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Cooking Interventions and Perceived Stress Levels Among College Students

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Abstract

College is full of new experiences and pressures that may prevent students from having adequate cooking skills and knowledge, which often leads to increased stress. An intervention designed to improve cooking ability may reduce students' stress levels by increasing their understanding surrounding food, and decreasing the time and effort needed to prepare meals. For this study, participants were randomly assigned to one of four intervention groups: cooking classes and meal kit, cooking classes only, meal kit only, and control. Phase 1 consisted of weekly cooking classes for six weeks, where the participants actively prepared a recipe and engaged in a sensory analysis of the food. Phase 2 consisted of a 6-week meal kit intervention, where participants were provided with a recipe and ingredients for three meals, for six weeks. Participants completed the Perceived Stress Scale questionnaire at the start of the intervention and at the end of each phase. Neither the cooking, nor the meal kit intervention reduced perceived stress levels among the participants. Further research is needed to determine whether a cooking-based intervention has the ability to reduce stress levels in college students.

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Chapter 1: Introduction and Purpose

Stress is generally a response to an external event a person might be experiencing, where the demands of the situation surpass the individual's resources to cope with those pressures.¹ Anxiety is a person's specific reaction to stress, originating internally.¹ The persistence and exacerbation of high stress levels in college students can progress to anxiety disorders.² which Anxiety disorders are the most common psychiatric problem among college students, as approximately 11.9% of college students suffers from anxiety.² Lack of or inadequate treatments for stress contributes to the persistence of mental health problems over an extended period of time, which can have long-term negative effects, both psychologically and physically.^{1,2,3,4,5,6} Some negative psychological effects of stress include anxiety, depression, hopelessness, loneliness, suicidal intentions, ineffective cognitive process and interpersonal problems.^{1,4,5,6} Negative physical effects of prolonged stress can include hypertension, increased levels of muscle tension, decreased immune system defenses, sleep disturbances, and gastrointestinal problems.^{1,3,4,5}

Students entering the collegiate level of education experience a huge transition in their lives where they have to learn how to be self-sufficient, which can lead to an increase in perceived stress levels. There is an increased amount of academic stress pertaining to pressure to succeed, meeting grade requirements, amount of course material, and time management to complete coursework.^{1,2,3,4,7} College students also experience a rise in stress levels due to social pressures to make new friends and maintain relationships with friends and family members.^{1,2,4,7} Personal factors that further impact feelings of stress in students include self-sufficiency, finances, self-esteem, gender identity, body image and internalized moral reasoning.^{1,4} These new

challenges, pressures and experiences often lead students to feel that they do not have enough time or energy to manage their new adult-like responsibilities.^{1,2,3,4}

Despite the overwhelming number of students experiencing increased stress levels in college, studies indicate that few students receive treatment for numerous reasons. While one study found that approximately 50% of students experience significant levels of stress in the forms of anxiety or depression⁶, another study concluded that less than half of the college students with mental health problems that persisted for over 2 years received treatment during that time period.² Students either preferred to deal with their stress alone, did not perceive treatment as essential, did not have time for treatment, or did not want to seek treatment due to fear of personal stigma.^{2,6} Without receiving proper treatment to combat stress, college students could develop additional mental illnesses and face negative long-term health effects.^{1,2,3,4,5,6}

Even though college students are less likely to receive treatment or receive inadequate treatment, there have been a few stress reduction treatments proven to be successful. While physical activity has been demonstrated to be a coping mechanism to reduce stress, cardiovascular exercise (vigorous physical activity) has been portrayed to be more effective in reducing physiological and psychological stress effects.^{1,7} Another effective treatment for stress in college students is stress management, which can be implemented in a variety of ways.^{1,6,7} Some personal stress management practices include cognitive-behavioral exercises, psycho-educational interventions, medication, mental and physical relaxation strategies, mindfulness-based techniques and wellness participation.^{1,2,6} It was further determined that the most effective means to reduce stress in college students is likely to be a combination of stress reduction programs and treatments.^{1,7} Many colleges and universities offer mental health treatment and prevention programs aimed at addressing student stress and potentially mitigating

resultant depression and anxiety.^{2,4,6} It is pertinent for universities to assess the mental health needs of their students in order to efficiently and effectively tailor prevention and treatment.^{4,6}

The stress from the transition into college, combined with the increased pressure to maintain a healthy lifestyle, has left college students with several barriers preventing them from having healthy eating patterns. Some of these barriers include a lack of time to prepare meals due to academic responsibilities and limited meal options provided by the university in the dining halls.^{8,9,10,11} Transportation to grocery stores, as well as financial constraints further impeded students from preparing healthy meals, leading students to eat the majority of their meals away from home or “on-the-go”.^{9,11} A major hindrance many college students face when it comes to nutrition is inadequate knowledge pertaining to cooking skills.^{8,9,10,11,12} Due to a lack of confidence about food preparation and a lack of self-efficacy to use fruits, vegetables and seasonings when cooking, students struggle to develop healthful eating habits.^{8,11} One research study reported that students lacking culinary skills were less likely to have healthier diets and in order to ensure meal provision, some students depended on convenience foods (pre-prepared meals), while others would skip meals.¹⁰ Another study found that students experiencing high stress demonstrated less healthy dietary behaviors, with two factors of stress being perceived as helplessness and self-efficacy.¹³

In the transition to college life, students also experience an increased autonomy over food and meal choices that was not present when they were living with their families.¹⁰ They are also exposed to new social groups and food cultures, potentially driving changes in dietary intake.¹⁰ Overall, the factors of limited personal time and resources (money, shopping, time spent cooking), limited environmental time and resources (access to food and academic/work

schedules), and inherited family dietary patterns and cooking abilities discourage college students from cooking their own nutritious meals.^{8,9,10,11}

There is limited current research that examines the relationship between nutritious eating habits and stress levels among college students. An exploratory focus group study was conducted to analyze the perceived barriers and enablers that are affecting healthy eating behaviors in U.S. college students.¹² The barriers remained consistent with previous literature, including time constraints, reliance on convenience foods, financial restraints and feelings of stress.¹² Students with inadequate knowledge or skills surrounding cooking and nutrition are likely to report stress as a barrier to nutritious eating behaviors.¹²

Enablers to nutritious behavior among students included enhanced food education and knowledge as well as involvement in food preparation and meal planning.¹² Students in the focus group found social enablers, such as the support of friends who are also trying to actively eat healthily, to be beneficial in their own food choices.¹² In order to ensure a healthy diet among students, the study suggested that nutritional professionals in the university community should devise tools and programs to enable motivation for healthy food choices.¹² Moreover, campus interventions should focus on improving students' behavioral controls and self-efficacy.¹² By teaching college students skills to be aware of what healthy eating means and implementing interventions to improve knowledge on food preparation, a feeling of empowerment to make better food choices is likely to result.¹² Also with improved cooking education and abilities, college students might experience a decrease in stress levels.

A different study similarly found students who cooked meals in a social setting, possibly with roommates or friends, self-prepared healthy meals more frequently and enjoyed cooking, despite the meal preparation challenges, emphasizing that social connection is a key aspect to

cooking interventions.⁹ Another previously mentioned research article reported that despite barriers such as lack of time and motivation, students had still expressed positive attitudes and an interest in cooking as means for healthy eating, showing that the barriers to cooking interventions are able to be overcome.¹¹

The purpose of this study was to focus on developing cooking skills and determine if there was a relationship with stress level reductions. The objective was to determine if a cooking and meal kit intervention could lower perceived stress levels in college students. The hypothesis of the study was that if college students undergo a cooking and meal kit intervention, they would experience decreased levels of perceived stress relative to control groups at the end of each phase because with improved cooking skills and knowledge, the act of cooking will become less stressful and could even be used as a stress relief mechanism among college students.

Chapter 2: Literature Review

Stress in college students

Stress is generally a response to an external event a person might be experiencing, where the demands of the situation surpass the individual's resources to cope with those pressures.¹ Anxiety is a person's specific reaction to stress, originating internally.¹ There is an abundance of research pertaining to the prevalence of stress, including research focused on college students and their experience of stress/anxiety.¹ Students entering the collegiate level of education are faced with several new challenges, new pressures, and new experiences.¹ There is an increased amount of academic stress related to meeting grade requirements, course workload, time management, and pressure to succeed.^{1,2,3,4,7} College students also experience a rise in stress levels due to social pressures to make new friends and maintain relationships with friends and family members.^{1,2,4,7} Personal factors that further impact feelings of stress in students include self-sufficiency, finances, self-esteem, gender identity, body image and internalized moral reasoning.^{1,4} This huge transition point in life that students undergo often leads them to feel that they do not have enough time or energy to manage their new adult-like responsibilities.^{1,2,3,4}

Ongoing physiological and psychological stress can both have several negative consequences. Some psychological effects of stress include anxiety, depression, hopelessness, loneliness, suicidal intentions, ineffective cognitive processing and interpersonal problems.^{1,4,5} One study found that approximately 60% of students in college disclosed high or very high stress levels.⁷ Another study reported that approximately 50% of students experience significant levels of stress in the forms of anxiety or depression.⁶ Additionally, approximately 11.9% of college students suffer from an anxiety disorder, making this the most prevalent psychiatric problem among college students; thus, demonstrating how the persistence and exacerbation of high stress

levels in college students can progress to anxiety disorders.² Other negative psychological effects are associated with a prolonged activation of the stress response, which can lead to repetitive negative thinking, as well as negative cognitive emotion regulation.³ This has caused sleep difficulties in many college students with 53.2% of college students reporting sleep difficulties or sleep disturbances.^{3,4} On the physiological side, college students are more likely to experience hypertension, increased muscle tension and a weakened immune system, contributing to colds and headaches due to stress.¹ It also has been reported that during stressful periods, over 40% of college students experienced differences in gastrointestinal habits, such as abdominal pain, abdominal discomfort and changes in stool consistency.⁵

Importance of stress relief and treatment

While it is evident that an overwhelming number of students experience increased stress levels in college, studies indicate that few students receive treatment for numerous reasons.^{2,6} In order to maintain mental and physical health, it is essential for students to find ways to cope with stressors associated with the college environment.⁷ Despite the high prevalence of students experiencing mental illnesses, one study concluded that less than half of the college students with mental health problems persisting for over 2 years, including anxiety and depression, received treatment during that time period.² The most common reason reported for not seeking treatment was that students prefer to deal with stress alone.⁶ Furthermore, around 52% of college students believe stress is normal in college and do not consider their need for treatment to be serious.⁶ Another barrier to seeking treatment was that approximately 47% of college students admitted that they do not have time for treatment.⁶ Regarding time constraints, students have to handle many responsibilities at once, such as academic responsibilities, work, and social commitments, which might conflict with healthcare service hours.² College students also are not

likely to seek treatment due to fear of personal stigma.^{2,6} Other obstacles college students might face when seeking treatment include both financial barriers and transportation barriers, and they might face issues related to the continuity of care during school breaks.² Lack of or inadequate treatments for stress contribute to the persistence of mental health problems over an extended period of time and can have long-term negative effects.²

Even though college students are less likely to receive treatment or receive inadequate treatment, there have been a few stress reduction treatments proven to be successful in this population. While physical activity in general has been demonstrated to be a coping mechanism to reduce stress, cardiovascular exercise (vigorous physical activity) has been found to be more effective in reducing physiological and psychological stress effects.^{1,7} Peer support interventions designed to improve physical activity levels among college students could also help decrease perceived stress levels and bolster mental health overall.⁷ Integrating social health components into intervention strategies targeting mental health among college students has been shown to enhance the effectiveness of the intervention.⁷

Another effective treatment for stress in college students is individual stress management, which can be implemented in a variety of way.^{1,6,7} Some personal stress management practices include cognitive-behavioral exercises, psycho-educational interventions, medication, mental and physical relaxation strategies, mindfulness-based techniques and wellness participation.^{1,2,6} It was further determined that the most effective means to reduce stress in college students is likely to be a combination of stress reduction programs and treatments.^{1,7} Many colleges and universities offer mental health treatment and prevention programs aimed to address student stress and potentially mitigate resultant depression and anxiety.^{2,4,6} It is pertinent for universities to assess

the mental health needs of their students in order to efficiently and effectively tailor prevention and treatment.^{4,6}

Impact of college transition stress on nutrition in college students

The transition from high school to college tends to be a period of change in students' dietary habits. Students in college often develop a higher intake of fast foods high in fat, sweets high in sugar, snacks high in salt, soft drinks and alcoholic beverages, and a lower intake of vegetables, fruits, fish, legumes and whole grains in comparison to when they were living at home.^{8,10,11} The American College Health Association-National College Health Assessment (ACHA-NCHA) discovered that only 5.6% of students consumed at least five daily servings of fruits and vegetables, while 60.1% of college students typically ate one to two servings a day.⁹ College students furthermore do not meet the daily recommendations for whole grains and calcium intake.¹¹

College students face several barriers preventing them from having healthy eating patterns, such as a lack of time to prepare meals due to academic responsibilities and limited options provided by the university in dining halls.^{8,9,10,11} Transportation to grocery stores as well as financial constraints are further impediments keeping students from preparing meals at home, leading students to eat the majority of their meals away from home or "on-the-go".^{9,11} A major hindrance many college students face when it comes to nutrition is inadequate knowledge pertaining to cooking skills.^{8,9,10,11,12} Due to a lack of confidence about food preparation and a lack of self-efficacy to use fruits, vegetables and seasonings when cooking, students struggle to cook at home.^{8,11} One research study reported that students lacking culinary skills were less likely to have healthier diets and in order to ensure meal provision, some students depended on convenience foods (pre-prepared meals), while others would skip meals.¹⁰ Another study found

that students experiencing high stress demonstrated less healthy dietary behaviors, with two factors of stress being perceived as helplessness and self-efficacy.¹³

In the transition to college life, students also experience an increased autonomy over food and meal choices that was not present when they were living with their families.¹⁰ Furthermore, they are being exposed to new social groups and food cultures, potentially driving changes in dietary intake.¹⁰ Overall, the factors of limited personal time and resources (money, shopping, time spent cooking), limited environmental time and resources (access to food and academic/work schedules), and inherited family dietary patterns and/or cooking abilities discourage college students from cooking their own healthy meals.^{8,9,10,11}

Importance of nutrition: physically and psychologically

A major negative health consequence of poor nutrition habits seen in college students is increased dieting, body dissatisfaction and eating disorders.^{10,14,15} Approximately 60-80% of young students, many of whom had a healthy body mass index (BMI), had been on a diet within the previous year due to a desire for a lower BMI.¹⁴ Female college students in particular are more likely to consider themselves overweight or obese despite having a BMI in the normal range.¹⁴ In addition, 43% of college females practiced dieting, and 32% were attempting to not gain weight, even though 78% of them had a normal BMI.^{14,15} Studies have also indicated an increased amount of extreme weight control behaviors, such as binge eating, diet pills, and laxative use among young females.¹⁵

Dieting, often a precursor to an eating disorder, has negative effects on mental and physical health.^{10,14} In terms of physical consequences, dieting can lead students to have a dysfunctional relationship with food that can affect dietary adequacy and cause nutrient

deficiencies, and can put females at a higher risk of infertility.^{10,14} Dieting also has the potential to create conflict and tension among students' relationships.¹⁰

Ways to increase nutritious eating and potentially decrease stress

There is limited current research that examines the relationship between nutritious eating habits and stress levels among college students. An exploratory focus group study was conducted to analyze the perceived barriers and enablers that are affecting healthy eating behaviors in U.S. college students.¹² The barriers remained consistent with previous literature, including time constraints, reliance on convenience foods, financial restraints and feelings of stress, while enablers to nutritious behavior included enhanced food education and knowledge as well as involvement in food preparation and meal planning.¹² Students with inadequate knowledge or skills surrounding cooking and nutrition are likely to report stress as a barrier to nutritious eating behaviors.¹² Another previously mentioned research article reported that despite barriers such as lack of time and motivation, students had expressed positive attitudes and an interest in cooking as means for nutritious eating.¹¹

Students in the focus group found that social enablers, such as the support of friends who are also trying to actively eat healthily, to be beneficial in their own choices.¹² Similarly, a different study found students who cooked meals in a social setting, possibly with roommates or friends, self-prepared healthy meals more frequently and enjoyed cooking, despite the meal preparation challenges.⁹ In order to ensure a healthy diet among students, the study suggested that nutritional professionals in the university community should develop tools and programs to enable motivation for healthy food choices, and campus interventions should focus on improving students' behavioral controls and self-efficacy.¹² By teaching college students skills to be aware of what healthy eating means and implementing interventions to improve knowledge on food

preparation, a feeling of empowerment to make better food choices is likely to result.¹² With improved cooking education and abilities, college students might experience a decrease in stress levels.

Chapter 3: Methods

Participants

The study was a randomized control trial with three treatment groups and a control group that spanned a period of 12 weeks. Undergraduate students at a public university in the northeast in the fall of 2019 were recruited to participate. Participants needed to reside off campus and have access to a kitchen. Additional inclusion criteria for this study included that the students must be aged 18-25 years with active junior or senior standing at the university, and currently cooked dinner at home 3 or less times per week on average. Exclusion criteria consisted of students residing with their parents or guardians and self-reported cooking dinners at home over 3 times per week on average in order to target those who did not cook often. Recruitment took place from September 2019 to October 2019 and approval was obtained by the Committee on Human Research in the behavioral Sciences at the University of Vermont. The study was registered through ClinicalTrials.gov (registration number: NCT04084028).

Screening Procedures

The opportunity to participate in this study was presented to students through tabling events in the student center and in front of the library, as well as through weekly announcement emails and social media. Students interested in the study filled out an online application form and, if eligible, the students were invited to an information session in person, following which they provided informed consent.

Based on their reported availability, enrolled participants were assigned to one of four scheduled class periods. The group assignment for each class period was established through a random assignment table. Students who were unable to attend the scheduled cooking classes

were allowed to participate in the groups that did not receive cooking instruction. A random number randomizations scheme determined if these study applicants were placed in a group that received meal kits only or in the control group.

The study consisted of four intervention groups: 1) cooking intervention followed by meal kit intervention (Cook + MK); 2) cooking intervention followed by no meal kit intervention (Cook only); 3) no cooking intervention followed by meal kit intervention (MK only); 4) control, with no cooking and no meal kit interventions (control). After all randomization procedures, study participants were grouped as follows: Cook + MK, n=18; Cook Only, n=16; MK Only, n=9; Control, n=10.

Cooking Intervention Procedures

In the 2019 fall semester, cooking classes were conducted each week for the cook + MK and cook only group for six consecutive weeks. Dr. Amy Trubek's cooking pedagogy focusing on food agency skills served as the model for the cooking lessons in this intervention, and the cooking classes were taught by a chef educator trained in the food agency pedagogy. The cooking classes began with a short lecture on the topic for the day, followed by a hands on laboratory session where participants worked with partners to cook a meal and actively practice potentially novel cooking skills. The classes were designed to broaden students' knowledge pertaining to cooking methods, skills, and ingredients. Each cooking class concluded with a taste test of the prepared meal and a sensory analysis designed to enable mindful eating with open discussion.

Meal Kit Intervention Procedures

Following the 2019/2020 winter break, participants in the Cook + MK and MK only groups received meal kit boxes delivered to their homes for 6 consecutive weeks. The meal kits every week contained all of the necessary ingredients and instructions to prepare and cook three meals, with a serving size of 2 people. The meal kits were from a leading brand and provided students with eighteen meals to choose from each week, with vegetarian, pescatarian, vegan and gluten free options to accommodate any dietary restrictions or preferences.

Data Measures

Data collection was conducted through an emailed survey sent out at the beginning for the study for baseline data, and sent out twice more at the end of each of the two study intervention periods. Incentives, ranging from gift cards to kitchen tools, were offered to participants through the study to complete the survey at each point in time. All participants completed the Perceived Stress Scale (PSS) at each assessment time.

This study was part of a larger study which looked at additional outcome variables that are not included in this paper.

Perceived Stress Scale (PSS)

The PSS consists of ten questions that work to assess an individual's feelings and thoughts that might be related to unpredictable, uncontrollable and overloaded events in their life. This scale measures perceived stress in a community sample of young adults and participants in this study completed the PSS at baseline and at the conclusion of each intervention period in order to demonstrate the impact of the cooking interventions on perceived

stress. The ten questions of the PSS designed to evaluate how different situations affect different people's emotions and stress levels are on a scale of 0-4, 0 being never and 4 being very often.

This scale is reversed for questions 4, 5, 7, & 8.¹⁶

Chapter 4: Results

Participants

The majority of participants were white, non-Hispanic females with junior or senior standing in college. Participants from both the Cook+MK and Cook Only groups regularly attended the cooking classes, with attendance for the four groups ranging from 83% to 93% during the six week intervention period.

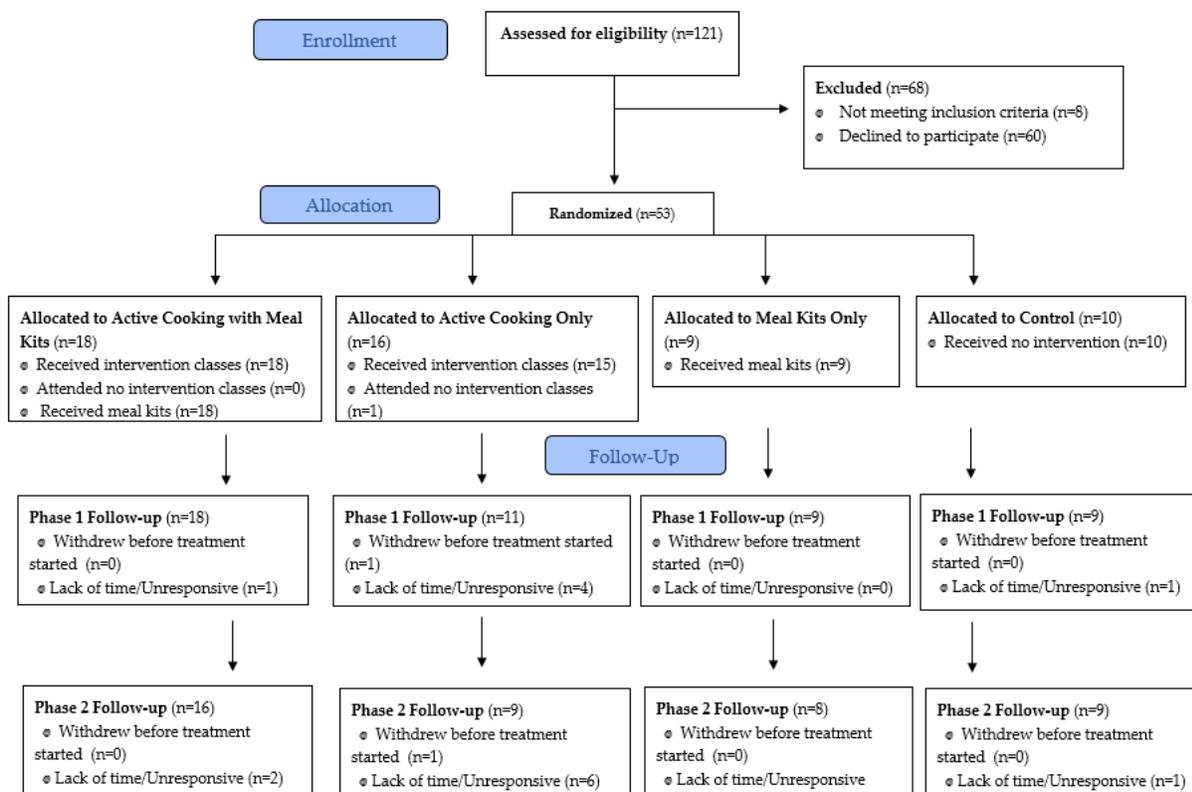


Figure 1. Consort Flow Diagram

Table 1. Demographic characteristics of participants.

	Cook+MK (n=18)	Cook Only (n= 16)	MK Only (n= 9)	Control (n= 10)
Age, years (mean ± SD)	20.6 ± 1.3	20.9 ± 1.2	20.6 ± .5	20.6 ± .8
University standing				
Junior	8 (44%)	4 (25%)	2 (22%)	4 (40%)
Senior	7 (39%)	12 (75%)	7 (78%)	6 (60%)
Other	3 (17%)	0	0	0
Gender (n,%)				
Female	12 (67%)	13 (81%)	7 (78%)	9 (90%)
Male	4 (22%)	3 (19%)	2 (22%)	1 (10%)
Non-binary/ third gender	1 (6%)	0	0	0
Prefer not to answer	1 (6%)	0	0	0
Race (n,%)				
Non-Hispanic White (n,%)	14 (78%)	14 (88%)	9 (100%)	10 (100%)
East Asian or Asian American	2 (11%)	0	0	0
Latino or Hispanic American	1 (6%)	0	0	0
Black, Afro-Caribbean, or African American	0	1 (6%)	0	0
South Asian or Indian American	1 (6%)	0	0	0
Bi-racial	0	1 (6%)	0	0
Relationship status (n,%)				
Single	18 (100%)	14 (88%)	8 (89%)	10 (100%)
Living with partner	0	2 (12%)	1 (11%)	0
Employment status				
10-20 hours per week	5 (28%)	3 (19%)	4 (44%)	2 (20%)
<10 hours per week	7 (39%)	5 (31%)	4 (44%)	7 (70%)
Not employed	6 (33%)	8 (50%)	1 (11%)	1 (10%)

Note. Percentages were rounded to nearest whole percent and may not add up to 100%.

Table 2. Perceived Stress Scale

Study Group	Baseline Score (n=53)	Phase 1 Change from baseline	p-value	Phase 2 Change from phase 1	p-value	Group * Phase p-value
Cook+MK	19.28 ± 1.55	-2.56 ± 1.22	.039	2.63 ± 1.27	.042	0.008
Cook Only	18.94 ± 1.65	1.51 ± 1.52	.324	-3.68 ± 1.96	.064	
MK Only	20.33 ± 2.20	1.00 ± 1.72	.563	-4.20 ± 1.80	.022	
Control	19.50 ± 2.09	0.48 ± 1.71	.776	-4.78 ± 1.72	.007	
Cook+MK vs Cook Only		n/a	n/a	6.31 ± 2.34	.009	
Mk Only vs Control		n/a	n/a	0.58 ± 2.49	.818	
(Cook+MK & Cook Only) Vs. (MK Only & Control)		-2.53 ± 3.11	.418	n/a	n/a	

Perceived Stress Scale (PSS)

The average PSS scores of the study participants were comparable across the four groups at baseline.

In phase 1 of the intervention, participants in the Cook+MK condition had a significant decrease in their PSS scores. In contrast, during the cooking intervention phase of the study, students in the Cook Only group exhibited an increase in PSS scores, however it was not a significant change. The PSS scores of participants in the Meal Kit Only and Control conditions showed an increase in phase 1 of the intervention, yet the data was not significant. When the PSS scores of the Cook+MK and Cook Only groups were compared to the PSS scores of the Meal Kit Only and Control participants for phase 1, a decrease in scores was reported, however it was not significant.

During phase 2 of the intervention, the Cook+MK students experienced a significant increase in stress. On the other hand, the Meal Kit Only group experienced a significant decrease in stress during the meal kit intervention phase of the study. The Control group also underwent a

significant decrease in PSS levels during phase 2. The Cook Only group had a decrease in PSS score during the second phase, however it was not significant. Also in phase 2, the results showed that the combined Cook+MK and Cook Only groups demonstrated a significant increase in PSS scores during phase 2 of the intervention, while the combined Meal Kit Only and Control groups portrayed a slight increase in PSS levels that was not significant.

Discussion

Students entering college experience a major transition, with many changes and additional pressures contributing to heightened stress levels.^{1,2} Insufficient cooking ability and self-efficacy is oftentimes a contributing factor to increased stress, as students have more independence over their food choices and are surrounded by diverse food cultures at college.¹⁰ College can further hinder students' food options through limited selections at dining halls, and oftentimes students do not have the time, resources or skills to cook meals on their own.^{8,9,10,11,12} This study aimed to determine if a cooking-based intervention could help reduce students' perceived stress levels by increasing knowledge pertaining to food education and cooking skills.

Overall, the results indicate that cooking classes and provision of meal kits did not appear to decrease stress levels in college students. The Cook+Meal Kit group demonstrated a significant decrease in PSS levels from baseline to the end of phase 1, the cooking intervention. However, this group experienced a significant increase in PSS scores during phase 2, the meal kit intervention. While students' perceived stress levels might have decreased after the cooking classes, the meal kits potentially contributed to escalated stress levels.

In addition, when the PSS levels of Cook+Meal Kit and Cook Only groups were compared with the PSS levels of Meal Kit Only and Control groups at the end of phase 1, there was no significant difference in PSS scores. This demonstrated no difference in stress levels for the participants in the cooking class intervention compared to those who were not. Therefore, it does not appear that a cooking intervention contributed to a decrease in stress.

During phase 1 of the intervention, the Cook+Meal Kit group might have experienced decreased stress because the students were actively cooking, which could have been used as a coping mechanism for stress. Also, the students were able to take their leftovers home; thus,

potentially reducing the stress of cooking at home. They also learned skills to improve their cooking abilities, which could decrease their stress when cooking at home. Additionally, the cooking classes ended in a mindful eating session with a sensory analysis of the food where the student described the food with their five senses before eating. This conclusion to the class could have created a relaxing environment that contributed to lower perceived stress levels.

Another important aspect to the cooking classes was the social interactions between the students and with the instructor. Previous studies analyzing nutritious eating among college students demonstrated that social enablers, including the support of friends and cooking meals in social settings, have contributed to more enjoyable attitudes surrounding cooking.^{9,12} In this study, these components contributed to a positive energy throughout the cooking classes, and it is possible that these relationships and environment contributed to decreased stress among this group.

While this ideally would have been the same situation for the Cook Only group throughout the cooking intervention, as the cooking classes were the same for both groups, the Cook Only participants exhibited no significant change in perceived stress scores. It is possible that there were other external and confounding factors contributing to the students' stress levels. Phase 1 occurred from the middle to the end of the fall semester, which could potentially coincide with the stress of school work, essays, and other exams. Having to make the time to attend the cooking classes could have added stress to the students' already busy lives. Previous research has indicated that a predominant factor preventing students from preparing healthy meals is time constraints.⁹ It is also possible that the cooking intervention interfered with students' schedules and caused an increase in stress in terms of time management, preventing the intervention from contributing to a decrease in their stress levels. The duration of the study also

might not have been long enough in order to adequately educate the students on food and cooking abilities. If the study was not long enough to effectively teach students cooking skills and did not increase their self-efficacy, the result could be an ineffectual impact on their perceived stress levels.

The meal kit intervention did not appear to reduce stress in college students either. There was a significant increase in stress levels when the PSS scores of the Cook+Meal Kit group were compared with the PSS scores of the Cook Only group from phase 2 of the study. This demonstrated that the meal kits might have played a role in heightening the stress of students' in the Cook+Meal Kit group.

The increase in PSS scores in the meal phase 2 for the Cook+Meal Kit group might have resulted because students had to cook everything on their own. The meal kit intervention was a step down in support compared with the cooking classes, where the students would learn about a food, watch a cooking instructor demonstrate skills, and then cook a meal with a partner. Even though the meal kits came with pre-proportioned ingredients and step-by-step instructions, it might not have been effective in decreasing students' stress while cooking as having in person support and social connections.

Furthermore, meal kits may come with an added, different level of stress because there is more pressure to cook the food quickly in order to prevent it from spoiling. If students are already stressed about time management in terms of cooking, it is possible for their stress levels to increase with the addition of trying to fit meal kits into their already busy lives.

Moreover since the social interactions and optimistic attitudes during the cooking classes played such a pertinent role for many students, it is possible that without these interactions students experienced an increase in PSS levels.

Interestingly, the Meal Kit Only participants experienced a significant decrease in stress over phase 2 of the study. It is possible that the Cook+Meal Kit group had experienced an increase in stress because the meal kits felt more overwhelming and stressful than the instructed cooking classes, in comparison with the Meal Kit Only group that did not have anything in phase 1. Since the Meal Kit Only group only encountered the benefits from the meal kits and were provided with 3 free meals each week, it is understandable as to how their stress might have decreased. It is challenging to conclude that meal kit provision had a consistent impact on college students' perceived stress levels.

In addition to the Meal Kit Only students, the Control group also experienced a significant decrease in stress levels during phase 2, while the Cook Only group had no significant change in PSS scores during this time. These trends suggest that there might have been other confounding factors that contributed to a decrease in stress for the groups. One potential reason for a decrease in stress levels at the end of the meal kit intervention could be the academic calendar. Phase 2 was wrapping up around the time of the 2020 spring break in March, meaning that the students completed their final PSS survey either right before or during spring break. Previous literature had demonstrated that at the end of a semester, college students are likely to experience increased stress levels.¹ The timing of this data could have potentially caused several students to naturally feel a decrease in stress as they were about to have less academic responsibilities.

Another potential reason as to why students' in the Meal Kit and Control group might have had lower stress levels was the weather. As mentioned, the timing of the final PSS survey was in March, meaning that the snow was beginning to melt, the sun was shining and spring was about to be on its way. Research has shown that since individuals are deprived of pleasant

weather during the winter time, spring can improve mood.¹⁷ While the weather was the same for all groups in the study, it is possible that some students were more impacted by the weather than others, causing variances in PSS levels.

This study has several strengths, such as the strategic use of both a cooking and meal kit intervention in a college student population, as both of which, to our knowledge, have not been conducted before in a college population. All students in the cooking groups received a standard curriculum created to have a direct effect on their food agency through the delivery of a specific research-based food agency pedagogy and a professional chef instructor. Another strength included the use of a validated tool, the PSS, to measure students' perceived stress levels.

A potential limitation of the study was the small sample size, as it was constrained by kitchen lab space and students schedules. Future studies could improve by increasing the sample size in order to hopefully see more significant differences in perceived stress levels and also allow for generalizability. The duration of the study also proved to be a possible limitation as 6 weeks might not have been a long enough time for students to gain a sense of self-efficacy cooking for their stress levels to decrease. More studies would be needed to determine if a longer intervention would have a more significant impact improving students' knowledge and skills pertaining to cooking, which could prompt a reduction in their stress levels.

Additionally, as mentioned previously, the academic calendar served as a confounding variable in the study. Previous research has reported that at the end of the college semester, students' stress levels for test anxiety, burnout and perceived stress are higher than at the start of the semester.¹ Consequently, additional studies could take place during school breaks or could involve a group of young adults who are not impacted by the academic calendar in order to see the true effects of the intervention without confounding academic stress catalysts. While there

have been several stress relief aids, including physical activity and stress management practices, a combination of stress reduction treatments have been most effective in decreasing students' stress levels.^{1,7} Future studies should strive to encompass multiple stress reduction programs and strategies.

Conclusions

The findings of this study indicate that neither a cooking intervention nor a meal kit intervention had a consistent impact on students' perceived stress levels. Future studies are necessary to determine how increasing cooking skills and knowledge may lead to decreased stress levels in college students.

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Appendix:
Perceived Stress Scale¹⁴

Scoring:

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

PSS scores are obtained by adding together the scores for the responses, where responses to questions 4, 5, 7 and 8 are reversed.

Questions:

1. In the last month, how often have you been upset because of something that happened unexpectedly?..... 0 1 2 3 4
2. In the last month, how often have you felt that you were unable to control the important things in your life? 0 1 2 3 4
3. In the last month, how often have you felt nervous and “stressed”? 0 1 2 3 4
4. In the last month, how often have you felt confident about your ability to handle your personal problems? 0 1 2 3 4
5. In the last month, how often have you felt that things were going your way?..... 0 1 2 3 4
6. In the last month, how often have you found that you could not cope with all the things that you had to do? 0 1 2 3 4
7. In the last month, how often have you been able to control irritations in your life?..... 0 1 2 3 4
8. In the last month, how often have you felt that you were on top of things?.. 0 1 2 3 4
9. In the last month, how often have you been angered because of things that were outside of your control?..... 0 1 2 3 4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? 0 1 2 3 4