. Students who indicated that they had never attempted suicide were coded [No], and students who indicated that they had attempted suicide at least one or more times were coded [Yes]. The dummy coding for both variables was [0 = No] and [1 = Yes]. Dietary intake of fruits and vegetables was measured from the reported times that fruit, potatoes, carrots, or other vegetables had been consumed within the past 7 days.

Complex samples binomial logistic regression was used to test the relationship between the intake of fruits and vegetables and suicidal ideation or suicide attempts in each research question because suicidal ideation was measured on the dichotomous scale and the independent variable was measured on the continuous scale. The variable suicide attempts was dichotomized as described above. The purpose of the analysis was to determine the relationship between the intake of fruits and vegetables and suicidal ideation or suicide attempts.

Theoretical Framework

Social cognitive theory emphasizes the interaction between people and their environment. The interaction of personal, behavioral, and environmental influences affects human behavior (Bandura, 1999). There are nine central concepts involved in this theory: reciprocal determinism, outcome expectations, self-efficacy, collective efficacy, observational learning, incentive motivation, facilitation, self-regulation, and moral disengagement. A few constructs are essential to highlight based on the nature of this study. First, the concept of *reciprocal determinism* emphasizes environmental influences on individuals and groups. These same individuals and groups can change their

environments (Bandura, 1999). Second, the *outcome expectations* concept refers to the likelihood of various outcomes resulting from specific behaviors. Last, *self-efficacy* is the assumption that one can perform specific actions to bring about desired outcomes (Bandura, 1999). To change dietary intake behavior, adolescents must understand the consequences of poor dietary intake versus healthy dietary intake. Adolescents must also believe that they can perform the actions required to bring about necessary changes.

The intake of fruits and vegetables among adolescents is currently well below the recommended level. To increase fruit and vegetable intake for this population, changes must first occur within the environment (Diep, Chen, Davies, Baranowski, & Baranowski, 2014). The environment includes where people live, work, and shop, as well as how information is presented. Nutritional information should be written without professional jargon, so that the general public can efficiently process dietary information (Chung, 2017). Additionally, neighborhood safety and food accessibility issues need to be addressed within communities. Lack of neighborhood safety and poor food accessibility are the most common factors in poor dietary intake (Christiansen, Qureshi, Schaible, Park, & Gittelsohn, 2013; Lardier, Barrios, Garcia-Reid, & Reid, 2016). Further, more information needs to be available on outcomes related to low fruit and vegetable intake as opposed to the recommended intake. For example, a higher risk of depression and suicidal ideation is a likely outcome related to low fruit and vegetable intake that should be reported if such an association is found (Diep et al., 2014). Results that indicate that there is not a significant relationship should be reported as well.

Nature of Study

This study was quantitative with a cross-sectional focus to evaluate the relationship between dietary intake of fruits and vegetables and suicidal ideation as well as suicide attempts. The dependent variables for this study were suicidal ideation or suicide attempts. The independent variable was dietary intake of fruits and vegetables.

Archival quantitative data from the 2007-2017 YRBSS were analyzed to determine if dietary intake of fruits and vegetables by adolescents reduced risk for suicidal ideation or suicide attempts. The YRBSS data were collected on a national representative sample of adolescents from Grades 9-12.

Definitions

Active ideation: Occurs when someone has a strong desire to die coupled with a specific plan to cause death (Klonsky & May, 2015; Klonsky, May, & Saffer, 2016).

Attempted suicide (suicide attempt): A nonfatal act self-inflicted with the intent to die (Bridge et al., 2006).

Food insecurity: Occurs when access to nutritionally adequate and safe food is limited or uncertain (HHS & USDA, 2015).

Dietary behaviors: An individual's complete dietary intake over time, including foods and beverages (HHS & USDA, 2015).

Health literacy: The extent to which people can acquire and understand necessary health information and analyze the available choices provided to make the best decisions for their benefit (Chung, 2017).

Nutrient dense: Containing vitamins, minerals, and other substances obtained from food and beverages that contribute to adequate nutrient intake or may have positive health effects (HHS & USDA, 2015).

Passive ideation: Occurs when someone has a desire to die but has not created a specific plan for causing death (Klonsky & May, 2015; Klonsky et al., 2016).

Socioeconomic status: The social class or income level of a specific individual or group of people (Porta & International Epidemiological Association, 2008).

Suicidal ideation: Refers to thoughts or plans where the end goal is to harm or kill oneself (Bridge et al., 2006).

Suicidal intent: Refers to the extent to which one wishes to die (Bridge et al., 2006).

Suicidality: Refers to all suicide-related behaviors (Bridge et al., 2006).

Assumptions

It was assumed that the YRBSS database was representative of national patterns regarding adolescent patterns of eating fruit and vegetables. The CDC used stratified sampling design to ensure that the results were representative. It was assumed that the self-report data of the adolescents who participated in the YRBSS reflected honest and accurate information (CDC, 2013).

Scope and Delimitation

The study was limited to adolescents enrolled in high school throughout the United States at the time that the YRBSS was conducted. It is essential to generalize the

findings of this study to other groups with caution, as the results may not be similar to those for other samples from other years.

Limitations

Due to the cross-sectional nature of the study, it was only possible to determine the association between intake of fruits and vegetables and suicidal ideation or suicide attempts. It was impossible to determine which variable occurred first (Crosby, DiClemente, & Salazar, 2013). Response errors, which occur when participants incorrectly report information, constituted a possible limitation of the study (Crosby et al., 2013). Further, due to the sensitive nature of many of the questions, social desirability may have impacted the responses (Szklo & Nieto, 2014). Because the YRBSS does not collect data on the socioeconomic status of adolescents, the variable of socioeconomic status was not controlled for in this study. Finally, recall bias may have occurred if participants incorrectly recalled past experiences. This type of bias appears more frequently when the instrument used to collect data is a questionnaire (Szklo & Nieto, 2014). To avoid recall bias with the YRBSS questionnaire, CDC conducted studies to ensure the quality of data provided. Additionally, the CDC has specific data-quality measures that are implemented to correct any information bias in the data (CDC, 2013).

Significance

At the time of this writing, most of the research conducted regarding the relationship between dietary intake and mental health has focused on adults. The studies conducted using the adolescent population have been done using participants residing

outside the United States. Thus, the information available is not generalizable to adolescents who live in the United States. Moreover, very few research studies have focused on the association between dietary intake and suicidal ideation or suicide attempts. This research study may increase the understanding of the relationship between dietary intake and suicidal ideation or suicide attempts in adolescents in the United States. It is understood that adolescents who experience depressive episodes, suicidal ideation, and suicide attempts have decreased quality of life. Any research investigating elements or risk factors that may influence suicidality will help to protect and improve the health of these adolescents (Kim, Moon, & Kim, 2011). It is crucial that prevention and intervention programs targeting the mental health of adolescents include education concerning proper nutrition and its effects on psychological health (Li et al., 2009). For example, if the intake of fruits and vegetables negatively associates with suicidal ideation, meaning the higher the consumption of fruits and vegetables, the lower the odds ratio for adolescents experiencing suicidal ideation or suicide attempts, then programs should focus on teaching proper nutrition to teenagers and young adults to help improve their mental health.

Summary

This chapter provides an overview of suicidal ideation and suicide attempts in adolescents and dietary intake of fruits and vegetables. The possible relationship of suicidal ideation or suicide attempts with dietary intake of fruits and vegetables was discussed, along with the statement of the problem, purpose statement, research questions, and hypotheses. The theoretical framework and nature of the study were

delineated. Additionally, key terms were defined, and the significance of the study was discussed.

The following chapter provides a review of relevant literature on dietary intake of fruits and vegetables, suicidal ideation, and suicide attempts in adolescents to provide a foundation for the study methodology. This study may contribute to positive social change by examining a possible relationship between dietary intake of fruits and vegetables and suicidal ideation or suicide attempts. If such a relationship is present, changes to improve quality of life may be suggested.

Chapter 2: Literature Review

Adolescence is one of the most critical developmental periods during an individual's lifetime. It is during this period that children transition into adulthood and lifestyle habits are developed (Cavadini et al., 2000; Yim, 2015). Progression through the adolescent period is associated with an increased risk of suicidal ideation, suicide attempt, and completed suicide (McLoughlin et al., 2015; Miranda et al., 2014). Researchers have established that diet and nutrition play an essential role in some of the pathophysiological factors of depressive illness (Allgöwer, Wardle, & Steptoe, 2001; Bodnar & Wisner, 2005; Brody, 2002; Liu, Yan, Li, & Zhang, 2016). In fact, components of a Western diet increase the odds of an individual self-reporting depression (Jacka et al., 2010). Intake of fruits and vegetables is a central component lacking in the Western diet. Fruits and vegetables are important because they provide sources of fiber and other nutrients necessary for healthy growth and development (Farvid et al., 2016; Kimmons et al., 2009). Unfortunately, very few consume the recommended intake of fruits and vegetables. To promote social change, the goal of this study was to increase knowledge of outcomes associated with poor dietary intake.

This quantitative study addressed the relationship between dietary intake of fruits and vegetables and suicidality in U.S. adolescents. In this chapter, I review significant themes from the literature relevant to dietary intake and suicidality. The following sections of this chapter detail how the supporting literature was obtained and how the research relates to the topic.

Literature Search Strategy

The information explored in this chapter was gathered using the Walden University Library System, scientific journals, textbooks, and Internet sources. The databases used included PubMed, ProQuest, EBSCO Host, CDC, and Google Scholar. The sources were selected for inclusion in this chapter based on reoccurring themes and issues. The key search terms used were *dietary intake*, *suicidal ideation*, *adolescents*, and *fruits and vegetables*. Several hundred references were found, including textbooks, reports, and articles. From the findings, 104 references were selected, including textbooks (n = 2), reports (n = 6), and articles (n = 96).

Theoretical Framework

Social cognitive theory emphasizes the interaction between people and their environment. The interaction of personal, behavioral, and environmental influences affects human behavior (Bandura, 1999). There are nine central concepts involved in this theory: reciprocal determinism, outcome expectations, self-efficacy, collective efficacy, observational learning, incentive motivation, facilitation, self-regulation, and moral disengagement. A few constructs are essential to highlight based on the nature of this study. First, the concept of *reciprocal determinism* emphasizes environmental influences on individuals and groups. These same individuals and groups can change their environments (Bandura, 1999). Second, the *outcome expectations* concept refers to the likelihood of various outcomes resulting from specific behaviors. Last, *self-efficacy* is the assumption that one can perform specific actions to bring about desired outcomes (Bandura, 1999). Food literacy is one aspect of self-efficacy impacting dietary quality.

Those who have higher food literacy levels are more likely to engage in the proper actions to improve their diet and intake of essential nutrients (Chung, 2017; Diep et al., 2014; Thomson & Ravia, 2011).

Definition of Mental Illness

Mental illness is ubiquitous in society. The term *mental illness* encompasses multiple components, including depressive disorders, anxiety disorders, posttraumatic stress disorders, schizophrenia, multiple personality disorders, and obsessive compulsion. About 400 million people worldwide suffer from depression, which accounts for 4.3% of the global burden of disease and is the most significant cause of disability (Liu et al., 2016). Although depression may be the most common mental disorder, almost all mental disorders are associated with increased suicidal ideation and suicide attempts (Milos et al., 2004). In fact, those with psychiatric disorders have a nine-fold increased risk for experiencing suicidal ideation (Bridge et al., 2006). Depressive disorders tend to appear more among adolescents who have thoughts about suicide or who attempt suicide (Gould et al., 2003). Depression is the most commonly identified predictor for both suicidal ideation and suicide attempts, with an odds ratio of 4.43 (Barzilay et al., 2015; Miranda et al., 2014; Yim, 2015). Actions preceding the completion of suicide include engaging in suicidal ideation, planning suicide, communicating about suicide, and attempting suicide (Lowry et al., 2014).

Suicidal Ideation and Suicide Attempts

There are risk factors associated with suicidal ideation. In adolescents, life stressors are a significant risk factor and include the loss of a parent, regardless of

whether this occurs via divorce or death (Bridge et al., 2006; Gould et al., 2003). Other risk factors include poor physical health and physical disability (Bridge et al., 2006). There are two main categories of suicidal ideation: *passive ideation* and *active ideation*. Passive ideation occurs when someone has a desire to die but does not have a specific plan for causing death. In contrast, active ideation occurs when someone has a strong desire to die as well as a particular intention to cause death (Klonsky & May, 2015; Klonsky et al., 2016). For example, someone with passive ideation may merely think, "sometimes I think I would be better off dead" (Klonsky & May, 2015, p. 118; Klonsky et al., 2016, p. 321). On the other hand, a person with active ideation would think, "as soon as I have the chance, I am going to kill myself" (Klonsky & May, 2015, p. 118; Klonsky et al., 2016, p. 321). Suicidal ideation among adolescents seems to be a common occurrence.

Adolescents who experience suicidal ideation have a higher risk of attempting suicide. Researchers define a *suicide attempt* as occurring when a person who conducts a nonfatal, self-directed, or potentially injurious behavior does so with the intent to die (Klonsky & May, 2015; Klonsky et al., 2016). Suicide attempts differ from suicidal behaviors. The term *suicidal behavior* is typically used to refer to any thought or action related to suicide (Klonsky et al., 2016). For example, adolescents who reported experiencing suicidal ideation at the age of 15 were 12 times more likely to have made a suicide attempt by the age of 20 (Miranda et al., 2014). Females are more likely to experience suicidal ideation and attempt suicide, whereas males are more likely to complete suicide (Gould et al., 2003). In addition to the presence of suicidal ideation, the

seriousness of the ideation enhances the risk for future suicide attempts (Miranda et al., 2014). However, suicidal ideation does not precede all attempts of suicide (Lowry et al., 2014). Thus, it is important to examine possible risk factors for suicidal ideation and suicide attempts.

Epidemiology of Suicidal Ideation and Suicide Attempts

Suicide is one of the top 10 leading causes of death among all age groups combined and the second leading cause of death among adolescents. Suicide causes about 5,000 adolescent deaths per year in the United States (Gould et al., 2003; Lowry et al., 2014; Ordaz et al., 2018). Suicide has become an international issue, and the global target is to reduce suicide rates by 10% by the year 2020 (McLoughlin et al., 2015). The point prevalence of suicidal ideation in adolescents is approximately 15% to 25%. Between 4.1% and 8.5% of U.S. adolescents have attempted suicide, and 1 in 5 teens seriously consider attempting suicide (Bridge et al., 2006; Gould et al., 2003). Adolescence is a critical time for individuals dealing with mental health concerns.

The lifetime prevalence of suicidal ideation in the United States increases acutely between 12 and 17 years of age (Gould et al., 2003; Lowry et al., 2014; McLoughlin et al., 2015). In addition to the lifetime prevalence of suicidal ideation rising sharply during adolescence, lifetime estimates of suicide attempts range from 1.3%-3.8% in males to 1.5%-10.1% in females (Bridge et al., 2006). Dietary habits also tend to change drastically during the adolescent period.

Dietary Intake

Unhealthy dietary behaviors established early in life extend into adulthood. Chronic diseases related to diet have risen due to lifestyle behaviors related to an unhealthy diet. Achieving a healthy diet requires changes in food and beverage choices (HHS & USDA, 2015). When considering dietary habits of children, researchers have noticed that fruit and vegetable intake decreases as age increases (Moore et al., 2016). The decrease in fruit and vegetable intake is problematic because higher consumption of fruits and vegetables is characteristic of healthy eating patterns. Further, a proper diet should limit the intake of saturated sugars and saturated fats and reduce the absorption of sodium (HHS & USDA, 2015). The consumption of fruits and vegetables decreases with age, meaning that healthy eating patterns decline over the course of a lifetime (Moore et al., 2016). The lack of fruits and vegetables in U.S. diets means that some nutrients and dietary fiber intake are lacking in daily meals. Approximately 75% of the U.S. population consumes less fruit than recommended, and about 87% consumes fewer vegetables than recommended (Moore et al., 2016; HHS & USDA, 2015). Further, less than 10% of high school students consume enough fruits, and only 2% consume enough vegetables (Birch & Fisher, 1997; Kranz et al., 2012; Moore et al., 2016). The recommended daily intake for children and adolescents who are inactive is 1 to 2 cups of fruit and 1 to 3 cups of vegetables. Active children and adolescents should consume more servings of fruits and vegetables (Moore et al., 2016; HHS & USDA, 2015). Intake of fruits and vegetables among adolescents decreases as total carbohydrate and sugar intake increases. This substitution indicates that many young people are not getting the

proper amount of nutrients needed to sustain the rapid growth occurring during this period (Birch & Fisher, 1997; Oddy et al., 2009; HHS & USDA, 2015; Yim, 2015). Vegetable intake tends to be lower among adolescent males, and fruit intake tends to be lower among adolescent females (HHS & USDA, 2015). Lower dietary intake is problematic because the primary source of dietary fiber is fruits and vegetables.

Elements That Influence Dietary Intake

Significant components of diets have changed drastically over the past few decades, causing the intake of fruits and vegetables to decrease. Changing dietary factors are concerning because a diet lacking adequate intake of fruits and vegetables may increase the prevalence of specific cancers (Cavadini et al., 2000). Additionally, poor diet is a significant cause of noncommunicable, chronic diseases (Li et al., 2009). Adolescents, in particular, are at greater risk for an inadequate diet because low fiber intake, low antioxidant intake, and low nutrient intake place them at risk for early onset of chronic diseases (Cavadini et al., 2000). A few elements may influence an adolescent's dietary intake. These dynamics are environmental factors, socioeconomic status, parental influences, and body image.

Environmental Factors

When examining dietary intake, it is essential to consider how environmental factors and nutritional literacy influence dietary intake. The settings in which people live, work, and shop influence food preferences and food choices (HHS & USDA, 2015). Being able to decipher nutrient information accurately is essential when planning a proper diet. However, nutritional information is usually written in professional jargon,

making it difficult for the general public to process dietary information (Chung, 2017). Poor readability of health and nutrition information may impact the increasing number of diet-related chronic diseases (Chung, 2017). Poor food choices and low dietary quality are directly related to poor health literacy (Chung, 2017). Changing the way in which nutritional information is presented and advertised in the environment may help to increase nutritional literacy and encourage proper dietary intake.

Another important environmental factor is stress. A shift in eating behaviors due to stress occurs as early as 11 years old (Cartwright et al., 2003; Yim, 2015). Adolescents who experience a high stress level are more likely to eat food and snacks high in fat. Additionally, they are less likely to consume five or more fruits or vegetables per day, which is the recommended intake (Cartwright et al., 2003). Adolescents under high levels of stress were 1.93 times more likely to consume fatty foods and 0.78 times less likely to consume five or more servings of fruits and vegetables (Cartwright et al., 2003). Factors causing stress include family situations, neighborhoods, and peers, with neighborhood safety and food accessibility being the most common factor contributing to poor eating habits (Christiansen et al., 2013; Lardier et al., 2016). Unsafe neighborhoods and minimal available healthy food choices are the most significant hindrances to proper dietary intake.

Another important environmental factor to consider is interaction with others. For most children and adolescents, eating occurs during social occasions, and the observation of the eating patterns of others influences food preferences. The eating behavior of people in the environment serves as a model on which to pattern eating behaviors (Birch

& Fisher, 1997). A model found in the environment can have powerful effects on food choice, especially when the model is similar to the observer or acts as a role model (Birch & Fisher, 1997). Common eating models often overlooked when considering dietary influences are the ones provided by television. The models and messages viewed on television influence food preferences and food selection among children and adolescents (Birch & Fisher, 1997). In fact, the most significant numbers of food advertisements appear during child and teen programming. Children who were exposed to food advertisements selected more sugary foods than those who had not viewed any advertisements (Birch & Fisher, 1997). Positive role models present in the environment may be limited for those of low socioeconomic status.

Socioeconomic Status

In addition to environmental factors, socioeconomic status or family circumstance must be considered because it is strongly associated with an adolescent's dietary habits. For example, adolescents from low socioeconomic backgrounds usually have regular diets that do not adhere to current recommendations (Ball et al., 2009). In fact, national intake data have indicated that dietary fiber intake is inadequate in the majority of U.S. children, especially in those from low-income backgrounds (Kranz et al., 2012). Socioeconomic status is related to the issue of food insecurity, and unfortunately only half of U.S. adolescents consume at least three meals a day. In fact, 48 million people live in households where food availability is scarce (HHS & USDA, 2015). Adolescents from families of low socioeconomic status are more likely to experience food insecurity and thus are more likely to suffer mental disorders (Burke, Martini, Cayir, Hartline-

Grafton, & Meade, 2016; McIntyre, Williams, Lavorato, & Patten, 2013). The diet of parents and the availability of foods in the home predict food consumption in children and adolescents. For example, having healthy foods in the house that are quickly accessible reduces the consumption of sugary snacks. However, homes of low socioeconomic backgrounds are less likely to have healthy foods available (Harris & Ramsey, 2015). Having consistent access to healthy, safe, and affordable food choices is crucial for an individual to maintain healthy dietary intake. Food choices are often influenced by parents and guardians.

Parental Influences

Parental influence plays a significant role in the development of child and adolescent eating habits. The food environment provided by the parent shapes child preferences and food acceptance patterns (Birch & Fisher, 1997). For example, two-parent homes and frequent family meals help improve dietary intake among adolescents and protect against suicidal ideation (Goldfarb, Tarver, & Sen, 2014; Im, Oh, & Suk, 2017; Kuramoto-Crawford, Ali, & Wilcox, 2017). The food preferences and food selection habits adopted by children and adolescents are shaped by observing the food selection patterns and eating behavior of parents and guardians (Birch & Fisher, 1997). The eating environments of families with obese parents differ in systematic ways from families where neither parent is obese. Harris and Ramsey (2015) asserted that families where neither parent is obese may have more healthy food choices available. The food choices available may impact adolescent body image.

Body Image

Body image becomes a significant concern for teens. During the adolescent period, teens experience rapid physical changes and may face confusion concerning personal identity and body image (Yim, 2015). Because stress influences dietary intake, these stressors can also have an impact on perceived body image. Those who are at higher levels of psychological distress are more likely to be unsatisfied with their weight. Thus, they may engage in binge eating and unhealthy weight control practices (Cohen, Kristal, Neumark-Sztainer, Rock, & Neuhouser, 2002; Cortese et al., 2009). Unhealthy dieting practices in adolescents correlate with high levels of depression. On the other hand, a healthy diet associates with low depression levels (Cairns, Yap, Pilkington, & Jorm, 2014). Students viewing themselves as overweight or obese are more likely to engage in weight loss behaviors. These methods may include lower food intake, fasting, and purging. Females were 2.09 times more likely than males to reduce caloric intake to lose weight (Demissie, Lowry, Eaton, & Nihiser, 2015; Lee & Lee, 2016). Females were 1.99 times more likely than males to fast and 1.68 times more likely than males to ingest diet pills to lose weight (Demissie et al., 2015; Lee & Lee, 2016). Skewed views of body weight perception lead to a higher risk of depression. Adolescents who view themselves as overweight or underweight are at higher risk of experiencing major depression (Roberts & Duong, 2013, 2015). Further, perceived body weight correlates with suicidal ideation and suicide attempts. Those who view themselves as overweight or obese are at a higher risk for experiencing suicidal ideation or suicide attempts (Eaton, Lowry, Brener, Galuska, & Crosby, 2005). One concern with the link between perceived body

weight, unhealthy weight control, depression, and suicidal ideation is the risk of developing eating disorders. The strict control of dietary intake may lead to mental health issues and eating disorders (Milos et al., 2004). Strict dieting may impact proper intake of nutrients and dietary fiber.

Fruits, Vegetables, and Dietary Fiber

Dietary Fiber

Dietary fiber is considered the portion of plants resistant to digestion by specific enzymes located in the human body. Dietary fibers are also considered the "non-digestible carbohydrates and lignin that are intrinsic and intact in plants" (Anderson et al., 2009; Kranz et al., 2012, p. 47; Slavin, 2005). The current dietary fiber recommendations are related to age, gender, and energy intake. However, the general advice is 14g/1000 kcal per day (Anderson et al., 2009). Dietary fiber breaks down into soluble and insoluble components (Kranz et al., 2012). Total fiber intake is calculated by combining dietary fiber intake and functional fiber intake. Functional fiber consists of isolated, nondigestible carbohydrates and fibers added to meals (Kranz et al., 2012; Slavin, 2005). Dietary fiber can be found in specific food items.

The Importance of Fruits, Vegetables, and Dietary Fiber

Fruits and vegetables are significant contributors to dietary fiber. Also, fruits and vegetables are important sources of antioxidants an anti-inflammatory component (Liu et al., 2016; Logan, 2006). The minerals and vitamins found in fruits and vegetables influence the pathology of depression (Logan, 2006; Moore et al., 2016). In fact, the lower the intake of antioxidant-rich fruits and vegetables, the higher the risk for

depression and suicide (Logan, 2006). The consumption of dietary fiber is also significant because it helps reduce weight gain and the development of chronic diseases. Dietary fiber intake is also an essential component in healthy gastrointestinal function and the maintenance of healthy blood glucose levels (Anderson et al., 2009; Slavin, 2005). Unfortunately, the majority of people in the United States consume less than half of the recommended daily dietary fiber intake. Also, the consumption of fiber is significantly lower among adolescents (Zhang, Li, & Torres, 2005). The recommended dietary fiber intake for adolescents is 38 g/d for males and 26 g/d for females (Anderson et al., 2009; Slavin, 2005).

Diet and Mental Health

Fruit and Vegetable Intake and Mental Health

Depression, suicidal ideation, suicidal behaviors, mood disorders, and other mental ailments all fall under the umbrella of mental health. Research has found poor nutrition may be a significant risk factor for mood disorders (Bodnar & Wisner, 2005; Oddy et al., 2009; HHS & USDA, 2015; Yim, 2015). Not having an adequate intake of fruits and vegetables is a contributing factor for poor nutrition. Also, unfavorable eating behaviors may cause poor mental health (Li et al., 2009). For example, having the proper levels of ascorbic acid was shown to decrease depression scores in adult participants. Ascorbic acid is a nutrient found in fruit. Thus, the intake of fruit, or the lack thereof, could impact mental health (Brody, 2002; Logan, 2006). Poor diets could be a risk factor for mental health, and healthy diets could reduce the risk of mental illness (Jacka et al., 2010, 2011; Liu et al., 2016; Oddy et al., 2009; Yim, 2015). Adolescents that ingested

high amounts of fast food were 1.89 times more likely to experience adverse mental health, and those who ingested leafy green vegetables were 2.05 times less likely to experience adverse mental health (Oddy et al., 2009). It is important foods available to adolescents are reflective of healthy eating. Developing research indicates regular diet plays a significant role in mental health (Jacka et al., 2011; Jacka, Rothon, Taylor, Berk, & Stansfield, 2013; Jacka, Cherbuin, Anstey, & Butterworth, 2015). A healthy diet should include a combination of green vegetables and one to three servings a day of fruit (Kim et al., 2015).

Fruit and Vegetable Intake and Depression

One category of mental health often discussed is depression. Depression is known to be a significant risk factor for suicidal ideation and suicide attempts; however, not everyone who engages in suicidal ideation shows signs of depression (Lowry et al., 2014). Thus, it is necessary to examine possible direct risk factors for suicidal ideation or suicide attempts. It is possible specific risk factors for depression may be the same for suicidal ideation or suicide attempts. Multiple researchers have identified that the reduced intake of fruits and vegetable associates with depression and an increase in the consumption of fruits and vegetables decreases depression (Allgöwer et al., 2001; Jacka, Mykletun, & Berk, 2012). However, findings are inconsistent because it has also been reported that there is no association between healthy diets which consists of high intake of fruits and vegetables with depressive symptoms (Hayward et al., 2016; Murakami & Sasaki, 2010). Just because an association between dietary intake of fruits and vegetables links with depression does not mean the same association will occur with suicidal

ideation or suicide attempts.

Fruit and Vegetable Intake and Suicidal Ideation

If diet associates with mood and depression, then it is possible diet also associates with suicidal ideation or suicide attempts. Li, Zhang, and McKeown (2009) found adults who have a lifetime history of suicide attempts significantly under consumed fruits and vegetables. Males were 2.47 times more likely to under-consume vegetables while females were 2.36 times more likely to under-consume fruit (Li et al., 2009). Yim (2015) identified a similar relationship between fruit and vegetable intake and suicidal ideation in Korean adolescents. Also, Logan (2006) stated food containing dietary fiber such as fruits and vegetables tend to be avoided by those who commit suicide. The research conducted by Zhang, Li, and Torres (2005) supports this claim as they identified participants who reported attempting suicide had lower daily dietary fiber intake than nonattempters. In females, those who attempted suicide had a daily intake of 12.8g of dietary fiber versus nonattempters who had a daily intake of 14.41g of dietary fiber (Zhang et al., 2005). However, findings are inconsistent because other researchers have reported the lack of an association between dietary intake of fruits and vegetables with suicidal ideation or suicide attempts (Hayward et al., 2016; Murakami & Sasaki, 2010).

Critique of Methods

Researchers utilized multiple research designs when examining the relationship between dietary intake and mental health (Burke et al., 2016; Cartwright et al.2003; Diep et al., 2014; Thomson & Ravia, 2011). Majority of the studies reviewed were quantitative, cross-sectional studies utilizing archival data. The main limitation of cross-

sectional studies was researchers were not able to identify causal relationships between variables (Auerbach, Millner, Stewart, & Esposito, 2015; Badr, 2017; Ball et al., 2009; Cavadini, Siega-Riz, & Popkin, 2000). In addition, it is not possible to test how the participants transitioned from one variable to the other. Another method used was the systematic review of the literature or meta-analysis. Systematic reviews are often limited due to minimal power available (Cairns et al., 2014). Also, specific search strategies used may unintentionally exclude related articles (Diep et al., 2014; Thomson & Ravia, 2011). Another limitation for systematic reviews is research with negative results may not have been published leading to an inflation of effect sizes (Thomson & Ravia, 2011). Some researchers were able to conduct a longitudinal study with set assessment periods scheduled during the course of the study (Burke et al., 2016; Cartwright et al., 2003; Duong & Roberts, 2016; Jacka et al., 2011; Kuramoto-Crawford et al., 2017; LaVome, Droege, Hipwell, Stepp, & Keenan, 2016; McIntyre et al., 2013). When utilizing the longitudinal study design researchers may have a limited time frame in which to conduct follow- up assessments and thus are not able to thoroughly examine the effect of the independent variable on the dependent variable (Burke et al., 2016). Also, participants may drop out of the study between assessments and introduce bias into the study (Kuramoto-Crawford et al., 2017; LaVome et al., 2016; McIntyre et al., 2013). Lastly, some researchers used the qualitative method to examine dietary habits of adolescents (Christiansen et al., 2013; Goldfarb et al., 2014). The main limitation of the qualitative design is the findings cannot be generalized to the larger population (Christiansen et al.,

2013). The qualitative design was not a proper research design to utilize for this research study because the research questions were not qualitative.

Conclusion

Based on the literature reviewed, most of the research conducted regarding the relationship between dietary intake and mental health has been done in adults leaving gaps in the literature regarding adolescents (O'Neil et al., 2014). The research conducted using the adolescent population has been done using subjects living in other countries such as Australia and Korea, where the diets differ from the diet in the United States, and thus cannot be generalized to U.S. adolescents. Also, very few research studies focus on the direct association between dietary intake and suicidal ideation or suicide attempts. This research study helps to increase the understanding of the relationship between mental health and suicidal ideation or suicide attempts in adolescents in the United States.

Chapter 3: Research Method

Research Design and Rationale

This quantitative, retrospective, cross-sectional study was designed to examine whether dietary intake of fruits and vegetables is associated with suicidal ideation or suicide attempts in adolescents. The dependent variables for this study were suicidal ideation and suicide attempts. The independent variable was dietary intake of fruits and vegetables. If dietary consumption of fruits and vegetables were associated with suicidal ideation or suicide attempts in adolescents, then the statistical interaction would be statistically significant based on the *p*-value previously selected. Because the research questions and hypotheses were quantitative, quantitative data were required to address the research questions and hypotheses. A retrospective, cross-sectional design using secondary data were appropriate to address the research questions and hypotheses because the purpose of the study was to determine if dietary intake of fruits and vegetables associates with suicidal ideation and/or suicide attempts in adolescents. The YRBSS data that were obtained were valid, reliable, and stratified to be nationally representative of high school students in the United States (CDC, 2013).

Setting and Sample

The CDC developed the YRBSS, which involves a national, school-based survey administered to students in Grades 9-12. Students are sampled to make sure that the population is representative of U.S. high school students of all races (CDC, 2013). The purpose of the survey is to track and assess the top risky health behaviors among adolescents. The questions included in the questionnaire are based on chronic diseases

and illnesses known to have a high morbidity or mortality rate among adolescents and young adults (CDC, 2013). The sample used in the YRBSS survey was collected using a three-stage cluster sample design in addition to stratification to ensure that YRBSS data would be representative of U.S. high school students (CDC, 2013). The YRBSS database included the demographic and behavioral variables necessary to test the hypotheses of this study.

Sampling and Sampling Procedures

The sampling plan used by the CDC is a three-stage cluster sampling design, which is a variation of the multistage cluster sampling strategy. This particular design ensured that the final population sample for the study was as representative of the total population as possible. This design also ensured that any potential selection biases were reduced as much as possible (CDC, 2013). The three-stage cluster sampling strategy is a useful way to stratify the sampling population when appropriate sampling frames are unavailable (Crosby et al., 2013). The sampling frames are used to identify all of the possible elements found within a specific population. Three different sampling levels were used to obtain the final sample of adolescents. First, the total sample population was divided into specific primary sampling units (PSUs). The PSUs consisted of larger counties or subgroups of smaller counties (CDC, 2013). Next, specific schools were selected from the PSUs. Schools were identified based on enrollment. Any school consisting of Grades 9-12 was classified as whole, whereas schools containing any combination of Graded 9-12 were identified as fragmented. Two fragmented schools were combined to match whole schools (CDC, 2013). Lastly, students were selected as

survey participants. The selection was made by selecting two classes from each grade in each school previously chosen in Level 2 (CDC, 2013).

Before the CDC administers the YRBSS in any chosen school, parental permission must be obtained. There are two different methods with which permission to participate can be obtained. One method is the active permission policy, where parents must return a signed permission form for their children to participate. The other method is the passive permission policy method where the parents return the permission form if they do not wish for their children to participate (CDC, 2013). Data collectors in charge of administering the questionnaire are thoroughly trained and have a standardized script containing necessary information concerning the survey. The survey is created and delivered to allow for anonymous responses and voluntary participation (CDC, 2013). For example, the survey is self-administered, and the students are encouraged to seal their answer booklets in an envelope provided before returning their completed survey to the administrator. Any student absent on the day that the survey is administered is allowed to complete the survey at a later date only if the student's privacy can be maintained. Allowing missing students to take the survey at a later time increases student response rates and provides data most representative of the general adolescent population (CDC, 2013). For example, students who tend to be frequently absent from school, especially those who are absent without parent permission, tend to engage in more risky behaviors than other students.

Sample Weights

In order to adjust for any school and student nonresponse, a sample weight was applied to each reported record. The applied weights also adjusted for the oversampling of Black and Hispanic students. The weight was based on participant sex, race/ethnicity, and grade level (CDC, 2013). The weights were scaled so that the final weighted counts of students were equal to the total sample size. In addition, the weighted proportions of students in each grade level matched the national population proportions of students (CDC, 2013). Adding the sample weights ensured that the data were representative of public and private students in Grades 9-12 in the United States.

Inclusion and Exclusion Criteria

Inclusion Criteria

The inclusion criteria required YRBSS participants to have complete data regarding depression, suicidal ideation, suicide attempts, and fruit and vegetable intake.

Exclusion Criteria

Participants were excluded from the study if the YRBSS questionnaire data were not complete regarding critical variables. Additionally, participants who indicated that they were not in Grades 9-12 were excluded.

Instrumentation and Materials

The instrument of choice for this research study was the CDC's YRBSS. The YRBSS was reliable and was designed specifically for high school students. Moreover, the YRBSS included a large sample size (CDC, 2013). The YRBSS consisted of all of the necessary variables for this study and was obtained from the CDC's YRBSS website.

Because the YRBSS data were in the public domain, permission was not required to access the data (CDC, 2013).

Suicidal Ideation

Suicidal ideation was operationally defined with reference to YRBSS Self-Report Items 27-28, which asked the participants to indicate if they had seriously considered attempting suicide in the past 12 months or had made a plan about how to attempt suicide in the past 12 months.

Suicide Attempt

Suicide attempt was operationally defined as how many times the participant had attempted to commit suicide in the past 12 months. Suicide attempt scores ranged from 0 to 6 or more. The variable was dichotomized as suicide attempter versus nonsuicide-attempter. Students who indicated that they had never attempted suicide were placed in the nonsuicide-attempter group, and students who reported that they had attempted suicide at least one or more times were placed in the suicide attempter group.

Fruit and Vegetable Intake

Fruit and vegetable intake was operationally defined as the sum of YRBSS Items 73-77, which asked the participants to indicate how many times they ate fruit, green salad, potatoes, carrots, and other vegetables in the past 7 days.

Depression

Depression was operationally defined with reference to YRBSS self-report data indicating if, during the past 12 months, participants ever felt so sad or hopeless almost

every day for at least 2 weeks in a row that they stopped doing some of their usual activities.

Procedures

Permissions and Approval

This study received approval from the Walden University Institutional Review Board (06-01-18-0419600) before secondary data collection. Because the YRBSS questionnaire was in the public domain, no additional permission was required (CDC, 2013).

Data Collection

The data for this archival study were collected from the CDC's YRBSS conducted between 2007 and 2017. The survey data were acquired via Internet download from the YRBSS database.

Data Management

Data downloaded from the YRBSS database were checked for errors and exclusion criteria. Hypothesis testing was conducted using SPSS, version 24 software. Descriptive statistics of participant characteristics were provided.

Research Questions and Hypotheses

RQ1: Is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

$H_0$1: There is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

H_A1: There is a relationship between the intake of fruits and vegetables

and suicidal ideation in adolescents.

RQ2: Is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

$H_0$2: There is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

H_A2: There is a relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

RQ3: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

$H_0$3: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

H_A3: Controlling for age, sex, race, and depression, there is a relationship between the intake of fruits and vegetables with suicidal ideation in adolescents.

RQ4: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

$H_0$4: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

H_A4: Controlling for age, sex, race, and depression, there is a relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

Dependent Variables

The dependent variables for this study were suicidal ideation and suicide attempt.

Independent Variable

The independent variable for this study was dietary intake of fruits and vegetables. The control variables were age, sex, race, and depression.

Table 1

Variable Table

Variable name	Type of variable	Level of measurement
Dietary intake of fruits and vegetables	Independent variable	Interval/ratio
Age	Control variable	Interval/ratio
Sex	Control variable	Nominal; dichotomous
Race	Control variable	Nominal
Depression	Control variable	Nominal; dichotomous
Suicidal ideation	Dependent variable	Nominal; dichotomous
Suicide attempts	Dependent variable	Nominal; dichotomous

Statistical Analysis

All hypotheses were tested in SPSS version 24 using complex samples binomial logistic regression. The dependent variable was suicidal ideation or suicide attempts. The independent variable was dietary intake of fruits and vegetables.

Univariate and Bivariate Analysis

Univariate analysis was conducted using descriptive statistics. The results were reported using tables, bar charts, and histograms, depending on the most appropriate method. Next, to determine the relationship between two variables, bivariate analysis was conducted. Complex samples binomial logistic regression was used to test the association of dietary intake of fruits and vegetables with suicidal ideation and with suicide attempts. Binomial logistic regression was the appropriate statistical test because suicidal ideation was measured on the dichotomous scale and the independent variable was measured on the continuous scale (Laerd Statistics, n.d.). The dependent variable of suicide attempts was dichotomized. The hypotheses were tested at the $p < .05$ threshold for statistical significance.

Sample Size Calculations

The sample size was calculated using G*Power 3.1 software. The option for "logistic regression" was selected because logistic regression was the primary statistical analysis. A priori analysis was selected to compute the necessary sample size based on the chosen alpha, power, and effect size. The odds ratio option was used to calculate the expected effect size. The odds ratio was set at 1.32 and the Prob(Y = 1 | X = 1) H0 was set as 0.09. The odds ratio and predicted probability values were chosen based on values

identified in a similar study (Yim, 2015). The effect size was estimated to be 0.5 to account for the moderate association between the covariates and the dependent variables. Because the effect size is was estimated as 0.5, the R^2 value was entered as 0.25. The alpha was entered as 0.05, and the power was entered as 0.80 because these values are commonly used in statistical testing (Szklo & Nieto, 2014). Last, X parm μ was entered as [0], and X parm σ was entered as [1]. The program calculated a minimum sample size of 1,639. The sample size calculated by the G*Power program ensures that the power of the statistical test is as high as possible and that the null hypothesis will be correctly rejected if necessary (Sullivan, 2012). However, it is imperative to note that the actual effect size cannot be determined until after the completion of statistical analysis (Sullivan, 2012).

Instrumentation and Operationalization of Constructs

The data for this study came from the YRBSS. The YRBSS was designed to obtain information about the health behaviors of adolescents in the United States. To develop the questionnaire, the CDC conducted an initial study in 1988 to identify the leading causes of deaths among adolescents. The same exact study was repeated in 2008 to determine any changes in the causes of deaths initially identified (CDC, 2013). The four specific causes of death identified were motor-vehicle crashes, unintentional injuries, homicide, and suicide. The YRBSS was an appropriate database for this study because the YRBSS was explicitly stratified to be representative of American high school youth and included reliable assessment data for testing the identified study hypotheses.

The reliability of the YRBSS questionnaire was conducted using the test-retest method. The first round was conducted in 1992 and the second was conducted in 2000. The 1991 version of the questionnaire was given to a sample of 1,879 adolescents who took the questionnaire on two different occasions (Brener, Kann, McManus, Kinchen, Sunberg, & Ross, 2002; CDC, 2013). The results obtained proved approximately three-fourths of the questions has substantial reliability. There were not any statistically significant differences observed between the two retakes. However, since responses obtained from Grade 7 students were less consistent than the responses obtained from students in higher grades, the questionnaire seems to be better suited for adolescents in Grades 9-12 (CDC, 2013). The second reliability test was conducted using the 1999 version of the questionnaire and administered to 4,619 high school students. Any questions raising reliability concerns were either revised or deleted from future versions of the questionnaire (Brener et al., 2002; CDC, 2013).

Researchers from the CDC have reviewed existing literature for any potential cognitive or situational factors that may impact the validity of self-reported behaviors (Brener et al., 2002; CDC, 2013). Based on the literature, there is not a specific factor that will affect the validity of any behavior equally. The validity of each self-reported behavior differs depending on the ability of the behavior to be validated by an objective measure (Brener et al., 2002; CDC, 2013; Szklo & Nieto, 2014). However, it is important to note over reporting and underreporting could present an issue in varying degrees with the self-reported behavior identified in the YRBSS (CDC, 2013). May and Klonsky (2011) conducted a study examining the convergent and discriminant validity of

the YRBSS suicide items. They found the suicide items were correlated with other items measuring suicidality and with criterion items that were similar (May & Klonsky, 2011). These specific results concerning the validity of suicide items included on the YRBSS indicates these items are accurate for estimating teen suicidality.

Operationalization of Constructs

Adolescents

Adolescence was defined as anyone who is enrolled in high school from Grades 9-12. According to the YRBSS survey, any participant who indicated they are not in Grades 9-12 is excluded. On the YRBSS questionnaire, Question 3 asks "*In what grade are you?"* The available responses were 9th grade; 10th grade; 11th grade; 12 grades; and Ungraded or another grade. Participants who responded "E" were excluded from this study for failing to meet the inclusion criteria of being a high school student in Grades 9-12.

Suicidal Ideation

Suicidal ideation was operationally defined as YRBSS self-report Items 27-28, which asks the participants to indicate if they seriously considered attempting suicide in the past 12 months or if the participant made a plan about how to attempt suicide in the past 12 months. On the YRBSS, question 27 asks "*during the past 12 months, did you ever seriously consider attempting suicide*?" Question 28 asks "*during the past 12 months, did you ever make a plan about how you would attempt suicide*?" The available responses were yes or no. The dummy coding was [0 = No] and [1 = Yes].

Suicide Attempt

Suicide attempt was operationally defined as how many times the participant attempted to commit suicide in the past 12 months. *Suicide attempt* scores ranged from 0 to 6 or more. On the YRBSS, Question 29 asks "*during the past 12 months, how many times did you actually attempt suicide*?" The available responses were 0 times; 1 time; 2 or 3 times; 4 or 5 times; and 6 or more times.

The responses were separated into two groups to dichotomize the variable. Students who indicated they have never attempted suicide were coded into the "no" group. On the other hand, students who indicated they have attempted suicide at least one or more times were coded in the "yes" group. The dummy coding was [0 = No] and [1 = Yes].

Dietary Fruits and Vegetables

Fruit and vegetable intake was operationally defined as the sum of YRBSS Items, 73-77, which asks the participants to indicate how many times they ate fruit, green salad, potatoes, carrots, and other vegetables in the past seven days. YRBSS Dietary Fruit and Vegetable Items are as follows: *(73) during the past 7 days, how many times did you eat fruit? (Do not count fruit juice.); (74) during the past 7 days how many times did you eat green salad; (75) during the past 7 days how many times did you eat potatoes? (Do not count French fries, fried potatoes, or potato chips.); (76) during the past 7 days how many times did you eat carrots; (77) during the past 7 days how many times did you eat other vegetables? (Do not count green salad, potatoes, or carrots.)* The available responses were I did not eat (specific food) during the past 7 days; 1 to 3 times during the

past 7 days; 4 to 6 times during the past 7 days; 1 time per day; 2 times per day; 3 times per day; and 4 or more times per day. The items were scored using the midpoint of the response and then summed so the score reflected the number of times fruits and vegetables were consumed in a week.

Depression

Depression was operationally defined as the YRBSS self-report of if the participant ever felt so sad or hopeless almost every day for at least two weeks in a row that they stopped doing some of their usual activities. On the YRBSS, Question 26 asks "*during the past 12 months, did you ever feel so sad and hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities*?" The available responses were yes or no. The dummy coding was [0 = No] and [1 = Yes].

Threats to Validity

It is essential to consider risks to validity to determine if other forces may have influenced the results. Possible threats to internal validity include history, maturation, experimental mortality, instrumentation, and testing (Creswell, 2009). History is a threat to validity when a study is conducted over a period, and an unanticipated event affects participant responses. On the other hand, maturation becomes a threat to validity when a developmental change happens among the participants and the responses are altered. However, in this study history or maturation was not a threat to validity because the study was cross-sectional and did not include measures over time (Creswell, 2009). Experimental mortality occurs when participants drop out of a study before all data points are collected. However, experimental mortality was not a concern due to the cross-

sectional nature of the study (Creswell, 2009). Other threats to internal validity include instrumentation and testing. Instrumentation would be a threat to validity if the instruments used to collect data change over the course of the study. In this study the measuring instrument was identical for all participants. Lastly, testing is a threat to validity when previous exposure to the measuring instrument affects scores collected at following data points. This type of risk to validity typically occurs in pretest-posttest designs (Creswell, 2009). Due to the cross-sectional nature of the study design, testing was not a threat to validity.

Presentation of Findings

Descriptive data were presented utilizing means, standard deviations, and frequencies as appropriate. For both hypotheses, the results included the overall model fit along with the coefficients. Also, the *p*-value was reported.

Compliance With Ethical Guidelines and Protection of Participants

This study complied with the ethical guidelines of Walden University and the American Psychological Association, including privacy, confidentiality, and anonymity. Data were collected from the CDCs YRBSS archival database only after the Walden University IRB board granted permission. Since this study used archival data, participants did not need to provide informed consent beyond the informed consent provided when they agreed to participate in the YRBSS study. The CDCs internal Institutional Review Board previously approved the research for the national study and is considered to be a public domain. Therefore, no additional permission was required to conduct this study. The YRBSS data is publicly available and uses codes throughout the

data, excluding names or other individually identifying information to protect participant privacy

Summary

This quantitative, retrospective, cross-sectional study was designed to examine the association between the dietary intake of fruits and vegetables with suicidal ideation and suicide attempts in adolescents. Quantitative data from the YRBSS database was obtained to answer four research questions: (1) is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?; (2) is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?; (3) controlling for age, sex, race, and depression is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?; (4) controlling for age, sex, race, and depression is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents? YRBSS data ranging from Years 2007 through 2017 were downloaded from the YRBSS website and analyzed using SPSS version 24 software. Complex samples binomial logistic regression was used to test the relationship between dietary intake of fruits and vegetables and control variables with suicidal ideation and with suicide attempts.

Chapter 4: Results

Introduction

The purpose of this cross-sectional, quantitative study was to investigate whether dietary intake of fruits and vegetables was associated with suicidal ideation or suicide attempts in adolescents using the YRBSS from year 2007 through year 2017. The following research questions and hypotheses were addressed:

RQ1: Is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

$H_0$1: There is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

H_A1: There is a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

RQ2: Is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

$H_0$2: There is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

H_A2: There is a relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

RQ3: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

$H_0$3: Controlling for age, sex, race, and depression, there is no

relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

H_A3: Controlling for age, sex, race, and depression, there is a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

RQ4: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

H_04: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

H_A4: Controlling for age, sex, race, and depression, there is a relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

This chapter begins with a review of the data collection process. Next, descriptive statistics are detailed. Then, statistical results to address the research questions are provided.

Data Collection

Data were obtained from the 2007-2017 YRBSS database. The YRBSS database was chosen because it is nationally stratified to be representative of high school students. Of the 89,848 cases, 71,776 cases met the criteria of being in Grades 9-12 and having

complete data regarding depression, suicidal ideation, suicide attempts, as well as fruit and vegetable intake data. Therefore, the final sample size for this study was $N = 71,776$.

Data Analysis

Data were downloaded from the CDC website into SPSS for Windows (Version 24) and then exported to Microsoft Excel for scoring. After scoring, the data were imported back into SPSS v.24 for analysis. Descriptive analysis for demographic data included frequencies, percentages, means, or standard deviations for grade, age, considering suicide, planning suicide, attempting suicide, dietary fruits and vegetables, depression, and race. Hypothesis testing consisted of complex samples logistic regression.

Descriptive Statistics

There were 71,776 participants, and 36,708 (51.1%) were female and 34,965 (48.7%) were male. The 71,776 participants were evenly divided across ninth graders [n = 18,044 (25.1%)], 10th graders [n = 17,584 (24.5%)], 11th graders [n = 18,219 (25.4%)], and 12th graders [n = 17,929 (25.0%)]. Most participants were 15 [n = 16,741 (23.3%)], 16 [n = 18,357 (25.6%)], or 17 [n = 18,478 (25.7%)] years of age. The remaining were 12 years old or younger [n = 75 (0.1%)], 13 years old [n = 54 (0.1%)], or 18 years old or older [n = 10,705 (14.9%)]. Of the 71,776 participants, 31,829 (44.3%) were classified as White, 11,441 (15.9%) were classified as Black or African American, 20,080 (28%) were classified as Hispanic or Latino, and 7,395 (10.3%) were classified as *other*. Among the 71,776 adolescents, 21,627 (30%) indicated that they had felt sad or hopeless almost every day in a row for the past 2 weeks; 11,561 (16.1%) indicated that they had

seriously considered suicide within the past 12 months; 9,493 (13.2%) indicated that they had made a plan to attempt suicide within the past 12 months; and 5,748 (8%) indicated that they had attempted suicide within the past 12 months.

The average age of participants was 16.112 years old (*SD* = 1.228; range = 12-18; *SEM* = .005), and participants averaged 2.637 portions of fruits and vegetables per week (*SD* = 2.638; range = 0- 20.00; *SEM* = 0.010).

Table 2

Baseline Characteristics of Study Participants Stratified by Suicidal Ideation

Variable	Total population (*n* = 71,776)	Suicidal ideation (*n* = 21,054)	No suicidal ideation (*n* = 50,722)
Demographic risk factors			
Female	51.1%	13.8%	88.5%
Mean age	16.1	7.78%	43.4%
Mean fruit and vegetable intake	2.64	4.37%	0.672%
Ethnicity			
Non-Hisp. White	44.3%	12.6%	76.1%
Non-Hisp. Black	15.9%	4.02%	27.8%
Hispanic	28%	5.94%	47.3%
Other	10.3%	3.66%	16.9%

Note. Intake of fruits and vegetables = servings per week.

Table 3

Baseline Characteristics of Study Participants Stratified by Suicide Attempts

Variable	Total population (*n* = 71,776)	Suicide attempts (*n* = 5,748)	No suicide attempts (*n* = 66,028)
Demographic risk factors			
Female	51.1%	5.39%	31.6%
Mean age (SE)	16.1	2.17%	23.4%
Mean fruit and vegetable intake	2.64	0.183%	2.34%
Ethnicity			
Non-Hisp. White	44.3%	2.82%	41.5%
Non-Hisp. Black	15.9%	1.34%	14.6%
Hispanic	28%	2.67%	25.3%
Other	10.3%	1.02%	9.28%

Note. Intake of fruits and vegetables = servings per week.

Summary of Participant Characteristics

This sample of 71,776 adolescents was evenly distributed across Grades 9-12, was well distributed across ages 14-18, and included a wide range of fruit and vegetable intake levels. Therefore, this sample was appropriate to test the research questions of this study, as detailed in the next section.

Results From Hypothesis Testing

Four research questions were addressed using complex samples logistic regression.

Research Question 1

Research Question 1: Is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

Null Hypothesis 1: There is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

Research Question 1 was tested using complex samples logistic regression. Null Hypothesis 1 was rejected because considering suicide and planning suicide were significantly associated with the intake of fruits and vegetables ($p < 0.05$). While statistically significant, the relationship was weak. The Nagelkerke R square for considering suicide was 2.7% and 1.8% for planning suicide. The relationship was positive in direction, indicating that the higher the intake of fruits and vegetables, the greater the odds of considering or planning suicide. As the intake of fruits and vegetables increased, the odds of considering suicide were 1.031 times greater. In addition, as the dietary intake of fruits and vegetables increased by one serving per week, the odds of planning suicide were 1.039 times greater.

Table 4

Complex Samples Logistic Regression Odds Ratios for Research Question 1

Variable	Odds ratio	95% confidence interval	
		Lower	Higher
Considered suicide	1.031	1.020	1.041
Planned suicide	1.039	1.027	1.051

Research Question 2

Research Question 2: Is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

Null Hypothesis 2: There is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

Research Question 2 was tested using complex samples logistic regression. Null Hypothesis 2 was rejected because attempting suicide was significantly associated with intake of fruits and vegetables ($p < 0.05$). While statistically significant, the relationship was weak. The Nagelkerke R square for attempting suicide was 2.9%. The relationship was positive in direction, indicating that the higher the intake of fruits and vegetables, the greater the odds of attempting suicide. As the intake of fruits and vegetables increased by one serving per week, the odds of attempting suicide were 1.078 times greater and the Null Hypothesis was rejected.

Table 5

Complex Samples Logistic Regression Odds Ratios for Research Question 2

Variable	Odds ratio	95% confidence interval	
		Lower	Higher
Attempting suicide	1.078	1.065	1.091

Research Question 3

Research Question 3: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicidal ideation in adolescents?

Null Hypothesis 3: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicidal ideation in adolescents.

Research Question 3 was tested using complex samples logistic regression. Null Hypothesis 3 was rejected because considering suicide and planning suicide were significantly associated with the intake of fruits and vegetables ($p < 0.05$). While statistically significant, the relationship was moderate. The Nagelkerke R square for considering suicide was 28.8% and 23.2% for planning suicide. The relationship was positive in direction, indicating that the higher the intake of fruits and vegetables, the greater the odds of considering or planning suicide. As the intake of fruits and vegetables increased, the odds of considering suicide were 1.019 times greater. In addition, as the intake of fruits and vegetables increased by one serving per week, the odds of planning

suicide were 1.027 times greater

Table 6

Complex Samples Logistic Regression Odds Ratios for Research Question 3

Variable	Odds ratio	95% confidence interval	
		Lower	Higher
Considered suicide	1.019	1.010	1.028
Planned suicide	1.027	1.016	1.037

Research Question 4

Research Question 4: Controlling for age, sex, race, and depression, is there a relationship between the intake of fruits and vegetables and suicide attempts in adolescents?

Null Hypothesis 4: Controlling for age, sex, race, and depression, there is no relationship between the intake of fruits and vegetables and suicide attempts in adolescents.

Research Question 4 was tested using complex samples logistic regression. Attempting suicide was significantly associated with intake of fruits and vegetables ($p < 0.05$). While statistically significant, the relationship was moderate. The Nagelkerke R square for attempting suicide was 22.9%. The relationship was positive in direction, indicating that the higher the intake of fruits and vegetables, the greater the odds of attempting suicide. As the intake of fruits and vegetables increased by one serving per week, the odds of attempting suicide were 1.066 times greater.

Table 7

Complex Samples Logistic Regression Odds Ratios for Research Question 4

Variable	Odds ratio	95% confidence interval	
		Lower	Higher
Attempting suicide	1.066	1.053	1.078

Summary of Results

This chapter has provided demographic descriptive results and the results of hypothesis testing. Participant data were evenly distributed across Grades 9-12 and well distributed across ages 14-18. A full range of fruit and vegetable intake was obtained, averaging 2.637 portions of fruits and vegetables per week. Suicidal ideation was significantly, positively correlated with fruit and vegetable intake. This finding resulted in the rejection of Null Hypothesis 1. Suicide attempts were significantly, positively correlated with fruit and vegetable intake, resulting in the rejection of Null Hypothesis 2. Controlling for age, sex, race, and depression, suicidal ideation was significantly, positively correlated with the intake fruits and vegetables. This finding resulted in the rejection of Null Hypothesis 3. Last, controlling for age, sex, race, and depression, suicide attempts was significantly, positively correlated with fruit and vegetable intake. Thus, Null Hypothesis 4 was rejected.

These findings indicate that the higher fruit and vegetable intake per week was, the greater the odds of suicidal ideation and suicide attempts were among this sample of 71,776 adolescents in high school.

Chapter 5: Discussions, Conclusions, and Recommendations

Introduction

The purpose of this quantitative, retrospective study was to determine whether there is a relationship between fruit and vegetable intake and suicidal ideation or suicide attempts in adolescents. If fruit and vegetable intake had a relationship with suicidal ideation or suicide attempts, the interaction between the variables would be statistically significant in the study's sample of adolescents in high school. This inquiry was important because adolescent suicide in the United States continues to be a significant cause of death and an increasingly important public health issue, and the effect of poor dietary habits upon suicidal ideation and suicide attempts is not well understood.

Interpretation of Findings

Suicidal ideation was significantly, positively correlated with fruit and vegetable intake. Even after controlling for age, sex, race, and depression, there was a significant, positive correlation of suicidal ideation with dietary fruit and vegetable intake. Suicide attempts was significantly, positively correlated with fruit and vegetable intake, even after controlling for age, sex, race, and depression. These findings indicate that the higher an adolescent's fruit and vegetable intake per week, the greater the odds of suicidal ideation and suicide attempts were. These results are contrary to previous findings. Depression is known to be a significant risk factor for suicidal ideation and suicide attempts, and multiple researchers have identified reduced intake of fruits and vegetables as being associated with depression and increased consumption of fruits and vegetables as being associated with decreased depression (Allgöwer et al., 2001; Jacka,

Mykletun, & Berk, 2012). Thus, it was assumed that suicidal ideation and suicide attempts would have a similar relationship with the intake of fruits and vegetables. Li, Zhang, and McKeown (2009) found that adults who had a lifetime history of suicide attempts significantly underconsumed fruits and vegetables. Yim (2015) identified a similar relationship between fruit and vegetable intake and suicidal ideation in Korean adolescents.

While researchers and physicians understand that nutrition is relevant for both physical and mental health, diet may not be relevant in the manner previously thought, and the results of this study support that claim (Rahe et al., 2015). Although the results of this study were contrary to previous findings where an increase in the intake of fruit and vegetables lowered the odds of suicidal ideation and suicide attempts, these results do support the claim that sugary foods and fast foods have a dopaminergic "reward effect." As the intake of fruits and vegetables decreases, it is assumed that the intake of fast foods and sweets increases (Jacka, Cherbuin, Anstey, & Butterworth, 2014). Fatty foods and sugar consumption is linked to behavioral signs of dependence, meaning that there are reduced levels of dopamine receptors in the brain. This reduction in dopamine receptors is like the reduction of dopamine receptors that occurs in drug-addicted individuals (Pretlow, 2011). As the dopamine receptors in the brain decrease, the reward value is reduced, and, in this case, one must eat more and higher pleasure-level foods to obtain the same degree of comfort (Avena & Hoebel, 2003; Cheval, Audrin, Sarrazin, & Pelletier, 2017; Pretlow, 2011; Smith & Robbins, 2012). As adolescents eat to ease emotional distress, changes in dopamine receptors occur. Once significant changes in dopamine

receptors occur, it becomes more difficult to cease eating unhealthy foods. Aversion to withdrawal symptoms such as cravings, irritability, and depression add to the vicious cycle (Pretlow, 2011; Schulte, Potenza, & Gearhardt, 2017). When the diet changes to reduce foods high in fat and sugar, one will experience withdrawal symptoms. Experiencing withdrawal symptoms may explain why the participants in this study with a higher intake of fruits and vegetables had greater odds of experiencing suicidal ideation and suicide attempts.

During the adolescent years, many teens become concerned with their weight and body image. This leads many to engage in dieting behaviors. Dieting during adolescence is associated with higher levels of depression and suicidal ideation (Cairns, Yap, Pilkington, & Jorm, 2014; Cortese et al., 2009). In addition, those who use unhealthy weight control practices are at a greater risk for experiencing psychological distress (Cohen et al., 2002). Researchers have found that those who have higher body mass index (BMI) and poor body image are at greater risk for suicidal ideation and suicide attempts (Duong & Roberts, 2016; Eaton et al., 2005). It is possible that the students in this study who had a higher intake of fruits and vegetables were dieting due to poor body image. In addition, bullying and ostracization due to body image my influence an adolescent's decision to engage in unhealthy dieting practices and may lead to suicidal ideation and suicide attempts.

Other researchers have reported the lack of an association between the intake of fruits and vegetables and suicidal ideation or suicide attempts (Hayward et al., 2016; Murakami & Sasaki, 2010). However, the results obtained in this study show a different

relationship than what has been previously reported between fruit and vegetable intake and suicidal ideation or suicide attempts. Thus, it is highly possible that other important factors influence the relationship between fruit and vegetable intake and suicidal ideation or suicide attempts. For example, it is possible that adolescents who report higher fruit and vegetable intake have unbalanced diets and lack proper protein intake. Increasing the variety of nutrient-dense foods within and across food groups also helps to ensure adequate intake of essential nutrients (Vilela, Hetherington, Oliveria, & Lopes, 2018). In addition, the relationship of fruit and vegetable intake with suicidal ideation or suicide attempts may be impacted by other factors that were not controlled for in this study, such as BMI or body image.

Limitations of Study

This study was limited by sample, measures, and research design. Although the present sample was stratified to be representative of the nation's adolescent population, it was not designed to explore regional differences. The dietary measure of fruit and vegetable intake did not include unhealthy eating habits. The dietary measure also did not include a measure of caloric intake or a distinction between fruits and vegetables that are low in glycemic load and higher in fiber and those that are starchy. In addition, the study did not account for socioeconomic status and cultural preferences in food choices. This study was retrospective in nature and did not include random assignment into groups or experimentally controlled levels of dietary intake. A true experimental design with random assignment and experimentally controlled treatments would be necessary to determine true cause-and-effect relationships (Creswell, 2014).

Recommendations for Future Studies

The present study should be replicated with a more diverse sample assembled by state to investigate possible cultural and regional differences. In addition, researchers conducting future studies in this area should pay closer attention to other components of dietary intake such as protein intake and fuller measures of dietary behavior. Future researchers should also account for socioeconomic status and cultural preferences. Because obese individuals may self-medicate via direct manipulation of neurotransmitter levels by overconsumption of high-fat and high-sugar foods, future researchers may need to repeat this study, controlling for the BMI of the participants (Smith & Robbins, 2012). In addition, a longitudinal study needs to be conducted to determine if dietary fruit and vegetable intake causes suicidal ideation or suicide attempts. The longitudinal study would need to include a dose-response analysis to evaluate if the relationship of dietary fruit and vegetable intake to suicidal ideation or suicide attempts is a graded relationship. Further, this study design would allow adolescents to be assessed at baseline.

Implications for Positive Social Change

The results of this study may foster positive social change by identifying the relationship between fruit and vegetable intake and suicidal ideation or suicide attempts in adolescents. Present findings imply that increasing fruit and vegetable intake can increase the risk of experiencing suicidal ideation or suicide attempts. This is important because adolescent suicide in the United States continues to be a significant cause of death and an increasingly important public health issue. It is important to determine whether an increase in fruit and vegetable intake is related to a decrease in intake of other

important nutrients and thus leads to an unbalanced diet. In addition, it is important to determine if increase in fruit and vegetable intake in adolescents is related to unhealthy diet practices and poor body image. Legislatures, educators, parents, and other stakeholders can use the knowledge from this study for guidance and direction in creating policies that can positively influence the mental health of adolescents. For example, it may be necessary to regulate dietary intake starting in children in order to avoid activating the dopaminergic "reward effect".

Conclusion

This study of YRBSS data based on 71,776 adolescents found that higher levels of fruit and vegetable intake were associated with higher risk of experiencing suicidal ideation or suicide attempts. These findings highlight the importance of understanding how diet may impact the risk for experiencing suicidal ideation or suicide attempts.

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