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## Effects of a Cooking and Gardening Nutrition Intervention in Food Insecure College Students

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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

EFFECTS OF A COOKING AND GARDENING NUTRITION INTERVENTION  
IN FOOD INSECURE COLLEGE STUDENTS

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF PHILOSOPHY

in

DIETETICS & NUTRITION

by

Alison K. Macchi

2021

To: Dean Stanislaw F. Wnuk  
College of Public Health and Social Work

This dissertation, written by Alison K. Macchi, and entitled Effects of a Cooking and Gardening Nutrition Intervention in Food Insecure College Students, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Date of Defense: June 25, 2021

The dissertation of Alison K. Macchi is approved.

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Andrés G. Gil  
Vice President for Research and Economic Development  
and Dean of the University Graduate School

Florida International University 2021

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## DEDICATION

I dedicate this dissertation to my mother, Astrid. Without her example, inspiration and unwavering support, I would not be where I am today.

I also dedicate this dissertation to my loving husband, Paul, who always believed in me, supported me, and pushed me to achieve my goals.

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ABSTRACT OF THE DISSERTATION  
EFFECTS OF A COOKING AND GARDENING NUTRITION INTERVENTION  
IN FOOD INSECURE COLLEGE STUDENTS

by

Alison K. Macchi

Florida International University, 2021

Miami, Florida

Professor Catherine Coccia, Major Professor

As higher education becomes more attainable to all populations, college students from low-income backgrounds are at an increased risk of food insecurity due to the financial burdens that come with the transition to college. Food insecurity on U.S. college campuses ranges up to 59%, quadrupling the average national household food insecurity rate of 14%. In college students, food insecurity is correlated with unhealthy eating, alcohol use, and mental health issues.

The aim of this study was to develop and examine the feasibility and promise of a Social Cognitive Theory based, urban gardening, cooking and nutrition education intervention on health behavior mediators, fruit and vegetable intake, stress, and life satisfaction in food insecure college students. In this 8-week randomized control trial, 107 food insecure college students were randomized to participate in a hands-on, interactive 6-week cooking and gardening intervention (n=42) or a control group (n=47).

Analysis of baseline data demonstrated significant correlations between baseline characteristics and health outcomes. High nutrition knowledge ( $\beta=.346$ ,  $t=3.73$ ,  $P<.01$ ) and self-efficacy ( $\beta=.301$ ,  $t=3.25$ ,  $P=.002$ ) were correlated with increased fruit and

vegetable intake ( $R^2=.201$ ). Parental financial support ( $\beta=.227$ ,  $t=2.32$ ,  $P=.022$ ) and negative personal health views ( $\beta=-.221$ ,  $t=-2.26$ ,  $P=.026$ ) were correlated with higher BMI ( $R^2=.115$ ). Additionally, females ( $\beta=.360$ ,  $t=4.13$ ,  $P<.01$ ), low self-efficacy ( $\beta=-.214$ ,  $t=-2.33$ ,  $P=.022$ ), and low reciprocal determinism ( $\beta=.200$ ,  $t=2.18$ ,  $P=.032$ ) were correlated with increased stress ( $R^2=.246$ ) and decreased life satisfaction ( $R^2=.149$ ). Students who participated in the intervention experienced a significant improvement in health mediators such as self-efficacy ( $F=17.65$ ,  $P<.001$ ), reciprocal determinism ( $F=4.16$ ,  $P=.045$ ), and personal health views ( $F=5.65$ ,  $P=.023$ ), as well as fruit and vegetable intake ( $F=19.19$ ,  $P<.001$ ), stress ( $F=16.20$ ,  $P<.001$ ), and life satisfaction ( $F=18.99$ ,  $P<.001$ ) when compared to students who did not participate in the intervention.

This study demonstrates the feasibility and effectiveness of a cooking and gardening nutrition program to improve diet and mental health indicators in this population. These findings contribute to the current body of knowledge by providing further insight into methods to help alleviate the negative effects of food insecurity in college students. Future studies should determine the long-term effects of such programs on a wider scale of universities.



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## ABBREVIATIONS AND ACRONYMS

BMI	Body mass index
CDC	Center for Disease Control and Prevention
CoNKS	Consumer Oriented Nutrition Knowledge Scale
FIU	Florida International University
F/V	Fruit and vegetable
GPA	Grade point average
IRB	International Review Board
NCI	National Cancer Institute
P1/P2/P3	Phase 1, Phase 2, Phase 3
PHV	Personal health view
SCT	Social Cognitive Theory
USDA	United States Department of Agriculture

# CHAPTER I

## INTRODUCTION

### **Food Insecurity**

Food insecurity is defined as the state of being without reliable access to a sufficient amount of affordable and nutritious food. According to the USDA, 10.5% of households in the United States had low food security in 2019, with 4.1% of those having very low food security.<sup>1</sup> Food insecurity can be caused by food deserts or lack of financial means. Food insecurity has been linked to various mental, physical, nutrition and health outcomes including overweight and obesity, hypertension, diabetes, and hyperlipidemia.<sup>2,3,4</sup> A study published in 2017 reported that 58% of food insecure households had at least one member with hypertension and 33% had at least one member with diabetes.<sup>4</sup> After adjusting for sociodemographic, environment, and lifestyle variables, food insecurity is the most significant predictor of overweight status in women but not necessarily in men.<sup>5</sup> Food insecurity has also been correlated with maternal depression in low socioeconomic families.<sup>6</sup> Due to its correlation with comorbidities, food insecurity has been shown to impact mortality rates among low-income populations.<sup>7</sup>

### **College Food Insecurity**

As higher education becomes more attainable to all populations, those from low-income backgrounds are at an increased risk of food insecurity due to the financial burdens that come with the transition to college.<sup>8</sup> New financial burdens, such as having a limited income and living away from home, combined with the increasing costs associated with university, make it difficult for some students to adequately afford a

balanced healthy diet.<sup>8,9</sup> In 2017 a meta-analysis estimated that food insecurity in college students varied between universities, ranging from 13%-59%, almost doubling the average national household food insecurity rate.<sup>10</sup> High rates of food insecurity for college students may be especially relevant for large urban universities and universities that cater to minority students. In 2016, 45% of students at Florida International University, a large urban Hispanic-serving institution, reported being food insecure.<sup>11</sup>

Food insecurity negatively impacts students physically, emotionally, and mentally.<sup>12</sup> In college students, food insecurity is correlated with a larger likelihood of unhealthy eating, alcohol use, and mental health issues.<sup>8</sup> Previous literature has demonstrated that college students have low intake of fruit and vegetable intake.<sup>13</sup> Lack of fruit and vegetable intake is largely associated with obesity in young adults.<sup>14</sup> College students are also at risk for mental health issues due to changing financial and social situations. Food insecurity may increase this risk through food and material deprivation, which may lead to increased stress and life dissatisfaction.<sup>15</sup> Food insecurity can also reduce the opportunity for social development and the development of success by reducing participation in college.<sup>16</sup> Attitudes and behaviors acquired during college years have been shown to be related to health habits and outcomes in adulthood affecting the risk of obesity-related diseases.<sup>17</sup> Improving physical and mental health behaviors, such as fruit and vegetable intake, stress, and life satisfaction, may help food insecure college students lead healthier and more successful lives.

### **Statement of the Problem**

Food insecurity on college campuses is an alarming and arising issue, with proven negative long-term effects. While campus initiatives to help food insecure students have

gained popularity, students are still unable to meet adequate nutritional intake and may be at a higher risk for chronic disease.<sup>18</sup> Previous literature has shown promising effects of nutrition education, cooking, and urban gardening interventions in the general college student population.<sup>13,19, 20, 21</sup> These programs have successfully increased self-efficacy for health promoting behaviors including fruit and vegetable intake however, they have predominately looked at these components individually, not as a collective and it is unknown the effectiveness of these interventions in food insecure college students.<sup>14,19,20,21</sup> Multiple studies have indicated the need for programs aimed towards food insecure students, which should include knowledge on nutrition and budgeting, food provisioning skills, and cooking skills.<sup>21-24</sup>

The overall purpose of this study is to develop and examine the feasibility and promise of an intervention that includes 3 components: 1. Urban gardening, 2. Cooking and 3. Nutrition education on self-efficacy, fruit and vegetable intake, weight status, stress and life satisfaction in food insecure college students. The study will examine behavior change through Bandura's Social Cognitive Theory, which has previously been used successfully in fruit and vegetable and nutrition education interventions.<sup>13,26</sup>

### **Theoretical Perspectives**

Bandura's Social Cognitive Theory (SCT) was used to develop and implement a program to increase self-efficacy, fruit and vegetable consumption and weight status in food secure and insecure students. The theory states that there is a reciprocal influence on behavior, which is influenced by the environment, both physical and socials, and by intrapersonal factors.<sup>27</sup> Reciprocal determinism, self-efficacy, facilitation, outcome expectation, observational learning, and self-regulation are all important constructs used



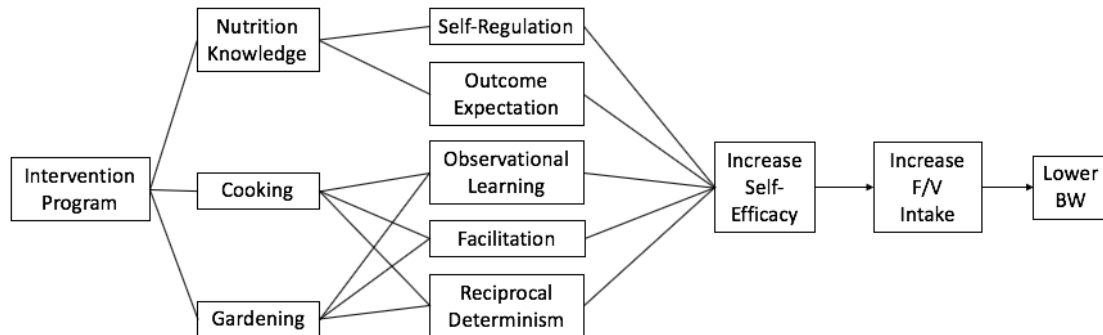
to mediate behavior change (Table 1). Intervention strategies should focus on facilitating behavior change by increasing awareness, self-efficacy, and self-regulation of nutrition knowledge and healthy eating behaviors such as increasing fruit and vegetable intake. Specifically in this study, self-regulation and outcome expectations mediators are addressed through nutrition education while observational learning, facilitation, and reciprocal determinism mediators are addressed through cooking and gardening activities (Table 1). By changing and addressing these mediators, the intervention ultimately impacts self-efficacy, fruit and vegetable intake, and body weight (Figure 1). The use of the SCT as part of a community intervention for health behavior change has been shown to be effective.<sup>28</sup>

*Table 1. SCT construct definition*

<b>SCT Construct</b>	<b>Definition</b>	<b>Component</b>
Outcome Expectation	Beliefs about the likelihood and value of the consequences of behavioral choices	Nutrition Knowledge
Observational Learning	Learning to perform new behaviors by exposure to interpersonal or media displays of them, particularly through peer modeling	Cooking Gardening
Self-Regulation	Controlling oneself through self-monitoring, goal-setting, feedback, self-reward, self-instruction, and enlistment of social support	Nutrition Knowledge
Reciprocal Determination	Environmental factors influence individuals and groups, but individuals and groups can also influence their environments and regulate their own behaviors	Cooking Gardening
Self-Efficacy	Beliefs about the ability to perform behaviors that bring desired outcomes	Nutrition Knowledge Cooking Gardening

Facilitation	Providing tools, resources, or environmental changes that make new behaviors easier to perform	Cooking Gardening
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Figure 1. Flow chart of intervention and social cognitive construct effects



### Specific Aims and Hypotheses:

**Aim 1.** Create an urban-gardening and nutrition education intervention using hands on gardening and cooking, and the social cognitive theory.

**Aim 2.** Examine the implementation feasibility and promise of an urban-gardening and nutrition education intervention on mediators for behavior change, fruit and vegetable intake, weight, and stress and life satisfaction.

- Feasibility
  - **Hypothesis 1:** Feasibility of the research design will be demonstrated by baseline recruitment of 140 college students, assuming 80% retention at post-test.
  - **Hypothesis 2:** Feasibility of the intervention will be demonstrated by 80% attendance and strong satisfaction with intervention

methods and content as reported by post-test surveys.

- Study Sample Characteristics
  - **Hypothesis 3:** Baseline demographic information, BMI, and mediators for behavior change will influence baseline fruit and vegetable intake, stress, and life satisfaction in food insecure college students.
- Intervention Theory
  - **Hypothesis 4:** College students who participate in the intervention will increase mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy.
  - **Hypothesis 5:** Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, and outcome expectations, will be correlated with change in self-efficacy.
- Promise
  - **Hypothesis 6:** College students who participate in the intervention will increase their fruit and vegetable consumption.
  - **Hypothesis 7:** Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will affect fruit and vegetable intake.
  - **Hypothesis 8:** College students who participate in the intervention will lower their stress and increase their satisfaction with life.
  - **Hypothesis 9:** Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome

expectations and self-efficacy, will affect stress and life satisfaction.

- **Hypothesis 10:** Stress and life satisfaction will mediate fruit and vegetable intake in participants who complete the intervention.
- **Hypothesis 11:** College students who participate in the intervention will maintain or reduce their body weight.

## **CHAPTER II**

### **LITERATURE REVIEW**

#### **Food Insecurity in College Students**

Due to the large quantities and prevalence of studies that have been conducted, three large scale systematic reviews have been completed to determine the overall state of food security across college campuses.<sup>10,29,30</sup> In 2017, Bruening et al. assessed both U.S. and international literature looking at food insecurity on college campuses. They estimated an average food insecurity rate of 35% in gray literature and 42% among peer-reviewed literature.<sup>10</sup> In 2019, Both Nazmi et al. and Nikolaus et al. published systematic reviews on rates of U.S. college food insecurity rates.<sup>29,30</sup> Nikolaus et al. determined an average rate between 10-75%, depending on how food insecurity was assessed, and Nazmi et al. averaged a national rate of 43.5%.<sup>29</sup> Specifically, a study done in a midsize, rural university in Oregon determined that nearly half of students were food insecure at one point within the previous year, with only 8% of the sampled population being Hispanic.<sup>17</sup> In Maryland, both urban and suburban community colleges were assessed for food insecurity. The results showed 56% of the students surveyed were food insecure, with the majority being African-American.<sup>31</sup> At the University of Hawaii at Manoa, 21% of students were determined to be food insecure with 24% being at risk for food insecurity.<sup>32</sup> Additionally, college food insecurity is not only localized to the United States. Studies in Canada and Australia have reported a college food insecurity of 10.4% and 12%, respectively.<sup>16,33</sup>

In 2016, 45% of students at Florida International University reported being food insecure.<sup>11</sup> While multiple studies have assessed the rates of food insecurity among other

US universities, the current literature does not address food insecurity rates at other large, urban, ethnically diverse universities similar to Florida International University.

### **Factors Related to Food Insecurity in College Students**

There are several factors that make college students more likely to be food insecure. Factors correlated with college food insecurity include living alone, receiving government assistance or financial aid, male gender, never cooking, and low incomes.<sup>8,16</sup> Food insecure students are also less likely to receive food from family, eat fast food and report unhealthy eating habits off campus.<sup>8</sup> Students who rarely eat breakfast, rarely eat home cooked meals, and those with higher levels of depression are also more likely to report food insecurity.<sup>8</sup>

To deal with food insecurity, college students use various coping methods to attain basic necessities. The most common coping strategies include income generation by working over 10 hours a week, living with parents, borrowing money or food, delaying bills, applying for loans, and using credit cards.<sup>16,33,34</sup> Students also purchase cheap, processed food, and eat less healthy meals to be able to eat more.<sup>24</sup>

### **Food Insecurity and Fruit and Vegetable Intake**

Previous literature has indicated that college students, including those who are food insecure, do not meet the recommended 5 servings of fruits and vegetables per day.<sup>13,35,36</sup> In addition, studies have indicated that food insecure college students consume lower rates of fruit and vegetables than their non-food insecure counterparts.<sup>37</sup> These coping mechanisms can have negative effects on students' financial stability and health.<sup>18</sup> Low fruit and vegetable intake, along with highly processed diets, have been associated with obesity and subsequent comorbidities such as diabetes and cardiovascular disease.

Fruit and vegetable intake has been found to be highly correlated with weight status. Diets high in fruit and vegetables are common for weight loss as fruits and vegetables enhance satiety and reduce hunger.<sup>38</sup> Currently, data on weight reduction in college students using high fruit and vegetable diets are limited. In a study done by Racette et al., it was observed that students who ate fewer than 5 fruits and vegetables daily increased weight within 1 year.<sup>39</sup> Additionally, Kasparek et al. observed weight gain in college freshman within 6 months of decreasing fruit and vegetable intake.<sup>40</sup> Thus, it is inferred that by maintaining or increasing fruit and vegetable intake, it is possible to maintain or lower body weight.

Self-efficacy, or the beliefs about the ability to perform behaviors that bring desired outcomes, is commonly associated with the ability to increase fruit and vegetable intake. Various studies have used this SCT construct as a mediator to create changes in health behaviors and have increased both self-efficacy and fruit and vegetable intake.<sup>41-45</sup> Looking at low-income communities, Anderson et al. tested the effect of self-efficacy in relation to fruit and vegetable servings using surveys in community churches. It was concluded that self-regulatory behavior, such as self-efficacy is pivotal to increasing healthy food choices.<sup>43</sup> In regards to college students, Poddar et al. used a 5 week web-based intervention to increase self-efficacy of dairy consumption, but did not increase actual consumption.<sup>45</sup> The study stated the lack of use of multiple SCT constructs may have had negative effects on behavior change.<sup>45</sup> The use of cooking, nutrition education, and gardening incorporates multiple SCT constructs which in turn should have maximum effect on self-efficacy and behavior change. Studies have concluded that including self-

efficacy in behavior change interventions, such as fruit and vegetable increase, is beneficial.<sup>43,46</sup>

### **Food Insecurity and Obesity**

As obesity rates in the United States have risen in the past decade, food insecurity rates have also steadily increased. While food insecurity used to only be only associated with weight loss, a new paradox of poverty, obesity, and malnutrition has emerged. This relationship has created a new category of “hidden hunger” or “overnutrition”.<sup>7,47</sup> This is often seen in low-income areas where the lack of quality food items creates an environment where food insecurity and malnutrition become prevalent. Studies have shown that individuals or families who are food insecure will select low-quality, high energy inexpensive food to meet adequate energy intake.<sup>7</sup> Fruit and vegetable intake is shown to decline with high rates of food insecurity as well. Weight gain due to food insecurity may also have psychological roots such as preoccupation with food, stress, depression, and physical limitations.<sup>7</sup> When looking at individuals who participate in food pantries specifically, it is noted that the mean BMI was high at 29.5 and those who were food insecure were two times less likely to eat fruit, vegetables, and fiber compared to those who are food secure.<sup>48</sup> A study looking at food pantry participants found that 67.5% had high blood pressure and a quarter reported that they or someone in their household had diabetes.<sup>48</sup> Several studies have reported poor diet quality in women pantry users as well as poor nutritional quality of pantry foods.<sup>48</sup> Ensuring nutritional adequacy in food pantries is an important consideration and the need to improve or supplement food pantries is important as this vulnerable group relies on the quality of donated food.



The 2016 American College Health Association's National Health Assessment states the average rate of obesity among college students to be approximately 33.5% and 41.1% in women and men, respectively.<sup>49</sup> To date, only a couple of studies have looked at the relationship of obesity and food insecurity among college students. Darling et al. found that college freshmen with a history of food insecurity during adolescence had above average BMIs and waist to height ratios.<sup>50</sup> More recently, in 2019 El Zein et al. determined that students who are food insecure have a significantly higher BMI than those who are not while in 2020 Reeder et al. determined that BMI and body fat percentage had no association with food security status.<sup>35,51</sup>

### **Mental Health Related to Food Insecurity and College Students**

College has proven to be a very stressful time for young adults.<sup>52-56</sup> Changes in independence, responsibility, and financial support are the most common causes for increased stress. Food insecurity has also been linked to elevated risk for stress and mental health illness in low-income populations.<sup>57,58</sup> Numerous studies have identified that young adults with a history of food insecurity reported more psychological distress (depression, anxiety, and stress) than those who did not experience food insecurity.<sup>24,50,51,59-63</sup> It has also been noted that students with current food insecurity and those history of food insecurity also reported being more stressed.<sup>50,61</sup> Other studies have focused on depression in food insecure students. In one study, Reeder et al. noted that food insecure students are 4.5 times more likely to be depressed than those who are food secure.<sup>51</sup> In another, Umeda et al., whose population consisted of 24% Hispanic food insecure students, noted that Hispanic heritage was positively correlated with depression among food insecure college students.<sup>63</sup> Additionally, food insecurity has also been

associated with decreased life satisfaction, specifically in areas where food insecurity is stigmatized, such as college campuses.<sup>15</sup> Food insecurity is linked to increased stress and decreased life satisfaction due to the constant worry of not getting enough food along with the sense of deprivation from material goods, social support, and necessities.<sup>15</sup> This sense of deprivation is often heightened in adolescents and young adults which can exacerbate the effect on mental health.

Higher rates of stress and depression may result in emotional eating and higher rates of disordered eating patterns, such as binge eating, leading to increased risk of obesity and other psychological issues.<sup>8,50</sup> Thus, there is a need to determine the relationship between food insecurity, perceived stress, and life satisfaction and how these factors may affect fruit and vegetable intake and weight gain in college students.<sup>50</sup> The issue of college food insecurity is an important area of research due to the alarming rates and subsequent lifelong negative effects.

### **Initiatives to Reduce Food Insecurity**

Food security programs have been implemented in various formats such as community meal programs, community gardens, school lunch programs, food banks, and food pantries.<sup>64</sup> The majority of food access assistance stems from government services such as SNAP, WIC, the national school lunch program.<sup>65</sup> These programs only help specific eligible populations, such as low-income minorities, women, and children, often not including college students. Private sectors have added to food security in the form of food banks and pantries, shelters, and soup kitchens. Food pantries have been the most common service created with 33,500 food pantries created nationwide, in which 33.9 million Americans receive food.<sup>65</sup> These programs often times provide unhealthy meal

options with high amounts of fat, salt, and sugar which can worsen diet related issues such as hypertension and hyperlipidemia.<sup>66</sup> With increasing awareness of this issue, efforts such as mobile, refrigerated produce pantries have been created.<sup>67</sup>

Food pantries have also become popular amongst colleges as a form of support for students struggling to make ends meet. In 2014, it was reported that over 70 colleges had created campus food pantries to help with food insecurity among students, with 22 colleges being added to The College and University Food Bank Alliance (CUFBA).<sup>18</sup> According to CUFBA, at the moment, 686 campuses have food pantries. Recent literature has shown low rates of campus food pantry participation. McArthur et al. noted that only 17% of their food insecure college study sample used the food pantry on campus.<sup>24</sup> Multiple studies have investigated the barriers to food pantry use and have attributed low participation to insufficient information, embarrassment, social stigmas, and the idea that others need it more.<sup>24,68,69</sup> At Florida International University, which has a population of almost 54,000 students, only 2,500 students used the food pantry in the fall semester of 2018 alone, as compared to 340 visitors in the 2014-2015 school year.<sup>11</sup> Universities are starting to use supplemental actions to help with food security such as food recovery programs, dining center meal donations, farmers markets, and community gardens to provide nutritious foods to students.<sup>70</sup> Currently, there are no studies which report the effectiveness of these strategies.

While college food banks are gaining popularity, there is no evidence to show any sort of nutrition education or additional resources to help food bank participants eat healthy meals.<sup>18</sup> The CUFBA Student Government Resource guidebook to creating campus food pantries has no guidelines for nutritional value of accepted donated foods or

the inclusion of nutrition education, both of which would specifically help food insecure students meet dietary guidelines for adequate nutrition.<sup>71</sup> Based on the specific needs of food insecure college students, such as budgeting, food access, and community resources potential nutrition interventions for this population may include urban gardening, cooking and nutrition education.

### **Effects of Nutrition Knowledge**

Current literature demonstrates a lack of nutrition knowledge amongst the general population of college students.<sup>72</sup> Lack of nutrition knowledge leads to unhealthy eating patterns which in turn leads to weight gain and obesity related diseases.<sup>73</sup> Nutrition knowledge interventions have been proven to significantly increase self-efficacy of healthy behaviors and fruit and vegetable intake in young adults.<sup>13,26,72</sup> These studies have succeeded at improving these variables using various SCT constructs, such as outcome expectations and self-regulation.<sup>13,72</sup> Ha & Caine-Bish and Evans et al. used goal-oriented hands-on activities in combination with conventional educational materials throughout a 15-week college nutrition course and 1 year on camps peer educator intervention, respectively.<sup>19,72</sup> Both interventions were successful at increasing fruit and vegetable intake among college students. Alternately, Richards et al. implemented a 4-month intervention composed of newsletters and computer-based communication, which successfully improved not only fruit and vegetable intake but self-efficacy of healthy behaviors as well.<sup>26</sup>

Multiple studies have also assessed the effects of nutrition education on food insecurity in low-income populations.<sup>50-52</sup> Eicher-Miller et al. and Dollahite et al. both determined that nutrition education improved food insecurity in two separate low-income

populations.<sup>74,75</sup> In a separate study, it was also determined that “shopping and stretching food dollars”, “cooking and making tasty, low-cost food”, recipes, and “healthful foods and nutrition” were the top interests in nutrition education among food insecure individuals.<sup>76</sup> Currently, no studies have been published on the effects of nutrition education on fruit and vegetable intake in food insecure college students.

### **Effects of Urban Gardening**

Urban gardening has been shown to have positive mental and physical health effects on people of all ages and races.<sup>77</sup> Gardening has been shown to improve access to food and nutrition, such as fruit and vegetables, which can result in improved eating behaviors.<sup>78</sup> Studies have also shown that contact with nature, such as gardening, can reduce the risk for heart disease, diabetes, and obesity.<sup>79,80</sup> An indirect benefit of urban gardening includes increased social health and community cohesion, which can promote a healthy mental state. Small scale urban gardening has been used as a method to increase food security and fruit and vegetable access in underserved communities. Growing food at home has been shown to increase food security for all income levels and increase overall health and wellbeing.<sup>81</sup>

Previous studies have looked at the effects of gardening on self-efficacy and fruit and vegetable intake in children, but few have looked at the effect of urban gardening on college students. A study of elementary school children found that a gardening intervention, supplemented with nutrition knowledge and cooking, increased both self-efficacy for healthy behaviors as well as fruit and vegetable intake, using SCT constructs such as reciprocal determinism and observational learning.<sup>82,83</sup>

While only a few studies have investigated the effects of gardening in college students, those that have associate gardening with positive health behaviors.<sup>19,20</sup> Hoffman et al. noted that students who participated in a gardening program had improved self-esteem, which in turn improved student's GPAs and made them more involved in the community.<sup>19</sup> It was also noted that the gardening program was effective at improving self-efficacy and self-esteem, specifically in having positive feelings for gardening and having confidence to complete tasks successfully.<sup>19</sup> Loso et al. concluded that students who gardened at some point in their lives, recently or as children, had a higher mean intake of fruits and vegetables compared to those who never gardened.<sup>20</sup> Fruit and vegetable intake also increased with frequency of gardening.<sup>20</sup> Additionally, in 2019, Staub et al. found an increase in fruit and vegetable intake in college students who gardened vs those who did not, with these students stating they felt more confident cooking from basic ingredients as well.<sup>84</sup> A major barrier associated with urban gardening is lack of skill and self-efficacy.<sup>18</sup> A gap in literature exists regarding urban-gardening interventions and their effects on health behaviors in food insecure college students.

### **Effects of Cooking**

Literature has stated that a major barrier to healthful eating is the lack of knowledge and skills to be able to prepare meals at home.<sup>23,41,76</sup> Combining these factors with the inability to acquire healthy food may increase the risk of food insecurity.<sup>41</sup> Knol et al. indicated that food insecure college students have low cooking self-efficacy and lower rates of making home cooked meals.<sup>22</sup> In a study done by Larson et al., it was reported that young adults believed they lacked the money, time and skills to prepare

food.<sup>23</sup> As a result of this, they are more likely to purchase nutritionally inadequate packaged or ready prepared foods.<sup>41</sup> Larson et al. also reported that those who were more likely to be involved in preparation of food included women, those living at home, and those who ate fast food less than 3 times a week.<sup>23</sup> It was also noted that individuals that prepared meals at home were more likely to meet dietary guidelines.<sup>23</sup>

To date, only one study has focused on increasing at home cooking and healthier eating behaviors in college students. Clifford et al. looked at the effect of a SCT-driven cooking TV show for off-campus college students.<sup>21</sup> The TV show consisted of 4, 15-minute episodes accessed online. The show used observational learning, facilitation, reciprocal determinism, and self-efficacy to successfully improve nutrition knowledge of fruit and vegetable recommendations.<sup>21</sup> In addition, one abstract has also been published looking at the effects of a cooking intervention to decrease food insecurity. The semester long intervention reported decreasing food insecurity rates from 52% to 30%.<sup>85</sup>

### **Summary and Conclusions**

In conclusion, food insecurity has been found to be a growing epidemic amongst college students. Factors such as increased college expenses, limited income, and living away from home make college students a vulnerable and at-risk population for food insecurity. Food insecurity in college students has both short-term and long-term negative effects, including lower GPAs, increased stress and depression, and higher risk for obesity and obesity related diseases in adulthood. While college campus initiatives to help food insecure students have become popular, there is a gap in literature regarding the actual effects and benefits of these initiatives. Nutrition education, cooking, and gardening interventions have all shown promising effects in changing health behaviors in

college students and low-income populations, but these effects have not been tested on food insecure college students. More research is needed to determine if the outcomes of these interventions can potentially increase self-efficacy and fruit and vegetable intake, leading to healthier behaviors among food insecure students, reducing the risk of obesity and obesity related diseases.



## CHAPTER III

### RESEARCH DESIGN AND METHODS

The purpose of this study was to develop and examine the feasibility and promise of an urban-gardening nutrition education intervention for food insecure college students.

#### **Design**

*8-week, randomized control trial*

Randomized control trials are considered the gold standard in research design. Additionally, several nutrition education interventions have shown positive results for increases in nutrition knowledge and fruit and vegetable intake using this design.<sup>26,31,36</sup> Previous literature has also shown that a 6-week intervention has been efficient at increasing knowledge and creating behavior change.<sup>36,45</sup> Thus, this study proposes to use of a randomized control trial including a 6-week intervention in an 8-week study time frame.

#### *Participants*

Previous literature has indicated the increasing rates of food insecurity across college campuses worldwide.<sup>10,30,87</sup> Many negative physical and mental health outcomes have been associated with food insecurity, including obesity and depression. While most college campuses have created resources such as food pantries to help mitigate the effects of food insecurity, previous studies have indicated that this population is at a greater need for additional nutrition education programming.<sup>87,88</sup>

#### *Recruitment*

Participants were recruited from the FIU Modesto Maidique Campus (MMC) campus using random sampling during the months of August 2019- March 2020.

Recruitment and educational sessions occurred in 3 phases: Phase 1 (August 2019), Phase 2 (January 2020), and Phase 3 (March 2020). During all phases, flyers were posted on social media and throughout campus in busy, common areas such as the student center, near large lecture auditoriums, and the gym. The researcher also emailed professors who taught large lecture and lab classes for permission to hand out flyers at the beginning of class and explain the project. Multiple professors offered extra credit for participation. Those who denied the request reported they would post the flyer on the learning platform Canvas or distribute via email. Throughout the academic year, different recruitment opportunities presented themselves. For phase 2 (P2), the researcher was able to obtain a table at a welcome event for the student rec center. For phase 3 (P3), the researcher was able to distribute flyers amongst all campus housing buildings and contacted all previous participants who had not signed up for previous phases via email.

### *Eligibility Criteria*

Interested students were instructed to fill out an online eligibility questionnaire. Eligibility criteria is shown in Table 2. Part of the eligibility criteria required students to be food insecure. Food security was assessed using the USDA Food Security Screener. Those who received a score of 0, indicating high food security, were excluded. Collegiate athletes and women who were pregnant or looking to become pregnant were not able to participate in the study as their weight and eating habits differ and may create skewed results. Those eligible were sent an email providing information on an informational session. The informational session provided further detail on the study, answered any questions, and was used to sign consent forms, complete the baseline survey, and take

anthropometric measurements. This study was reviewed and approved by the FIU Institutional Review Board (IRB) with the approval number of IRB-19-0134.

*Table 2. Eligibility criteria*

<b>Inclusion criteria</b>	<b>Exclusion criteria</b>
Must be enrolled at FIU	Not meeting the inclusion criteria
Age 18+ years old	Students who are student athletes
Literate in English	Women who are pregnant or planning to become pregnant within the next 6 months
Food insecure	

*Power analysis and sample size*

Based on previous research and a power analysis, the researcher planned on recruiting 140 participants, assigning 56 to each group (control and intervention).<sup>89</sup> This sample size incorporates an expected dropout rate of 20%.<sup>13,36,90</sup> A power analysis for sample size was done using G-power software. Effect size was determined using a meta-analysis for fruit and vegetable intake changes among various communities.<sup>89</sup> The effect size for low-income populations (.50), with alpha .05 and 80% power, yielded a total sample size of 112 participants, with 56 participants per group (control and intervention). The planned recruitment of 140 participants at baseline incorporated an expected 20% drop out rate.

*Randomization*

Recruited participants were randomized into two groups after signing consent and completing baseline questionnaires and anthropometrics. Using a computer program, participants were randomly assigned to either a control group or an intervention group, stratifying for BMI. Participants were notified of their assigned group via email which

provided instructions of when and where they would have their next meeting. Initial visits and post-test visits, which included demographics, pre/post testing, and anthropometric measurements, took approximately 1 hour to complete. Both groups received a \$5 gift card after their initial visit and a \$10 gift card after their posttest.

- *Intervention Group*: Intervention group participants completed in person 1-hour educational sessions, once a week for 6 weeks, and completed the posttest and anthropometric measurements on the 7<sup>th</sup> week. The sessions included nutrition education, recipes, cooking demos, home gardening tips, and a take home vertical garden. A satisfaction survey was also administered at the last educational session (week 6). Multiple weekly sessions were scheduled to accommodate the participants' schedules. Sessions were capped at 12 students to allow for a more personalized experience. Text messages were used weekly to remind the participants and confirm attendance for each session.
- *Control Group*: When notified of their assigned group post randomization, control group participants were asked to sign up for their follow up meeting which took place 8 weeks after their initial meeting. Participants were then sent email reminders two weeks before the meeting and then again one day before the meeting. Post-tests and anthropometric measurements were completed at the follow up meeting.

### *Blinding*

Demographic questionnaires, anthropometrics, pre-tests, and post-tests were blinded to the primary study investigator to reduce bias. The surveys and anthropometrics were measured and administered by a lab team member.

### **Intervention Development**

#### *Program Theory*

Session content was constructed using the Social Cognitive Theory. Previous studies have shown the SCT to be effective in changing health behaviors when combined with an intervention program.<sup>36,72</sup> Intervention sessions were created using constructs from the SCT as their core (Table 3). Session content was also based on educational needs stated in previous literature.<sup>13,36</sup> Studies have shown student's nutrition knowledge is relatively low and students tend to consume high carbohydrate, energy dense diets that lack fruit and vegetables.<sup>8,24</sup> Studies have also shown that cost of food and budgeting are major concerns for those who are food insecure.<sup>74-76</sup>

At the start of each 1-hour session, students would sign an attendance sheet and pick up an information packet, which included the daily nutrition education content and recipes or gardening tips. Sessions would then begin with the hands-on cooking or gardening demonstrations. Cooking demonstrations were conducted using food pantry and dorm friendly recipes. Gardening activities were also based on dorm accommodations, with the use of plastic over the door shoe racks as the final vertical take home gardens. This ensured students had enough space to keep their gardens in an easy and non-cumbersome format. Student volunteers were each selected to perform a specific portion of the demonstration. As students conducted the demonstration, the

researcher would verbalize what the volunteer was doing while incorporating the nutrition education found in the packets. Students were also allowed to ask questions throughout the demonstration. At the conclusion of the demonstration, the researcher would explain the nutrition education packet in more detail and answer any additional questions. At this time, students also had the opportunity to eat if applicable to the session. At the end of the session, the participants would complete the assigned activity, such as a quiz or worksheet, before leaving.

*Table 3. Intervention components*

<b>Week/ Session</b>	<b>Intervention Component</b>	<b>Session Content</b>	<b>SCT Construct</b>	<b>Activity</b>
<b>1</b>	Nutrition Education	MyPlate Food Groups	Outcome expectation*	Quiz
	Cooking Demonstration	Zesty Chicken Salad Recipe	Self-efficacy*/ Observational Learning  Facilitation	Hands on Demonstration  Handouts/Recipe
<b>2</b>	Nutrition Education	Food Labels	Outcome expectation*	Quiz
	Cooking Demonstration	Italian Pasta Salad Recipe	Self-efficacy*/ Observational Learning  Facilitation	Hands on Demonstration  Recipe
<b>3</b>	Nutrition Education	Budgeting and meal planning	Self-efficacy*/Self-regulation	Meal Planning/Goal setting worksheet
	Cooking Demonstration	Hummus Wraps Recipe	Self-efficacy*/ Observational Learning  Facilitation	Hands on Demonstration  Recipe
<b>4</b>	Gardening Tips	At home gardening information	Facilitation	Take home instructions
	Gardening Activity	Planting Seeds	Self-efficacy*	Hands on demonstration

<b>5</b>	Gardening Tips	Veggies Scraps Video/Handout	Facilitation	Take home instructions
	Gardening Activity	Veggies Scraps	Self-efficacy* Reciprocal determinism*	Hands on demonstration Take home veggies/post test
<b>6</b>	Gardening Activity	Transplant plants	Self-efficacy	Hands on demo
		Create home garden	Reciprocal determination*	Take home plants

\*Construct measured via pre/post-test (reciprocal determinism, self-efficacy, outcome expectation)

### Outcome Measures

Validated measures and questionnaires were used in this study to determine nutrition knowledge, fruit and vegetable intake, and anthropometrics. Demographic information collected at baseline included participant age, gender, race, ethnicity, academic year, marital status, major, income, living arrangements, along with use of the campus meal plan, food pantry, and government services. Table 4 includes all assessments used to evaluate each intervention component.

*Table 4: Table of assessments*

Assessment	Eligibility	Study Week								Assessment Tools
		1	2	3	4	5	6	7	8	
Food Security	X									USDA Food Security <sup>91</sup> Radimer/Cornell hunger scale <sup>92</sup>
Informed consent		X								
Demographics		X								
Anthropometrics		X							X	Weight: digital scale Height: stadiometer BMI: Standard Equation

SCT Constructs		X							X	Self-efficacy, Outcome Expectation, Reciprocal Determinism <sup>93</sup> Health Views
Nutrition Knowledge		X							X	Dickson-Spillman CoNKS <sup>94</sup>
Fruit and Vegetable Intake		X							X	NCI Fruit and Vegetable Screener <sup>95</sup> 1-item Screener
Stress and Life Satisfaction		X							X	Perceived Stress Scale <sup>96</sup> Life Satisfaction Scale <sup>97</sup>
Satisfaction (Intervention Group Only)								X		Likert scale

### *Feasibility*

Feasibility of research design was assessed by the baseline recruitment of 140 students and an 80% retention rate at post-test. Intervention feasibility was demonstrated by 80% attendance to each weekly session and strong satisfaction with intervention methods and content as reported by a post intervention survey. Satisfaction was evaluated at the end of the 8-weeks through a researcher made survey regarding usefulness and enjoyment of the intervention.

### *Mechanisms of Action*

Study participants were evaluated for nutrition knowledge, fruit and vegetable intake, and anthropometrics using multiple validated measures at baseline and post intervention. Specific information on the questionnaires used, such as scale, response choice, number of items and range, can be seen in Table 5.



*Fruit and Vegetable Intake:* Fruit and vegetable intake was measured using the National Cancer Institute's Fruit and Vegetable Screener<sup>95</sup> as well as through a 1-item question, "Yesterday, how many servings of fruits and vegetables did you consume?"

*Stress and Life Satisfaction:* Cohen's Perceived Stress Scale and Diener's Quality of Life questionnaire was used to determine to the relationship between food insecurity with stress and quality of life.<sup>96, 97</sup>

*Anthropometrics:* Anthropometrics were collected from all participants using standard techniques. Height was measured barefoot by stadiometer and weight was measured barefoot by a digital scale, with empty pockets and without heavy clothing such as sweaters. Participants will also self-report their height and weight for reference. BMI was calculated using the standard equation using height (cm) and weight (kg).

#### *Distal Outcomes*

Distal outcomes were collected from all participants at baseline and after 8 weeks, if applicable.

*Food Security:* Food insecurity was determined using the U.S. Household Food Security Survey Module: Six-Item Short Form by the USDA.<sup>91</sup> Scores for this survey are based on food security varying from high food security, low food security, and very low food security. The score ranged from 0-6 with a score of 0 indicating food secure individuals and 6 indicating very low food security. An additional malnutrition component was included and measured through 2 questions from the Radimer/Cornell Hunger Scale.<sup>92</sup>

*Nutrition Knowledge:* Nutrition knowledge was measured using an adapted version of 20-item Dickson-Spillmann Consumer Oriented Nutrition Knowledge Survey (CoNKS).<sup>94</sup> 10 population relevant True or False style questions were included.

*Self-efficacy, Outcome Expectation, and Reciprocal Determinism:* Behavior change was measured through Social Cognitive Theory constructs. These will be measured through Dewar’s SCT constructs scales.<sup>93</sup>

*Health views:* Personal and family health views were measured using 1-item questions, “In general how would you rate your/your family’s health”. These items are answered in a 5-point Likert scale ranging from Poor to Excellent.

*Table 5. Questionnaires*

<b>Tool</b>	<b>Scale</b>	<b>Example Question</b>	<b>Response Choice</b>	<b># of Items</b>	<b>Range</b>	<b>Reliability (Cronbach’s alpha)</b>
Cohen’s Perceived Stress Scale <sup>96</sup>	5-point Likert	<i>In the last month, how often have you felt that things were going your way?</i>	Never- Very often	10	0-40	.91
Deiner’s Life Satisfaction Scale <sup>97</sup>	7-point Likert	<i>In most ways my life is close to my ideal.</i>	Strongly disagree-Strongly agree	5	5-35	.74
Self-efficacy: Dewar’s <sup>93</sup>	6-point Likert	<i>I believe I have the knowledge and ability to choose/prepare healthy snacks.</i>	Strongly disagree-Strongly agree	7	1-6	.77
Outcome expectation: Dewar’s <sup>93</sup>	6-point Likert	<i>Healthy eating can reduce my risk for some illness and diseases.</i>	Strongly disagree-Strongly agree	5	1-6	.70
Reciprocal determinism: Dewar’s Situation Scale <sup>93</sup>	6-point Likert	<i>At home vegetables are always available to eat.</i>	Strongly disagree-Strongly agree	4	1-6	.72
Nutrition Knowledge: Dickson-	True/ False	<i>Fat is always bad for your health, therefore you should always avoid it.</i>	True or False	10	0-100	.20

Spillman CoNKS <sup>94</sup>						
Fruit and Vegetable Intake: NCI <sup>95</sup>	Multiple choice	<i>Over the last month, how often did you eat lettuce salad?</i>  <i>Each time you ate lettuce salad, how much did you usually eat?</i>	Never – 5 or more times a day  Less than ½ cup-More than 2 cups	12  11	-	.70
USDA 6-item short Food Security survey <sup>91</sup>	Multiple choice	<i>“The food that I bought didn’t last and I didn’t have money to buy more.”</i>  <i>In the last 12 months did you ever cut the size of a meal or skip meals because there wasn’t money for food?</i>	Often true- Never true  Yes/No	6	0-6	.50
Radimer/ Cornell Hunger <sup>92</sup>	Multiple choice	<i>“I eat the same thing several days in a row because I only have a few different kinds of food and I don’t have money to buy more”</i>  <i>Has your body weight dropped in the last year because of lack of food?</i>	Often true- Never true  Yes - No	2	0-2	.50
Personal and family health views	5-point Likert	<i>In general, how would you rate your health?</i>  <i>In general, how would rate your family’s health?</i>	Poor- Excellent	2	1-5	.79

### Statistical Analysis

Primary outcomes included changes in fruit and vegetable intake, health behavior mediators, stress, life satisfaction and BMI. Data was analyzed using SPSS v.26

(Armonk, NY: IBM Corp.). Baseline data was described using means, standard deviations, and percentages. One-way ANOVAs and independent t-tests were used to assess differences among intervention, control, and study completer and non-completer groups. Bonferoni test was used as a post hoc analysis for any significant findings. Linear regressions were also used to assess relationships between baseline characteristics. Repeated measures ANOVAs were used to assess changed pre and post intervention between both control and intervention groups. Finally, a mediation analysis was used to assess whether stress and life satisfaction had a mediating effect on the primary outcome of fruit and vegetable intake. A *P*-value of less than 0.05 indicated statistically significant differences among all tests.

*Table 6. Statistical analysis*

<b>AIM 1.</b> Create an urban-gardening and nutrition education intervention using hands on gardening and cooking, and the social cognitive theory.			
<b>AIM 2:</b> Examine the implementation feasibility and promise of an urban-gardening and nutrition education intervention on mediators for behavior change, fruit and vegetable intake, weight, and stress and life satisfaction.			
<b>Hypothesis</b>	<b>Variables</b>	<b>Outcomes</b>	<b>Statistical Analyses</b>
<b>H1:</b> Feasibility of the research design will be demonstrated by baseline recruitment of 140 college students and 80% retention post-test.	<u>Dependent:</u> recruitment and retention	Recruitment of 140 participants and 80% retention of participants at post test	Descriptive statistics
<b>H2:</b> Feasibility of the intervention will be achieved through 80% attendance to weekly sessions and strong satisfaction with intervention methods and content as reported by a post intervention survey.	<u>Dependent:</u> Attendance and satisfaction	80% overall attendance to sessions and strong satisfaction with the intervention	-Descriptive statistics - Qualitative thematic analysis
<b>H3:</b> Baseline demographic information, BMI, and mediators for behavior change will influence baseline fruit and vegetable intake, stress, and life satisfaction in food insecure college students.	<u>Independent:</u> Demographics and mediators <u>Dependent:</u> Fruit and vegetable intake, stress, life satisfaction, and BMI	Baseline mediators and demographics will be correlated with fruit and vegetable intake, stress, life satisfaction, and BMI	- Descriptive statistics - One way ANOVA -Independent <i>t</i> -test -Linear regressions

<b>H4:</b> College students who participate in the intervention will increase mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy.	<u>Independent:</u> Intervention <u>Dependent:</u> Nutrition knowledge, reciprocal determinism, outcome expectation, self-efficacy	The intervention group will have higher mediators for behavior change at posttest compared to the control group.	Repeated measures ANOVA
<b>H5:</b> Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, and outcome expectations, will be correlated with change in self-efficacy.	<u>Independent:</u> Intervention, theory mediators <u>Dependent:</u> Self-efficacy	Improvement in theory mediators will increase self-efficacy in the intervention group.	Linear regression
<b>H6:</b> College students who participate in the intervention will increase their fruit and vegetable consumption.	<u>Independent:</u> Intervention <u>Dependent:</u> Fruit and vegetable intake	The intervention group will have higher fruit and vegetable intake at posttest compared to the control group.	Repeated measures ANOVA
<b>H7:</b> Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will affect fruit and vegetable intake.	<u>Independent:</u> Intervention, theory mediators <u>Dependent:</u> Fruit and Vegetable intake	Improvement in theory mediators will increase fruit and vegetable intake in the intervention group.	Linear regression
<b>H8:</b> College students who participate in the intervention will lower their stress and increase their satisfaction with life.	<u>Independent:</u> Intervention <u>Dependent:</u> Stress and life satisfaction	The intervention group will have lower stress and better life satisfaction at posttest compared to the control group.	Repeated measures ANOVA
<b>H9:</b> Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will affect stress and life satisfaction.	<u>Independent:</u> Intervention, theory mediators <u>Dependent:</u> Stress and life satisfaction	Improvement in theory mediators will decrease stress and increase life satisfaction in the intervention group.	Linear regression
<b>H10:</b> Stress and life satisfaction will mediate fruit and vegetable intake in participants who complete the intervention.	<u>Independent:</u> Stress and life satisfaction <u>Dependent:</u> Relationship between self-efficacy and fruit and vegetable intake	Stress and life satisfaction will mediate the relationship between self-efficacy and fruit and vegetable intake.	Mediation analysis
<b>H11:</b> College students who participate in the intervention will maintain or reduce their body weight.	<u>Independent:</u> Intervention <u>Dependent:</u> Weight, BMI	The intervention group will not increase their weight or BMI at posttest compared to the control group.	Repeated measures ANOVA

*Study Timeline and COVID-19*

The study timeline can be seen below in Table 7. Due to COVID-19 and subsequent campus closures, in March 2020 the study had to be converted into an online format. An IRB amendment was obtained to approve these changes. To accommodate safety measures and physical distancing, P2 participants were instructed to complete their post-test online via FIU Qualtrics and self-report their heights and weights. They were sent the remaining gift card amount for completion virtually to their emails. P3 intervention group participants were sent gardening kits via Amazon. Cooking and gardening sessions were filmed and uploaded to a non-public YouTube account. Private YouTube video links, recipes, informational handouts, and quizzes were sent weekly via email to each participant. Participants were asked to return quizzes by the end of the week and send pictures of their plants/meals. On the 8<sup>th</sup> week, both P3 intervention and control group participants were sent the post-test online via FIU Qualtrics, which included self-reported heights and weights. Gift cards for completion were sent virtually via email.

*Table 7. Study timeline*

Activity	Jul 19	Aug 19	Sep 19	Oct 19	Nov 19	Jan 20	Feb 20	Mar 20	Apr 20	May 20	Jun 20	Jul 20	Aug 20
<b>Development</b>	X												
<b>IRB</b>		X											
<b>Recruitment</b>		X	X			X		X					
<b>Intervention</b>				X	X		X	X	X online	X online			
<b>Data cleaning and analysis</b>											X	X	X

## CHAPTER IV

### RESULTS

The purpose of this study was to develop an urban gardening and cooking nutrition education intervention for food insecure college students. The study sought to test the feasibility and acceptability of the program design and examine the effectiveness of the intervention on programmatic mediators, diet, weight status, stress, and life satisfaction.

#### **Feasibility**

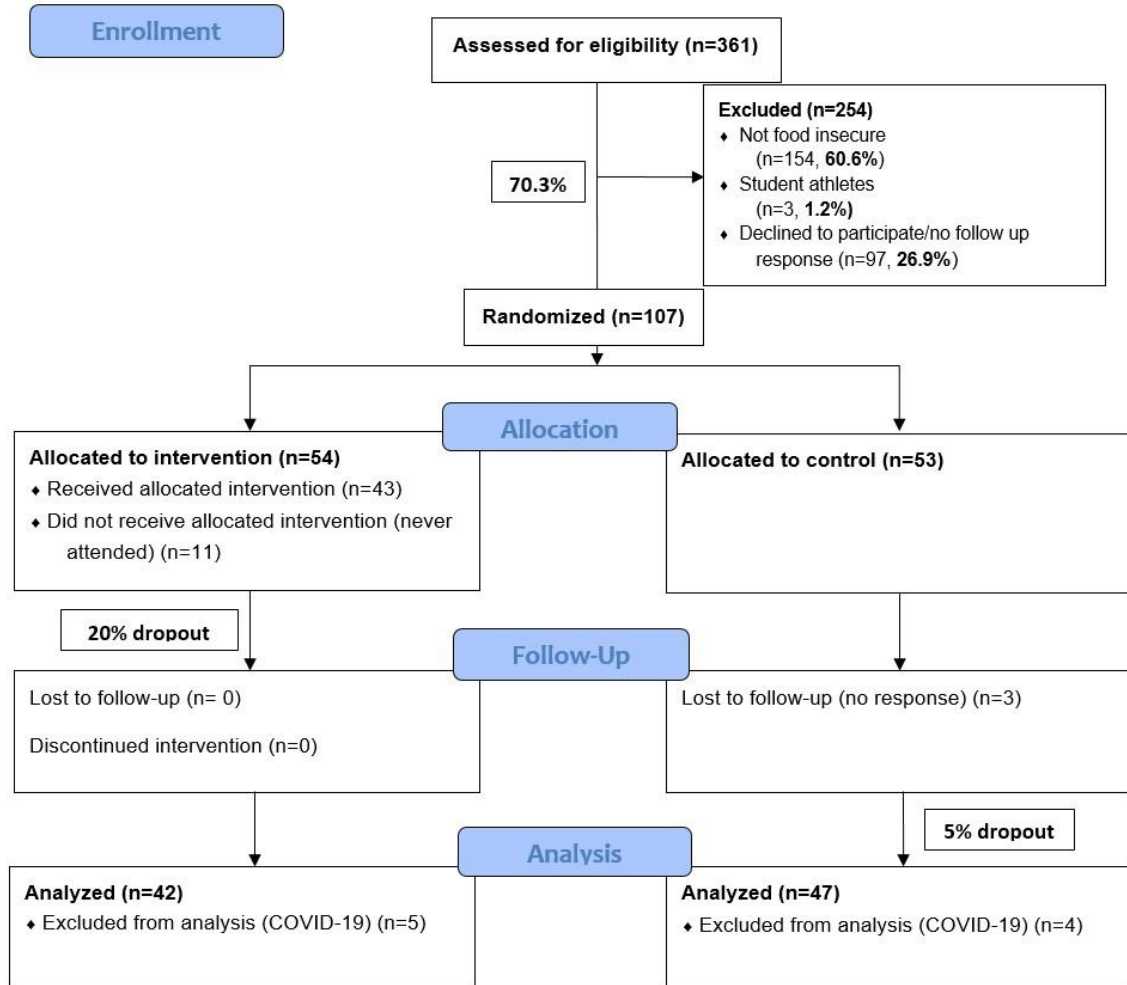
##### **Hypothesis 1:**

*Feasibility of the research design will be demonstrated by baseline recruitment of 140 college students, assuming 80% retention (with complete data) at post-test.*

A total of 361 students filled out an eligibility form, with 204 meeting eligibility requirements (56%). The majority of students who were not eligible were excluded due to being food secure (60.6%) with few students excluded due to being student athletes (1.2%). Of those eligible students, 97 did not respond, attend orientation sessions, or sign up. Thus, a total of 107 students were recruited into the study (52% of eligible). During randomization, 54 participants were placed into the intervention group and 53 were placed into the control group. In the intervention group, 11 students never attended, leaving 43 students for analysis. In the control group, 3 students did not complete their final survey, leaving 50 students for analysis. Due to COVID-19 and the resulting program changes in P3, this cohort was excluded from final analysis. Thus, a total of 89 participants were included in the final analysis. This data can be seen in the Consort

diagram in Figure 2. The intervention had a total dropout rate of 13.1%, with the intervention and control dropout rates as 20% and 5% respectively.

Figure 2. *Consort diagram*



## Hypothesis 2:

*Feasibility of the intervention will be demonstrated by 80% attendance at program sessions and strong satisfaction with intervention goals, content, and format as reported by post-test surveys.*

Total attendance for Phase 1 (P1) of the intervention was 90% and total attendance for Phase 2 (P2) was 88.9%, with a combined total attendance for both



sessions of 89.5%. Satisfaction rates were also measured and can be seen in Table 8. Satisfaction for both P1 and P2 (n=43) was measured using 4-point Likert scale questions. When asked if the intervention was enjoyable and helpful, 97.7% of participants chose “very enjoyable” and 90.9% of participants indicated the sessions were “very helpful”. Additionally, 100% of the participants stated they would recommend these sessions to a friend and thought it would be a useful resource on college campuses.

Table 8. *Satisfaction survey responses*

		<i>N(43)</i>	<i>%</i>
<b>Did you find the sessions to be:</b>	Very enjoyable	42	97.7
	Somewhat enjoyable	0	0
	Enjoyable	1	2.3
	Not very enjoyable	0	0
	Not enjoyable	0	0
<b>Did you find the sessions to be:</b>	Very helpful	39	90.7
	Somewhat helpful	2	4.65
	Helpful	2	4.65
	Not very helpful	0	0
	Not helpful	0	0
<b>Would you recommend these sessions to a friend?</b>	Yes	43	100
	No	0	0
<b>Do you think this would be a useful resource on college campuses?</b>	Yes	43	100
	No	0	0

At the end of the intervention, participants were asked to state what they liked most about the sessions. Their statements were reviewed by the researcher and key words and main ideas were assessed and coded. Each response was assigned a code or label which correlated to a respective theme. Codes were then summed together to organize examples and tally the number of relevant responses. Overall, the students most enjoyed the sense of community, being interactive and the hands-on gardening and cooking sessions. In addition, they thought the intervention was informative and fun. The themes, and specific examples are listed in Table 9.

Table 9. *Common themes in post intervention satisfaction*

Theme	# of students	Example
<b>Community</b>	6	<ul style="list-style-type: none"> <li>▪ “Comfortable environment that doesn’t feel forced and is engaging and insightful”</li> <li>▪ “I liked getting to learn with other students about healthy eating and gardening. It makes it a lot more fun and easier to stick than just going it alone”</li> <li>▪ “...also loved how small and personal the class was”</li> <li>▪ “I enjoyed how interconnected everyone felt and how warm they were. It felt like each participant and each person running this study genuinely cared about one another and wanted to make a difference”</li> <li>▪ “The atmosphere felt very amicable and I felt comfortable asking questions about anything and felt like I would get an honest and trustworthy answer”</li> <li>▪ “I liked how everyone can get involved and share their opinions”</li> </ul>
<b>Interactive/Hands on</b>	10	<ul style="list-style-type: none"> <li>▪ “How interactive and informative the sessions are”</li> <li>▪ “I like how interactive you were with us always having us feel involved with what we’re doing, it didn’t feel like you were just lecturing us.”</li> <li>▪ “Getting to be interactive/hands on while preparing the food helped me the most as I am living alone in my house and do not have too many opportunities to prepare my own food. It always seemed foreign to me until I was able to see up close how easy this seemed. It definitely motivated me to save money by making my own food, while eating healthier”</li> <li>▪ “I loved how interactive the sessions were, and how inviting and welcoming the atmosphere was! Overall, so wholesome.”</li> <li>▪ “I love the hands on experience that I was able to get put it. It was very informative!”</li> </ul>
<b>Informative</b>	6	<ul style="list-style-type: none"> <li>▪ “I loved how informative each session was. They were all so helpful.”</li> <li>▪ “All the information given. Very clear and easy to understand.”</li> </ul>

<b>Gardening</b>	12	<ul style="list-style-type: none"> <li>▪ “we got to see our progress when it comes to the growth of our plants”</li> <li>▪ “I most liked how to grow plants by ourselves and I highly think that it will help me for a lifetime and it is therapeutic for me”</li> <li>▪ “I really enjoyed planting my own veggies”</li> <li>▪ “the hands on gardening”</li> <li>▪ “I really enjoyed the gardening session. I find it therapeutic and had found a new hobby to pursue!”</li> </ul>
<b>Cooking/Recipes/Food</b>	13	<ul style="list-style-type: none"> <li>▪ “Food”</li> <li>▪ “I loved the cooking portion!”</li> <li>▪ “Learning how to make healthy and quick meals”</li> <li>▪ “I liked all the information received especially the recipes that were so easy, cheap, and delicious.”</li> <li>▪ “The mini cooking lessons that taught us how to complete fast and nutritious meals.”</li> <li>▪ “Learning about reading a food label, how to make food without cooking, and planting seeds.”</li> <li>▪ “The quick, affordable and easy ways to make healthy foods was enjoyable.”</li> <li>▪ “the recipes”</li> <li>▪ “being able to make my own food”</li> <li>▪ “I enjoyed the meals the most. This is because seeing the meals made in front of me and trying it made it more enjoyable and made me we want to cook healthy meals. I always see healthy cooking online and on IG but I never think to do this myself but experiencing the cooking and trying the food made me want to. And so delicious!”</li> </ul>
<b>Fun/Enjoyable</b>	5	<ul style="list-style-type: none"> <li>▪ “They were engaging, the handouts were useful, and the presenter made learning fun”</li> <li>▪ “The sessions were very fun and informative. The in-class activities and pamphlets we received are going to help me improve my overall eating habits”</li> </ul>

## Study Sample Characteristics

### Hypothesis 3:

*Baseline demographic information and mediators for behavior change will influence baseline fruit and vegetable intake, BMI, stress, and life satisfaction in food insecure college students.*

Participants provided baseline demographic information through a self-reported questionnaire. Demographic information is provided in Table 10 and Table 11. A total of 107 participants were recruited at baseline. The majority of participants were female (85.9%), white Caucasian (49%), and Hispanic (58.9%). Participants had an average age of 20.47 (SD: 2.56) and an average BMI of 24.81 (SD: 6.02) with the majority of participants (50.5%) falling under a normal/healthy BMI. The majority of participants were undergraduate juniors (30.8%) who lived at home with family (55.7%). The average GPA was 3.35 (SD: .462). All participants were categorized as food insecure with 65.4% falling under the 'low food security' category. Participants were employed (53.3%), had a personal yearly income of \$0-\$10,000 (26.2%), were Pell grant recipients (53.3%) and also received parental financial support (60.7%). In addition, most students did not partake in the student meal plan (72.9%) nor use the campus food pantry (87.9%). At baseline, the average nutrition knowledge score was 67.7% (SD: 15.58) and daily servings of fruits and vegetables averaged 2.15 (SD: 2.84). Participants were moderately stressed (66%) and generally dissatisfied with life (29.9%). Life satisfaction scores and perceived stress scores had a mean of 22.37 (SD: 5.21) and 21.27 (SD: 6.59), respectively. Theory constructs were measured using Dewar's SCT scale and scored on a scale of 1-6. At baseline, participants had a mean score of 3.33 (SD: .813) for self-

efficacy, 3.91 (SD: 1.08) for reciprocal determinism, and 5.62 (SD: .417) for outcome expectations. Finally, the majority of participants rated their personal health views as “good” (37.8%).

Table 10. *Participant demographic information*

		<b>N(108)</b>	<b>%</b>	<b>Mean±SD</b>
<b>Gender</b>	Male	15	14.1	
	Female	92	85.9	
<b>Age</b>				20.47±2.56
<b>Race</b>	African American	18	17	
	Caribbean Islander	23	21.7	
	Native American	1	.9	
	White Caucasian	52	49	
	Asian	5	4.7	
	Other	7	6.6	
<b>Ethnicity</b>	Hispanic	63	58.9	
	Non-Hispanic	44	41.1	
<b>BMI</b>	Underweight	11	10.3	24.81±6.02
	Normal	54	50.5	
	Overweight	24	22.4	
	Obese	18	16.8	
<b>Food Security Category</b>	Very low	35	32.7	
	Low	70	65.4	
	High	2	1.9	
<b>GPA</b>				3.35±.46
<b>Academic Year</b>	Freshman	30	28	
	Sophomore	26	24.3	
	Junior	33	30.8	
	Senior	14	13.1	
	Graduate student	4	3.7	
<b>Living arrangements</b>	Campus- Roommate	34	32.1	
	Campus- Alone	4	3.8	
	Off campus- Alone	2	1.9	
	Off campus- Family	59	55.7	
	Off- campus- Roommate	7	6.6	
<b>Pell grant recipient</b>	Yes	57	53.3	
	No	50	46.7	

<b>Employed</b>	Yes	57	53.3
	No	50	46.7
<b>Income</b>	0-10k	28	26.2
	10k-20k	14	13.1
	20-30	19	17.8
	30-40	11	10.3
	40-50	5	4.7
	50-60	11	10.3
	60+	18	16.8
<b>Parental Support</b>	Yes	65	60.7
	No	42	39.3
<b>Campus Meal Plan</b>	Yes	29	27.1
	No	78	72.9
<b>Campus Food Pantry</b>	Yes	13	12.1
	No	94	87.9
<b>First generation student</b>	Yes	50	47.2
	No	56	52.8
<b>Community Food Banks</b>	Yes	1	.9
	No	105	99.1

Note. N: *sample size*

Table 11. *Participant baseline mediator values*

	<b>N</b>	<b>%/Mean±SD</b>
<b>Nutrition Knowledge Score</b>	107	67.7±15.58
<b>Daily Serving of Fruits and Vegetables</b>	107	2.15±2.84
<b>Self-efficacy Score</b>	107	3.33±.81
<b>Situation Score</b>	107	3.91±1.08
<b>Outcome Expectations Score</b>	107	5.62±.42
<b>Perceived Stress Category</b>		
<i>Low</i>	10	9.4%
<i>Moderate</i>	70	66.0%
<i>High</i>	26	24.5%
<b>Life Satisfaction Category</b>		
<i>Extremely Satisfied</i>	1	0.9%
<i>Satisfied</i>	5	4.7%
<i>Slightly satisfied</i>	31	29.0%
<i>Slightly dissatisfied</i>	28	26.2%
<i>Dissatisfied</i>	32	29.9%
<i>Extremely dissatisfied</i>	10	9.3%

**How would you rate your health?**

<i>Excellent</i>	2	2.0%
<i>Great</i>	15	15.3%
<i>Good</i>	37	37.8%
<i>Average</i>	34	34.7%
<i>Poor</i>	10	10.2%

*Note.* N: sample size

To determine whether all cohorts were equal at baseline, a one-way ANOVA was run to test for significant baseline differences. No significant differences were found across the 3 cohorts (Table 12). Since all cohorts were deemed equal at baseline, a one-way ANOVA was subsequently run to determine whether the intervention and control groups were also equal at baseline. Since not all participants completed the study, completion status was included in the analysis to determine any differences between completers and non-completers as well. This data is shown in Table 13. There was a significant baseline difference between all four groups in the 1-item fruit and vegetable intake ( $F = 3.43$ ,  $P = .020$ ). Intervention completers had the lowest intake compared to other groups with  $1.67 \pm 1.02$  servings per day, followed by intervention non-completers ( $2.00 \pm 1.34$ ), control completers ( $2.31 \pm 1.08$ ), and control non-completers had the highest intake with  $3.00 \pm 1.41$  daily servings. A Bonferroni post hoc analysis identified no significant differences between the four groups (Table 13).

Table 12. *Baseline differences between cohort groups of intervention*

	<b>Phase 1 (N=30)</b>	<b>Phase 2 (N=68)</b>	<b>Phase 3 (N=9)</b>	<b>F</b>	<b>P</b>
<b>1-item Fruit/Vegetable intake</b>	2.00±1.02	2.074±1.23	2.00±.87	.051	.950
<b>Food Insecurity Category</b>	1.7±.59	1.69±.47	1.67±.50	.015	.985
<b>Nutrition Knowledge</b>	69.67±12.73	66.47±16.00	70.00±21.21	.544	.582
<b>Life Satisfaction Score</b>	21.03±5.58	22.71±5.01	24.33±4.95	1.79	.171
<b>Perceived Stress Score</b>	22.13±6.93	21.16±6.34	19.22±7.51	.697	.500
<b>Situation Score</b>	3.95±1.12	3.84±1.12 <sup>a</sup>	4.33±.43	.847	.432
<b>Self-efficacy Score</b>	3.28±.713	3.35±.85	3.35±.90	.074	.929
<b>Outcome Expectation Score</b>	5.67±.39	5.61±.44	5.62±.32	.198	.821
<b>Fruit and Vegetable Intake</b>	2.69±3.89 <sup>b</sup>	1.99±2.44 <sup>a</sup>	1.61±.97	.804	.451
<b>BMI</b>	23.4±5.21	25.64±6.46	23.26±3.95	1.79	.172

<sup>a</sup>N = 67, <sup>b</sup>N = 29



Table 13. Baseline differences between intervention completers and non-completers

	Intervention Completers (IC) (N=43)	Intervention Non-completers (IN) (N=11)	Control Completers (CC) (N=49)	Control Non-completers (CN)(N=4)	Post hoc pairwise comparison															
					F	P	Mean diff CC-CN	P	Mean diff CC-IC	P	Mean diff CC-IN	P	Mean diff CN-IC	P	Mean diff CN-IN	P	Mean diff IC-IN	P		
1-item F/V intake	1.67±1.02	2.00±1.34	2.31±1.08	3.00±1.41	3.43	.020*	.689	1	.644	.052	.168	1	1.33	.151	.857	1	.476	1		
Food Insecurity Category	1.77±.479	1.73±.467	1.61±.53	1.75±.50	.567	.638	-	-	-	-	-	-	-	-	-	-	-	-		
Nutrition Knowledge	67.44±12.93	72.73±17.37	65.51±17.2	82.5±9.57	2.01	.118	-	-	-	-	-	-	-	-	-	-	-	-		
Life Satisfaction Score	22.39±5.29	22.64±4.96	21.98±3.40	26.25±5.29	.206	.892	-	-	-	-	-	-	-	-	-	-	-	-		
Perceived Stress Score	21.12±6.18 <sup>a</sup>	18.91±8.02	22.47±6.02	14.75±10.1	.944	.423	-	-	-	-	-	-	-	-	-	-	-	-		
Situation Score	3.93±1.09 <sup>a</sup>	3.75±1.14	3.92±1.12	4.13±.66	.631	.597	-	-	-	-	-	-	-	-	-	-	-	-		
Self-efficacy Score	3.18±.82	3.195±.75	3.43±.795	4.07±.83	1.65	.184	-	-	-	-	-	-	-	-	-	-	-	-		
Outcome Expectation Score	5.69±.42	5.64±.33	5.57±.423	5.6±.46	.542	.655	-	-	-	-	-	-	-	-	-	-	-	-		
F/V Intake	1.68±1.49	3.02±5.79	2.41±2.88 <sup>c</sup>	1.91±1.46	1.29	.282	-	-	-	-	-	-	-	-	-	-	-	-		
BMI	25.27±5.78	22.44±3.16	24.73±6.79	27.42±2.71	.513	.674	-	-	-	-	-	-	-	-	-	-	-	-		
Personal Health	2.67±1.03 <sup>a</sup>	2.57±.97 <sup>b</sup>	2.63±.88 <sup>d</sup>	2.67±.58 <sup>e</sup>	.244	.866	-	-	-	-	-	-	-	-	-	-	-	-		

Note: \*- significant p-value < .05, <sup>a</sup>N = 42, <sup>b</sup>N = 7, <sup>c</sup>N = 47, <sup>d</sup>N = 46, <sup>e</sup>N = 3

## Correlations

A correlation matrix was created to examine the relationship between the participants' baseline demographics, mediators for behavior change, fruit and vegetable intake, stress, and life satisfaction. Results can be seen in Table 14. Among the variables tested, academic year and food pantry use were positively correlated ( $\alpha = .196, P = .043$ ). BMI was positively correlated with parental financial support ( $\alpha = .282, P = .003$ ) and negatively correlated with personal health views ( $\alpha = -.268, P = .005$ ). Nutrition knowledge was negatively correlated with age ( $\alpha = -.202, P = .037$ ), and being a first-generation college student ( $\alpha = -.215, P = .027$ ), and positively correlated with race ( $\alpha = .214, P = .027$ ), fruit and vegetable intake ( $\alpha = .284, P = .003$ ), and personal health views ( $\alpha = .225, P = .020$ ). Since race was a categorical variable, a one-way ANOVA was conducted to determine the relationship between the different races and nutrition knowledge. The ANOVA demonstrated that there was no significant difference between races ( $F = 1.55, P = .207$ ). This data can be seen in Table 15. Self-efficacy scores were positively correlated with ethnicity ( $\alpha = .226, P = .019$ ), reciprocal determinism ( $\alpha = .311, P = .001$ ), life satisfaction ( $\alpha = .332, P = .000$ ), fruit and vegetable intake ( $\alpha = .292, P = .002$ ), and personal health views ( $\alpha = .412, P = .000$ ) and negatively correlated with perceived stress ( $\alpha = -.281, P = .000$ ). An independent *t*-test was run to determine the relationship between self-efficacy and ethnicity. There was no significant difference between ethnicities ( $F = -2.05, P = .800$ ). This data can be seen in Table 16. In addition, outcome expectation scores were positively correlated with academic year ( $\alpha = .280, P = .004$ ). Situation scores, or reciprocal determinism, was negatively correlated with first generation students ( $\alpha = -.233, P = .017$ ) and perceived stress ( $\alpha = -.265, P = .006$ ) and

positively correlated with self-efficacy score ( $\alpha = .311, P = .001$ ), life satisfaction ( $\alpha = .285, P = .003$ ), and personal health views ( $\alpha = .294, P = .002$ ). Fruit and vegetable intake was positively associated with race ( $\alpha = .227, P = .019$ ) and personal health views ( $\alpha = .241, P = .012$ ). To determine the relationship between fruit and vegetable intake with the different races, a one-way ANOVA was conducted. There was no significant difference between the different races and fruit and vegetable intake ( $F = 1.61, P = .192$ ). This data can be seen in Table 17. Finally, perceived stress was positively associated with BMI ( $\alpha = .216, P = .026$ ) and gender ( $\alpha = .360, P = .000$ ), with women having higher scores of perceived stress. Perceived stress was also negatively associated with life satisfaction ( $\alpha = -.541, P = .000$ ) and personal health views ( $\alpha = -.296, P = .002$ ). Lastly, life satisfaction was negatively associated with gender ( $\alpha = -.256, P = .008$ ) with women having lower life satisfaction scores, BMI ( $\alpha = -.243, P = .012$ ) and positively associated with self-efficacy ( $\alpha = .332, P = .000$ ), fruit and vegetable intake ( $\alpha = .219, P = .024$ ), and personal health views ( $\alpha = .292, P = .002$ ).

Table 14. *Correlation Matrix*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.Age	1																	
2.Gender	.074	1																
3.Race	-.008	-.011	1															
4.Ethnicity	-.116	.009	-.223*	1														
5.Parental Support	.123	.049	-.044	-.088	1													
6.Academic Year	.691*	.096	-.117	-.028	.103	1												
7.Campus Food Pantry Use	.167	-.097	-.015	.096	.053	.196*	1											
8.First Gen. Student	-.016	-.104	.069	-.029	.200*	-.096	.050	1										
9.FS Cat	.062	.074	.055	-.092	-.155	-.111	-.171	-.110	1									
10.BMI	.053	.119	-.187	.040	.282**	.134	-.144	.169	.025	1								
11.NK Score	-.202*	-.026	.214*	-.058	-.039	-.085	-.073	-.215*	-.033	-.061	1							
12.SE Score	.121	-.021	-.080	.226*	.010	.155	.151	-.007	-.036	-.119	-.060	1						
13.OE Score	.146	.051	-.009	-.062	-.023	.280**	.142	.000	.084	.012	.033	.076	1					
14.SS Score	.097	-.014	-.126	.006	-.180	.105	.097	-.233*	.185	-.189	-.154	.311**	.110	1				
15.PS Score	.067	.360**	.092	-.085	.022	.116	-.160	-.016	-.154	.216*	-.022	-.281**	-.073	-.265**	1			
16.LS Score	-.066	-.256**	.067	.031	-.087	-.076	.100	-.116	.005	-.243*	.095	.332*	.147	.285**	-.541**	1		
17.FV Intake (1-item)	-.079	.040	.227*	-.001	-.016	.022	.010	-.064	-.074	.060	.284*	.292**	.133	.058	.037	.219*	1	
18.PHV	-.093	-.229*	.061	-.021	-.160	-.138	.035	-.247*	.092	-.268**	.225*	.412**	.121	.294**	-.296**	.292**	.241*	1

Note: FS Cat: Food Security Category, NK: Nutrition knowledge, SE: Self-efficacy, OE: Outcome expectation, SS: Situational, PS: Perceived stress, LS: Life satisfaction, FV: Fruit and vegetable, PHV: Personal health view

Note: \*\* - Correlation is significant at the 0.01 level (2-tailed). \* - Correlation is significant at the 0.05 level (2-tailed)

Note: Numbers in the top row of the table are similar items as the variables in the left column.

Table 15. *One way ANOVA between nutrition knowledge and race*

	<b>Nutrition Knowledge Score Mean±SD</b>	<b>F</b>	<b>P</b>
<b>African American (N = 18)</b>	63.89±12.89	1.55	.207
<b>Caribbean Islander (N = 23)</b>	63.91±17.77		
<b>White Caucasian (N = 52)</b>	70.96±15.37		
<b>Other (N = 13)</b>	77.14±9.51		

Table 16. *Independent t-test between baseline self-efficacy and ethnicity*

	<b>Self-efficacy Mean±SD</b>	<b>t</b>	<b>P</b>
<b>Hispanic (N = 63)</b>	3.18±.80	-2.05	.800
<b>Non- Hispanic (N = 44)</b>	3.55±.79		

Table 17. *One way ANOVA between fruit and vegetable intake and race*

	<b>Fruit and Vegetable Intake Mean±SD</b>	<b>F</b>	<b>P</b>
<b>African American (N = 16)</b>	1.67±.84	1.61	.192
<b>Caribbean Islander (N = 23)</b>	1.78±1.04		
<b>White Caucasian (N = 45)</b>	2.27±1.17		
<b>Other (N = 13)</b>	2.15±1.41		

To determine possible predictors of BMI, fruit and vegetable intake, stress, and life satisfaction, the Social Cognitive Theory was used to determine mediators which might impact food insecure college students. Theory mediators included reciprocal determinism, outcome expectations, self-efficacy, nutrition knowledge, and personal health views. These mediators, along with significant demographics from the correlation matrix were used to run regression analyses.

### **Predictors of fruit and vegetable intake**

To determine predictors of fruit and vegetable intake, a stepwise regression was performed using the theory mediators. It was determined that nutrition knowledge ( $\beta =$

.346,  $t = 3.73$ ,  $P < .01$ ) and self-efficacy ( $\beta = .301$ ,  $t = 3.25$ ,  $P = .002$ ) had a significant positive correlation with fruit and vegetable intake ( $R^2 = .201$ ), as seen in Table 18.

Table 18. *Regression analysis results showing significant associations between theory mediators and fruit and vegetable intake*

Variables	<i>B</i>	<i>SE</i> <i>B</i>	$\beta$	<i>t</i>	<i>P</i>	<i>F</i>	Sig.	$R^2$ (Adj- $R^2$ )
<b>Fruit and Vegetable Intake</b>						11.67	.000*	.201(.183)
Nutrition knowledge	.026	.007	.346	3.73	.000*			
Self-efficacy	.429	.132	.301	3.25	.002*			

Note: \*- significant p-value < .05

### Predictors of BMI

To determine predictors of BMI in food insecure college students, a stepwise regression was performed using the theory mediators and presence of parental financial support. It was determined that parental financial support ( $\beta = .227$ ,  $t = 2.32$ ,  $P = .022$ ) had a positive correlation and personal health views ( $\beta = -.221$ ,  $t = -2.26$ ,  $P = .026$ ) had a significant negative correlation with BMI ( $R^2 = .115$ ), as seen in Table 19.

Table 19. *Regression analysis results showing significant associations between baseline characteristics and baseline BMI*

Variables	<i>B</i>	<i>SE</i> <i>B</i>	$\beta$	<i>t</i>	<i>P</i>	<i>F</i>	Sig.	$R^2$ (Adj- $R^2$ )
<b>BMI</b>						6.17	.003*	.115(.096)
Parental financial support	2.83	1.22	.227	2.32	.022*			
Personal health views	-.46	.645	-.221	-2.26	.026*			

Note: \*- significant p-value < .05

### Predictors of stress and life satisfaction

To determine predictors of stress and life satisfaction, two stepwise regressions were performed using the theory mediators, BMI, fruit and vegetable intake, and gender,

which was coded as 1 for male and 2 for female in this analysis. When looking at stress, the stepwise regression determined that gender ( $\beta = .360, t = 4.13, P < .01$ ) had a significant positive association and self-efficacy ( $\beta = -.214, t = -2.33, P = .022$ ) and reciprocal determinism, or environment, ( $\beta = .200, t = 2.18, P = .032$ ) had significant negative associations with perceived stress ( $R^2=.246$ ). This data can be seen in Table 20. When looking at life satisfaction, the stepwise regression also determined that gender ( $\beta = -.252, t = -2.82, P = .006$ ) had a significant negative association with life satisfaction while self-efficacy ( $\beta = .273, t = 2.90, P = .005$ ) and reciprocal determinism ( $\beta = .191, t = 2.03, P = .045$ ) had significant positive associations ( $R^2 = .149$ ). This data can be seen in Table 21.

Table 20. *Regression analysis results showing significant associations between theory mediators and stress*

Variables	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>	<i>F</i>	<i>P</i>	$R^2(\text{Adj-}R^2)$
<b>Stress</b>						10.79	.000*	.246(.224)
Gender	6.76	1.64	.360	4.13	.000*			
Self-efficacy	-1.73	.739	-.214	-2.33	.022*			
Reciprocal Determinism	-1.23	.563	-.200	-2.18	.032*			

Note: \*- significant p-value < .05

Table 21. *Regression analysis results showing significant associations between theory mediators and life satisfaction*

Variables	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>	<i>F</i>	<i>P</i>	$R^2(\text{Adj-}R^2)$
<b>Life satisfaction</b>						8.802	.000*	.211(.187)
Self-efficacy	1.74	.598	.273	2.90	.005*			
Gender	-3.74	1.33	-.252	-2.82	.006*			
Reciprocal Determinism	.925	.456	.191	2.03	.045*			

Note: \*- significant p-value < .05

## Intervention Theory

### Hypothesis 4:

*College students who participate in the intervention will increase mediators for health behavior change i.e. nutrition knowledge, self-efficacy, reciprocal determinism, outcome expectations and health views.*

For hypothesis 4, repeated measures ANOVA was utilized. This analysis technique is used to measure one dependent variable, measured over two or more time points. Within group effect size and between group effect size were analyzed for all ANOVAs using Hedge's  $g$ . For this measure, a small effect size is determined as a value  $< .50$ , a moderate effect size is determined as  $.5 - .79$ , and a large effect size is determined as a value  $> .80$ . The changes in mediators for health behavior for over the span of the intervention for both intervention and control groups can be found in Table 22.

### *Nutrition Knowledge*

The intervention group did not significantly change nutrition knowledge scores when compared to the control group post intervention,  $F=.291$ ,  $P = .591$  (Table 22). Both group effect size (Hedge's  $g = .272$ ) and between group effect size (Hedge's  $g < .20$ ) was small for this analysis. The intervention group significantly answered the questioned the specific question, "a healthy meal consists of half meat, a quarter vegetables, and a quarter side" correctly compared to those in the control group post intervention, which can be seen in Table 23. The intervention group increased their average from 61.9% of the participants answering correctly to 76.2%, while the control group decreased from 44.7% correct to 36.2% correct,  $F = 5.33$ ,  $P < .05$ . The effect size was small for this



analysis (intervention group Hedge's  $g = .309$ , between group Hedge's  $g = .459$ ). No other question responses were significant.

#### *Self-efficacy*

Self-efficacy was scored on a scale of 0-6, with the higher score indicating better self-efficacy. The intervention group showed significant improvement in self-efficacy scores as compared to the control group post intervention. The intervention group increased mean self-efficacy scores from 3.16 (SD: .817) to 4.09 (SD: .701) while the control group only slightly increased from 3.45 (SD: .788) to 3.61 (SD: .858),  $F = 17.65$ ,  $P < .01$  (Table 22). Both intervention within group effect size (Hedge's  $g = 1.22$ ) and between group effect size (Hedge's  $g = .960$ ) were large for this analysis.

#### *Reciprocal Determinism*

Reciprocal determinism was assessed via a situation scale which was scored on a scale of 0-6, with the higher score indicating a healthier environment and reciprocal determinism. The intervention group showed significant improvement in reciprocal determinism when compared to the control group post intervention,  $F = 4.16$ ,  $P < .05$  (Table 22). The intervention group increased their average scores from 3.95 (SD: 1.09) to 4.81 (SD: .726) while the control group only slightly increased their scores from 3.87 (SD: 1.14) to 4.32 (SD: .856). The intervention within group effect size for this change was large (Hedge's  $g = .918$ ) while the between group effect size was small (Hedge's  $g = .409$ ).

#### *Outcome Expectation*

Outcome expectation was scored on a scale of 0-6, with a higher score indicating a better understanding of outcomes. The intervention group did not significantly change

their outcome expectation scores when compared to the control group post intervention,  $F = .288, P = .593$  (Table 22). Since there was no change, both the within group and between group effect were small.

### *Health Views*

Students had 5 choices to determine their personal and family health views: poor, average, good, great, and excellent, which were scored 1-5, respectively. A repeated measures ANOVA was used to determine whether college students who participated in the intervention changed their personal and family health views and readiness to change. These results are seen in Table 22. When compared to the control group, students who were part of the intervention group did significantly increase their personal health views from an average score of 2.64 (SD: 1.03) to 3.27 (SD: .857) post intervention,  $F = 5.65, P = .020$ . The intervention group had a moderate within group effect size (Hedge's  $g = .633$ ) while the between group effect size was small (Hedge's  $g = .389$ ) Students who were part of the intervention group also significantly increased their family health views, from 2.48 (SD: 1.13) to 2.95 (SD: .962) when compared to the control group post intervention,  $F = 5.36, P = .023$ . Both effect sizes for this change were small (intervention group Hedge's  $g = .416$ , between group Hedge's  $g = .33$ ).

When looking at the change in personal and family health views in the intervention group specifically, McNemar's test was utilized to determine if there was a significant change in amount of people who changed from a poor health view to a good health view (Table 24). Poor and average ratings were categorized into poor health views and good, great, and excellent ratings were categorized into the good health view category. There was a significant change in the amount of people who increased their

personal health view from poor to good ( $P = .003$ ) while there was no significant change in those who changed their family health view ( $P = .109$ ). At baseline, 22 participants had a poor personal health rating and 27 had a good personal health rating. Post intervention, only 8 participants rated their health as poor and 34 participants rated their health as good (Table 24). Although there was no significant change in family health views, the amount of participants with poor health ratings decreased post intervention and the amount of participants with good health rating increased post intervention (Table 24).

Table 22. Repeated measure ANOVA and effect sizes for theory mediators (pre-post)

Intervention				Control			Comparison		
Mean±SD	N	Within Group Effect (Hedge's g)	Mean±SD	N	Within Group Effect (Hedge's g)	F	P	Between Group Effect (Hedge's g)	
<b>Nutrition knowledge</b>									
Pre	67.38±13.08	42	.27	66.81±16.29	47	.12	.291	.591	.11
Post	71.19±14.85			68.94±18.21					
<b>Self-efficacy</b>									
Pre	3.16±.82	42	1.22	3.45±.79	47	.19	17.65	.000*	.96
Post	4.09±.70			3.61±.86					
<b>Reciprocal determinism</b>									
Pre	3.95±1.09	41	.92	3.87±1.14	47	.45	4.16	.045*	.41
Post	4.81±.73			4.32±.86					
<b>Outcome expectation</b>									
Pre	5.69±.43	42	0	5.56±.43	47	.10	.288	.593	.12
Post	5.69±.50			5.51±.53					
<b>Personal Health Views</b>									
Pre	2.67±1.03	42	.63	2.64±.87	47	.29	5.65	.020*	.39
Post	3.27±.857			2.87±.71					
<b>Family's Health</b>									
Pre	2.48±1.13	42	.42	2.45±.93	47	.14	5.36	.023*	.33
Post	2.95±.96			2.58±.95					

Note: \*- significant p-value < .05

Table 23. Repeated measure ANOVA and effect sizes for nutrition knowledge questions (pre-post)

Intervention			Control			Comparison			
Mean±SD	N	Within Group Effect (Hedge's g)	Mean±SD	N	Within Group Effect (Hedge's g)	F	P	Between Group Effect (Hedge's g)	
<b>A healthy meal consists of half meat, a quarter vegetables, and a quarter side</b>									
Pre	.619+.492	42	.309	.447+.502	47	.171	5.33	.023*	.459
Post	.762+.431			.362+.486					
<b>If you have eaten high-fat foods, you can reverse the effects by eating an apple</b>									
Pre	.905+.297	42	0	.894+.312	47	0	.000	1	0
Post	.905+.297			.894+.312					
<b>If cream is whipped it contains less calories than in its liquid form</b>									
Pre	.738+.445	42	.112	.894+.312	47	.068	.711	.401	.184
Post	.786+.415			.872+.337					
<b>Fat is always bad for your health, you should therefor avoid it as much as possible</b>									
Pre	.952+.216	42	.128	.936+.247	47	.093	.003	.956	.013
Post	.976+.154			.957+.204					
<b>A balanced diet implies eating all foods in the same amount</b>									
Pre	.809+.397	42	0	.872+.337	47	.060	.058	.810	.057
Post	.809+.397			.851+.359					
<b>The health benefit of fruit and vegetables lies alone in the supple of vitamins and minerals</b>									
Pre	.619+.492	42	.128	.575+.499	47	0	.146	.703	.097
Post	.667+.477			.575+.499					
<b>Brown sugar is much healthier than white sugar</b>									
Pre	.214+.415	42	.057	.298+.462	47	.178	.495	.483	.139
Post	.238+.431			.383+.491					
<b>Skimmed milk contains fewer minerals than full-fat milk</b>									
Pre	.452+.504	42	.237	.511+.505	47	.213	.009	.925	.026
Post	.571+.501			.617+.491					
<b>For a healthy nutrition, dairy products should be consumed in the same amounts as fruits and vegetables</b>									
Pre	.809+.397	42	0	.851+.359	47	.060	.067	.796	.056
Post	.809+.397			.872+.337					
<b>Pasta with tomato sauce is healthier than pasta with mushroom and cream sauce</b>									
Pre	.619+.491	42	.049	.404+.496	47	.214	.978	.325	.265
Post	.595+.497			.511+.505					

Note: \*- significant p-value < .05

Table 24. Pre/post changes in personal and family health views in intervention group (McNemar's Test)

	Pre (N)	Post (N)	Sig.
<b>Personal Health View</b>			
Poor	22	8	.003*
Good	27	34	
<b>Family Health View</b>			
Poor	27	15	.109
Good	22	27	

Note: \*- significant p-value < .05

### Hypothesis 5:

*Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, and outcome expectations, will be correlated with change in self-efficacy.*

According to the Social Cognitive Theory, mediators for behavior change can have a direct effect on self-efficacy. To determine whether change in any of the behavior mediators affected change in self-efficacy in the intervention group, a linear regression was performed. This data is seen in Table 25. The regression determined that only change in reciprocal determinism ( $\beta = .369, t = 2.359, P = .024$ ) had a significant positive effect on change on self-efficacy ( $R^2 = .184$ ). Effect size for the model was analyzed using Cohen's  $f^2$  which indicates a small effect size with a value of .02, a medium effect size with a value of .15, and a large effect size with a value of .35. This model had a medium effect size with a value of .226.

Table 25. Regression analysis results showing significant associations between change in theory mediators and self-efficacy change in the intervention group, controlling for ethnicity

Variables	B	SE B	$\beta$	t	p	F	Sig.	$R^2$ (Adj- $R^2$ )	$f^2$
<b>Self-efficacy change</b>						2.787	.054*	.184(.118)	.226
Reciprocal determinism change	.328	.139	.369	2.36	.024*				
Nutrition knowledge change	.009	.008	.116	1.09	.283				
Outcome expectation change	-.095	.262	-.055	-.362	.720				

Note: \*- significant p-value < .05

## Promise

For hypothesis 6, 8, and 11 a repeated measures ANOVA was utilized. This analysis technique is used to measure one dependent variable, measured over two time points. The changes demonstrated by the intervention and control groups for fruit and vegetable intake, stress and life satisfaction, and weight and BMI, can be found in Table 26, Table 28, and Table 34, respectively. For hypothesis 7 and 9, a stepwise regression analysis was performed to determine in the association between theory mediators and fruit and vegetable intake, stress, and life satisfaction, which can be seen in Tables 27, 29, 30. For hypothesis 10, a linear regression and mediation analysis were performed. The mediation analyses were performed using PROCESS v 3.5 in SPSS. This data can be seen in Table 31, 32, and 33.

### **Hypothesis 6:**

*College students who participate in the intervention will increase their fruit and vegetable consumption.*

Fruit and vegetable intake was determined using two different methods, the NCI screener and a 1-item question, “How many fruits and vegetables did you consume yesterday”. When looking at the 1-item question, the intervention group significantly increased their fruit and vegetable intake post intervention, from 1.67 servings per day (SD: 1.03) to 2.86 (SD: 1.14) servings per day. This is compared to the control group post intervention, which did not change, staying near 2.36 (SD: 1.15) servings per day at 2.38 (SD: 1.07),  $F = 19.19$ ,  $P < .01$  (Table 26). When looking at the NCI screener, the intervention group increased fruit and vegetable intake from 1.68 (SD: 1.51) to 2.28 (SD: 1.89) while the control group decreased fruit and vegetable intake post intervention, from

2.47 (SD: 3.00) to 2.25 (SD: 1.83). This resulted in a marginally significant change,  $F = 3.72$ ,  $P = .057$  (Table 26). Within group effects and between group effects were measured using Hedge's  $g$ . Using the NCI Fruit and Vegetable screener, the effect size was small for both values (intervention within group Hedge's  $g = .351$ , between group Hedge's  $g = .159$ ). For the 1-item screener, there was a large effect size for both values (intervention within group Hedge's  $g = 1.09$ , between group Hedge's  $g = 1.07$ ).

Table 26. Repeated measure ANOVA and effect sizes for fruit and vegetable intake (pre-post)

Intervention				Control			Comparison		
Mean±SD	N	Within Group Effect (Hedge's $g$ )	Mean±SD	N	Within Group Effect (Hedge's $g$ )	F	P	Between Group Effect (Hedge's $g$ )	
<b>NCI Fruit and Vegetable Intake</b>									
Pre	1.68+1.51	42	.351	2.47+3.00	43	.089	3.72	.057	.159
Post	2.28+1.89			2.25+1.83					
<b>1-item Fruit and Vegetable Intake</b>									
Pre	1.67+1.03	42	1.09	2.36+1.15	47	.018	19.19	.000	1.07
Post	2.86+1.14			2.38+1.07					

### Hypothesis 7:

*Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will be correlated with change in fruit and vegetable intake.*

To determine whether intervention mediators had an effect on fruit and vegetable intake, a linear regression was performed. The regression demonstrated that none of the intervention mediators had a significant effect on change in fruit and vegetable intake,  $F = .580$ ,  $P = .679$ ,  $R^2 = .061$  (Table 27). The effect size (Cohen's  $f^2$ ) for this relationship was small with a value of .065.

Table 27. Regression analysis results showing significant associations between changes in theory mediators and fruit and vegetable intake change in the intervention group

Variables	<i>B</i>	<i>SE</i> <i>B</i>	$\beta$	<i>t</i>	<i>p</i>	<i>F</i>	<i>Sig.</i>	<i>R</i> <sup>2</sup> ( <i>Adj-R</i> <sup>2</sup> )	<i>f</i> <sup>2</sup>
<b>Fruit and Vegetable Intake Change</b>						.580	.679	.061 (-.044)	.065
Nutrition knowledge change	.010	.012	.138	.817	.419				
Self-efficacy change	.072	.229	.056	.312	.757				
Reciprocal determinism change	-.231	.208	-.203	-1.11	.274				
Outcome expectation change	.388	.365	.177	1.063	.295				

### Hypothesis 8:

*College students who participate in the intervention will lower their stress and increase their satisfaction with life.*

#### *Stress*

Perceived stress was score on a scale of 0-40, with a higher score indicating higher perceived stress. Students in the intervention group significantly decreased their perceived stress score compared to those in the control group post intervention,  $F = 16.20, P < .01$  (Table 28). Those in the intervention group decreased their average perceived stress scores from 21.15 (SD: 6.26) to 16.66 (SD: 6.56) while the control group's scores stayed the same, slightly shifting from 22.32 (SD: 6.05) to 22.13 (SD: 5.66). Students in the intervention group also decreased their perceived stress category, compared to those in the control group, post intervention,  $F = 4.07, P < .01$  (Table 28). For both measures, the within group and between group effect sizes were moderate.

#### *Satisfaction with Life*



Satisfaction with life was scored on a scale of 5-35, with the higher score indicating a greater satisfaction with life. Students in the intervention group significantly increased their satisfaction with life scores, compared to those in the control group, post intervention,  $F = 18.99, P < .01$  (Table 28). Those in the intervention group increased their life satisfaction from 22.3 (SD: 5.32) to 26.09 (SD: 5.36) while the control group's scores stayed the same, slightly shifting from 21.87 (SD: 5.29) to 21.79 (SD: 5.64). Students in the intervention group significantly increased their satisfaction with life category, compared to those in the control group, post intervention,  $F = 13.18, P < .01$  (Table 28). For both measures, intervention within group and between group effect sizes were moderate.

Table 28. Repeated measure ANOVA and effect sizes for perceived stress and life satisfaction (pre-post)

Intervention				Control			Comparison		
Mean±SD	N	Within Group Effect (Hedge's g)	Mean±SD	N	Within Group Effect (Hedge's g)	F	P	Between Group Effect (Hedge's g)	
<b>Perceived Stress Score</b>									
Pre 21.15+6.26	41	.70	22.32+6.05	47	.032	16.20	.000*	.699	
Post 16.66+6.56			22.13+5.66						
<b>Perceived Stress Category</b>									
Pre 2.12+.557	41	.535	2.21+.549	47	.113	4.07	.047*	.452	
Post 1.81+.601			2.15+.509						
<b>Life Satisfaction Score</b>									
Pre 22.31+5.32	42	.708	21.87+5.29	47	.015	18.99	.000*	.728	
Post 26.09+5.36			21.79+5.64						
<b>Life Satisfaction Category</b>									
Pre 4.05+1.13	42	.599	4.00+1.07	47	.055	13.18	.000*	.655	
Post 4.71+1.07			3.94+1.11						

Note: \*- significant p-value < .05

### Hypothesis 9:

*Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will be correlated to changes in stress and life satisfaction.*

To determine whether intervention mediators had an effect on stress and life satisfaction, a linear regression was performed. The regression, performed controlling for gender, demonstrated that none of the intervention mediators had an effect on change in stress ( $F = .917, P = .465$ ) or life satisfaction ( $F = .615, P = .655$ ) as seen in Table 29 and Table 30. Effect size was measured using Cohen's  $f^2$ , which was calculated as .105 and .068 for each, respectively. This represents a small-moderate effect size for the model.

Table 29. Regression analysis results showing associations between change in theory mediators and stress change, controlling for gender

Variables	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>	<i>F</i>	<i>Sig.</i>	$R^2(Adj-R^2)$	$f^2$
<b>Stress change</b>						.917	.465	.095 (-.009)	.105
Nutrition knowledge change	.029	.056	.088	.527	.602				
Self-efficacy change	-.655	1.066	-.109	-.614	.543				
Reciprocal determinism change	-1.21	.965	-.226	-1.25	.220				
Outcome expectation change	2.115	1.809	.195	1.169	.250				

Table 30. Regression analysis results showing associations between change in theory mediators and change in life satisfaction, controlling for gender

Variables	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>	<i>F</i>	<i>Sig.</i>	$R^2(Adj-R^2)$	$f^2$
<b>Life satisfaction change</b>						.615	.655	.064 (-.040)	.068
Nutrition knowledge change	.042	.039	.181	1.075	.290				
Self-efficacy change	.503	.768	.117	.655	.517				
Reciprocal determinism change	.105	.697	.028	.151	.881				
Outcome expectation change	-.354	1.224	-.048	-.289	.774				

**Hypothesis 10:**

*Stress and life satisfaction will mediate fruit and vegetable intake in participants who complete the intervention.*

Using the Social Cognitive Theory and a literature analysis, a theoretical model was proposed for the intervention, which indicated that self-efficacy would have a direct effect on the participants' fruit and vegetable intake. Previous analysis determined there was no direct relation between these two variables (Table 27). To determine whether stress and life satisfaction had a mediating effect on the relationship between self-efficacy in the intervention group, a hierarchical multiple regression analysis was conducted using SPSS PROCESS v.03. First, we used stress as a mediator and the results are as follows: in step 1 of the mediation model, the regression of self-efficacy on fruit and vegetable intake, when ignoring the effect of the mediator, was not significant,  $B = .0199$ ,  $t = .096$ ,  $P = .924$ . Step 2 indicated that regression of self-efficacy on the mediator, stress, was also not significant  $B = -1.15$ ,  $t = -1.24$ ,  $P = .224$ . Step 3 of the mediation process showed that the mediator, stress, affecting fruit and vegetable intake, was not significant  $B = .021$ ,  $t = .611$ ,  $P = .545$ . Step 4 showed that controlling for the mediator, self-efficacy did not significantly affect fruit and vegetable intake,  $B = -.005$ ,  $t = -.023$ ,  $P = .982$ . Sobel test found non-significant mediation in the model ( $z = -.548$ ,  $P = .584$ ). In this case, effect size was  $-.025$  (95% CI=  $-.148$  to  $-.078$ ) (Table 31).

Table 31. *Test of hypothesized mediator change in stress*

<b>Criteria</b>	<b>B</b>	<b>SE</b>	<b>t</b>	<b>P</b>	<b>Lower CI</b>	<b>Upper CI</b>
Step 1: Effect of change in self-efficacy on fruit and vegetable change when ignoring the mediator (path c').						
Intake	.019	.207	.096	.924	-.399	.439
Step 2: Effect of self-efficacy change on the mediator, stress change (path a).						
Intake	-1.15	.931	-1.24	.2236	-3.04	.732
Step 3 & 4: Effect of the mediator, stress change, on fruit and vegetable change (path b) and the indirect effect of stress change on fruit and vegetable change (path c).						
Intake	.021	.035	.610	.545	-.049	.092
Self-efficacy	-.005	.202	-.023	.982	-.413	.403
Indirect effect of X on Y	Effect	Lower CI	Upper CI	SE	z	P
	-.025	-.149	.078	.047	-.548	.584

We replaced stress with life satisfaction and ran the model again. In step 1, the regression of self-efficacy on fruit and vegetable intake, when ignoring the effect of the mediator, was not significant,  $B = .007$ ,  $t = .036$ ,  $P = .972$ . Step 2 indicated that regression of self-efficacy on the mediator, life satisfaction, was also not significant  $B = .714$ ,  $t = 1.09$ ,  $P = .284$ . Step 3 of the mediation process showed that the mediator, life satisfaction, affecting fruit and vegetable intake, was not significant  $B = .007$ ,  $t = .137$ ,  $P = .892$ . Step 4 showed that controlling for the mediator, self-efficacy did not significantly affect fruit and vegetable intake,  $B = .012$ ,  $t = .061$ ,  $P = .952$ . Sobel test found non-

significant mediation in the model ( $z = .135, P = .892$ ). In this case, effect size was .005 (95% CI= -.066 to .087) (Table 32).

Table 32. *Test of hypothesized mediator change in life satisfaction*

Criteria	<i>B</i>	<i>SE</i>	<i>t</i>	<i>P</i>	Lower CI	Upper CI
Step 1: Effect of change in self-efficacy on fruit and vegetable change when ignoring the mediator (path c').						
Intake	.007	.204	.036	.971	-.406	.420
Step 2: Effect of self-efficacy change on the mediator, life satisfaction change (path a).						
Intake	.714	.657	1.09	.284	-.614	2.04
Step 3 & 4: Effect of the mediator, life satisfaction change, on fruit and vegetable change (path b) and the indirect effect of life satisfaction change on fruit and vegetable change (path c).						
Intake	.007	.048	.137	.892	-.091	.105
Self-efficacy	.012	.199	.061	.952	-.389	.414
Indirect effect of X on Y	Effect	Lower CI	Upper CI	SE	<i>z</i>	<i>P</i>
	.005	-.066	.087	.037	.135	.892

A linear regression analysis also demonstrated that change in stress and life satisfaction had no direct effect on changes in fruit and vegetable intake ( $F = .283, P = .755$ ), as seen in Table 33. The effect size was determined to be small, with Cohen's  $f^2 = .015$ .

Table 33. Regression analysis results showing associations between change in life satisfaction and stress and change in fruit and vegetable intake

Variables	<i>B</i>	<i>SE</i> <i>B</i>	$\beta$	<i>t</i>	<i>p</i>	<i>F</i>	<i>Sig.</i>	<i>R</i> <sup>2</sup> ( <i>Adj-R</i> <sup>2</sup> )	<i>f</i> <sup>2</sup>
<b>Fruit and Vegetable intake change</b>						.283	.755	.015(-.037)	.015
Stress change	.248	.554	.081	.448	.657				
Life satisfaction change	.029	.039	.135	.744	.461				

**Hypothesis 11:**

*College students who participate in the intervention will maintain or reduce their body weight.*

Students who were part of the intervention group did not significantly change or increase body weight when compared to the control group post intervention,  $F = .035$ ,  $P = .851$  (Table 34). Students who were part of the intervention group also did not significantly change or increase their BMI when compared to the control group post intervention,  $F = .115$ ,  $P = .735$  (Table 34). As a result, the BMI category also did not significantly change for the intervention group as compared to the control group,  $F = .088$ ,  $P = .767$  (Table 34). Since there was no significant change between either group, the within group and between group effect sizes were small.

Table 34. *Repeated measure ANOVA for weight and BMI (pre-post)*

Intervention			Control			Comparison			
Mean±SD	N	Within Group Effect (Hedge's g)	Mean±SD	N	Within Group Effect (Hedge's g)	F	P	Between Group Effect (Hedge's g)	
<b>BMI</b>									
Pre	25.41+5.77	42	.042	24.85+6.92	47	.053	.115	.735	.020
Post	25.17+5.52			24.48+7.03					
<b>BMI Category</b>									
Pre	2.59+.939	42	.074	2.41+.909	46	.044	.088	.767	.119
Post	2.52+.943			2.37+.928					
<b>Weight (kg)</b>									
Pre	67.37+15.3	42	.051	66.10+20.15	47	.046	.035	.851	.095
Post	66.61+14.45			65.15+20.79					

## Summary

In conclusion, various statistical tests were run to determine the baseline characteristics of low-income college students, feasibility, intervention theory, and promise outcomes of this study. While baseline recruitment was not successful, feasibility of attendance and satisfaction were met. While exploring study sample characteristics, it was determined that baseline characteristics had a significant influence on fruit and vegetable intake, BMI, stress and life satisfaction. Self-efficacy and BMI were positively associated with both stress and life satisfaction, while self-efficacy and nutrition knowledge were positively associated with fruit and vegetable intake. Additionally, personal health views and parental financial support were positively associated with BMI. When looking at intervention theory and promise outcomes, Social Cognitive Theory behavior mediators significantly increased and were found to significantly affect self-efficacy in those who participated in the intervention. In addition, those who participated in the intervention significantly increased their fruit and vegetable

intake and life satisfaction, decreased their stress, and maintained body weight and BMI, although theory mediators did not significantly affect or mediate the change in any of these variables.



## CHAPTER V

### DISCUSSION

#### **Overview:**

The purpose of this study was to examine the feasibility and promise of a cooking and gardening nutrition education intervention targeting food insecure college students. The study consisted of 2 aims; Aim 1: Examine factors related to food insecure college students and create a nutrition education intervention using gardening, cooking, and the Social Cognitive Theory, and Aim 2: Examine the implementation feasibility and promise of an urban-gardening and nutrition education intervention on mediators for behavior change, fruit and vegetable intake, weight, stress, and life satisfaction. The study used a randomized control trial design to implement a 6-week, in person, interactive approach to cooking and gardening while providing recipes, gardening tips, and nutritional information such as MyPlate, food groups, food labels, and budgeting. Validated questionnaires were used pre and post intervention to measure changes in health behavior, fruit and vegetable intake, stress and life satisfaction in comparison to a control group. To date, this is the first study to investigate the effect of nutrition education along with cooking and gardening skills to improve health behaviors in food insecure college students.

#### **Discussion of Hypotheses**

**Hypothesis 1: Feasibility of the research design will be demonstrated by baseline recruitment of 140 college students, assuming 80% retention (with complete data) at post-test.**

In this hypothesis, we aimed to recruit 140 participants at baseline and retain 80% of participants at post-test, resulting in a total of 112 participants, providing 80% power.

Recruitment was performed in three phases, one session in Fall 2019, and two sessions in Spring 2020. A total of 361 students were recruited to participate in the study however 157 were excluded for not meeting the overall eligibility requirements. Of the 157 excluded participants, 155 participants were food secure with a score of 0 on the USDA Food Security Survey. Out of the 204 participants that were eligible to participate, a total of 107 students (50.2%) completed baseline measurements and were randomized to the study design. Due to COVID-19 and subsequent program changes, 9 students were excluded from post-test analysis. Although minimum baseline recruitment was not met, an effect size of .50 was utilized to calculate enough power to change fruit and vegetable intake as the primary outcome variable. In our study, however, the intervention resulted in a large effect size ( $>0.80$ ) so we were able to show significant changes in the fruit and vegetable intake variable as the result of the intervention. Retention in the program was higher than expected. Of the 98 participants included in the initial analysis, 89 were retained at post-test indicating an 91% retention rate.

Recruitment was affected by several factors. Recruitment for phase 3, which was ultimately discarded from analysis, began at the start of the COVID-19 pandemic, which not only forced the intervention to be online, but minimized recruitment for this phase. Other factors which potentially affected recruitment included the eligibility requirements, the lack of opportunity for extra credit and recruiting during midterms or finals weeks. While no data was collected regarding effectiveness of recruitment efforts, anecdotally, participants seemed more likely to sign up for the study when the study and its components were verbally explained versus reading the information on flyers or social media postings. Future studies should collect data in regards to recruitment methods to

determine effective methodology for this demographic. Some factors of the research design may have helped recruitment efforts. Eligibility requirements, specifically the need to be food insecure, was not advertised or discussed during recruitment. This may have benefited recruitment as food insecure students were not directly targeted which helped eliminate potential associated insecurities. In addition, the use of the USDA Food Security Survey may have overestimated food insecurity in our sample making more students eligible to participate. Recent literature has suggested that this survey may overestimate rates of food insecurity in the college population.<sup>30,86,98,99</sup>

When examining the recruitment rates of other studies that target college students, our study had lower enrollment rates (~50%). Other studies have shown higher enrollments of up to 75% of eligible participants. Compared to previous studies, this study mainly consisted of Hispanic and low-income participants which are characteristics that have been correlated to low enrollment rates. To date, nutrition education intervention studies focused on food insecure college students are scarce and no studies have investigated the motivations or barriers food insecure college students may face in regard to participating in research studies. Currently, only a few abstracts have implemented nutrition education targeting food insecure college students, in which recruitment and retention rates are not discussed.<sup>85,100</sup>

This study had a low dropout rate of 9%. The high rate of retention through the 6-week intervention was likely due to self-selection and self-bias. Those who were interested in cooking or gardening were more likely to sign up for the study, which ultimately predicted their enjoyment and retention throughout the study. Feedback for improvement was also taken at each session and implemented within the next session.

This allowed us to tailor the intervention to participants and to increase enjoyment. In addition, one of the participant incentives was free food. Since these students struggle with food insecurity, free food may have been a large motivation factor to attend sessions. Other studies have shown that retention rates of nutrition education programs vary as well with an average dropout rate of 20%, which is higher than what was found in this study.<sup>13,36,90,101</sup>

**Hypothesis 2: Feasibility of the intervention will be demonstrated by 80% attendance to weekly intervention sessions and strong satisfaction with intervention methods and content as reported by a post intervention survey.**

Feasibility of the intervention was defined as 80% attendance throughout the 6-week intervention portion of the study as well as strong satisfaction scores related to educational material, helpfulness and enjoyability of the intervention. The results of this study supported hypothesis 2. Goal attendance and satisfaction rates were achieved with an average 89.5% attendance and with high satisfaction scores. Satisfaction was measured using 5, 5-point Likert scale questions regarding whether the participants enjoyed the sessions, found them useful and whether they would recommend the study to a friend. 100% of participants stated they would recommend the program to a friend and over 90% of the participants found the program very enjoyable and very helpful. An additional open response question was included for feedback. The open-ended responses indicated that overall, students most enjoyed the community, interactive, gardening, and cooking portions of the sessions. These aspects should be incorporated into future nutrition education interventions to increase effectiveness and satisfaction. Previous interventions with food insecure students have indicated that hands on cooking

approaches have been successful in improving health behaviors, specifically in comparison to non-interactive modalities.<sup>85,100</sup> This idea has also been supported by cooking interventions in general college students.<sup>21,102,103</sup> The high satisfaction rates in this study aligned with other nutrition education interventions in low-income populations. Previous in-person interventions have had an average of 80-90% satisfaction.<sup>104,105</sup>

**Hypothesis 3: Baseline demographic information and mediators for behavior change will influence baseline fruit and vegetable intake, BMI, stress, and life satisfaction in food insecure college students.**

The third hypothesis aimed to determine whether demographic and health behavior factors correlated to fruit and vegetable intake, BMI, stress, and life satisfaction in food insecure college students. The study results indicated that these factors were correlated.

*Demographics*

The majority of participants recruited were female (86%) and Hispanic (59%). A large number of participants also identified as African American or Caribbean Islander (36%). In this study sample, 57% of students screened were found to be food insecure. This rate of food insecurity is consistent with previous literature. Recent studies have indicated a college food insecurity rate which ranges from 10%-75%, with an average of 43.5%.<sup>10,29,30,86</sup> Of the 107 students recruited, 65.4% were categorized as low food security status and 32.7% had very low food security. While previous literature has stated that the rate of very low food security is often just as prevalent as low food security, the current rate observed was much lower.<sup>30</sup> The high rate of food insecurity could be due in part to the high percentage of Hispanic and African American participants. Previous

studies have demonstrated that Hispanic and African American college students are at higher risk for food insecurity.<sup>51,106</sup>

Participants had a mean self-efficacy score of 3.33 (SD: .813), mean situation score (reciprocal determinism) of 3.91 (SD: 1.08), and a mean outcome expectation score 5.62 (SD: .417). This demonstrated average self-efficacy and reciprocal determinism and high outcomes expectations of health behaviors. An average self-efficacy score indicates that participants adequately believed they were capable of making healthy diet choices. Reciprocal determinism scores indicated that students sometimes had healthy foods readily accessible at home and that the availability of those foods influenced their intake. Finally, a high outcome expectation indicated that participants believed their diet had a direct effect on their overall health. While there is no present data related to food insecure college students, general college students were found to have average scores for self-efficacy and outcome expectations of health behavior changes in previous studies.

Participants had an average nutrition knowledge score at baseline of 68% (SD: 15.58). Nutrition knowledge in this population was moderate-low, which is consistent with baseline nutrition knowledge scores for college students in previous studies.<sup>36,107,108</sup> In contrast, Cuy-Castellanos et al. found that 80% of food insecure students analyzed had adequate nutrition literacy using the Newest Vital Sign screening tool related to food labels.<sup>109</sup> Adequate literacy of food labels indicates students have the ability to read and understand a nutrition food label. This differs from general nutrition knowledge as students may be able to understand food labels but may not understand what a healthy diet consists of or how to use these labels to choose healthy food items.

Participants consumed an average of 2.15 (SD: 2.84) servings of fruits and vegetables per day, which did not meet the adequate intake of daily fruit and vegetables of 5 servings per day as recommended by the U.S. Department of Agriculture. This is consistent with previous literature that has demonstrated low fruit and vegetable intake in the college population.<sup>110</sup> When looking specifically at food insecure college students, the intake of fruit and vegetables in our study sample was high compared to a previous study conducted by El Zein et al. This study determined that food insecure college students had an average intake of 1.6 servings of fruits and vegetables, although it was measured using a different screener (Dietary Screener Questionnaire) than the one in the current study.<sup>35</sup>

The majority of participants (50%) were of normal or healthy BMI with 39.2% of participants classified as overweight or obese. This rate aligns with the current estimated BMI rates in the general U.S. college population.<sup>111,112</sup> Currently, literature correlating BMI and food security status is scarce and inconclusive. Reeder et al. noted that there was no association between BMI and food security status while El Zein et al. found that food insecurity was associated with a higher BMI.<sup>35,51</sup> The results of this study show no correlation between food security status and a higher BMI category, with the rate of obesity actually being lower than the estimated average for college students in general. Lastly, when looking at current food pantry use, only 12% of participants used the on-campus food pantry. This is supported by current literature that demonstrates low food pantry use across many campuses.<sup>24,69</sup>

Baseline surveys showed that participants were moderately stressed (66%) and overall dissatisfied with life (65%). Previous literature has indicated that food insecure college students have a higher prevalence rate of perceived stress and decreased

psychological wellness, including increased rates of depression and anxiety.<sup>24,51,59,60-63</sup>

Another researcher, Umeda et al, whose population consisted of 24% Hispanic participants, indicated a positive correlation between food insecurity and depression.<sup>63</sup>

### *Correlations*

The study sought to determine whether baseline demographics and mediators would have an effect on baseline fruit and vegetable intake, BMI, stress and life satisfaction. Ultimately, results showed that baseline nutrition knowledge and self-efficacy had a direct positive correlation with baseline fruit and vegetable intake, indicating those with more nutrition knowledge and a higher self-efficacy had higher fruit and vegetable intake. Nutrition knowledge and self-efficacy have both been shown in previous studies to have a significant correlation on fruit and vegetable intake and other healthy eating habits such as increasing low fat dairy intake and decreasing sugar sweetened beverages.

Results also showed that BMI was influenced by parental financial support and personal health views. Participants with negative personal health views and those who received financial help from their parents had a higher BMI. A negative personal health view, or the belief that one is not healthy, has been correlated with higher BMIs in previous literature.<sup>113</sup> Additionally, those who had parental support may have been less likely to use campus resources and meal plans, which may lead to the consumption of cheap, unhealthy food items which can contribute to weight gain and unhealthy eating habits.<sup>34,56,76,114</sup>

Stress and life satisfaction were also directly correlated with self-efficacy and reciprocal determinism. Stress was correlated with lower self-efficacy and reciprocal



determinism scores while life satisfaction was correlated with high self-efficacy and reciprocal determinism scores. These results indicate that those who believe they have the ability to eat a healthy diet and who have environments which are conducive to healthy eating are less stressed and have a higher life satisfaction. Low self-efficacy has been correlated with negative mental health outcomes in previous studies. The effect of a person's immediate environment in the context of diet and health promotion, such as availability of fruits and vegetables and access to unhealthy food items, on mental health has not been investigated. Previous literature has indicated that a person's work and social environment has an effect on mental health and stress.<sup>115</sup> In this literature, the participant's stress stems from the work or social aspect they are assessing. Since food and access to food is large stress factor in food insecure college students, it can be assumed that their food environment would also contribute to their mental health. Additionally, the female gender was also associated with higher perceived stress and higher life satisfaction. Past literature has indicated that females, specifically those who are food insecure, report higher rates of anxiety and depression.<sup>61</sup>

The results from the analysis demonstrate that SCT constructs and specific personal demographics are associated with physical and mental health behaviors in food insecure college students. These constructs and demographics can be used to identify and possibly predict food insecurity and health behaviors in college students. These results also support the use of the SCT to change healthy behaviors. Theoretically, if the SCT constructs are correlated with the behaviors at baseline, by improving constructs such as nutrition knowledge, self-efficacy, and creating healthy environments through

intervention, then health behaviors such as fruit and vegetable intake, stress, life satisfaction, and BMI, will change and improve as well.

**Hypothesis 4: College students who participate in the intervention will increase mediators for health behavior change ie. nutrition knowledge, self-efficacy, reciprocal determinism, outcome expectations and health views.**

The fourth hypothesis aimed to determine whether mediators for health behavior change would increase in those who participated in the intervention. The study partially supported Hypothesis 4. Self-efficacy, reciprocal determinism, and personal health views all significantly increased in those who participated in the intervention compared to those who did not. However, nutrition knowledge and outcome expectations did not significantly change in the intervention group.

Before analysis, both the control and the intervention group, as well as participants who did or did not complete the study, were compared at baseline to determine any significant differences. Four groups were compared, intervention completers, intervention non-completers, control completers, and control non-completers. There was a significant difference in the baseline 1-item fruit and vegetable intake among the four groups. Those who did not complete from the control group had the highest baseline intake and those who completed the intervention had the lowest baseline intake. Those who completed the intervention likely were aware of their low intake and had a greater motivation to complete the intervention and improve their health. This difference was not noted in the NCI Fruit and Vegetable screener which looks at the average fruit and vegetable intake over the past month. Due to the differences among groups at baseline between the questionnaires, and the fact that each measure determines the intake

over different time points, both measures were used during analysis to support any possible changes.

In this particular study, nutrition knowledge and outcome expectations had no significant change pre and post intervention. When investigating why nutrition knowledge scores did not change, the content of the nutrition education program was compared to the specific question in the nutrition knowledge questionnaire. While the questionnaire was validated and relevant to this demographic, it was found that the questionnaire content was not congruent with the materials being taught within the sessions. The sessions taught general information on MyPlate and food groups while the questions on the questionnaire asked about specific foods and their effect on health. Upon analysis, the average correct response for the one relevant question, ‘a healthy meal consists of half meat, a quarter vegetables, and a quarter side’ did significantly increase in the intervention group compared to the control group.

Additionally, outcome expectation scores, which did not significantly change, were initially high at baseline. Previous nutrition education studies using the SCT have improved these scores and increased the understanding of the importance of health in young adults.<sup>13,72</sup> However, compared to other studies, the study sample had unusually high outcome expectation scores at baseline.<sup>13,72</sup> This left little room for improvement post intervention.

Alternately, reciprocal determinism, personal health views, and self-efficacy were all increased post intervention. While previous studies have not directly assessed changes in reciprocal determinism and personal health views directly, many interventions have improved health behaviors by incorporating constructs from the SCT.<sup>13,62,100</sup> Alternately,

many studies have directly assessed change in self-efficacy as it is a key construct in the SCT for changing health behaviors.<sup>22,36,44,45,108</sup> These studies, which have all individually used gardening and cooking with nutrition education, have successfully improved self-efficacy of health behaviors. Specifically, studies that have utilized interactive experiences have been shown to be more effective at improving self-efficacy than those using other modalities.<sup>21,100,116</sup> The results from this study indicate that by teaching gardening, cooking, and nutrition skills to food insecure college students, they will view themselves as healthier, create healthier environments for themselves, and increase their self-efficacy for healthy behaviors.

**Hypothesis 5: Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, and outcome expectations, will be correlated with change in self-efficacy.**

The fifth hypothesis aimed to determine whether mediators for health behavior change had an effect on change in self-efficacy in those who participated in the intervention. The findings of this study partially supported Hypothesis 5. The results determined that only changes in reciprocal determinism were significantly correlated with change in self-efficacy. This is to say, by creating a healthy environment, food insecure college students believed they were able to follow a healthy diet. Specifically, this study used gardening and the accessibility to fresh herbs and vegetables to create a healthy environment. As noted earlier, nutrition knowledge and outcome expectations did not significantly change in the intervention group, thus change scores were not related to the change in self-efficacy in the intervention group. It is possible that a more accurate measure of nutrition knowledge change in the current study might correlate differently

with the change in self-efficacy. While no studies have specifically looked at the effects of reciprocal determinism or changes in environments on self-efficacy, various studies using the SCT as a whole have seen positive changes in self-efficacy, including those using gardening and cooking interventions.<sup>42,100,116-119</sup>

**Hypothesis 6: College students who participate in the intervention will increase their fruit and vegetable consumption.**

The sixth hypothesis aimed to determine whether the intervention would increase intake of fruit and vegetables. The findings of this study supported Hypothesis 6.

Compared to those who were in the control group, those who were part of the intervention did increase their fruit and vegetable intake. The results of this study are supported by previous literature which has shown that nutrition education and gardening can successfully increase fruit and vegetable intake in college students.<sup>13,20,84</sup>

Currently, only one previous study has successfully increased fruit and vegetable intake in the college population.<sup>13</sup> Many other nutrition education intervention studies have been implemented in college students and have been successful in improving self-efficacy associated with fruit and vegetable intake as well as improving other dietary behaviors, such as increasing low fat dairy intake and reducing consumption of sugar sweetened beverages.<sup>36,100,101,120</sup> These studies have used both in person and online modalities. Reviewing the literature, online methods are more cost effective but lack the benefit of hands on activities which have been proven to be an effective and more enjoyable modality in food insecure students.<sup>20,84,100</sup>

Gardening has also previously been associated with increasing fruit and vegetable intake in multiple populations. In college students specifically Loso et al. and Staub et al.

have directly associated gardening with increased fruit and vegetable intake. In comparison to the current study, these studies did not actively apply a gardening intervention but assessed self-reported gardening reports in comparison to fruit and vegetable intake.<sup>20,84</sup> The study did determine that college students who gardened on a consistent basis had a greater intake of fruits and vegetables in comparison to those who gardened infrequently or those who did not garden at all.<sup>84</sup> It is hypothesized that the act of gardening increases fruit and vegetable through an exposure effect. Exposure to fruits and vegetables directly connects with the concept of reciprocal determinism, which in this study relates to an environment which promotes healthy behaviors. By increasing reciprocal determinism, the study essentially also increases exposure to fruits and vegetables, validating this concept. Those who surround themselves with and actively participate in the care and procurement of fruits and vegetables are more likely to create positive associations and consume them.

When determining the effect of cooking interventions alone in fruit and vegetable intake of college students, previous studies have successfully increased self-efficacy, knowledge, and behaviors associated with cooking and healthy behaviors but have been unable to increase fruit and vegetable intake directly.<sup>21,85,100,102,116</sup> These studies have tested both remote and hands on activities as well as different lengths of time. The results of the current study suggest that a hands on and interactive cooking component as part of an 6-week intervention can be successful in increasing fruit and vegetable intake in food insecure college students.

The results from this study show that the combination of these three intervention modalities, nutrition education, cooking, and gardening, is effective at increasing in fruit

and vegetable intake in food insecure college students. It is important to note that all studies mentioned have assessed fruit and vegetable intake in a self-reported measure which allows results to be directly comparable to this study.

**Hypothesis 7: Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will be correlated with change in fruit and vegetable intake.**

The seventh hypothesis aimed to determine whether theory mediators would be correlated with change in fruit in vegetable intake in those who participated in the intervention. The findings of this study did not support Hypothesis 7. It was determined that these theory mediators had no correlation with the change in fruit and vegetable intake. The intervention did not improve nutrition knowledge and outcome expectation scores and thus these would not have an effect on changing fruit and vegetable intake. Self-efficacy, which ultimately did improve post intervention, was also not associated with change in fruit and vegetable intake in this study. Previous nutrition education studies have linked self-efficacy to changes in fruit and vegetable intake in nutrition education interventions in college students.<sup>13,36</sup>

Many studies have used the SCT as part of their intervention to increase fruit and vegetable intake via different modalities successfully. Additionally, a meta-analysis compiled by Guillaumie et al. suggested that the SCT may be the preferable theory to predict behavior change, specifically for fruit and vegetable intake.<sup>121</sup> To date, previous literature has not assessed the direct relationship between reciprocal determinism and outcome expectations on change in fruit and vegetable intake. Thus, it is unknown

whether these constructs would have individual effects as opposed to offering compounding effects along with other constructs.

The lack of significance and correlation between the constructs and intake in this study is likely due to the small sample size. Additionally, the effect size of the regression was small. While it was hypothesized that specific mediators would have an effect on change in fruit and vegetable intake, it is plausible and likely that the change in fruit and vegetable intake arose from the mediators working together as whole or from other factors not considered. The combination of using three educational modalities (cooking, gardening, and nutrition education) likely played a large role in the ultimate behavior change.

**Hypothesis 8: College students who participate in the intervention will lower their stress and increase their satisfaction with life.**

The eighth hypothesis aimed to determine whether the intervention would increase life satisfaction and decrease perceived stress in food insecure college students. The findings of this study supported Hypothesis 8. Compared to those who were in the control group, those who were part of the intervention significantly increased life satisfaction and significantly decreased their perceived stress.

Many interventions have successfully decreased stress in the general college population, with the majority of these studies using psychology-based interventions.<sup>122,123</sup> In food insecure college students, the stress of baseline strain that many college students deal with is magnified by the inability to find or afford adequate nutrition. Gardening, which can improve access to fruits and vegetables, has been proven to reduce stress and increase life satisfaction.<sup>77</sup> While there is substantial research on the effects of gardening



and improved mental health and quality of life on various age groups, races, and ethnicities, the literature connecting gardening and stress in college students, specifically, is limited.<sup>124-130</sup> Currently, only one study has assessed this relationship.<sup>131</sup> In this study, 4 weeks of daily 45 minute gardening sessions significantly improved perceived stress in college students.<sup>131</sup> The results of the current study supports and add to existing literature and indicates that gardening can be an effective method of reducing stress in food insecure college students.

Additionally, previous studies have indicated that interventions focused on food procurement, cooking, and budgeting would greatly benefit food insecure college students, which could also reduce stress.<sup>87,88,132</sup> The results of this study support these calls and demonstrate that improving cooking and gardening skills, and nutrition education, can improve mental health, ultimately benefiting food insecure college students.

**Hypothesis 9: Theory mediators for health behavior change ie. nutrition knowledge, reciprocal determinism, outcome expectations and self-efficacy, will be correlated to changes in stress and life satisfaction.**

The ninth hypothesis aimed to determine whether theory mediators would be correlated with change in stress and life satisfaction in those who participated in the intervention. The findings of this study did not support Hypothesis 9. It was determined that these theory mediators had no correlation with stress and life satisfaction. The intervention did not improve nutrition knowledge and outcome expectation scores and thus these would not have an effect on changing stress or life satisfaction. Self-efficacy, which ultimately did improve post intervention, was also not associated with change in

stress and life satisfaction in this study. Both the SCT and Lazaur's Cognitive Model of Stress have established that stress and self-efficacy are interrelated concepts. Outside stressors can be mediated or affected by one's self-efficacy.<sup>27,133</sup> Those with higher self-efficacy are more likely to perceive stress as a challenge instead of threat. Previous studies have investigated the joint effect of stress and self-efficacy on academic and health outcomes in the college population.<sup>134-136</sup> In these studies, self-efficacy has been found to be significantly negatively correlated with stress in Hispanic college students and adolescents.<sup>134-137</sup>

The lack of significance and correlation with stress and life satisfaction is likely due to the sample size in this study. Both models had small-moderate effect sizes for both within and between groups. While it was hypothesized that certain mediators would have a direct effect on change in mental health, it is more likely that the mediators working together improved both life satisfaction and stress. Changes in stress and life satisfaction may also be attributed to the combination of cooking, gardening, and healthy eating skills they acquired throughout the intervention.

**Hypothesis 10: Stress and life satisfaction will mediate fruit and vegetable intake in participants who complete the intervention.**

The tenth hypothesis aimed to determine whether stress and life satisfaction had a mediating effect on fruit and vegetable intake. The findings of this study did not support Hypothesis 10. While previous studies have identified the relationship between self-efficacy to both fruit and vegetable intake and stress, no studies to date have looked at the combined effect of these factors.<sup>13,36,134-137</sup> Due to the unique situation of this study sample in which high levels of stress can stem from both college and food insecurity,

future studies should compare this relationship to college students who are not food insecure. This can ultimately determine whether this specific college population is at greater need for extra resources due to their food insecurity.

**Hypothesis 11: College students who participate in the intervention will maintain or reduce their body weight.**

The eleventh hypothesis aimed to determine whether the 6-week intervention would help students maintain or reduce their body weight. The findings of this study partially supported Hypothesis 11. Those who participated in the intervention maintained their body weight pre and post intervention, although there was also no change in the control group's weight. College weight gain is a well-known phenomenon and interventions, especially those focused on nutrition education, have been successful in reducing the prevalence of weight gain in the first years of college.<sup>90,101</sup> The lack of knowledge surrounding shopping, prepping, and cooking are factors that contribute to college weight gain.<sup>138</sup> Incorporating these skills into the intervention could have aided in reducing weight gain in this group. Additionally, while previous studies have shown that 6-week intervention is a sufficient timeframe for weight changes, longer interventions, including those with follow ups, have shown more promising effects on weight changes.<sup>90,101</sup> Additionally, due to COVID-19, a large percentage (77%) of the participants had to self-report their weights at the end of the intervention. Self-reporting is a common cause for bias and could potentially skew data.

**Strengths and Limitations**

This study has several strengths and limitations. Strengths included the use of a randomized control trial and the stratification of participants though BMI. This design

ensured proper comparison among even distributed groups. The study also had a strong theoretical design using Social Cognitive Theory to create the 6-week nutrition education program. When creating an intervention based on theory, the nutrition educator relies on a set of components that describe, predict, and explain behavior change which when addressed should result in a direct effect on what drives behavior change.<sup>139</sup> Additionally, the SCT, specifically, has been shown in multiple studies to be successful in creating health related behavior changes.<sup>13,36,45,116</sup> Another important strength of this study was the large population of Hispanic participants. Participants in previous studies focused on food insecure college students are largely White Caucasian. Previous literature has demonstrated that Hispanic and other minorities are at a greater risk for food insecurity.<sup>51,63,106</sup> The results of this study demonstrate the ability to improve healthy behaviors in an at risk population.

Limitations of this study include an uneven distribution of gender, a small sample size and the use of self-reported data. The study had a large majority of female participants which does not represent the general college population or the food insecure college population.

Current literature estimates the gender distribution of food insecure college students matches that of the general college population, composed of 50-75% female.<sup>10</sup> At Florida International University, the gender ratio is about equal, with slightly more female (55%) than male students (45%), which correlates to the national average. Additionally, the intervention group of the study consisted of only 42 students. While this sample was large enough to produce significant effects for outcome variables, a larger sample size would allow for more profound and generalizable conclusions. As mentioned

previously, COVID-19 was a large contributing factor to the inability to meet the adequate sample size.

The use of self-reported data can lead to inconsistencies and bias. Self-reported data in this study included the use of questionnaires to determine food insecurity, nutrition knowledge, fruit and vegetable intake, stress, and life satisfaction. All pre intervention and post intervention heights and weights aside from the last cohort were physically measured by study investigators to remove bias and have accurate measurements. Due to COVID-19, post intervention weights for the Spring 2020 cohort had to be self-reported via online methods. Self-reported weights, while largely accurate, are often underestimated, especially in women, and thus a limitation to this study.<sup>140-142</sup>

Previous literature looking at rates of food insecurity across college campuses investigated the high rates in relation to the questionnaire used.<sup>30,98,99</sup> The most commonly used and current gold standard for establishing food insecurity is the USDA Adult Food Security Survey Model, which was used in this study. Nikolaus et al. investigated the rates of college food insecurity related to different survey styles used and discovered large inconsistencies. Additionally, the reliability of this scale in this sample was poor (Cronbach's alpha = .50) At the moment it is unclear why college students respond differently than the general population to these surveys. Nikolaus et al. proposed a possible reasoning might include the changing and unstable lifestyle of students which leads to misinterpretations of terms such as 'money' and 'household'. Studies have proposed for future research to evaluate the validity of these surveys on this specific population and develop a more appropriate survey.<sup>30,98,99</sup>

In addition to self-reporting food insecurity, participants also self-reported fruit and vegetable intake. The NCI fruit and vegetable screener has been used as a validated tool to assess fruit and vegetable intake although it can overestimate the number of daily servings.<sup>95,143</sup> The 1-item fruit and vegetable screener was used as an additional measure to support any change predicted by the NCI screener. While also self-reported, the 1-item screener has been shown to underestimate current fruit and vegetable intake.<sup>144</sup> By using both questionnaires, a median representation of daily fruit and vegetable intake can be obtained.

Additionally, the nutrition knowledge questionnaire used was another major limitation to the study. The lack of association between the education provided and the measurements of the questionnaire hindered the possibility of a potential association and effect of the study outcomes. Also, the reliability of this scale in this sample was poor (Chronbach's alpha = .20) Future studies should use a closer related and more reliable questionnaire to accurately assess the change in knowledge in this population.

Lastly, COVID-19 could have potentially affected post intervention stress and life satisfaction scores for the Spring 2021 cohort. Measurements for phase 2 participants were assessed the week quarantine was initiated, universities closed and began remote learning. These changes could have potentially increased stress and decreased life satisfaction as students were adjusting to a major change.

### **Future Directions**

Future research should involve a larger sample and an even gender distribution to provide generalizable data on the effects of education interventions on health behaviors in food insecure college students. Large scale studies, including students from different

college campuses should be included. Future intervention studies on food insecure college students should include a follow up or longitudinal design to determine whether an intervention can increase healthy behaviors long term. In addition, studies should also include students who are not food insecure, in a randomized control trial, to compare differences in the two groups and to determine if mediators, such as stress and life satisfaction, differ among the two groups as this might influence change in healthy behaviors. Finally, implementation of this program and additional resources across college campuses may improve college food insecurity rates and should be evaluated in the future.

## **Conclusions**

The current study demonstrated the feasibility and promise of an urban gardening, cooking, and nutrition education intervention on the physical and mental health behaviors of food insecure students. By using a hands-on, interactive approach alongside nutrition education tailored for food insecurity, food insecure students increased their fruit and vegetable intake, health mediators, and life satisfaction, and decreased their perceived stress. The results of this study overall supports the use of a multimodal intervention in improving the overall health of food insecure college students and supports previous calls for the need for additional resources for food insecure college students. Interventions of this kind would be useful across all college campuses to help decrease the effects of and possibly the high rate of food insecurity found in this population. Future studies should consider more expansive and longitudinal studies to determine the long-term efficacy of these interventions on health behaviors, mental, and physical health.

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## APPENDICES

### Appendix 1.

#### Recruitment flyer

FLORIDA INTERNATIONAL UNIVERSITY

**URBAN GARDENING  
AND  
NUTRITION EDUCATION  
PROJECT**

LEARN STRATEGIES TO HELP INCREASE  
FRUIT AND VEGETABLE INTAKE.

8- WEEK PROGRAM  
1 MEETING PER WEEK  
OCTOBER-NOVEMBER  
WHERE: FLORIDA INTERNATIONAL  
UNIVERSITY

If you choose to participate in this program you will be asked to complete a survey on your food security, nutrition knowledge, and health behaviors and study personnel will also take your height, weight, and body fat percentage.

PLEASE VISIT [WWW.LINK.COM](http://WWW.LINK.COM) TO  
FILL OUT AN ELIGIBILITY SURVEY

**SIGN UP TODAY!**

**WHAT YOU WILL LEARN:**

- Basic nutrition information
- Why its important to eat all 5 food groups
- How to read food labels
- How to budget for groceries
- How to choose healthy snacks
- How to grow your own produce
- How to create healthy delicious meals

**BENEFITS:**

Participating in this study you will receive easy, healthy, recipes and a take home windowsill garden

FOR QUESTIONS, PLEASE EMAIL ALISON MATTHYSSE  
[AMATT008@FIU.EDU](mailto:AMATT008@FIU.EDU)

Appendix 2.

*Consent form*

FIU IRB Approval:	08/26/2019
FIU IRB Expiration:	04/23/2022
FIU IRB Number:	IRB-19-0134



**ADULT CONSENT TO PARTICIPATE IN A RESEARCH STUDY**  
Effects of an urban-gardening nutrition intervention in college students with and without food insecurity

**SUMMARY INFORMATION**

Things you should know about this study:

- **Purpose:** The purpose of the study is to determine the health effects of an urban-gardening nutrition education intervention.
- **Procedures:** If you choose to participate, you will be asked to attend cooking and gardening educational sessions and fill out a survey.
- **Duration:** This will take about 10 hours over 8 weeks.
- **Risks:** The main risk or discomfort from this research is that you may feel uncomfortable answering some questions about your health or your level of food security.
- **Benefits:** The main benefit to you from this research is increased healthy eating behaviors and possible extra credit for class.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Participation:** Taking part in this research project is voluntary.

Please carefully read the entire document before agreeing to participate.

**PURPOSE OF THE STUDY**

The purpose of this study is to determine whether an 8-week urban-gardening nutrition intervention can improve fruit and vegetable intake, nutrition knowledge, Body Mass Index (BMI) and body fat percentage in college students with and without food insecurity.

**NUMBER OF STUDY PARTICIPANTS**

If you decide to be in this study, you will be one of 200 people in this research study.

**DURATION OF THE STUDY**

Your participation will involve a time commitment of 10 hours: a 20 minute eligibility survey, a one-time 20 minute information session, 1 hour for anthropometric measurement, and participation in 8, 1-hour education sessions, once a week for 8 weeks.

FIU IRB Approval:	08/26/2019
FIU IRB Expiration:	04/23/2022
FIU IRB Number:	IRB-19-0134

### **PROCEDURES**

If you agree to be in the study, we will ask you to do the following things:

1. Fill out a questionnaire regarding demographics, food insecurity, fruit and vegetable intake, nutrition knowledge, self-efficacy, and health beliefs.
2. Allow researchers to measure your height, weight, and body fat percentage.
3. Participate in a 1-hour educational cooking or gardening session once a week for 8 weeks.
4. You will receive text message reminders for meeting dates.

### **RISKS AND/OR DISCOMFORTS**

The study has the following possible risks to you: there is minimal risk of becoming uncomfortable with the idea of being food insecure.

### **BENEFITS**

The study has the following possible benefits to you: increased fruit and vegetable intake, increased nutrition knowledge, increased self-efficacy in healthy behaviors and gardening, and increased awareness of college food insecurity. Participation in this study may also provide you with extra credit for one of your classes.

### **ALTERNATIVES**

There are no known alternatives available to you other than not taking part in this study. Any significant new findings developed during the course of the research which may relate to your willingness to continue participation will be provided to you.

### **CONFIDENTIALITY**

The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report we might publish, we will not include any information that will make it possible to identify you. Research records will be stored securely, and only the researcher team will have access to the records. However, your records may be inspected by authorized University or other agents who will also keep the information confidential.

### **USE OF YOUR INFORMATION**

Identifiers about you might be removed from the identifiable private information and that, after such removal, the information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you or your legally authorized representative.

### **COMPENSATION & COSTS**

You will receive \$15 for your participation in this study, \$5 will be awarded for participating in the pre-test and \$10 at the completion of the post-test and the completion of 6 out of 8 sessions for the intervention group. There are no costs to you for participating in this study.

### **RIGHT TO DECLINE OR WITHDRAW**

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. You will not lose any benefits if you decide not to

FIU IRB Approval:	08/26/2019
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participate or if you quit the study early. The investigator reserves the right to remove you without your consent at such time that he/she feels it is in the best interest.

**RESEARCHER CONTACT INFORMATION**

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Dr. Catherine Coccia at 11200 SW 8<sup>th</sup> St. AHC5, #316, Miami, FL 33174, 305-348-0194, or coccia@fiu.edu

**IRB CONTACT INFORMATION**

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

**PARTICIPANT AGREEMENT**

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. I understand that I will be given a copy of this form for my records.

\_\_\_\_\_  
Signature of Participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name of Participant

\_\_\_\_\_  
Signature of Person Obtaining Consent

\_\_\_\_\_  
Date



Appendix 3.

*IRB- Florida International University*



Office of Research Integrity  
Research Compliance, MARC 414

**MEMORANDUM**

**To:** Dr. Catherine Coccia  
**CC:** Alison Matthyse  
**From:** Elizabeth Juhasz, Ph.D., IRB Coordinator *EJ*  
**Date:** April 24, 2019  
**Protocol Title:** "Effects of an urban-gardening nutrition intervention for food insecure college students"

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The Social and Behavioral Institutional Review Board of Florida International University has approved your study for the use of human subjects via the **Expedited Review** process. Your study was found to be in compliance with this institution's Federal Wide Assurance (00000060).

**IRB Protocol Approval #:** IRB-19-0134      **IRB Approval Date:** 04/23/19  
**TOPAZ Reference #:** 107763      **IRB Expiration Date:** 04/23/22

As a requirement of IRB Approval you are required to:

- 1) Submit an IRB Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved by the IRB prior to implementation.
- 2) Promptly submit an IRB Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
- 3) Utilize copies of the date stamped consent document(s) for obtaining consent from subjects (unless waived by the IRB). Signed consent documents must be retained for at least three years after the completion of the study.
- 4) **Receive annual review and re-approval of your study prior to your IRB expiration date.** Submit the IRB Renewal Form at least 30 days in advance of the study's expiration date.
- 5) Submit an IRB Project Completion Report Form when the study is finished or discontinued.

*HIPAA Privacy Rule:* N/A

*Special Conditions:* N/A

For further information, you may visit the IRB website at <http://research.fiu.edu/irb>.

Appendix 4.

*IRB Amendment- Florida International University*



Office of Research Integrity  
Research Compliance, MARC 414

**MEMORANDUM**

To: Dr. Catherine Coccia  
CC: Alison Matthyse  
From: Elizabeth Juhasz, Ph.D., IRB Coordinator *EJ*  
Date: August 27, 2019  
Proposal Title: "Effects of an urban-gardening nutrition intervention for food insecure college students"  
Approval # IRB-19-0134-AM01  
Reference # 107763

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The Social and Behavioral Institutional Review Board has approved the following modification(s):

- Participants recruited will only be food insecure students as this intervention is tailored specifically for those students.
- Funding was added to the study. It was received from the FEF McKnight Dissertation Award, totaling \$3,000.
- Recruitment locale has been updated to include on campus classroom recruitment with the possibility of extra credit for these classes with permission from professors.
- Participants will receive \$15 in gift cards for completing the study. This is to ensure an adequate sample size and participation. Students will receive \$5 for completing pre- test and \$10 for completing post test. Those in the intervention group must complete 6/8 of sessions to receive post test compensation, which is explained to them in the consent form.
- Text message reminders of meeting dates will be used to help with retainment.
- Number of participants has increased to 200 to have an adequate sample size for effect.
- Lastly, a key personnel, Shante Earle, will also be added to help with survey administration as a way to control for blinding and bias.

There are no additional requirements in regards to your study. However, if there are further changes in the protocol after you commence your study, then you are required to resubmit your proposal for review. As a reminder, you are still required to receive continuing review and re-approval prior to your expiration date of **April 23, 2022**. For further information, you may visit the FIU IRB website at <http://research.fiu.edu/irb>.  
EJ

Appendix 5.

*Eligibility questionnaire*

1. Are you a currently enrolled FIU student?
  - a. Yes
  - b. No
2. Are you over the age of 18?
  - a. Yes
  - b. No
3. Can you read and write in English?
  - a. Yes
  - b. No
4. Are you a woman who is pregnant or planning to become pregnant?
  - a. Yes
  - b. No
5. Are you a student athlete?
  - a. Yes
  - b. No
6. “The food that I bought didn’t last and I didn’t have money to get more.” Was that often, sometimes, or never true for you in the last 12 months?
  - a. Often true
  - b. Sometimes true
  - c. Never true
  - d. Don’t know
7. “I couldn’t afford to eat balanced meals.” Was that often, sometimes, or never true for you in the last 12 months?
  - a. Often true
  - b. Sometimes true
  - c. Never true
  - d. Don’t know
8. In the last 12 months, did you ever cut the size of meals or skip meals because there wasn’t enough money or food?
  - a. No
  - b. Yes
9. If yes, how often did this happen?
  - a. Almost every month
  - b. Some months but not every month
  - c. Only 1 or 2 months

10. In the last 12 months, did you and/or your family ever eat less than you felt you should because there wasn't enough money for food?
- No
  - Yes
11. In the last 12 months, were you and/or your family ever hungry but didn't eat because there wasn't enough money for food?
- No
  - Yes
12. "I eat the same thing for several days in a row because I only have a few different kinds of food on hand and don't have money to buy more." Was that often, sometimes, or never true for you in the last 12 months?
- Often true
  - Sometimes true
  - Never true
  - Don't know
13. Sometimes a person's body weight drops because of not eating enough. Has your body weight dropped in the last year because of the lack of food?
- Yes
  - No
14. What is your email address? \_\_\_\_\_

Appendix 6.

*Demographics questionnaire*

1. What is your age? \_\_\_\_\_
2. What is your height? \_\_\_\_\_ ft \_\_\_\_\_ in
3. What is your weight? \_\_\_\_\_ lbs
4. What is your gender?
  - a. Male
  - b. Female
5. What is your academic major? \_\_\_\_\_
6. What is your academic year?
  - a. Freshman
  - b. Sophomore
  - c. Junior
  - d. Senior
  - e. Graduate student
7. What best describes your racial background?
  - a. African American
  - b. Caribbean Islander
  - c. Native American
  - d. White Caucasian
  - e. Asian
  - f. Other: \_\_\_\_\_
8. What best describes your ethnicity?
  - a. Hispanic
  - b. Non-Hispanic
9. What are your living arrangements?
  - a. On-campus: with roommate/s
  - b. On-campus: alone
  - c. Off-campus: alone
  - d. Off-campus: with family
  - e. Off-campus: with roommate/s
10. Yearly household income:
  - a. 0-\$10,000
  - b. \$10,000-\$20,000
  - c. \$20,000-\$30,000
  - d. \$30,000-\$40,000
  - e. \$40,000-\$50,000
  - f. \$50,000-\$60,000
  - g. \$60,000+
11. Marital status:
  - a. Single
  - b. Married
  - c. Divorced
  - d. Widowed

12. How many people live in your household?
- 1-2
  - 3-4
  - 4-5
  - 5+
13. How many people under the age of 18 live in your household?
- 0
  - 1
  - 2
  - 3
  - 4+
14. Do you participate in the campus meal plan?
- No
  - Yes
15. Are you employed?
- Yes
  - No
16. If yes, how many hours/week are you in paid employment? \_\_\_\_\_
17. Do you receive financial support from your parents?
- Yes
  - No
18. If you answered yes, how much money (in \$) do you receive in a typical month?
19. Do you use the campus food pantry?
- No
  - Yes, but almost never
  - Yes, frequently
20. Are you a first generation college student?
- No
  - Yes
21. Are you a Pell Grant recipient?
- No
  - Yes
22. What is your cumulative undergraduate GPA? \_\_\_\_\_

**Health Service Usage**

23. Do you use any of the following government services?
- WIC \_\_\_\_\_
- EBT (Food stamps) \_\_\_\_\_
- Off campus Food Pantries/Banks (Ex: Food for Life) \_\_\_\_\_

Appendix 7.

*Pre/Post Test*

**Health Rating**

24. In general, how would you rate your health?
1. Poor
  2. Average
  3. Good
  4. Great
  5. Excellent
25. In general, how would you rate your family's health?
1. Poor
  2. Average
  3. Good
  4. Great
  5. Excellent
26. Do you think you will make changes to better your health within the next 6 months?
- a. No
  - b. Yes, I intend to in the next 6 months
  - c. Yes, I intend to in the next 30 days

**Fruit and Vegetable Intake**

27. Yesterday, how many fruits and vegetables did you consume?
- a. 1
  - b. 2
  - c. 3
  - d. 4
  - e. 5+
28. Over the last month, how many times per month, week, or day did you drink 100% fruit juice such as orange, apple, grape, or grapefruit juice? Do not count fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at all meal times and between meals.
- a. Never (Skip next question)
  - b. 1-3 times last month
  - c. 1-2 times per week
  - d. 3-4 times per week
  - e. 5-6 times per week
  - f. 1 time per day
  - g. 2 times per day
  - h. 3 times per day
  - i. 4 times per day
  - j. 5 or more times per day
29. Each time you drank 100% juice, how much did you usually drink?

- a. Less than  $\frac{3}{4}$  cup (less than 6 ounces)
  - b.  $\frac{3}{4}$  to  $1\frac{1}{4}$  cup (6 to 10 ounces)
  - c.  $1\frac{1}{4}$  to 2 cups (10 to 16 ounces)
  - d. More than 2 cups (more than 16 ounces)
30. Over the last month, how many times per month, week, or day did you eat fruit? Count any kind of fruit- fresh, canned, and frozen. Do not count juices. Include fruit you ate at all mealtimes and for snacks.
- a. Never (Skip next question)
  - b. 1-3 times last month
  - c. 1-2 times per week
  - d. 3-4 times per week
  - e. 5-6 times per week
  - f. 1 time per day
  - g. 2 times per day
  - h. 3 times per day
  - i. 4 times per day
  - j. 5 or more times per day
31. Each time you ate fruit, how much did you usually eat?
- a. Less than  $\frac{1}{2}$  a cup
  - b. About  $\frac{1}{2}$  cup
  - c. About 1 cup
  - d. More than 1 cup
32. Over the last month, how often did you eat lettuce salad (with or without other vegetables)?
- a. Never (Skip next question)
  - b. 1-3 times last month
  - c. 1-2 times per week
  - d. 3-4 times per week
  - e. 5-6 times per week
  - f. 1 time per day
  - g. 2 times per day
  - h. 3 times per day
  - i. 4 times per day
  - j. 5 or more times per day
33. Each time you ate lettuce salad, how much did you usually eat?
- a. Less than  $\frac{1}{2}$  a cup
  - b. About 1 cup
  - c. About 2 cups
  - d. More than 2 cups
34. Over the last month, how often did you eat French fries or fried potatoes?



- a. Never (Skip next question)
- b. 1-3 times last month
- c. 1-2 times per week
- d. 3-4 times per week
- e. 5-6 times per week
- f. 1 time per day
- g. 2 times per day
- h. 3 times per day
- i. 4 times per day
- j. 5 or more times per day

35. Each time you ate French fries or fried potatoes, how much did you usually eat?

- a. Small order or less (about 1 cup or less)
- b. Medium order (about 1 ½ cups)
- c. Large order (about 2 cups)
- d. Super Size order (About 3 cups or more)

36. Over the last month, how often did you eat other white potatoes? Count baked, boiled, and mashed potatoes, potato salad, and white potatoes that were not fried.

- a. Never (Skip next question)
- b. 1-3 times last month
- c. 1-2 times per week
- d. 3-4 times per week
- e. 5-6 times per week
- f. 1 time per day
- g. 2 times per day
- h. 3 times per day
- i. 4 times per day
- j. 5 or more times per day

37. Each time you had these potatoes, how much did you usually eat?

- a. 1 small potato or less (1/2 cup or less)
- b. 1 medium potato (1/2 cup to 1 cup)
- c. 1 large potato (1 to 1 ½ cups)
- d. 2 medium potatoes or more (1 ½ cups or more)

38. Over the last month, how often did you eat cooked dried beans? Count baked beans, bean soup, refried beans, pork and beans and other bean dishes.

- a. Never (Skip next question)
- b. 1-3 times last month
- c. 1-2 times per week
- d. 3-4 times per week
- e. 5-6 times per week
- f. 1 time per day
- g. 2 times per day

- h. 3 times per day
- i. 4 times per day
- j. 5 or more times per day

39. Each time you ate these beans, how much did you usually eat?

- a. Less than ½ cup
- b. ½ to 1 cup
- c. 1 to 1 ½ cups
- d. More than 1 ½ cups

40. Over the last month, how often did you eat other vegetables? Do not count lettuce salads, white potatoes, cooked dried beans, vegetables in mixtures (such as in sandwiches, omelets, casseroles, Mexican dishes, stews, stir-fry, soups, etc), rice. Do count all other vegetables, raw, cooked, canned, and frozen.

- a. Never (Skip next question)
- b. 1-3 times last month
- c. 1-2 times per week
- d. 3-4 times per week
- e. 5-6 times per week
- f. 1 time per day
- g. 2 times per day
- h. 3 times per day
- i. 4 times per day
- j. 5 or more times per day

41. Each of these times you ate other vegetables, how much did you usually eat?

- a. Less than ½ cup
- b. ½ to 1 cup
- c. 1 to 2 cups
- d. More than 2 cups

42. Over the last month, how often did you eat tomato sauce? Include tomato sauce on pasta or macaroni, rice, pizza, and other dishes

- a. Never (Skip next question)
- b. 1-3 times last month
- c. 1-2 times per week
- d. 3-4 times per week
- e. 5-6 times per week
- f. 1 time per day
- g. 2 times per day
- h. 3 times per day
- i. 4 times per day
- j. 5 or more times per day

43. Each of these times you that you ate tomato sauce, how much did you usually eat?
- About 1/4 cup
  - About 1/2 cup
  - About 1 cup
  - More than 1 cup
44. Over the last month, how often did you eat vegetable soup? Include tomato soup, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetable.
- Never (Skip next question)
  - 1-3 times last month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2 times per day
  - 3 times per day
  - 4 times per day
  - 5 or more times per day
45. Each of these times you that you ate vegetable soup, how much did you usually eat?
- Less than 1 cup
  - 1 to 2 cups
  - 2 to 3 cups
  - More than 3 cups
46. Over the last month, how often did you eat mixtures that included vegetables? Count foods such as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.
- Never
  - 1-3 times last month
  - 1-2 times per week
  - 3-4 times per week
  - 5-6 times per week
  - 1 time per day
  - 2 times per day
  - 3 times per day
  - 4 times per day
  - 5 or more times per day

**Nutrition Knowledge**

47. If you have eaten high-fat foods, can you reverse the effects by eating an apple.
- True
  - False

48. If cream is whipped it contains less calories than in its liquid form.
- a. True
  - b. False
49. A healthy meal should consist of half meat, a quarter vegetables, and a quarter side dishes.
- a. True
  - b. False
50. Fat is always bad for your health; you should therefore avoid it as much as possible.
- a. True
  - b. False
51. A balanced diet implies eating all foods in the same amount.
- a. True
  - b. False
52. The health benefit of fruit and vegetables lies alone in the supply of vitamins and minerals.
- a. True
  - b. False
53. Brown sugar is much healthier than white sugar.
- a. True
  - b. False
54. Skimmed milk contains fewer minerals than full-fat milk.
- a. True
  - b. False
55. For a healthy nutrition, dairy products should be consumed in the same amounts as fruits and vegetables.
- a. True
  - b. False
56. Pasta with tomato sauce is healthier than pasta with mushroom and cream sauce.
- a. True
  - b. False

**Self-efficacy Scale**

Circle ONE option to indicate how much you agree or disagree with each statement.

Whenever I have a choice of the food I eat...

1. I find it difficult to choose low-fat foods (e.g. fruit or “lite” milk rather than “full cream” milk).
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
2. I find it easy to choose a healthy snack when I eat in between meals (e.g. fruit or reduced-fat yoghurt).
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
3. I believe I have the knowledge and ability to choose/prepare healthy snacks.
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
4. I find it difficult to choose healthy meals/ snacks when I am eating out with my friends.
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
5. I find it easy to eat at least 3 servings of fruit each day.
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
6. I find it easy to eat at least 4 servings of vegetables/ salad each day.

- a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
7. I find it easy to have healthy portion sizes during meals (e.g. not eating till I feel full).
- a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree

**Situation Scale**

Circle ONE option to indicate how much you agree or disagree with each statement:

1. At home there are healthy snacks available to eat.
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
2. At home there are healthy drinks available (e.g. cold water in the fridge, sugar-free drinks, reduced-fat milk).
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
3. At home fruit is always available to eat (including fresh, canned or dried fruit).
  - a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
  
4. At home vegetables are always available to eat (including fresh, frozen or canned vegetables).

- a. Strongly Disagree
- b. Disagree
- c. Disagree Slightly
- d. Slightly Agree
- e. Agree
- f. Strongly Agree

### **Outcome Expectations Scale**

Please tick (✓) ONE option to indicate how much you agree or disagree with each benefit and how important each benefit is to you:

1a. Healthy eating can reduce my risk for some illnesses and diseases (e.g. heart disease, diabetes, some cancers etc).

- a. Strongly Disagree
- b. Disagree
- c. Disagree Slightly
- d. Slightly Agree
- e. Agree
- f. Strongly Agree

1b. How important is reducing your risk for illness and disease to you?

- a. Not at all important
- b. Only slightly Important
- c. Important
- d. Extremely Important

2a. Healthy eating can help me to feel better physically.

- a. Strongly Disagree
- b. Disagree
- c. Disagree Slightly
- d. Slightly Agree
- e. Agree
- f. Strongly Agree

2b. How important is feeling better physically to you?

- e. Not at all important
- f. Only slightly Important
- g. Important
- h. Extremely Important

3a. Healthy eating can help me to control my weight.

- a. Strongly Disagree
- b. Disagree
- c. Disagree Slightly
- d. Slightly Agree

- e. Agree
  - f. Strongly Agree
- 3b. How important is controlling your weight to you?
- a. Not at all important
  - b. Only slightly Important
  - c. Important
  - d. Extremely Important
- 4a. Healthy eating (e.g. not skipping meals) can help to improve my concentration at school.
- a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
- 4b. How important is improving your concentration at school to you?
- a. Not at all important
  - b. Only slightly Important
  - c. Important
  - d. Extremely Important
- 5a. Healthy eating can help me to feel more energetic throughout the day
- a. Strongly Disagree
  - b. Disagree
  - c. Disagree Slightly
  - d. Slightly Agree
  - e. Agree
  - f. Strongly Agree
- 5b. How important is feeling more energetic to you?
- a. Not at all important
  - b. Only slightly Important
  - c. Important
  - d. Extremely Important

**Perceived Stress Scale**

1. In the last month, how often have you been upset because of something that happened unexpectedly?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often



2. In the last month, how often have you felt that you were unable to control the important things in your life?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
3. In the last month, how often have you felt nervous and “stressed”?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
5. In the last month, how often have you felt that things were going your way?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
7. In the last month, how often have you been able to control irritations in your life?
  - a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
8. In the last month, how often have you felt that you were on top of things?
  - a. Never
  - b. Almost Never
  - c. Sometimes

- d. Fairly Often
  - e. Very Often
9. In the last month, how often have you been angered because of things that were outside of your control?
- a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?
- a. Never
  - b. Almost Never
  - c. Sometimes
  - d. Fairly Often
  - e. Very Often

### **Life Satisfaction Scale**

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

\_\_\_\_\_ In most ways my life is close to my ideal.

\_\_\_\_\_ The conditions of my life are excellent.

\_\_\_\_\_ I am satisfied with my life.

\_\_\_\_\_ So far I have gotten the important things I want in life.

\_\_\_\_\_ If I could live my life over, I would change almost nothing.

Appendix 8.

*Satisfaction survey*

1. Did you find the sessions to be:
  - a. Very enjoyable
  - b. Somewhat enjoyable
  - c. Enjoyable
  - d. Not very enjoyable
  - e. Not enjoyable
2. Did you find the sessions to be:
  - a. Very helpful
  - b. Somewhat helpful
  - c. Helpful
  - d. Not very helpful
  - e. Not helpful
3. Would you recommend these sessions to a friend?
  - a. Yes
  - b. No
4. Do you think this would be a useful resource on college campuses?
  - a. Yes
  - b. No
5. How would you change or improve the sessions?
6. What did you like most about the sessions?

## VITA

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