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# CONNECTING SELF-EFFICACY OF DIETARY CHOICES AND THE ASSOCIATION WITH DIETARY INTAKE AMONG RURAL ADOLESCENTS IN NORTH CAROLINA AND KENTUCKY

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THESIS

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A thesis submitted in partial fulfillment of the  
requirements for the degree of Master of Science in Nutrition and Food Systems  
in the College of Agriculture, Food and Environment  
at the University of Kentucky

By

Rachel Gillespie

Lexington, Kentucky

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Lexington

2017

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## ABSTRACT OF THESIS

### CONNECTING SELF-EFFICACY OF DIETARY CHOICES AND THE ASSOCIATION WITH DIETARY INTAKE AMONG RURAL ADOLESCENTS IN NORTH CAROLINA AND KENTUCKY

Determining the level of belief one has in themselves, or their self-efficacy, can be a key factor to improve certain dietary patterns and choices in the rural youth population. Sugar sweetened food and beverage consumption continues to rise and fruit and vegetable intake remains a struggle in rural areas; addressing both the food environment and adolescents' self-efficacy could have a lasting impact on changing the nature of a generation of rural student's food and beverage choices. This study measured self-efficacy levels of (n=425) adolescents in rural Kentucky and North Carolina using the Youth Impact Questionnaire and dietary intake using the NHANES Dietary Screener. Multiple linear regression analysis found that higher levels of self-efficacy resulted in a statistically significant ability to consume more vegetables. Further associations found that higher levels of self-efficacy resulted in increased fruit consumption, and improved added sugar food and beverage selections. These findings suggest that it could be beneficial to target adolescents' self-efficacy as a way to modify certain health behaviors in a sparse food environment such as these rural Appalachian areas.

**KEYWORDS:** Self-efficacy, Rural Adolescents, Dietary Intake, Social Cognitive Theory, Rural Obesity

Rachel Gillespie

November 21<sup>st</sup>, 2017

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## **Chapter One: Introduction**

Consumption of sugar sweetened food and beverages has increased over the last three decades, partially do to their excessive availability and mainstream distribution in all food environments, such as grocery stores, gas stations, and other food venues. Fruit and vegetable intake remains to be an issue in rural areas with lower rates of consumption compared to urban. Rural areas may be at an equal disadvantage for providing spaces with access to healthy foods. Although the food environment is a key construct in promoting healthy dietary choices, self-efficacy or the belief in one's ability to make a choice, may also play a role in shaping behaviors within the confines of where adolescents live.

Analyzing the level of rural adolescents' self-efficacy could be a productive way of determining whether healthful food choices could be made. Considering the obesity rate has been steadily increasing over the last few decades, rural areas experience a higher prevalence of overweight and obesity, 38% compared to 31% nationally (Hoying et al, 2016). Exploring the mental power that can influence and determine behavior change is an important component to combating this epidemic. There remains a gap in literature that analyzes together the self-efficacy of a rural adolescent population and their ability to consume and purchase fruits and vegetables, as well as their ability to make sugar sweetened food and beverage adjustments.

### **Problem Statement**

Added sugars from processed foods and beverages along with subsequent low intake of fruits and vegetables may be one part of the rise in obesity rates among rural

adolescents. Strategies promoting improved dietary choices among adolescents may benefit from targeting self-efficacy as a key construct in behavior change.

### **Purpose**

Creating more individualized intervention methods is necessary in order to create behavior change in a population. Interventions that have targeted self-efficacy have been shown to create positive behavior change, which can be catered to making appropriate dietary decisions in a particular environment. Therefore, the purpose of this project is to determine how self-efficacy is associated with certain food choices and eating habits among rural adolescents.

### **Research Questions**

- 1.) Is there an association between self-reported self-efficacy on making reduced sugar food and beverage choices and the intake of added sugars?
- 2.) Is there an association between self-reported self-efficacy on consuming and buying fruits and vegetables and reported intake of fruits and vegetables?

### **Research Hypotheses**

- 1.) The greater the self-reported self-efficacy the more likely to make reduced sugar food and beverage choices versus the intake of added sugars.
- 2.) The greater the self-reported self-efficacy the greater the intake and decision to purchase fruits and vegetables.

### **Justification**

Rural areas in the United States face a number of public health problems. Providing a tailored approach to certain health behaviors, such as increasing fruit and vegetable consumption and making reduced sugar choices, may assist in modifying an

already sparse food environment. Working to improve adolescents' self-efficacy has the potential to improve their dietary choices, and in turn their health and weight status.

## **Chapter Two: Literature Review**

### **Introduction**

Mental acuity or “toughness” can play a role in behavior change when it comes to modifying and improving dietary habits. The degree to which someone exercises those changes is known as one's self-efficacy. However, further exploration remains as to how self-efficacy may play a direct role in adolescent's dietary choices, specifically their fruit and vegetable intake and their intake of sugar-sweetened beverages. The purpose of this thesis is focused on two specific research aims; to determine the association between self-reported self-efficacy on making reduced sugar food and beverage choices and the intake of added sugars, and to determine the association between self-reported self-efficacy on consuming and buying fruits and vegetables and reported intake of fruits and vegetables.

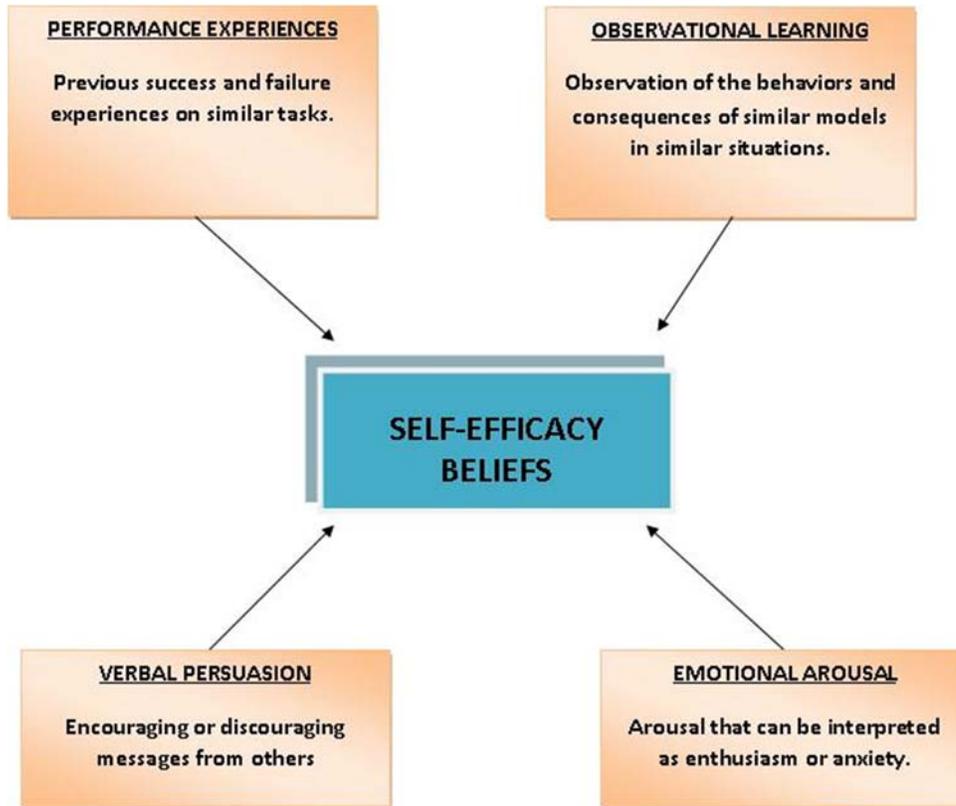
### **Social Cognitive Theory and Self-Efficacy**

Self-efficacy has long been a strong psychological component of human nature when determining whether an individual adapts certain behaviors. It is defined as one's belief in their capability to achieve and execute certain goals or actions. The Social Cognitive Theory suggests that individuals' self-efficacy, outcome expectation, and perceived environmental barriers and facilitators can influence behavior (Lowenstein et al, 2013). In terms of diet changes in individuals, self-efficacy can present the strongest and most deterministic component to accomplishing these positive changes. The Social Cognitive Theory, established by Albert Bandura, encompasses three factors that determine motivation and behavior in individuals- personal, behavioral, and

environmental (Crothers, Hughes, & Morine, 2008). While it can be believed that one factor is more heavily considered than others, all three in conjunction explain human behavior. Self-efficacy in particular is highly associated with goal realization, and directly refers to people's judgments regarding their capability to perform a particular set of tasks (Barline & Beattie, 1983). The basic principle behind self-efficacy is that an individual is more likely to engage in an activity in which they have high self-efficacy, as opposed to an activity in which they do not (Van der Bijl & Shortridge-Baggett, 2002), which essentially makes self-efficacy a functioning self-fulfilling prophecy (Redmond). It has strong influence over people's ability to learn, their motivation to perform, and their desire to engage in a task (Lunenborg, 2011).

The self-efficacy construct describes four sources where an individual's beliefs are developed (see Figure 2.1). Through performance experiences, observational learning, verbal persuasion, and emotional arousal, an individual formulates specific beliefs about their potential. High and low forms of self-efficacy then interact between the individual and their environment, which ultimately produces a certain behavior, or rather, potential for behavior change. Individuals that have a high level of self-efficacy have been found to face a challenge as something to be mastered and learned (Pajares & Schunk, 2001). Although they may face setbacks, they strive to not give up and view the task as an opportunity rather than an impossible barrier (Pajares & Schunk, 2001). Bandura also found that individuals with high levels of self-efficacy are more likely to be committed to setting challenging goals for themselves, which ultimately enhances their self-efficacy through the perseverance to reach that goal (Bandura, 1995).

**Figure 2.1: Albert Bandura’s Social Cognitive Self-Efficacy Construct (Redmond)**



This is an important factor to consider when gauging the behavior and health changes of adolescents. Individuals that engage in a self-efficacy focused intervention or thought process have shown to be more successful in goal achievement or behavior modification (Lunenburg, 2011) (Pajares & Schunk, 2001) (Bandura, 1995) (Roach et al, 2003). Self-efficacy has strong influence on how individuals view themselves and directly targeting this association with diet change and the effect on overall health status could produce the greatest results of change within this demographic.

### **Childhood Obesity Epidemic**

Since the 1980s, the childhood obesity has been rising at epidemic and alarming levels and has emerged to be one of the most serious public health epidemics of the 21<sup>st</sup>

century. Its prevalence among the child population has nearly tripled the last three decades (Gunger, 2014) (Johnson & Johnson, 2015). This is concerning because of the earlier onset of such obesity-related diseases such as hypertension, dyslipidemia, diabetes, fatty liver disease, and other psychosocial complications (Gunger, 2014). Due to its extremely rapid emergence and growth among this generation, each community and demographic is facing its own set of challenges in order to fight and combat this issue. Adolescents and children are forced to cope with a different kind of public health and food environment when growing up in a rural environment versus an urban area in the United States. It is in these environments that children are struggling in across several disciplines than their urban adolescent counterparts.

### **Rural Disparities in Communities**

Emerging literature has begun to support the idea that rural areas reflect poorer health status in adolescents. However, there are several behavioral and environmental characteristics that influence childhood obesity such as socioeconomic status, rural residence, and racial/ethnic minority status, all that have been associated with an increased likelihood of childhood obesity (Johnson & Johnson, 2015). A systematic meta-analysis conducted in 2015 analyzing the childhood obesity prevalence in rural versus urban areas in the United States found that among the 10 included studies, all but one found a higher prevalence or increased risk of obesity among children living in rural areas compared to those living in urban areas (Johnson & Johnson, 2015). Although the pathways leading to childhood obesity are still needing to be understood, it is clear that a rural environment has significant impact on health and weight status of adolescents.

The Appalachian region, in particular, displays a higher prevalence of obesity among adolescents compared to national averages, 38% versus 32% (Hoying, Melnyk, & Arcoleo, 2016). Additionally, mental health problems among these teens show much more prevalence than national frequency rates by three percent (Hoying, Melnyk, & Arcoleo, 2016). It is not uncommon that these two conditions exist together, supporting further evidence of the connection between mental acuity and behaviors within certain geographic areas.

Although the patterns and related factors can be complex, between socioeconomic status, food environment, gender, and ethnicity, it is clear that some population groups are affected more seriously than others (Wang, 2011). These obesity disparities essentially are a result of environmental and genetic interactions, which need to be further studied, but targeting multiple levels of a community and the individual themselves, could help contribute to some improvement within this epidemic (Wang, 2011). Addressing a particular component that is consistently increasing an adolescent's daily caloric intake, such as sugar sweetened beverages, could be a proactive initiative to minimizing disparities in these communities.

### **Sugar Sweetened Beverage and Added Sugar Intake**

Consumption of sugar-sweetened beverages (SSB) has long been suggested to be a contributing factor to obesity rates among adolescents. There has been consistent evidence connecting SSB and weight gain in children and adolescents (Juonala et al, 2011) (Hu & Malik, 2010) (Nestle, 2000) (Kaiser et al, 2013) (Trumbo & Rivers, 2014) (Althuis & Weed, 2013) (Massougbodji et al, 2014) (Harrington, 2008) (Dietz & Gortmaker, 2001). Evidence has suggested that consumption of these sugar-sweetened

beverages contribute between 10% and 15% of an adolescent's daily caloric intake and is the primary source of added sugar in their diet (Keller & Bucher, 2015). The CDC reports that during 2007-2015, daily soda consumption has in fact decreased from 33.8% to 20.5% (Miller et al, 2017). Although there has been a decline, consumption still remains high given the current dietary recommendations of added sugar ingestion per day.

The number of Calories (kcal) per day consumed has increased from 88 to 166 in the last 20 years solely from sugar-sweetened beverages, and although SSB consumption differs by age range, 76% of adolescents are consuming them daily (Scharf & DeBoer, 2016). This can have a drastic effect on body weight status, which highly contributes to our overweight and obesity epidemic. In particular, the *2010 Dietary Guidelines for Americans* recommend reducing sugar-intake and sugar-sweetened beverages because of the strong evidence demonstrated between consumption and weight gain (Dietary Guidelines Advisory Committee, 2010) (*Dietary Guidelines for Americans*, 2010). The CDC also reports that from 2011-2015 daily milk and fruit juice consumption decreased as well from 44.3% to 37.4% and from 27.2% to 21.6% respectively (Miller et al, 2017). These beverages provide a more nutrient dense alternative to soda, yet their level of consumption did not change much over the course of five years. Additional support is necessary to be implemented for adolescents to make more healthful beverage choices, such as low-fat milk or water, in place of soda and SSB.

Despite conflicting studies that did not produce significant findings, the additional calories that teens are consuming due to such an increase in sugar-sweetened beverages intake is a source contributing to the obesity epidemic in the United States (Scharf & DeBoer, 2016) (Dietary Guidelines Advisory Committee, 2010) (*Dietary Guidelines for*

*Americans*, 2010) (Ambrosini et al, 2013) (Stoof, Twisk, & Olthof, 2011). Further evidence has shown that less healthy dietary patterns- such as high fast food consumption, increased portion sizes of food and SSB within those fast food outlets, and a rich Western diet- are contributing to the added calories consumed by the average American (Poti et al, 2014) (Briefel & Johnson, 2004).

### **Fruit and Vegetable Intake**

It has long been recognized that a greater intake of fruits and vegetables is inversely associated with BMI and weight status. Additionally, increased fruit and vegetable intake has been showing to lower the risk of chronic diseases (Hartley et al, 2013) (Turati et al, 2015). The 2010 USDA dietary recommendations include eating at least five servings of fruits and vegetables a day as part of a healthy balanced diet (*Dietary Guidelines for Americans*, 2010). However, despite these recommendations, Americans are still falling short on nutrient intake and remain unable to implement these dietary changes (Guenther et al, 2006).

Further, adolescents display a dip in overall intake of fruit and vegetables from childhood (Kim et al, 2014) (Yngv et al, 2005) (Holman & White, 2011) (Albani et al, 2017). Several factors could be contributing to the decline intake as individuals progress through adolescence, which supports intervention focuses on this age demographic. The benefits of adequate fruit and vegetable consumption has been highly broadcasted- improved health status across the entire biomarker board, and can ultimately lead to an increased quality of life. Intervention efforts as well as food environment targets should continue to be focused on improving intakes in adolescents.

Socioeconomic status has revealed to be a potential factor affecting fruit and vegetable intake in families. Particular interventions have found that during follow up investigations, children from higher income families reported greater intake of fruit and vegetables when compared to children from lower income families (Oldroyd et al, 2008). In 2012, a study conducted in school-aged children found that students from middle and lower social classes were more likely to consume fruits and vegetables more infrequently. Therefore, social class could be an explanatory modifier between the relationship of fruit and vegetable intake and food environment (Syastisalee & Holstein, 2012). Nutrition inequalities need be addressed, particularly in populations that suffer from poor food access and a very limited food environment, such as the Appalachia region.

### **Self-Efficacy and Fruit and Vegetable Intake**

As mentioned above, self-efficacy has been coined to be associated with a more advantageous and healthier lifestyle. Research has evolved to include a stronger psychological analysis to the particular food choices that individuals are making, and specifically how their perception of themselves (their self-efficacy), affects certain dietary behaviors. In relation to healthy eating, self-efficacy has been shown to be positively related to the consumption of fruits and vegetables, while being inversely associated with unhealthy snack and food choices (Gebremariam et al, 2015) (Erinosho et al, 2015). Psychosocial and individual factors comprise self-efficacy as a whole in an individual, these in combination with environmental influences can determine the fruit and vegetable intake an adolescent is consuming.

Perceptions of healthy eating could be one of the most important factors affecting the relationship between self-efficacy and fruit and vegetable intake. If individuals

perceive strong benefits of consuming fruits and vegetables they are, in turn, much more likely to consume them. Because this association between self-efficacy and fruit and vegetable intake have been clearly established, promoting interventions that focus on developing and improving adolescents' level of self-efficacy and their perceptions on healthy eating can have a direct association with their fruit and vegetable intake (Gebremariam et al, 2015) (Erinosho et al, 2015) (Verstraeten et al, 2016) (Lotrean & Tutui, 2015).

### **Self- Efficacy and Sugar Sweetened Beverage Intake**

Sugar sweetened beverages, as mentioned, are one of the greatest sources of added calories to the American diet without providing any viable nutrients. Literature lacks substantial evidence analyzing a clear association between a self-efficacy targeted intervention and a decrease in SSB intake. However, there is clear understanding that an individual's level of self-efficacy projects implications for behavior change outcomes. Existing studies do note that it is necessary to develop programs that promote healthy lifestyles as a form of prevention for overweight or obesity development (Vegting, Schrijver, Otten, & Nanayakkara, 2012) (Liu et al, 2013) (Banos et al, 2015). As discussed, promoting these kinds of focused interventions will create an overall healthy eating mantra, and perhaps culture shift, to encourage the decline of SSB consumption.

### **Existing Gaps in Literature**

Further research is still needed to explore the association between an individual's self-efficacy and their corresponding food choices. In particular, adolescents need be focused on more directly. This particular age demographic is unique in that they exercise a certain level of freedom while still maintaining strong dependence on their parents and

family units. The psychological component that comprises the Social Cognitive Theory still warrants further research in terms of the short and long-term effects, and to what degree it can have on food choices and ultimately, health status. Considering how relatively young the theory is, its applicability to the nutrition field in general resulted in some gaps in the available literature. It is important to remember that all efforts and interventions still must be community focused to improve the nutrient intake of these individuals.

### **Conclusion**

The aims of this review were to determine the association between self-reported self-efficacy on making reduced sugar food and beverage choices and intake of added sugars, and to determine the association between self-reported self-efficacy on consuming and buying fruits and vegetables and reported intake of fruits and vegetables. Current literature shows that there is still heavy prevalence of poor diet quality among adolescents, whether its increased SSB consumption or decreased fruit and vegetable consumption. The obesity epidemic has reached alarming highs, and the Appalachian region in particular is suffering. Self-efficacy has shown to have a strong association between motivation and in turn, positive or negative actions, which is worth investigating further in order to determine and cater any interventions targeting food choices in a specific environment.

## **Chapter Three: Methodology**

### **Research Design**

This study used a cross-sectional survey research design among n=425 adolescents in North Carolina and Kentucky.

## **Subjects**

Rural Kentucky and North Carolina high school adolescents ages 14-18 were recruited to participate in this study (n=434). Three high schools in Kentucky and four high schools in North Carolina were included. Each of these high schools administered free and reduced school lunches to students school-wide, as over 50% of their student population qualified for free lunch. School districts in each county granted permission to participate in the study and parental consent forms were sent home with students that required authorization signatures for participation. Adolescents completed assent forms to participate in the survey.

The exclusion criteria included English not the primary language and having reported any serious illness, such as diabetes or Crohn's Disease, in order to be deemed eligible to participate. Once eligibility was established, a total of 425 (n=425) adolescents were willing to participate and completed the survey. Parents must have consented for their child to participate beforehand through completion of parent assent form, followed by a consent form completed and collected by the child.

## **Measurements**

This study used a combination of several survey measurement tools. The use of reliable and valid pre-established surveys was used to develop a comprehensive gauge of dietary intake and self-efficacy levels.

### ***Dietary Intake***

To capture dietary intake the NHANES 2009-2010 Dietary Screener was used. This questionnaire is comprised of 26 questions that ask about consumption frequency of

certain foods over the last month. Questions of certain food categories range from fruits and vegetables, dairy/calcium, added sugars, whole grains/fiber, red meat, and processed meat in order to capture the most encompassing picture of the students' normal diet. Measurements can then be converted into "real-world" quantity measurements (i.e. cups, grams, etc.) to assess dietary intake of each food item reported. Psychometric properties have been established for majority of items that are included (Thompson et al, 2009).

### ***Measurement of Self-Efficacy***

Self-efficacy levels were measured using questions extracted from the Youth Impact Questionnaire (Shin et al., 2015). This survey has found to be valid and reliable for assessing self-efficacy in children and adolescents. These questions required students to answer whether they thought they could complete certain tasks or make a variety of dietary changes and how confident they were in their ability to make or not make those certain changes and modifications. Questions addressing fruit and vegetable intake included "I can eat vegetables several times a day", "I can choose veggies for a snack instead of chips or cakes, if I try hard enough"; "I can eat at least one fruit everyday outside of school"; and "I can buy fruit to snack on at the corner store". Questions asked regarding added sugar included, "I can eat a bowl of low-sugar cereal for breakfast even if I am running late"; and "I can drink sugar-free drinks like Crystal Light instead of fruit punch". Students were required to respond 1) I know I can, 2) I think I can, 3) I'm not sure I can, or 4) I know I can't. (See Appendix A).

Based on the distribution of the data self-efficacy binary variables were created for the following questions: self-efficacy 0= I know I can and I think I can and 1= I'm not

sure and I know I can't. This coding was used for self-efficacy vegetables, fruit, and snack foods.

### **Survey Administration**

Once assent and consent forms were collected and signed, all qualified and eligible students were either taken to the library during a certain class period by research assistants, or the survey was administered in the classroom while all non-participating students worked on other class work. Research assistants remained in the room to pass out and collect surveys to the students and answer any questions. Because a relationship with the school administrators and faculty had been pre-established, there generally were one to two specific teachers that had their classroom students participate. The survey took approximately 30-40 minutes to complete and responses were recorded into Research Electronic Data Capture (REDCap) by research assistants.

Covariates were addressed to determine age, gender, race, and ethnicity of each participant. Age, weight and height required the student to self-report while gender, race and ethnicity provided pre-selected options that required indication by the participant. Race and ethnicity questions encouraged the students to indicate all options that may apply. Race options included American Indian, Asian, Black, Native Hawaiian/Pacific Islander, White, Unknown, or Other- requiring specification. Ethnicity options included Hispanic Cuban, Hispanic Mexican American, Hispanic Puerto Rican, not Hispanic/Latino, unreported, or Hispanic other. Gender options included male, female, transgender male to female, and transgender female to male. (See Appendix B).

## Data Analysis

Demographic information was collected from every participant, including age, race, sex, and home address. Weight and height was also asked as part of demographic collection and were self-reported. Self-efficacy was treated as a categorical variable with four different categories separated by the self-efficacy survey responses. Fruit and vegetable intake, added sugar and sugar sweetened beverage intake were treated as continuous variables. The following four linear regression models were used to test the association between self-efficacy and fruit and vegetable intake, and SSB and added sugar intake of the students using STATA statistical software. 1) Self-efficacy regarding ability to choose and consume vegetables and actual dietary intake of vegetable ounces; 2) self-efficacy regarding ability to consume and choose fruits and actual dietary intake of fruit ounces; 3) self-efficacy regarding added sugar from food and beverage choices and dietary intake of added sugars; 4) self-efficacy regarding changes to sugar sweetened beverage (SSB) intake and dietary intake of SSB. In order to assess frequency of individual percentage statistics, self-efficacy variables were grouped into binary categories with self-efficacy responses in which students knew they could or felt confident they could grouped together (coding=0), and responses in that students were not sure they could or knew they could not were grouped together (coding=1). To model self-efficacy against dietary intake a multilinear regression model was used after adjusting for covariates. Regression analysis adjusted for covariates by equating each dietary intake to be the sum of self-reported self-efficacy responses, their gender, age, and race.

## **Chapter Four: Results**

A total of 425 eligible participants were included in this study; 41% were female and 59% were male with an average age of 15. Race demographics of the adolescents identified as 62% white, 26% black, and 12% indicating other. Of the participants, 55% were normal weight, 24% were overweight, and 21% were obese. The average BMI of the adolescents was 24 (Table 4.1).

There were six total questions that addressed the particular dietary intake aims of this study regarding the adolescents' level of self-efficacy (Table 4.2). Students were asked to respond to the prompt, "I can eat vegetables several times a day". When responses were grouped and distributed into binary categories, 80.88% of respondents said they felt they knew they could or thought they could, while 19.12% of students said they were not sure they could or knew they could not. This resulted in statistically significant finding ( $p=0.00$ ) that those students who are not sure or cannot consume vegetables everyday consume .12 ounces less vegetables everyday than those students with high self-efficacy (-.12 [95% CI: -.19, -.07]\*). Another prompt asked students to respond to "I can choose vegetables for a snack instead of chips or cake, if I try hard enough". 73.04% of students indicated that they knew they could or thought they could, while 26.96% of students did not think they could or knew they could not. Again, this resulted in a statistically significant finding ( $p=0.001$ ). Students who were not sure they could or knew they could not choose vegetables as a snack, consume .09 ounces less vegetables than students with higher self-efficacy (-.09 [95% CI: -.14, -.04]\*).

Further questions measured the self-efficacy of the students and fruit intake. Students were asked to respond appropriately to the prompt, "I can eat at least one fruit

everyday outside of school”. Of the 425 respondents (n=425) 92.4% responded that they were confident that they could or thought they could complete such a task, while 7.6% did not think they could or knew they could not. Regression found that those students consume .03 ounces less of fruit compared to the students with higher self-efficacy (-.03[95% CI: -.10, .03]), despite findings not being statistically significant (p=0.317). Self-efficacy was further measured by asking students to respond to whether they felt they could “buy fruit to snack on at the corner store”. 82.26% of the adolescents reported high self-efficacy and 17.74% reported lower self-efficacy in response to this behavior prompt. Statistically significant findings were not determined (p=0.86), however, those adolescents who did not think they could or knew they could not purchase fruit at corner stores are consuming .004 less ounces than those students who felt they could or knew they could choose fruit (-.004 [95% CI: -.05, .04]).

Two questions addressed added sugar and sugar sweetened beverages for the adolescents. “I can eat a bowl of low sugar cereal for breakfast even if I am running late” attempted to measure efforts and capability to decrease added sugar intake in participants’ diet. 68.43% of the students knew they could or felt confident they could eat low sugar cereal, while 31.57% of students did not think they could or knew they could not. Further regression did not produce statistically significant findings (p=0.113) however, students that reported lower levels of self-efficacy were consuming on average .08 more ounces of added sugar in their diet than those students with higher self-efficacy (.08, [95% CI: -.70, .87]). Lastly, students were asked to respond to “I can drink sugar-free drinks like Crystal Lite instead of fruit punch”. 72.35% reported high self-efficacy feeling confident they could or thought they could make the appropriate substitutions,

and 27.65% reported lower self-efficacy. Regressions for both added sugar and sugar-sweetened beverages were conducted in response to this proposition, however neither produced statistically significant findings ( $p=0.255$ ). Students that reported a lower level of self-efficacy were found to be consuming .66 more ounces of added sugar from SSB in comparison to higher self-efficacy reporting students (.66, [95% CI: -.16, 1.49]). Further, these students are consuming .01 more ounces of sugar-sweetened beverages than students with a greater sense of self-efficacy in response to this dietary intake behavior (.01, [95% CI: -.01, .04]).

After adjusting for covariates, multiple linear regressions were conducted to assess correlations between self-efficacy varieties and dietary intake of the adolescent participants. Both vegetable associated questions and responses produced statistically significant correlations, while fruit intake, added sugar, and SSB correlations provided clear associations but did not produce statistically significant findings (Table 4.3).

**Table 4.1: Subject descriptive demographics of adolescents in rural Kentucky and North Carolina**

<i>Demographics</i>	N=425
<b>Race</b>	
White	62%
Black	26%
Other	12%
<b>Average Age in Years</b>	15
<b>Gender</b>	
Female	41%
Male	59%
<b>BMIGP</b>	
Normal	55%
Overweight	24%
Obese	21%
<b>Average BMI</b>	24

**Table 4.2: Dietary intake associated self-efficacy responses and distribution among study participants**

I can eat vegetables several times a day [1]		
	Freq	Percent
0	351	80.88%
1	83	19.12%
Total	425	100.00%

I can choose veggies for a snack instead of chips or cake, if I try hard enough [2]		
	Freq	Percent
0	317	73.04%
1	117	26.96%
Total	425	100.00%

I can eat at least one fruit everyday outside of school [3]		
	Freq	Percent
0	401	92.40%
1	33	7.60%
Total	425	100.00%

I can buy fruit to snack on at the corner store [4]		
	Freq	Percent
0	357	82.26%
1	77	17.74%
Total	425	100.00%

I can eat a bowl of low sugar cereal for breakfast even if I am running late [5]		
	Freq	Percent
0	297	68.43%
1	137	31.57%
Total	425	100.00%

I can drink sugar-free drinks like Crystal Lite instead of fruit punch [6]		
	Freq	Percent
0	314	72.35%
1	120	27.65%
Total	425	100.00%

N=425

0= student response of I know I can/ I think I can  
 1= student response of I'm not sure I can/ I know I can't

*Distributions unadjusted for covariates*

**Table 4.3: Association between self-efficacy and dietary intake among rural adolescents in Kentucky and North Carolina in 2016**

<b>Self-efficacy</b>	<b>Vegetable Intake</b>	<b>Fruit Intake</b>	<b>Added Sugar</b>	<b>SSB</b>
<b>Eat vegetables [1]</b>	-.12 (-.19, -.07)*	NA	NA	NA
<b>Vegetable snack [2]</b>	-.09 (-.14, -.04)*	NA	NA	NA
<b>Eat fruit [3]</b>	NA	-.03 (-.10, .03)	NA	NA
<b>Fruit snack [4]</b>	NA	-.004 (-.05, .04)	NA	NA
<b>Low Sugar Cereal [5]</b>	NA	NA	0.08 (-.70, .87)	NA
<b>Sugar-free drinks [6]</b>	NA	NA	.66 (-.16, 1.49)	NA
<b>Sugar-free drinks [6]</b>	NA	NA	NA	.01 (-.01, .04)

*All regression analysis adjusted for covariates- gender, age, and race*

\*Indicants p-value <0.05; obtained using Pearson correlation test

Significance level ( $\alpha=0.05$ )

\*\*Bracketed notations indicate full questions listed in Table 4.2

## **Chapter Five: Discussion**

The results of this study indicate a relationship between the self-efficacy of dietary choices and dietary intake among rural adolescents in North Carolina and Kentucky. Although research has been clear so far in connecting higher self-efficacy with behavior changes (Pajares & Schunk, 2001), these results point to the role that self-efficacy has among rural adolescents in conjunction with the previous reports. This study further supports the role that self-efficacy, as a construct within the Social Cognitive Theory, plays in purchasing and consuming fruits and vegetables, especially among this vulnerable population.

This study sample was homogenous in their geographic topography, yet there was a racial representation that mimics other locations in the United States. The majority of the individuals reported Caucasian race, yet, 26% were African American. Additionally, 45% of the students in this study were overweight or obese, which is more than double the national averages collected by the CDC of children nationwide (*Centers for Disease Control, Childhood Obesity Facts; 2017*). These statistics are representative of similar areas within the United States (Hoying, Melnyk, & Arcoleo, 2016). Given the sample, these findings highlight how this construct may be influential in behaviors across various sub-populations.

The first aim addressed with this study assessed self-reported self-efficacy among this demographic and their consumption and buying of fruits and vegetables. Key insights from the results suggest the role that self-efficacy of vegetables is significantly associated with intake of vegetables. It has been suggested that self-efficacy and affective attitudes are some of the most important factors affecting vegetable consumption. Not being

confident in choosing these items result in lower consumption, just as higher levels of self-efficacy reflect greater vegetable consumption (Woo & Lee, 2017) (Granner & Evans, 2012) (Van Duyn et al, 2001). Although statistically significant findings in regards to fruit intake were not determined in this study, it is fair to say that high levels of self-efficacy and fruit consumption are associated and highly correlated as found in several studies (Gebremariam et al, 2016) (Hong & Piaseu, 2017) (Zaronwiecki, Parletta, & Dollman, 2014). One inference that can be made for the lack of statistical significance between both food groups could simply be availability within the food environment. Other studies have found that fruit intake remains more prevalent than vegetable consumption in part because fresh, unprepared fruit is more appealing to this age group rather than fresh raw vegetables (Hall et al, 2015) (Wang et al, 2016). This poses a legitimate research question for future work in order to conclude causation for this difference. However, findings from this study add a new perspective to the literature that could help direct any intervention development targeting adolescents, in that self-efficacy would be a major component in accomplishing significant results for increasing fruit and vegetable intake.

The second aim of this study investigated the association between sugar sweetened beverages (SSB) and the self-reported self-efficacy from the adolescents. This was in part because of the obvious trend of increased intake of SSB and added sugar among adolescents in the United States within the last 20 years. However, this study revealed promising results in that students that reported high self-efficacy levels were receptive to making sugar-free drink choices. Despite no statistically significant results, they were consistent in determining that the individuals with higher self-efficacy were

consuming less added sugar and sugar from SSB (Wright et al, 2014). Therefore, the positive effect of utilizing the Social Cognitive construct within any nutrition message delivery could eventually have far reaching effects on the health status of this population, and particularly SSB intake.

This environment is a prime example of the shortcomings that a rural area faces in Appalachia. It was evident that these individuals suffer from availability of food outlets, but additionally, they have little connectivity to urban trends, and resources. These rural adolescents are at a tipping point in their lives in that they are embracing the beginning stages of conscious decision-making based on their own experiences and knowledge base up to this point and now have the ability to proactively carry out those choices.

Unfortunately, given the geographic remoteness, limited resources available, and current state of the food environment in much of rural Appalachia, it results in both a delayed chain of information and constant lack of healthy food options for this demographic. These could be additional factors affecting adolescent's current food and dietary choices within this region.

Healthy food access remains a constant struggle of the Appalachia region in order to combat nutrition inequalities. However, encouraging intake of healthy foods that are available can gradually improve a variety of health biomarkers among these adolescents. The implications of this study mean that the majority of these students felt they could or were very confident that they could consume fruit and vegetables both everyday and outside of school. Therefore, despite the food desert disparities they face, this population shows promise. Shifting the perceptions of healthy eating could be the most indicative aspect of any intervention that changes the relationship these adolescents have with

consuming fruit and vegetables, and minimizing SSB consumption and added sugar in their diet.

The concept behind self-efficacy has been proven to be positively associated with behavior changes and can allow that individual to be more successful in achieving a goal when they engage in a self-efficacy focused intervention (Lunenburg, 2011) (Pajares & Schunk, 2001) (Bandura, 1995) (Roach et al, 2003). This study contributes greatly to further research and hypotheses centered around this construct and aids in minimizing the literature gap surrounding this population. Therefore, It would be advantageous for interventions to consist language, material and action that encourage high levels of self-efficacy of students, given the results from this study.

### **Implications**

The implications of this study could create a ripple effect of change for this population. Further understanding of this area will serve to improve health status, economic, and social growth within each community. By targeting adolescents in particular, it has the potential to create a generational shift between this demographic and their relationship with food. This study found that self-efficacy has a strong association with an adolescent's food choices, particularly vegetable choices. Despite a limited food environment, the results of this study could help steer future intervention efforts to create a psychologically driven message aimed at targeting one's self-efficacy in order to increase fruit and vegetable consumption, and limit SSB demand.

### **Future Work**

This demographic falls victim to several environmental shortages. However, this study has helped further understand what can be an effective mode of changing habits

and overall outlook among this population. Despite the shortcomings they face with their current nutritional knowledge and food environment, future work can better take into account both factors when intervening by way of the individual's self-efficacy. Future work could also target the food outlets specifically through self-efficacy centered marketing in order to encourage healthy food consumption directly when individuals are making food and drink choices.

### **Limitations**

This study consisted of several limitations. This study was cross-sectional which does not allow causation to be made for any findings. Although sample size was relatively large, generalizability to all of Appalachia is limited. All survey responses were self-reported and thus, social desirability could skew what students reported. It would be of interest to conduct a similar study among a larger study population that exhibits much of the same food environment these areas possess. Additionally, the Youth Impact Questionnaire consisted of limited questions addressing dietary intake, particularly regarding SSB intake and modes of ingestion.

### Appendix A- Measurement of Self-Efficacy

	I know I can	I think I can	I'm not sure I can	I know I can't
I can eat vegetables several times a day.				
I can reduce to eating only one small bag of chips a day.				
I can eat a bowl of low-sugar cereal for breakfast even if I am running late.				
I can drink sugar-free drinks like Crystal Light instead of fruit punch.				
I can choose veggies for a snack instead of chips or cakes, if I try hard enough.				
I can eat at least one fruit everyday outside of school.				
I can ask for low-fat mayo/miracle whip on my sandwich.				
I can buy fruit to snack on at the corner store.				
I can buy baked chips instead of regular chips at the corner store.				
I can try healthier side dishes like apples/yogurt at fast food places instead of fries.				
I can talk to my parents about buying me healthy snacks.				
I can make a sandwich on whole wheat bread versus white bread.				

## Appendix B- Demographic Collection

Gender:

- Female
- Male
- Transgender Male to Female
- Transgender Female to Male

Race (choose all that apply):

- American Indian
- Asian
- Black
- Native Hawaiian/Pacific Islander
- White
- Unknown
- Other (specify: \_\_\_\_\_)

Ethnicity (choose all that apply):

- Hispanic Cuban
- Hispanic Mexican American
- Hispanic Puerto Rican
- Not Hispanic/Latino
- Unreported
- Hispanic Other (specify: \_\_\_\_\_)

What is your age in years? \_\_\_\_\_

About how much do you weigh (lbs) without shoes? \_\_\_\_\_

About how tall are you without shoes? \_\_\_\_\_ feet \_\_\_\_\_ inches (i.e. 5 feet 2 inches)

Has a doctor or health care professional ever told that you have diabetes, Crohn's disease, celiac disease, or something that really alters the types of foods you can eat?

- Yes
- No

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