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Eating for Environmental and Personal Health: Green Eating, Health Behavior and Environmental Perceptions at the University of Maine

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EATING FOR ENVIRONMENTAL AND PERSONAL HEALTH: GREEN EATING, HEALTH BEHAVIOR AND ENVIRONMENTAL PERCEPTIONS AT THE UNIVERSITY OF MAINE

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Thesis Advisor: Dr. Adrienne A. White

An Abstract of the Thesis Presented
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The purpose of this study was to determine if green eating (GE), defined as environmentally conscious eating, in college students had an impact on BMI, health behavior, fruit and vegetable intake, physical activity, and perceptions of the campus environment. This was a cross-sectional study of undergraduate and graduate students (n=190) at the University of Maine. The GE Survey was used to determine GE stage of change; participants were classified as either pre-action (precontemplation, contemplation, preparation) (n=113) or post-action (action, maintenance) (n=77). The GE Survey was also used to assess GE behavior, decisional balance, and self-efficacy. A *de novo* health behavior scale was used to measure frequency of healthful behavior (10 (never) to 50 (frequently)), including looking for healthy foods and participating in on-campus health programs. The National Cancer Institute (NCI) Screener was used to assess fruit and vegetable intake, the International Physical Activity Questionnaire (IPAQ) was used to assess

physical activity in MET (Metabolic Equivalents of Task)-minutes, and a *de novo* environmental perceptions scale (0 (strongly disagree) to 100 (strongly agree)) was used to assess students' perceptions of the campus environmental supports for healthful behavior, including availability of healthy foods on campus and presence of policies to promote healthy eating. Statistical analyses included chi-square and two-way ANOVA tests were used to compare pre- and post-action stages of change by gender. Significance was set at $p \leq 0.05$.

Overall, the participants were mostly female (67.9%) and almost all were white (94.6%). The mean BMI was 24.2±4.9, with no difference between pre- and post-action. Participants in the post-action stage of change had higher scores than pre-action for GE behavior (p=0.0001), and were more confident in their ability to practice GE at school (p=0.0001) and at home (p=0.005). Post-action participants also placed greater importance on pros of GE (p=0.0001) and less importance on cons of GE (p=0.001). Post-action participants had higher health behavior scores than pre-action (30.9±5.0 vs. 33.5±4.8) (p=0.001). Based on the NCI Screener, post-action participants had higher daily intake of fruits and vegetables (5.0±4.4 cups) compared to pre-action (2.9±2.4 cups) (p=0.0001). Post-action participants also engaged in more weekly vigorous physical activity (1439.7±1475.7 MET-minutes) than pre-action (984.0±1367.2 MET-minutes) (p=0.003), and more total physical activity (2662.9±1781.5 MET-minutes) than pre-action (2237.11±2104.5 MET-minutes) (p=0.012). For perceptions of the campus environmental supports for healthful behavior, there was an interaction between GE stage of change and gender; males in the pre-action stage had more positive perceptions (65.2±12.5)

and females in the pre-action stage had more negative perceptions (55.5±9.6), whereas males and females in the post-action stage had similar perceptions (males: 59.3±12.0; females: 60.4± 11.4) (p=0.047).

College students who were green eaters engaged in more healthful behavior, consumed more cups of fruits and vegetables, and engaged in more physical activity than those who were not green eaters. Based on these results, increased awareness of GE may raise consciousness about the environmental impact of food choices and one's own health behavior among college students. In the future, educating college students about GE may have an added benefit of promoting healthful behavior.

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CHAPTER 1: INTRODUCTION

Currently, the issues of climate change and environmental sustainability are at the forefront of global issues.[1–3] Evidence is strong that humans are contributing to climate change, and that Greenhouse Gas (GHG) emissions are the main drivers behind climate change.[1–3] A major source of GHG emissions is our food system, which produces large amounts of waste and GHG emissions, especially from the production of livestock.[1–3] Environmentally conscious eating practices, also known as "green eating" (GE), can help to reduce the GHG emissions from food production and other environmental impacts of food production. GE encompasses a number of factors that can help to lessen one's personal negative impact on the environment, including eating organic and local foods, limiting consumption of meat, especially red meat, choosing free range and antibiotic-free meats, and limiting food waste.[4] This change on a personal level can have great benefits to the environment; researchers have found changing one's diet, including following a plant-based diet and limiting or excluding meat intake, can reduce a person's diet-associated GHG emissions by up to 50%.[5]

As there is a link between personal diet and environmental sustainability, researchers have studied how having an environmentally sustainable diet, or being a "green eater" may impact dietary quality. College students are an interesting population to assess as they are beginning to make their own decisions about their diet and health, and may become more aware of community and global issues,[6] including climate change. Researchers have found college student health behavior, overweight and obesity tend to track into adulthood, so it is important for college

students to establish positive health-related behavior and maintain a healthy weight.[7] Researchers have found students and adolescents who are green eaters tend to have higher diet quality, including intake of fruits and vegetables, compared to students who are not green eaters.[4,8–11] It is presently unknown how GE may impact other health behavior, including physical activity.

Additionally, the presence or lack of campus supports for healthful behavior can help or inhibit healthy behavior, respectively. Recently, researchers have found that perceptions of the environmental supports for healthful behavior can impact dietary quality, with more positive perceptions associated with higher intake of fruits and vegetables.[12] It has not yet been determined how GE in college students may affect how they perceive the environmental supports for healthful behavior. The goal of this study was to determine if GE in college students positively impacts health behavior, diet, physical activity, and perceptions of the supports for healthful behavior in the campus environment of the University of Maine.

CHAPTER 2: LITERATURE REVIEW

Environmental Sustainability and the Food System

Climate change is well established by scientific research.[1-3] The effects of climate change include global temperature increases with melting ice, acidification of oceans, rising sea levels, and extreme weather patterns such as prolonged drought and stronger storms.[1,3] Researchers have determined climate change is predominantly caused by humans, with greenhouse gas (GHG) emissions as the primary cause.[1,3] The GHG emissions are created in large part by the burning of fossil fuels and production of heat-trapping gasses. The global food system is a key contributor to climate change, contributing an estimated 19-29% of total GHG emissions.[13,14]

Within the food system, livestock production is the greatest contributor of GHG emissions, making up about 80% of the GHG emissions associated with the food system.[15] Methane gas released from livestock enteric fermentation and manure alone is reported to make up approximately 18% of total global GHG emissions.[13] Additional aspects of food production that contribute to climate change include deforestation, processing and transport of meat and grains, and use of nitrogen-containing fertilizers.[13-15] Not only does the food system contribute significantly to climate change, researchers have found that climate change also challenges the ability of the food system to provide for the population, largely due to extreme weather.[14] Further, there is additional stress on the food system to produce adequate food for the global population, which is projected to reach 10 billion by 2100.[16] Based on these facts, there is a movement for individuals to take steps to

reduce the GHG emissions caused by their dietary choices. These steps have been defined by Weller and colleagues[4] as green eating (GE), which encompasses eating a plant-based diet, limiting consumption of red meat, limiting food waste, and choosing organic and local foods.

Globally, world leaders have convened and pledged to help reduce GHG emissions, mainly from fossil fuel combustion.[1,17] As these steps are taken, there is a call for individual citizens to take action to reduce their personal GHG emissions. The scientific report prepared by the Dietary Guidelines for Americans (DGA) Advisory Committee includes a chapter dedicated to food sustainability and safety.[18] In the report, the DGA Advisory Committee defined a sustainable diet as "a pattern of eating that promotes health and well-being and provides food security for the present population, while sustaining human and natural resources for future generations."[18] The DGA Advisory Committee recommended a move toward a more plant-based diet to promote both health and environmental sustainability. Although this recommendation was submitted in the report, it is important to note that food sustainability and sustainable diet recommendations were not included in the final 2015 Dietary Guidelines for Americans.[19]

Despite there being no official U.S. government recommendations for environmentally sustainable food choices, there is increased interest from the public in environmentally conscious food choices. Consumer demand for sustainable foods is increasing in the United States, including the demand for local food directly from farmer to consumer, which is often sold at farmers' markets.[20] The number of

farmers' markets in the United States has grown over the past 20 years, with an increase from 1,755 farmers' markets in 1994 to 8,476 farmers' markets in 2015.[21]

Researchers have studied the environmental sustainability and human health implications of local food,[22,23] a term which currently does not have a clear definition. Proposed definitions include food produced within 100 miles of one's home,[24] within one's state in the United States, or within one's country outside of the United States.[23] In the context of environmental sustainability, consuming locally grown foods is often included in the definition of GE.[4] In contrast to this concept, Weber and colleagues[22] found that only 11% of food system-associated GHG emissions were from transportation; the majority (83%) of GHG emissions were from food production. Considering the relatively small amount of GHG emissions associated with food transportation, the researchers suggested following a vegetarian diet or replacing red meat and dairy with chicken, fish and eggs to decrease GHG emissions instead of focusing on purchasing only local foods.

Researchers have found organic food production to be more environmentally sustainable, by conserving water, soil, and energy resources, than conventional food production.[25] Consumer demand for organic foods is also increasing in the United States.[26,27] Organic foods in the United States must be certified and in adherence with the Organic Food Production Act (OFPA).[28] Rules for the production of organic food in accordance with the OFPA include producing foods without using synthetic fertilizer, pesticides or genetically modified organisms (GMOs) and raising livestock humanely and with organic feed.[28]

Motivation for eating organic foods encompasses health, food safety, environmental sustainability and humane treatment of animals.[29,30] Although many people choose organic foods for personal health,[31,32] Smith-Spangler and colleagues[29] conducted a review and found that compared to conventionally grown foods, organic foods contained only slightly higher phosphorus in produce, and higher omega-3 fatty acid content in organic milk and chicken. There was no significant difference in nutrient content of other organic and conventionally grown foods. Considering food safety, they found organic foods contained 30% fewer pesticide residues and 30% lower chance of antibiotic-resistant bacteria in chicken and pork.

Environmental Sustainability, Diet and Health

Researchers, health advocates, and environmental advocates have clarified the link between environmental sustainability principles and health behavior.[33,34] Skouteris and colleagues[33] and Ascheman-Witzel[34] have described how environmentally sustainable behavior can have an added benefit of promoting a healthful lifestyle and diet. Examples of this concept include eating a plant-based diet to prevent meat-production associated GHG emissions, eating less processed foods to avoid packaging, water, and energy costs, and biking or walking instead of driving to cut down on automobile emissions.[33,34] Environmentally friendly behavior can translate to a healthful lifestyle while contributing to environmental protection. This behavior may be motivated by self-centered motivators, such as

personal health and taste, or by altruistic motivators, like environmental conservation.[34]

Goetzke and colleagues[35] assessed health behavior in relation to organic food as well as functional food in a sample of German adults. They found significant positive correlations between consumption of organic foods and the use of alternative medication or spirituality (r=0.29), social community involvement (r=0.22), healthy diet (r=0.12) and physical activity (r=0.12). Based on these results, there appears to be a positive, albeit weak to moderate, correlation between health behavior and consumption of organic foods in German adults.

Considering the motivations for and barriers to an environmentally sustainable diet, researchers are now trying to determine foods that are most environmentally friendly, while ensuring affordability, cultural appropriateness, and nutritional adequacy.[36] Masset and colleagues[36] evaluated commonly eaten foods in the French diet for these characteristics. They found animal products had the greatest environmental impact, while starchy foods, fruits and vegetables had the lowest impact. Fruits and vegetables had the highest nutritional quality, whereas desserts, soda, butter and deli meats had the lowest nutritional quality. They also found a positive correlation (r=0.59) between food costs in price per kilogram and GHG emissions, but when food costs were computed in price per kilocalorie, there was no association with GHG emissions. There were 94 foods that were the most sustainable when considered by price per kilogram, including fruits, vegetables, legumes, yogurt, and excluding almost all meat products. When assessed using price per kilocalorie, many fruits and vegetables were no longer the most sustainable food

choices. Based on this research, although plant-based foods have a lower price and environmental impact when considered by weight, their low kilocalorie density can decrease their environmental sustainability when the environmental impact is considered by kilocalorie density.

Consumer Motivations for and Perceptions of Green Eating

Researchers have assessed consumers' motivation for and attitudes toward choosing environmentally conscious diets. Bellows and colleagues[37] examined GE-related attitudes and behaviors of American adults. They found the most important food qualities were ease of access, ease of preparation, U.S. grown and high vitamin content. Respondents who were the primary meal preparer had more positive attitudes toward locally grown and organic foods, and cared more that their food be free of genetically modified organisms (GMOs). There were no differences between genders.

Tobler and colleagues[38] assessed Swiss consumers' willingness to adopt environmentally conscious dietary habits. Respondents were asked to rate a number of behaviors based on how much impact the behavior would have on environmental protection. This group of consumers believed avoiding excess packaging would have the greatest impact and believed eating less meat and more organic food would have the smallest environmental impact. Interestingly, researchers found consumers who ate meat more frequently believed consuming less meat would have little environmental impact. Females were more likely to be willing to decrease their intake of meat. The majority of respondents already ate

regional and seasonal foods. These results are interesting, as the production of meat, in fact, has the greatest negative impact on the environment,[13,15] indicating there is likely a knowledge deficit regarding this aspect of food production.

Vanhonacker and colleagues[39] assessed Belgian consumers' attitudes about sustainable food choices and behavior related to environmental sustainability. About two-thirds (63.3%) of participants were concerned about climate change. Similar to the findings of Tobler and colleagues,[38] Vanhonacker and colleagues[39] found consumers were not aware of the environmental impact of meat consumption. Subjects were more willing to reduce meat consumption than to eat meat substitutes.[39] The most common environmentally sustainable behavior was recycling (89.1%), followed by choosing seasonal foods (56.1%), consuming less meat (33.9%), and choosing local foods (31.7%). Participants who were conscious about their own environmental footprint were more likely to be concerned about climate change and to understand the impact of meat consumption. The researchers also found that barriers to adoption of sustainable food choices included cost and taste.

Smith and colleagues[40] compared Australian consumers' intentions to purchase organic vegetables, knowledge about organic vegetables, attitudes toward organic vegetables, and concern for the environment. They found positive correlations between attitudes toward organic vegetables and intention to purchase organic vegetables, as well as knowledge about organic vegetables and attitudes toward organic vegetables. Although these consumers had the intent to purchase organic vegetables, there was no correlation between attitudes and actual purchase

behavior. Consumers who were concerned about health or concerned about the environment were more likely to intend to purchase organic vegetables.

Finally, Hjelmar and colleagues[31] assessed Danish consumers' reasons for buying organic foods. They used interviews with consumers and found the greatest barrier to purchasing organic foods was higher cost. If organic cost the same as non-organic, these consumers said they would buy organic. Other reasons for choosing organic foods were the perception of better taste and quality, health, and environmental sustainability. Parents also expressed a desire to choose organic foods for their children's health. In addition to the higher cost of organic foods, other barriers to choosing organic foods included accessibility and supply.

Transtheoretical Model

The Transtheoretical Model (TTM), also known as stages of change, is used in the Green Eating Survey to assess readiness for change, GE behavior, and attitudes toward GE. The TTM is a theory of behavior change developed by Prochaska.[41] The theory is used to assess a person's readiness for change in relation to a new health behavior. The TTM was first developed for use in cigarette smokers but has since been used in a wide array of health-related behavior and health issues, including alcohol abuse, sunscreen use, eating disorders, high fat diets, and obesity.[41,42] TTM can be effectively used in diet-related behavior change to assess readiness for change, which can allow a care provider to tailor an intervention to the client's stage of change.[43,44] For example, a person in precontemplation should not be challenged

to take action, but should first be encouraged to raise his consciousness regarding a behavior and its associated health issues.[41,42]

At the center of TTM is stages of change, which is used to identify a person's readiness to adopt a new behavior at a certain point in time.[42,43] The five stages of change are precontemplation (no intention to change in the next six months), contemplation (thinking about changing within the next six months), preparation (planning to change in the next 30 days), action (changed within the past six months), and maintenance (made change more than six months ago, maintaining new behavior).[42,43,45] Precontemplation, contemplation and preparation can be considered "pre-action" and action and maintenance can be considered "post-action." The stages assess a person's readiness for change at a certain moment. People may move linearly across the stages from precontemplation to maintenance, but most people move back and forth among the stages, or "relapse," before completely changing and maintaining a behavior.[41]

The TTM also includes three other constructs, including behavior, self-efficacy, and decisional balance.[41,42] The behavior construct is used to assess the frequency of behavior associated with the chosen health behavior, and self-efficacy is used to assess a person's confidence in avoiding the temptation to relapse in difficult situations. Finally, decisional balance is used to assess the importance of "pros" and "cons" relative to the new health behavior. Di Noia and Prochaska[45] conducted a meta-analysis review of the use of the TTM in nutrition behavioral research and they found that decisional balance (pros and cons) is a reliable indicator of an individual's stage of change. In 87% of studies, cons were rated as

more important than pros in the precontemplation stage, and in 95% of studies, pros were rated as more important than cons in the maintenance stage. When considering decisional balance over the stages of change from precontemplation to maintenance, cons decreased over the stages. Pros will generally increase from precontemplation to preparation, and then become stable over the post-action stages (action and maintenance).

Green Eating Survey

As the population becomes more aware of the environmental impact of their food choices, the term green eating (GE) has emerged to characterize environmentally conscious eating patterns. GE includes making environmentally sustainable food choices, including eating local and organic foods as possible, limiting intake of meat and processed foods, and trying to limit food waste.[4] In order to measure GE behavior, attitudes and perceptions, Weller and colleagues developed a 28-item Green Eating Survey.[4] They utilized the Transtheoretical Model (TTM) to develop the survey, with self-reported GE stage of change, as well as GE behavior, decisional balance, and self-efficacy related to GE. The survey was validated for use in college students[4] and demonstrated adequate test-retest reliability, with precontemplation and maintenance being the most stable stages of change.[46] The sample used in this validation study was mainly white (78%) and female (68%). The majority (72.4%) of the participants were in the pre-action stage of change (precontemplation, contemplation, preparation). They also found that participants who identified in the post-action stage (action, maintenance) consumed an average

of one cup more fruits and vegetables per day (action=3.44±1.55 cups; maintenance=3.74±1.64 cups) ($p<0.001$).[4]

Greene and Weller investigated dependent variables associated with college students' GE stages of change (not ready for action (NR) = precontemplation, contemplation; ready for action = (RA) preparation, action, maintenance).[8] In this study, the majority (66%) of students were NR. There were differences between NR and RA groups, with those in the NR group more likely to be male, first-year students, non-white, to reside on campus and usually eat in a dining hall or restaurant ($p<0.05$).

Young Adult Attitudes Toward and Perceptions of Green Eating

Researchers have also assessed GE attitudes and perceptions in college students.[47–49] Wilkins and colleagues[47] asked college students in nutrition and economics classes about their awareness and use of the terms "local" and "seasonal" foods. They found a wide understanding of constituents of GE since 87% and 75% of students had heard of the terms "seasonal foods" and "local foods," respectively. Students were also able to identify foods that were local or seasonal and foods that were not. As this study was published in 2000, it is possible the current college student population is even more aware of the terms "local" and "seasonal" due to increasing popularity of GE.

Bissonnette and colleagues[48] assessed views and behaviors relative to organic and local foods in a sample of high school seniors. Of the students in this sample, 57.6% described themselves as environmentally concerned and 60.9% as

health conscious. Most students also believed organic foods were better for the environment (71.8%) and better for their health (74.8%). These attitudes did not necessarily translate into action, with the majority of students stating they had neither bought nor asked the food purchaser in their house to buy organic (60.1%) or local (66.4%) foods in the past 2 months. Females were more likely than males to have higher behavioral intention, more positive attitudes towards both local and organic foods, and were more likely to identify as health and environmentally conscious.

Dahm and colleagues[49] assessed college students' (n=443) knowledge about organic foods and compared attitudes toward organic foods to eating, purchase, and health behavior. The sample was mostly female (55.8%) and white (54.6%). About half of the participants correctly defined organic foods. There was a positive correlation between participants' knowledge of organic food and attitudes toward organic food ($p<0.05$). Motivators toward eating organic food included taste, price, appearance, and availability. Attitude toward organic food was positively correlated with buying and consuming organic foods ($p<0.01$), and with the participants reporting having a healthy lifestyle ($p<0.01$).

Green Eating and Dietary Quality of College Students and Adolescents

Because of the common characteristics shared by GE and a plant-based diet, there is a growing interest in understanding the impact of GE on dietary quality, especially in adolescent and college-age students. Based on a review of the literature, there were three studies in which researchers have used the Green Eating

Survey to compare GE stage of change and dietary quality in college students.[8,50,51] Greene and Weller[8] compared students who were not ready for change (NR) with regard to GE and students who were ready for action (RA). They found that students who were NR ate more red meat and fast food than those who were RA. Compared to RA students, students in the NR group also ate fewer cups of fruits and vegetables.

Brown and colleagues[50] compared the dietary intakes of University of Rhode Island students (n=26; female=65%; white=77%) in the precontemplation stage of change for GE with those in the action and maintenance stages of change using three 24-hour dietary recalls. The dietary intake was quantified in comparison to the Healthy Eating Index (HEI), which is used to measure diet quality in relation to the 2005 Dietary Guidelines for Americans and MyPyramid recommendations.[52] The sample had a mean BMI of 24±4.3 and 31% of participants were in action and maintenance stages of change. There were no differences between stages of change for fruit, vegetable, saturated fat or sodium intake. Participants in the action and maintenance stages ate more foods with fiber ($p<0.05$) and less processed meat ($p<0.05$) than those in the precontemplation stage. There were no differences between groups for answers to health-related questions in the College Environment Perceptions Survey (CEPS).

Hall and colleagues[51] used the Green Eating Survey to compare diet quality of college students based on GE stage of change in the context of food availability at the University of Maine. Participants in the study were mostly female (70.2%) and white (91.9%). Participants were categorized as either “pre-action”

(precontemplation, contemplation, preparation) or "post-action" (action, maintenance). Fruit and vegetable intake was assessed by one question asking how many cups of fruits and vegetables participants ate per day. Females in the post-action stage of change consumed more fruits and vegetables than females in pre-action (3.4±1.8 vs. 2.5±1.4 cups) ($p=0.002$). There was no significant difference in fruit and vegetable intake between pre- and post-action males.

There are also studies of environmentally conscious eating behavior and dietary quality assessed by methods other than the Green Eating Survey. Robinson-O'Brien and colleagues[9] compared the dietary quality of adolescents who placed moderate-high importance on sustainable eating practices and adolescents who did not. Diet quality was assessed using the Youth and Adolescent Food Frequency Questionnaire (YAQ) and categorized the results compared to the Healthy People 2010 objectives. Adolescents who placed moderate-high importance on GE practices were more likely to meet the Healthy People 2010 guidelines for fat, saturated fat, fruits and vegetables ($p<0.001$).

Similarly, Gerson and colleagues[10] examined the impact of positive or negative/neutral views about sustainable food on diet quality in college students. Diet quality was assessed using an overall diet quality mean score (ODQMS), which included frequency of intake of "fruits, vegetables, sweets, sodas/soft drinks, fast food, ready-to-eat food, snack foods and vitamin supplements". Scores ranged from 1 (lowest diet quality) to 6 (highest diet quality). The study found 48% of subjects had positive views about local foods, and 40% had negative views about genetically modified organisms. The overall mean ODQMS score was 4.08, with significantly

higher diet quality scores in students with positive opinions of local foods ($p=0.042$), negative opinions of genetically modified organisms ($p=0.035$), and in students who attended farmers' markets ($p=0.012$). There were no significant differences in diet quality or perceptions of sustainable food practices based on race.

Pelletier and colleagues[11] examined a diverse sample of college students' attitudes toward environmentally sustainable food choices. Students were grouped by the level of importance they placed on environmentally sustainable food choices (low or moderate-high importance). Diet quality was assessed using the National Cancer Institute (NCI) five-factor screener. Students who placed a moderate-high importance on sustainable food practices (49%) ate an average of 4.4 servings of fruits and vegetables per day, which was significantly greater than students who placed a low importance on sustainable food practices ($p<0.001$). When compared with low-importance group, the moderate-high importance group also ate breakfast more often ($p<0.001$), and ate fast food about 50% less often ($p<0.001$).

Based on these studies, college students who have positive attitudes toward sustainable food production practices tend to have a higher quality diet when compared to those who do not. Researchers used a range of tools to assess dietary quality and they recommended a validated tool be used to assess dietary quality in order to improve the generalizability of results.

Green Eating Interventions in College Students

As more researchers suggest there is an association between GE and healthful behavior, they have begun to attempt to use education about environmental sustainability concepts to promote health behavior, including improved diet quality. There are two such studies in college students, one in an in-person course for credit[53] and the other a set of online educational modules given for credit or extra credit.[54]

Hekler and colleagues[53] developed an in-person course at Stanford University focused on food and society, which was described by the authors as a "stealth intervention," meaning there was no direct discussion about environmental sustainability and personal health behavior. The researchers developed a course centered on social issues related to food and compared these students to a group of students in three biology and health courses. Pre- and post-tests were taken to assess health-related behavior and attitudes toward environmental sustainability. At post, students in the intervention group had within-group increases in vegetable consumption ($p=0.001$) and decreases in intake of high-fat dairy, sweets, and high-fat meat ($p=0.02$). The control group experienced no within-group changes other than a decrease in vegetable consumption. When the control and intervention groups were compared at posttest, the intervention group had a greater improvement in dietary quality ($p=0.02$) and placed higher importance on the environment and eating a healthy diet. Based on these results, education on social and environmental issues related to food may be an effective means to promote

health behavior in college students, without specifically discussing health benefits related to GE behavior.

This concept has also been explored in college students using brief online courses. In 2015, Monroe and colleagues[54] aimed to promote an increase of GE behavior in college students using an online intervention with a set of four online lessons about GE behavior. The researchers assessed control and intervention groups using the Green Eating Survey at baseline and post-intervention. There were no between-group differences in GE survey responses at baseline. At posttest, the intervention group had significant increases in GE behavior score ($p<0.001$), GE decisional balance pros ($p<0.05$), and GE self-efficacy at school ($p<0.001$). There were no significant changes in GE decisional balance cons and GE self-efficacy at home. The intervention group had a significant improvement in GE knowledge at posttest both within-group ($p<0.001$) and between-group ($p<0.001$). This online intervention focused on GE was an effective means to increase knowledge and promote behavior change regarding GE in college students. It is unknown how this intervention may impact students' diet quality or health behavior. Using online courses could be an effective and economical means to educate college students about environmental sustainability and health.

International Physical Activity Questionnaire (IPAQ)

In addition to a healthful diet, researchers have shown adequate physical activity is necessary to improve overall health, prevent weight gain and prevent chronic disease.[55] The United States Department of Health and Human Services

(DHHS) has established weekly physical activity guidelines for Americans.[56] In the 2008 Physical Activity Guidelines, it is recommended that adults age 18 to 64 engage in at least 150 minutes of moderate activity or 75 minutes of vigorous activity per week, as well as strength training at least two times per week.[56] Based on data from the National Health and Nutrition Survey (NHANES), as of 2012, 47% of adults in the U.S. did not meet the aerobic and strength training recommendations.[57] There is a similar trend for physical activity in college students. In 2005, Keating and colleagues[58] conducted a review of physical activity in college students and found that 30-50% of college students did not meet physical activity recommendations.

The International Physical Activity Questionnaire (IPAQ) was developed and evaluated by Craig and colleagues[59] to assess physical activity in adults 18-65 years of age. There are two forms of the questionnaire, a short form and a long form. The short form of the questionnaire is composed of nine items and is used to assess the weekly frequency and duration of walking, moderate physical activity, vigorous physical activity and time spent sitting. The long form consists of 31 items, which provide a detailed account of physical activity in the realms of transportation, occupation, household and leisure physical activity. In the IPAQ, physical activity is measured in METs, which are Metabolic Equivalents of Task, and physical activity is reported in MET-minutes per week. Craig and colleagues[59] found that the short ($r=0.30$) and long ($r=0.33$) forms had similar correlations with accelerometer physical activity data. The IPAQ short form was also validated for use in college students. Dinger and colleagues[60] found the short form was significantly correlated

with accelerometer data (r=0.24). Vigorous activity had the highest correlation (r=0.30-0.47), and walking had the lowest correlation (r=0.05-0.12).

National Cancer Institute (NCI) Fruit and Vegetable Screener

Adequate intake of fruits and vegetables is a cornerstone of health promotion and the prevention of chronic disease.[61] The National Cancer Institute (NCI) and the CDC Behavioral Risk Factor Surveillance System (BRFSS) both have brief screeners to estimate fruit and vegetable intake for use in research.[62] The NCI screener is an all-day screener for fruit and vegetable intake.[62,63] Participants are asked to report the portion size and frequency of intake of 10 items (fruit, fruit juice and eight types of vegetables/vegetable mixtures) over the past month, ranging from never to 5 or more times per day.[62] Thompson and colleagues[62] compared the NCI screener to fruit and vegetable intake reported in a 24-hour recall and was found to be strongly correlated for males (r=0.66) and females (r=0.51). This survey has been used to measure fruit and vegetable consumption in college students. Greene and colleagues[64] found average daily fruit and vegetable intakes by college students (n=1,603) to be 3.4±2.4 cups for males, 3.0±2.2 cups for females, with a mean of 3.1±2.3 cups for the total sample. Researchers calculated 2005 MyPyramid fruit and vegetable recommendations for each participant based on their gender, age and physical activity level. Approximately 22.9% of the students met MyPyramid recommendation for fruit consumption, and only 12.4% met the vegetable recommendation.

Student Health Behavior and Environmental Perceptions

College students are a unique population, as they are beginning to make their own decisions, which include decisions related to health behavior, such as diet and physical activity habits.[7] Researchers have found that overweight and obesity in college students, and health-related habits, including diet and physical activity habits, tend to track into adulthood.[7] Overall, dietary quality and frequency of physical activity tend to decrease from adolescence to college, and rates of overweight and obesity increase.[7,65] Bertoia and colleagues[65] found an inverse relationship between intake of total servings of vegetables and weight change over time. Based on these findings, it is important that college students establish positive health behavior to maintain health over time and into adulthood.[7]

Walsh and colleagues[66] developed a survey to assess health behavior and potential for change in college students. This survey is used to assess physical activity behavior, nutrition behavior and stress management, as well as changeability in terms of the environment and personal health behavior. They also used the TTM to determine stage of change for fruit and vegetable intake, stress management and physical activity. Most participants in this sample were female (63%), white (66%) and lived on campus (55%). When students were in the action/maintenance stages of change for exercise, they tended to have higher scores for exercise behavior and environmental changeability. These students requested more environmental supports for their health behavior. In the action/maintenance stages of change for fruit and vegetable intake, students tended to have higher scores nutrition behavior and changeability but there was no effect on

environmental changeability in this group. Based on these results, it appears that students who were in later stages of change for physical activity desired more environmental supports for healthy behavior, but students in later stages for fruit and vegetable intake did not place a high priority on an increase in environmental supports for health behavior. Students in later stages for both exercise and fruit and vegetable intake had higher scores for exercise and nutrition behavior, respectively.

Researchers have established that the health environment, including availability and cost of healthful foods and availability of space for physical activity, has an impact on health, including BMI and dietary intake. Objective tools have been developed to measure the healthfulness of the environment on college campuses, including physical activity accessibility, walkability and bikeability, dining facilities, and food stores on or near college campuses.[67–70] Perceptions of the environment may be related to health as well. Blitstein and colleagues[12] found that a positive perception of the environment was associated with eating more servings of fruits and vegetables. An environmental perceptions survey was developed by Green and colleagues[71] for use in the general adult population to assess perceptions of accessibility and cost of healthy foods, transportation availability to access healthy foods, and behavior related to healthy foods. The relationship between the objective food and nutrition environment and perceptions of the environment is unknown and requires further study.

Study Justification

Based on the findings of this literature review, there is a need to promote environmentally sustainable behavior in order to quell GHG emissions and the

related progression of climate change. College students are at a critical time in the development of positive health behavior habits, including diet and physical activity.[7] Researchers have found college students who have positive opinions of GE, or self-identify as green eaters, tend to have higher diet quality.[4,8–11] The purpose of this study was to build on this concept by studying fruit and vegetable intake using the NCI fruit and vegetable screener, and the impact of GE on BMI and additional health-related behavior, including physical activity. This study was the first to this researcher's knowledge designed to evaluate the relationship between physical activity and GE behavior in college students. Students' perceptions of the campus environmental supports for healthful behavior relative to their stage of change for GE were also studied. Based on past research, a positive opinion of the nutrition environment may be associated with greater intake of fruits and vegetables.[12] If college students' perceptions of the campus environmental supports for healthful behavior are influenced by whether or not they are green eaters, there could be evidence of a relationship between GE and college students' perceptions of how the campus environment supports healthful behavior.

CHAPTER 3: METHODOLOGY

Goal and Objectives

The goal of this research was to determine how being a green eater affects college students' BMIs, health behavior, fruit and vegetable intakes, physical activity, and perceptions of the college environment.

The objectives were to:

1. Compare BMI, health behavior, fruit and vegetable intake, physical activity, and environmental perceptions in college students in pre- and post-action stage of change for green eating (GE); and
2. Determine if being in the post-action stage of change for GE positively affects college students' BMIs, health behavior, fruit and vegetable intakes, physical activity, and perceptions of the college environment.

Study Design

This was a cross-sectional study of GE stages of change and GE behavior, health behavior, and environmental perceptions among college students at the University of Maine. The data used in this study were gathered from a portion of a larger, multistate study called Get Fruved: A peer-led, train-the-trainer social marketing intervention to prevent unwanted weight gain in older adolescents (hereinafter referred to as Fruved). Fruved is a 5-year, 8-state research project to prevent unwanted weight gain and promote healthful behavior in college students, and increase the healthfulness of the college environment. The data used in this study were collected to gather preliminary information about students' perceptions

of the college environment as well as their behavior in the college environment and to validate instruments. The data were collected by an online survey composed of multiple instruments, five of which are included in this research. These instruments are the Green Eating Survey (Appendix A), a *de novo* health behavior scale (Appendix B), the National Cancer Institute (NCI) Fruit & Vegetable Screener (Appendix C), and the International Physical Activity Questionnaire (IPAQ) (Appendix D), and a *de novo* environmental perceptions scale (Appendix E). Selected demographic questions and self-reported height and weight were included in the analysis (Appendix F). Any missing responses or selection of "choose not to answer" were excluded from data analysis.

Participant Recruitment

Participants were recruited in the fall of 2014. Recruitment was conducted using a flyer (Appendix G) through the Announcements and Alerts email folder in the First Class email system at the University of Maine, and by sending the flyer via email to students in introductory animal science and sustainable agriculture courses. Eligibility criteria for the study included that participants were current students at the University of Maine and were 18 years of age or older at the time of survey completion. All undergraduate and graduate students were eligible. Participants provided informed consent (Appendix H) electronically before beginning the survey. The study protocol was approved by the Institutional Review Board at the University of Maine.

Participant Incentive

Each participant who completed the survey was given an incentive of $5.00 in "Black Bear Bucks." Students may use their "Black Bear Bucks" to buy food and goods on campus and at selected off-campus vendors. The participants were asked to provide their University ID (MaineStreet ID) and first and last name at the end of the survey. This information was collected separately from all other survey responses. This information was provided to Daniel Sturrup at Auxiliary Services, who deposited $5.00 to the participants' MaineCard "Black Bear Bucks" accounts.

Survey Instruments

Green Eating Survey

The Green Eating Survey (Appendix A) is a 25-item instrument developed and validated by Weller and colleagues[4] at the University of Rhode Island. The Transtheoretical model (TTM) was used in the Green Eating Survey to assess the subject's readiness to adopt GE behavior and also to assess GE behavior, decisional balance (pros and cons) for GE, and self-efficacy (confidence in ability to eat green in difficult circumstances). The stages of change algorithm, which is the first question of the survey, was used to assess readiness for change related to GE. There were four subsequent scales included in the survey. The first scale was the GE behavior scale (α=0.910), which was a six-item scale to assess the frequency of GE behavior, ranging from "barely ever to never"(1) to "almost always" (5). GE behavior questions included "how often do you eat locally grown foods?" and "how often do you shop at farmers' markets?" Responses to these six questions were averaged to

provide a score for overall GE behavior. The next scale was the GE decisional balance scale (pro: α=0.845; con α=0.719), which was used to average scores for "pros" and "cons" of GE. Responses ranged from "not at all important" (1) to "supremely important" (5). "Pro" questions included "by eating green, I can help protect the planet" and "eating minimally processed foods is better for my health". "Con" questions included "eating green can be too expensive" and "eating green would be too difficult". The sub-scale for "pros" was computed by averaging responses to the five "pro" questions (3C, 3E, 3F, 3G, 3I) and the sub-scale for "cons" was computed by averaging responses to the five "con" answers (3A, 3B, 3D, 3H, 3J). The final scale was used to assess GE self-efficacy at school (α=0.795) and at home (α=0.859). Responses ranged from "not at all confident" (1) to "extremely confident" (5). Self-efficacy was measured at school and at home by statements about confidence in being able to eat green "when I am at school during the semester" and "when it is inconvenient" or "when I am with my family". The sub-scale for self-efficacy at school was computed by averaging the responses to the five "at school" questions (4A, 4B, 4D, 4F, 4G) and the sub-scale for self-efficacy at home was computed by averaging responses to the three "at home" questions (4C, 4E, 4H).

Health Behavior Scale

A *de novo* health behavior scale (Appendix B) was developed by researchers in the Healthy Campus Research Consortium (N.C. 1193 Technical Research Committee), and was used to assess frequency of health behavior in college students. The health behavior scale included 10-items, with questions such as "I

look for healthy food options when I shop and eat" and "I participate in programs on campus that promote health." Responses ranged from "never" (1) to "frequently" (5). The behavior scale was computed by summing each participant's responses, with scores ranging from "never" (10) to "frequently" (50).

National Cancer Institute (NCI) Fruit and Vegetable Screener

The NCI Fruit and Vegetable Screener (Appendix C) was used to assess the participants' daily fruit and vegetable intakes in cup equivalents. Participants were asked to rate the frequency of their consumption of juice, fruits and vegetables, ranging from "never" to "5 or more times per day." Participants were then asked to choose the portion size usually consumed when the juice, fruit or vegetable was consumed. Responses for portion size varied based on the type of fruit or vegetable consumed. The total daily serving of fruits and vegetables was computed based on the frequency of consumption and serving size. Servings were expressed in 2005 MyPyramid cup equivalents.[72]

International Physical Activity Questionnaire (IPAQ) – Short Form

The IPAQ (Appendix D) was used to assess the physical activity habits of participants. Physical activity was expressed in MET (Metabolic Equivalent of Task) minutes. Participants chose the number of days per week (0 to 7 days) they engaged in vigorous activity, moderate activity, and walking for at least 10 minutes at a time. The participants then chose the number of minutes per day they usually spent doing each type of activity (10 to 180 minutes). Participants selected how many minutes

they spend sitting on a weekday (10 to 180 minutes). Scores were computed for vigorous activity, moderate activity, and walking. MET-minutes for walking, moderate activity, and vigorous activity were summed for the total physical activity. Scores are for walking, moderate activity, vigorous activity, and total activity were expressed as MET-minutes per week.

College Environment Perceptions Scale

A *de novo* college environmental perceptions scale (Appendix E), developed by researchers in the Healthy Campus Research Consortium, was a 15-item instrument used to assess college students' perceptions of the campus environmental supports for healthful behavior.[73] There were seven factors assessed within the tool (physical activity, healthy food, policy, water, vending, sleep and stress). Questions included "there are policies on campus that promote healthy eating," "there are safe places for me to walk on campus," and "there are healthy foods available where I usually eat in dining halls on campus". Responses to these 15 questions ranged from "strongly disagree" (1) to "strongly agree" (5). Questions were weighted differently based on the number of questions in the factor and importance of the information provided in the factor (i.e., physical activity and healthy food were most important). Physical activity questions (n=4) were scored from 0 to 6 (total possible points=24). Sleep questions (n=1) and stress questions (n=1) were each scored from 0 to 6 (total possible points for each question=6). Healthy food questions (n=2) were scored from 0 to 10 (total possible points=20) and policy questions (n=2) were also scored from 0 to 10 (total possible points=20).

The water questions (n=3) were each scored from 0 to 4 (total possible points=12). Vending questions (n=2) were each scored from 0 to 6 (total possible points=12). Each participant's responses for each factor were summed to create a score ranging from "strongly disagree" (0) to "strongly agree" (100).

Demographics

Demographic questions (Appendix F), included age, gender, race, year in school, where the student lives during the school year (on or off campus), relationship status, weekly hours spent working for pay, and grade point average (GPA). Self-reported height and weight were included on the demographic form, and body mass index (BMI) was computed from these data.

Statistical Analysis

Statistical analyses of the data were completed by this researcher using SPSS (version 22) (IBM Corporation © 2013). Descriptive statistics were computed for categorical data. Chi-square tests for independence were used to compare categorical variables among pre- and post-action stages of change for GE. Reliability was computed for the Green Eating Survey, health behavior scale, and environmental perceptions scale. For dependent variables, histograms were used to test for normality and box-plots were used to detect outliers. Extreme outliers were removed from data analysis. Two-way ANOVA tests were used to test dependent variables for main effect for gender and GE stage of change, and for interaction between gender and GE stage of change. Skewness of data was assessed. A square

root or logarithmic transformation was applied to fruit and vegetable data and physical activity. Partial eta squared was used to determine strength of effect size based on Cohen's guidelines (Small = 0.01; Medium = 0.06; Large = 0.138).[74] Results were significant at $p \leq 0.05$. Jonathan Moyer of Husson University served as consultant statistician for the analyses.

CHAPTER 4: RESULTS

There were 247 participants who responded to the survey. There were 40 participants excluded due to choosing not to answer all survey questions or the respondent quitting the survey with the majority of questions unanswered. There were 17 participants excluded because they did not choose an answer for the question about the stage of change for green eating (GE) in the Green Eating Survey. The final sample size after exclusion of incomplete surveys was 190. In the following presentation of findings, when the number does not equal 190, the difference is due to participants selecting "choose not to answer."

Participant Characteristics

There were 190 participants who identified their stage of change for green eating (GE) in the stage of change algorithm (Table 1). There were 113 participants (59.5%) who were in the pre-action stage of change, with 24.7% in precontemplation, 23.7% in contemplation, and 11.1% in preparation. There were 77 participants (40.5%) who were in the post-action stage of change, with 12.1% in action, and 28.4% in maintenance.

Table 1: Participants' Stage of Change Distribution for Green Eating (GE)

Stage of Change[1]	n	Percent
Precontemplation[2]	47	24.7
Contemplation[3]	45	23.7
Preparation[4]	21	11.1
Action[5]	23	12.1
Maintenance[6]	54	28.4
Total	190	100.0

[1] Green Eating Survey (Appendix A).
[2] Precontemplation = no plan to become a green eater in the next 6 months.
[3] Contemplation = plan to become a green eater in the next 6 months.
[4] Preparation = plan to become a green eater within the next month.
[5] Action = became a green eater within the past 6 months.
[6] Maintenance = became a green eater over 6 months ago.

Characteristics of the participants are shown in Table 2, grouped by whether they were in pre-action (precontemplation, contemplation, preparation) or post-action (action, maintenance) for GE. The majority of the total sample was female (69.7%) and nearly all were white (94.6%). Similar percentages of the participants lived off campus (50.5%) and on campus (49.5%). The majority of participants were between the ages of 18 and 21 (78%), and the remaining 22.1% of participants were age 22 or older. Similar percentages of students were in committed relationships or married (50.5%) as were single (49.5%). Participants were relatively evenly distributed among year in school from first year to senior, with a lower percentage of graduate students (8.6%). The majority of participants reported having a GPA above a 3.0 (77.6%). Most participants (49.5%) reported working 1 to 19 hours per week during the school year, 20.7% worked 20 hours or more, and 29.8% did not work.

Table 2: Participant Characteristics

Characteristics[1,2]	Pre-Action[3] n (%)	Post–Action[4] n (%)	Total n (%)
	113 (59.5)	77 (40.5)	190 (100)
Gender			
Female	73 (65.8)	56 (75.7)	129 (69.7)
Male	38 (34.2)	18 (24.3)	56 (30.3)
Total	111 (100)	74 (100)	185 (100)
Age (years)[5]			
18	14 (12.4)	13 (16.9)	27 (14.2)
19	25 (22.1)	12 (15.6)	37 (19.5)
20	32 (28.3)	11 (14.3)	43 (22.6)
21	26 (23.0)	15 (19.5)	41 (21.6)
22 and older	16 (14.2)	26 (33.8)	42 (22.1)
Total	113 (100)	77 (100)	190 (100)
Relationship Status[6]			
Single	52 (46.8)	36 (48.6)	88 (47.6)
Committed	58 (52.3)	29 (39.2)	87 (47.0)
Married	1 (0.9)	9 (12.2)	10 (5.4)
Total	111 (100)	74 (100)	185 (100)
Year in School			
First Year	17 (15.2)	17 (23.0)	34 (18.2)
Sophomore	31 (27.7)	11 (14.9)	42 (22.6)
Junior	28 (25.0)	19 (25.6)	47 (25.3)
Senior	30 (26.8)	17 (23.0)	47 (25.3)
Graduate	6 (5.3)	10 (13.5)	16 (8.6)
Total	112 (100)	74 (100)	186 (100)
Overall GPA			
3.0 to 4.0	82 (74.5)	60 (82.2)	142 (77.6)
Below 3.0	28 (25.5)	13 (17.8)	41 (22.4)
Total	110 (100)	73 (100)	183 (100)

[1] When n≠190, difference is due to non-responders and/or choose not to answer.

[2] Results from demographics survey (Appendix E).

[3] Green eating stage of change. Pre-Action = Precontemplation, Contemplation, Preparation.

[4] Green eating stage of change. Post-Action = Action, Maintenance.

[5] Significant relationship between green eating stage of change and age (p=0.008); more participants ages 19-21 in pre-action than post-action; greater numbers of participants ages 22 and older in post-action than pre-action.

[6] Significant relationship between green eating stage of change and relationship status (p=0.002); more married participants in post-action than pre-action; more participants in committed relationships in pre-action than post-action.

There were no differences across GE stages of change for gender, race, place of residence, hours worked during the school year, or GPA. There was a significant relationship between GE stage of change and age (X^2 = 13.9, df = 4, p=0.008). There were greater numbers of participants ages 19 to 21 in the pre-action stage than in the post-action stage, and greater numbers of participants ages 22 and older in the post-action stage than in the pre-action stage. Similar numbers of 18 year olds were in pre- and post-action stages. There was also a significant relationship between GE stage of change and relationship status (X^2 = 12.1, df = 2, p=0.002). There were greater numbers of married participants in the post-action stage than in the pre-action stage, and greater numbers of participants in committed relationships in the pre-action stage than in the post-action stage. Similar numbers of single participants were in pre- and post-action stages of change.

Results for gender differences were unrelated to the GE stage of change, so the differences that were found are within Appendix I. Comparisons by gender for GE behavior, decisional balance and self-efficacy are displayed in Table A.1 (Appendix I). There was a significant main effect for gender on GE behavior with a small to medium effect size (F (1, 167) = 6.116, p=0.014; partial eta squared = 0.035) and on self-efficacy at home with a small to medium effect size (F (1, 179) = 6.374, p=0.012; partial eta squared = 0.034); females had higher scores for GE behavior and self-efficacy at home than males. Comparisons of fruit and vegetable intake by gender are displayed in Table A.2 (Appendix I). There were significant main effects for gender on consumption of tomato sauce with a large effect size (F (1, 173) = 31.241, p=0.0001; partial eta squared = 0.153), potatoes with a medium

to large effect size (F (1, 181) = 21.259, p=0.0001; partial eta squared = 0.105), and French fries with a medium to large effect size (F (1, 181) = 9.906, p=0.002; partial eta squared = 0.106); females consumed fewer cups of tomato sauce, potatoes and French fries than males.

Green Eating Survey

Comparisons between pre- and post-action participants for GE behavior, decisional balance, and self-efficacy are shown in Table 3. There was a significant main effect for GE stage of change on GE behavior score with a large effect size (F (1, 167) = 34.913, p=0.0001; partial eta squared = 0.173); the post-action participants had higher GE behavior scores than the pre-action participants. There was a significant main effect for GE stage of change on the GE pros score with a medium effect size (F (1, 172) = 13.001, p=0.0001; partial eta squared = 0.070), as well as for the GE cons score with a medium effect size (F (1, 169) = 11.617, p=0.001; partial eta squared = 0.064); the post-action participants had higher pro scores and lower con scores than the pre-action participants. There was a significant main effect for GE stage of change on GE self-efficacy at home with a small to medium effect size (F (1, 179) = 7.899, p=0.005; partial eta squared = 0.042), as well as for GE self-efficacy at school with a large effect size (F (1, 178) = 38.709, p=0.0001; partial eta squared = 0.179); the post-action participants had higher scores for GE self-efficacy at home and at school than the pre-action participants.

Table 3: Mean±SD Scores for Green Eating (GE) Beliefs and Behavior by Stage of Change for Green Eating

Green Eating Survey[1,2,3]	Pre-Action[4] n=113	Post-Action[5] n=77
	Mean±SD	Mean±SD
Behavior Scale		
Green Eating Behavior[6] (n=171)	2.35±0.95	3.38±0.95[9]
Decisional Balance: Pros[7] (n=176)	3.49±0.96	4.03±0.79[10]
Decisional Balance: Cons[7] (n=173)	3.14±0.80	2.67±0.79[11]
Self-Efficacy at Home[8] (n=183)	3.35±1.02	3.94±0.95[12]
Self-Efficacy at School[8] (n=182)	2.33±0.75	3.12±0.77[13]

[1] Green Eating Survey (Appendix A).
[2] Results based on two-way ANOVA.
[3] Pre- and Post-Action participants compared with two-way ANOVA.
[4] Pre-Action = precontemplation, contemplation, preparation
[5] Post-Action = action, maintenance
[6] Scale ranges from 1 (barely ever to never) to 5 (almost always).
[7] Scale ranges from 1 (not at all important) to 5 (supremely important).
[8] Scale ranges from 1 (not at all confident) to 5 (extremely confident).
[9] Significant main effect for GE stage of change (p=0.0001); post-action had higher mean±SD GE behavior score than pre-action.
[10] Significant main effect for GE stage of change (p=0.0001); post-action had higher mean±SD GE pro score than pre-action.
[11] Significant main effect for GE stage of change (p=0.001); post-action had higher mean±SD GE con score than pre-action.
[12] Significant main effect for GE stage of change (p=0.005); post-action had higher mean±SD GE self-efficacy at home score than pre-action.
[13] Significant main effect for GE stage of change (p=0.0001); post-action had higher mean±SD GE self-efficacy at school score than pre-action.

Anthropometrics by Pre- and Post-Action Stages of Change for Green Eating

Body Mass Indices (BMI) for pre- and post-action groups are reported in Table 5. The mean BMI for the total sample was 24.2±4.9, which is within the normal BMI category (18.5-24.9). The participants in the post-action stage of change had a mean BMI of 23.2±4.2 and the participants in the pre-action stage of change had a mean BMI of 24.9±5.2. Both the pre- and post-action participants' mean BMIs were within the normal BMI category (18.5-24.9), although the pre-action

participants were at the high end of the normal BMI category. The main effect for GE stage of change on BMI approached significance (F (1, 161) = 3.018, p=0.08), with a small effect size (partial eta squared = 0.018). There was no significant main effect for gender or interaction between GE stage of change and gender.

Table 4: Mean±SD Body Mass Indices (BMI) by Gender and Stage of Change for Green Eating (GE)

BMI[1,2]	**Pre-Action**[3] n=99	**Post-Action**[4] n=66	**Total** n=165
	Mean BMI±SD[1]	Mean BMI±SD[1]	Mean BMI±SD[1]
Total (n=165)	24.9±5.2	23.2±4.2	24.2±4.9
Male (n=54)	25.4±5.5	24.3±4.5	25.0±5.1
Female (n=111)	24.6±5.1	22.7±4.0	23.8±4.8

[1] BMI = kg/m[2].
[2] Results based on two-way ANOVA.
[3] Green eating stage of change. Pre-Action = Precontemplation, Contemplation, Preparation.
[4] Green eating stage of change. Post-Action = Action, Maintenance.

Health Behavior of Pre- and Post-Action Stages of Change for Green Eating

Health behavior scores for pre- and post-action stages of change for GE are presented in Table 6. There was a significant main effect for GE stage of change on mean health behavior score (F (1, 176) = 10.443, p=0.001), with a medium effect size (partial eta squared = 0.056). Participants in the post-action stage of change had a greater mean health behavior score (33.5±4.8) than those in the pre-action stage of change (30.9±5.0). There was no significant main effect for gender or interaction between GE stage of change and gender. Reliability of the *de novo* health behavior scale was α=0.485, which is considered low.

Table 5: Mean±SD Health Behavior Scores by Stage of Change for Green Eating (GE)

Health Behavior Survey[1,2]	**Pre-Action** n=53	**Post-Action** n=127	**Total** n=180
	Mean±SD	Mean±SD	Mean±SD
Total (n=180)	30.9±5.0	33.5±4.8[5]	32.0±5.0

[1] Health behavior scale (Appendix B).
[2] Frequency of health behavior (n=10 questions), ranging from 1 (Never) to 5. Score computed on 10 (never) to 50 scale.
[3] GE stage of change. Pre-Action = Precontemplation, Contemplation, Preparation.
[4] GE stage of change. Post-Action = Action, Maintenance.
[5] Significant main effect for GE stage of change (p=0.001), based on two-way ANOVA; post-action had higher mean±SD health behavior score than pre-action.

Fruit and Vegetable Intake by Pre- and Post-Action Stages of Change for Green Eating

Daily fruit and vegetable intakes based on the NCI Screener for pre- and post-action stages of change for GE are compared in Table 7. There was a significant main effect for GE stage of change on total fruit and vegetable consumption with a medium to large effect size (F (1, 181) = 16.050, p=0.0001; partial eta squared = 0.081); participants in the post-action consumed an average of 2.18 more cups of fruits, fruit juice, and vegetables per day than those in pre-action (5.05±4.42 cups vs. 2.87±2.41 cups). There was also a significant main effect for GE stage of change on consumption of other vegetables not specified on the scale as single items, with a large effect size (F (1, 178) = 27.271, p=0.0001; partial eta squared = 0.133), fruit with a medium effect size (F (1, 181) = 10.693, p=0.001; partial eta squared = 0.056), lettuce salad with a small to medium effect size (F (1, 181) = 8.885, p=0.003; partial eta squared = 0.047), and dried beans with a small effect size (F (1, 181) = 4.336, p=0.039; partial eta squared = 0.023); post-action participants consumed more cups of other vegetables, fruit, lettuce salad and dried beans than pre-action

participants. There was also a significant main effect for GE stage of change on consumption of French fries with a medium to large effect size (F (1, 181) = 21.488, p=0.0001; partial eta squared = 0.106), and tomato sauce with a medium to large effect size (F (1, 181) = 16.167, p=0.0001; partial eta squared = 0.082); post-action participants consumed fewer cups of French fries and tomato sauce than pre-action participants. There were no significant main effects for GE stage of change on the consumption of fruit juice, potatoes or vegetable soup. There was no significant interaction between GE stage of change and gender.

Physical Activity by Pre- and Post-Action Stages of Change for Green Eating

The results from the IPAQ by GE stage of change are displayed in Table 8. There was a significant main effect for GE stage of change on vigorous physical activity (F (1, 179) = 8.769, p=0.003), with a small to medium effect size (partial eta squared = 0.047). Participants in the post-action stage of change reported significantly more MET-minutes per week of vigorous activity (1493.7±1475.7 MET-minutes) compared to the pre-action stage (984.0±1367.2 MET-minutes). There was also a significant main effect for GE stage of change on mean MET-minutes per week of total physical activity, (F (1, 175) = 6.52, p=0.012), with a small to medium effect size (partial eta squared = 0.036). Participants in the post-action stage of change reported more weekly MET-minutes of total physical activity (2662.9±1781.5 MET-minutes) than the pre-action stage of change (2237.1±2104.6 MET-minutes). There was no significant main effect for gender or interaction between GE stage of change and gender for total physical activity. There were also no significant main effects for

GE stage of change or gender, and no interaction between GE stage of change and gender for weekly MET-minutes of moderate, weekly MET-minutes of walking or daily minutes spent sitting.

Table 6: Mean±SD Daily Cups of Fruits and Vegetables by Stage of Change for Green Eating (GE)

NCI Fruit and Vegetable Screener[1]	**Pre-Action[2]** n=113	**Post-Action[3]** n=77
	Mean±SD Cups[4]	Mean±SD Cups[4]
Total Fruit & Vegetable	2.87±2.41	5.05±4.42[6]
Other Vegetables[5]	0.63±0.72	1.92±2.14[6]
Fruit	0.57±0.73	1.38±1.77[7]
Lettuce Salad	0.23±0.34	0.59±1.06[8]
Dried Beans	0.10±0.39	0.23±0.46[9]
French Fries	0.16±0.31	0.04±0.05[10]
Tomato Sauce	0.23±0.37	0.08±0.10[11]
Potatoes	0.20±0.42	0.11±0.15
Fruit Juice	0.60±1.03	0.48±0.71
Vegetable Soup	0.15±0.31	0.20±0.33

[1] NCI Fruit and Vegetable Screener (Appendix C).
[2] Green eating stage of change. Pre-Action = Precontemplation, Contemplation, Preparation.
[3] Green eating stage of change. Post-Action = Action, Maintenance.
[4] Fruit and vegetable intake reported as cup-equivalents per day.
[5] All vegetables other than those specified in fruit and vegetable screener.
[6] Significant main effect for green eating stage of change (p=0.0001); post-action consumed more cups of fruits and vegetables and other vegetables than pre-action.
[7] Significant main effect for GE stage of change (p=0.001); post-action consumed more cups of fruit than pre-action.
[8] Significant main effect for GE stage of change (p=0.003); post-action consumed more cups of lettuce salad than pre-action.
[9] Significant main effect for GE stage of change (p=0.039); post-action consumed more cups of dried beans than pre-action.
[10] Significant main effect for GE stage of change (p=0.0001); post-action consumed fewer cups of French fries than pre-action.
[11] Significant main effect for GE stage of change (p=0.001); post-action consumed fewer cups of tomato sauce than pre-action.

Table 7: Mean±SD Weekly MET-minutes of Physical Activity and Daily Minutes Spent Sitting by Stage of Change for Green Eating (GE)

IPAQ[1]	**Pre-Action**[2] n=111	**Post-Action**[3] n=73	**Total** n=184
	Mean±SD	Mean±SD	Mean±SD
Vigorous[2] (n=183)	984.0±1367.2	1493.7±1475.7[4]	1187.3±1429.5
Moderate[2] (n=182)	539.8±754.4	545.2±598.5	542.0±694.3
Walking[2] (n=181)	721.4±769.7	665.9±506.9	699.0±675.1
Total[2] (n=179)	2237.1±2104.6	2662.9±1781.5[5]	2408.4±1986.8
Sitting[3] (n=184)	154.4±37.1	150.4±40.0	152.8±38.3

[1] IPAQ (Appendix D).
[2] Physical activity expressed in MET-minutes per week. MET are metabolic minutes of task, which is the rate of energy expenditure during physical activity compared to the rate of energy expenditure while at rest. Range of MET-minutes per week for health benefits is 500-1000 (DHHS, 2008 Physical Activity Guidelines).
[3] Time spent sitting; expressed in minutes per day.
[4] Significant main effect for GE stage of change (p=0.003), based on two-way ANOVA; post-action engaged in more vigorous physical activity than pre-action.
[5] Significant main effect for GE stage of change (p=0.012), based on two-way ANOVA; post-action engaged in more total physical activity than pre-action.

Environmental Perceptions by Pre- and Post-Action Stages of Change for Green Eating

Comparisons for scores for perceptions of the campus environmental supports for healthful behavior by GE stage of change and gender are shown in Table 9. Reliability, assessed for the instrument, was α=0.599. There were no significant main effects for GE stage of change change or gender. There was a significant interaction between GE stage of change and gender on perceptions of the campus environmental supports for healthful behavior (F (1, 89) = 4.1, p=0.047), with a small to medium effect size (partial eta squared = 0.044). This interaction is displayed in the Figure. Males in the pre-action stage of change had a more positive

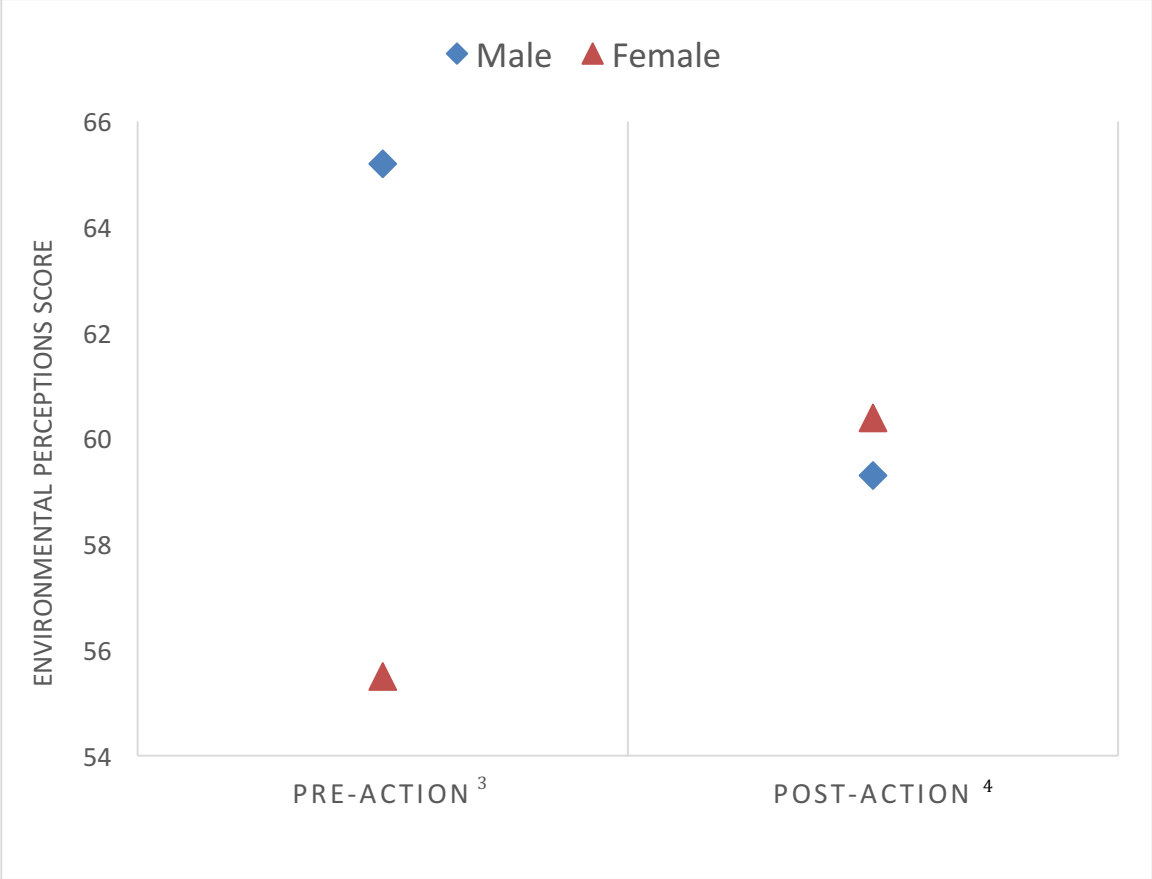
perception of the campus environmental supports for healthful behavior (65.2±12.5), and females in the pre-action stage of change had a more negative perception of the campus environmental supports for healthful behavior (55.5±9.6). The males and females in the post-action stage of change had similar perceptions of the campus environmental supports for healthful behavior (post-action males=59.3±12.0; post-action females=60.4±11.5).

Table 8: Mean±SD Environmental Perceptions Scores by Stage of Change for Green Eating (GE)

Environmental Perceptions Survey[1,2]	**Male** n=29	**Female** n=64	**Total** n=93
	Mean±SD	Mean±SD	Mean±SD
Green Eating Stage of Change			
Pre-Action[3] (n=62)	65.2±12.5	55.5±9.6	58.8±11.6
Post-Action[4] (n=31)	59.3±12.0	60.4±11.5	60.1±11.4
Total (n=93)	63.6±12.4[5]	57.2±10.5	59.2±11.5

[1] Environmental Perceptions Scale (Appendix E).
[2] Environmental Perceptions Score. Based on 15 questions weighted based on importance and number of questions. Scores range from 0 (strongly disagree) to 100 (strongly agree).
[3] GE stage of change. Pre-Action = Precontemplation, Contemplation, Preparation.
[4] GE stage of change. Post-Action = Action, Maintenance.
[5] Significant interaction between GE stage of change and gender (p=0.047), based on two-way ANOVA; pre-action males had more positive perceptions, pre-action females had more negative perceptions, and post-action males and females had similar perceptions.

Figure 1: Interaction Between Gender and Green Eating (GE) Stage of Change on Mean±SD Environmental Perceptions Score[1,2]



[1] Environmental Perceptions Scale (Appendix E).
[2] Environmental Perceptions Score. Based on 15 questions weighted based on importance and number of questions. Scores range from 0 (strongly disagree) to 100 (strongly agree).
[3] GE stage of change. Pre-Action = Precontemplation, Contemplation, Preparation.
[4] GE stage of change. Post-Action = Action, Maintenance.
* Significant interaction between GE stage of change and gender (p=0.047), based on two-way ANOVA; pre-action males had more positive perceptions, pre-action females had more negative perceptions, and post-action males and females had similar perceptions.

CHAPTER 5: DISCUSSION

The goal of this study was to examine the relationship between environmentally conscious eating practices in college students based on green eating (GE) stage of change and BMI, health behavior, fruit and vegetable intake, physical activity, and environmental perceptions. Researchers have found that GE is associated with higher dietary quality in college students' adolescents.[4,8–11] This study used the NCI fruit and vegetable screener to confirm this association. Students' perceptions of the healthfulness of the campus environment were assessed to determine how GE in college students may impact perceptions of the healthfulness of their environment.

Participants in this study were very homogenous by race and geographic location; 94.6% of participants were white and all attended the University of Maine. The majority of this sample was also female (69.7%), which is similar to studies conducted using a convenience sample of college students.[4,50,51] The mean BMI of the total sample was 24.2±4.9. There was no significant difference in mean BMI between pre- and post-action stages of change. The mean BMI for the total sample was slightly higher than the mean BMI in studies by Greene[64] and Weller,[4] and they also had large samples of college students, but they were at multiple universities. The BMI for the total sample was very similar to that of the participants in the study by Brown at the University of Rhode Island (24±4.3).[50]

In current study, GE stage of change was used to to classify participants as either pre-action (59.5%) or post-action (40.5%). Surprisingly, 28.3% of participants were in the maintenance stage of change, meaning that they had been a

green eater for at least six months. This proportion of participants in the action and maintenance stages was greater than Brown[50] (30%), Weller[4] (23%) and Hall[51] (25%). Students from introductory sustainable agriculture and animal sciences were recruited to ensure adequate numbers of green eaters for the purpose of this study. These students may have been more likely to be interested in this topic, leading to higher rate of response. It is also possible a higher percentage of students in sustainable agriculture and animal science courses were green eaters than in the general student population at the University of Maine. Unfortunately, the demographic survey used in this study did not include college major, so it is unknown how major may have impacted the GE stage of change. Students in sustainable agriculture and animal science courses may also have more familiarity with farming prior to enrolling in these courses. Alternatively, the larger proportion in the post-action stage of change may be indicative of a growing interest in GE among college students at the University of Maine.

Considering the constructs of the Transtheoretical Model, these results very closely followed the usual established patterns of Prochaska's Stages of Change compared with the constructs of behavior, self-efficacy and decisional balance.[41,42] The participants in the post-action stage of change placed a higher importance on the pros of GE and lower importance on the cons, and those in the pre-action stage of change put lower importance on the pros of GE and higher importance on the cons of GE when making decisions about GE. This was very similar to the trends in stages of change and decisional balance reported in a meta-analysis by DiNoia and Prochaska.[45] Participants in the post-action stage of change were also more

confident in their ability to practice GE at home and at school. Current results are also similar to results from Weller[4] and Hall.[51] Hall[51] assessed a similar population at the University of Maine and found significantly higher scores in the post-action stage for GE behavior, pros of GE and self-efficacy for GE, but there were no differences between groups for cons of GE. Based on the current results and the reliability for the subscales, there is strong support for the framework of the Green Eating Survey and its validity in college students. There were gender differences for GE behavior and self-efficacy at home; females had significantly higher scores for GE behavior and self-efficacy at home. Although there were gender differences among the whole sample, there was no interaction with GE stage of change.

When considering the measures of health behavior, including the health behavior score, fruit and vegetable intake, and physical activity, participants in the post-action group overall tended to have more healthful behavior. The fruit and vegetable data provided a compelling case for the application of GE to promote adequate intake of fruits and vegetables in college students. Based on USDA's MyPlate,[75] an adult consuming a 2200-calorie diet should aim to eat five cups of fruits and vegetables daily, specifically two cups of fruits and three cups of vegetables, focusing on whole fruits and vegetables. In this study, participants in the post-action stage of change met the MyPlate guidelines for five cups of fruits and vegetables per day.[75] The post-action participants' total fruit and vegetable consumption was significantly greater than the pre-action participants. The pre-action participants' total fruit and vegetable consumption only met 59.2% of the MyPlate guidelines for daily fruit and vegetable consumption. The post-action

group's intake of fruits, including fruit and fruit juice, was higher than the pre-action group, and was close to meeting the MyPlate recommendation for two cups per day. Based on the American College Health Association's (ACHA) spring 2014 National College Health Assessment,[76] only 6.5% of college students reported eating five or more servings of fruits and vegetables per day. Considering this, the post-action participants in this study eating a mean of just over five cups of fruit and vegetables per day is impressive. These results are similar to other researchers' findings regarding the diet quality of college students and adolescents who are green eaters or have positive opinions of sustainable food production and practices.[4,8–11]

There were significant differences between pre- and post-action stages of change for total physical activity and vigorous physical activity. Overall, this sample was very physically active, with the mean weekly physical activity (2408.4±1986.8 MET-minutes) exceeding the Department of Health and Human Services 2008 Physical Activity Guidelines[56] of 500-1000 MET-minutes per week. These results are fairly similar to the findings by Greene and colleagues,[64] who also used the IPAQ to assess physical activity and found college students reported a mean total physical activity of 2920.5±2215 MET-minutes per week. The mean MET-minutes of total physical activity for the total sample also falls within the range of MET-minutes of total physical activity reported by University of Maine students assessed by Courtemanche[77] in 2009 (range from 2194±1504 to 4366±3181 MET-minutes/week). College students in the post-action stage of change for GE engaged in more total (pre-action: 2237.1±2104.6; post-action: 2662.9±1781.5) and vigorous (pre-action: 984.0±1367.2; post-action: 1493.7±1475.7) physical activity when

compared to college students in the pre-action stage of change. There appears to be a link between environmentally conscious eating and increased physical activity, which may be related to higher consciousness about health behavior, or possibly a tendency to practice more environmentally sustainable transportation as well, such as walking or biking instead of driving.

Based on comparison of GE stage of change with scores from the health behavior scale, college students in the post- versus pre-action stages of change for GE reported significantly higher frequency of participating in a number of health behaviors, including looking for healthy foods and participating in a variety of types of physical activity. When considering reports on the instruments measuring fruit and vegetable intake (NCI fruit and vegetable screener) and amount of physical activity (IPAQ), findings were consistent, in which participants in the post-action stage of change consumed more fruits and vegetables and engaged in total and vigorous physical activity more frequently than participants in the pre-action stage. It has been proposed that environmental sustainability may be an effective means to encourage health behavior.[7,33,34] This concept is supported by the findings of this study.

Participants were also asked about their perceptions of the campus environmental supports for healthy behavior. It was interesting that pre-action males and females differed in their perception of whether there were adequate environmental supports for healthful lifestyles on the University of Maine campus. Males in the pre-action stage of change agreed there were adequate environmental supports, while pre-action females were neutral about the presence of adequate

environmental supports. Males and females in the post-action stage of change had very similar perceptions of the environment, both were between neutral and agreeing that there were adequate supports for healthful lifestyles in the campus environment. Blitstein and colleagues[12] found that when a person's perception of the environment was positive versus negative, consumption of fruits and vegetables was higher. Considering fruit and vegetable intake among pre- and post-action stages of change for GE, these results do not fully agree with Blitstein's findings. Females in the post-action stage of change had higher environmental perceptions scores than pre-action females, and also had higher daily intakes of fruits and vegetables. Males in the post-action stage of change had lower environmental perceptions scores that pre-action, but post-action males had higher intakes of fruits and vegetables than pre-action males. When males and females were combined and compared by pre- and post-action stages of change, there were no significant differences in the environmental perceptions scores. Gender appears to play a role in how the campus environment is perceived. Walsh and colleagues[66] found that college students who were in the post-action stage physical activity desired more environmental supports for healthful behavior, but those in post-action for fruit and vegetable intake did not desire more environmental supports. Based on this, it is possible that male college students in the post-action stage of change for GE are more aware of the health environment than those in pre-action, because they are more likely to seek out healthier foods and opportunities for physical activity, and could be more likely to notice deficiencies in the healthfulness of the college environment.

There were some limitations to this study. The participants were very homogeneous by race, with approximately 94% of the sample identifying as white and the sample was from one northeastern university, the University of Maine, so generalizability to the larger college population would be suspect. In addition, students in certain fields of study, such as sustainable agriculture, were targeted to increase the likelihood of achieving a sample of green eaters large enough for statistical analyses. Therefore, findings may not be a true representation of the total University of Maine student population. Additionally, the height, weight, fruit and vegetable intake and physical activity data were self-reported, which is usually considered suspect, although researchers have found there is a strong correlation between self-reported and researcher-measured height and weight in young adults.[78] The health behavior scale and environmental perceptions scale are both *de novo*, which must be considered when interpreting results. The reliability for the health behavior scale was considered low, so caution should be taken when weighing those results. The reliability of the environmental perceptions scale was acceptable.

In the future, research could be done to test whether in person or online courses designed to educate college students about the environmental impact of the foods systems is an effective way to increase health behavior in college students. Additionally, testing the Green Eating Survey in other populations could help to determine if populations outside of college students follow GE behavior and whether this is associated with improved dietary quality, physical activity, and

health behavior. Finally, further testing of the effect of GE on health behavior in other populations is warranted to determine the generalizability of these results.

CHAPTER 6: CONCLUSION

There is a need for more environmentally sustainable dietary patterns in order to protect the environment. Green eating (GE) is an environmentally conscious eating practice that may be accompanied by improved health behavior and awareness of the environmental supports for healthful lifestyles. The goal of this study was to compare the BMIs, health behavior, fruit and vegetable consumption, physical activity and environmental perceptions of college students at the University of Maine who were eating green (EG) to those who were not eating green. The stages of change algorithm was used to categorize students into pre-action or post-action for GE. Participants in pre-action and post-action stages of change were compared by GE characteristics, health behavior, BMI, daily fruit and vegetable intake, weekly physical activity, and perceptions of the supports for healthful behavior in the campus environment.

Students who were in the post-action versus pre-action stage of change for GE were more likely to exhibit GE behavior, perceive pros of GE as more important, and cons of GE as less important when making decisions to eat green, and were more confident in their ability to eat green at home as well as at school. There was no difference in mean BMI between groups. Both groups had mean BMIs within the normal BMI category, although pre-action participants were on the cusp of the overweight category. Participants in the post-action stage had higher health behavior scores than those in pre-action. Participants in the post-action stage had higher mean intakes of fruits and vegetables than participants in the pre-action stage. Participants in the post-action stage met the MyPlate recommendations for

mean daily fruit and vegetable intake, whereas students in the pre-action stage fell short of the recommendations by an average of 2.18 cups. For weekly physical activity, post-action participants engaged in more weekly vigorous physical activity and more weekly total physical activity than pre-action participants. Finally, overall, based on scores from the college environmental perceptions scale, participants in the post-action stage had similar perceptions of the healthfulness of the college environment compared to those in the pre-action stage. When tested for interaction between GE stage of change and gender, there was a significant interaction for gender, with pre-action males having a more favorable perception of the environment and pre-action females having a more negative perception of the environment. There were no gender differences for perception of the healthfulness of the environment in the post-action stage of change.

There is a relationship between following an environmentally sustainable diet and healthful behavior, including higher intake of fruits and vegetables, and more total and vigorous physical activity. Overall, GE did not appear to have a strong impact on perception of the environment, with both pre- and post-action participants scores falling between neutral and agreeing there were adequate environmental supports for healthful lifestyles, although there was an interaction between stage of change and gender.

Making changes to one's diet to support environmental sustainability, such as eating a plant-based diet, limiting intake of red meat and dairy, and choosing organic and local foods, can help to reduce greenhouse gas (GHG) emissions.[13,18,22,33,34] As has been previously found,[4,8–11] in the current study,

students who were green eaters had better diet quality than those who were not. Based on this research, following an environmentally sustainable diet may have the added benefit of promoting healthful behavior in college students, including greater frequency of healthful behavior, higher fruit and vegetable intake, and more physical activity. These findings are fairly dramatic and further study is warranted to confirm GE is a marker for lifestyle choices that are health-promoting for the individual and the environment. College students who are green eaters may achieve both altruistic and egoistic goals through environmental protection and personal health promotion.

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APPENDIX A: GREEN EATING SURVEY

1. Green Eating is: Eating locally grown foods, limited amounts of processed/fast foods, eating meatless meals at least one day per week, choosing organic foods as much as possible, and only taking what you plan on eating.
Are you a green eater?

1. No, and I do not intend to start within the next 6 months
2. No, but I am thinking about becoming a green eater within the next 6 months
3. No, but I am planning on becoming a green eater within the next 30 days
4. Yes, I am a green eater and have been for less than 6 months
5. Yes, I am a green eater and have been doing so for 6 months or more
6. I choose not to answer

Score: Green Eating Stage of Change 1=Precontemplation, 2=Contemplation, 3=Preparation, 4=Action, 5=Maintenance, (6=missing-do not score)

2. Please select the answer that BEST describes your usual behavior.

	Barely ever to never (1)	Rarely (25%) (2)	Sometimes (50%) (3)	Often (75%) (4)	Almost always (5)	Choose not to answer (6)
2a. Locally grown foods are grown within 100 miles of your location. Based on this, how often do you eat locally grown foods?	o	o	o	o	o	
2b. When in season, how often do you shop at farmer's markets?	o	o	o	o	o	
2c. How often do you choose foods that are labeled certified organic?	o	o	o	o	o	
2d. How often do you select meats, poultry, and dairy products that are raised without antibiotics or hormones?	o	o	o	o	o	
2e. How often do you select food or beverages that are labeled fair trade certified?	o	o	o	o	o	

2f. How often do you buy meat or poultry products labeled "free range" or "cage free"?	o	o	o	o	o	

Green Eating Behavior Score: 1. Delete any item scored 6 or missing, 2. (Sum of 2a through 2f)/6

3. Here are some advantages and disadvantages of green eating. Please indicate HOW IMPORTANT each one is in your deciding to eat green.

	Not at all important (1)	A little important (2)	Neutral (3)	Very important (4)	Supremely important (5)	Choose not to answer (6)
3a. Eating green is not practical in my life right now	o	o	o	o	o	
3b. Eating green can be too expensive	o	o	o	o	o	
3c. By eating green, I can help protect the planet	o	o	o	o	o	
3d. Eating green would be too difficult	o	o	o	o	o	
3e. Eating minimally processed foods is better for my health	o	o	o	o	o	
3f. By eating green I can improve the quality of my diet	o	o	o	o	o	

3g. By eating green I can support the local economy	o	o	o	o	o	
3h. Sustainably produced foods aren't available to me	o	o	o	o	o	
3i. I am proud that I can help the environment by eating green	o	o	o	o	o	
3j. I can't find green foods where I shop	o	o	o	o	o	

Green Eating Decisional Balance Score: 1. Delete any item scored 6 or missing; 2. Decisional Balance Pro Score= (sum of items 3c, 3e, 3f, 3g, 3i)/5; Decisional Balance Con Score= (sum of items 3a, 3b, 3d, 3h, 3j)/5.

4. REMINDER: Green Eating is: Eating locally grown foods, limited amounts of processed/fast foods, eating meatless meals at least one day per week, choosing organic foods as much as possible, and only taking what you plan on eating.
Please rate HOW CONFIDENT you feel that you could eat green under each of the following circumstances?

	Not at all Confident (1)	Not very Confident (2)	Somewhat Confident (3)	Very Confident (4)	Extremely Confident (5)	Choose not to answer (6)
4a. When I am busy	o	o	o	o	o	
4b. When I am at school during the semester	o	o	o	o	o	
4c. When I am at home	o	o	o	o	o	

4d. When It is inconvenient	o	o	o	o	o	
4e. When I am with my family	o	o	o	o	o	
4f. When I go out to eat	o	o	o	o	o	
4g. When I eat in the dining halls or cafeterias	o	o	o	o	o	
4h. Over the summer	o	o	o	o	o	

Green Eating Self Efficacy Score: 1. Delete any item scored 6 or missing; 2. Confidence at School Score = (sum of items 4a, 4b, 4d, 4f, 4g)/5; Confidence at Home Score= (sum of items 4c, 4e, 4h)/3

APPENDIX B: HEALTH BEHAVIOR SCALE

10 items

1. I look for healthy food options when I shop and eat (including in grocery stores, vending machines, dining halls, restaurants, convenience stores and food courts/snack bars).
   Never 1 2 3 4 5 Frequently

2. I use the university's exercise facilities and equipment.
   Never 1 2 3 4 5 Frequently

3. I use the stairs in most buildings on campus.
   Never 1 2 3 4 5 Frequently

4. I walk on campus during day.
   Never 1 2 3 4 5 Frequently

5. I walk around on campus at night.
   Never 1 2 3 4 5 Frequently

6. I participate in exercise classes offered at the rec center on campus.
   Never 1 2 3 4 5 Frequently

7. I play sports (intramural or club) on campus.
   Never 1 2 3 4 5 Frequently

8. I bike on campus.
   Never 1 2 3 4 5 Frequently

9. I use water fountains on campus.
   Never 1 2 3 4 5 Frequently

10. I participate in programs on campus that promote health (healthy eating, physical activity, stress management).
    Never 1 2 3 4 5 Frequently

APPENDIX C: NATIONAL CANCER INSTITUTE FRUIT AND VEGETABLE SCREENER

NCI Fruit and Vegetable Screener (19 item)

Think about what you usually ate last month. Please think about all the fruits and vegetables that you ate last month. Include those that were:

- ***Raw and cooked,***
- ***Eaten as snacks and at meals***
- ***Eaten at home and away from home (restaurants, friends, take-out), and***
- ***Eaten alone and mixed with other foods.***

Report how many times per month, week, or day you ate each food, and if you ate it, how much you usually had.
If you mark "never" for a question, follow the "Go to" instruction.
Choose the best answer for each question. Mark only one response for each question.

1) Over the last month, how many times per month, week, or day did you drink **100% 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 mealtimes and between meals.
(1) never (go to question 3)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

2) Each time you drank **100% juice**, how much did you usually drink?
(1) Did not drink 100% juice
(2) Less than ¾ cup (less than 6 ounces)
(3) ¾ to 1¼ cup (6 to 10 ounces)
(4) 1¼ to 2 cups (10 to 16 ounces)
(5) More than 2 cups (more than 16 ounces)
(6) Choose not to answer

3) 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.
(1) never (go to question 5)
(2) 1-3 times last **month**

(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

4) Each time you ate **fruit,** how much did you usually eat?
(1) Did not eat fruit
(2) Less than 1 medium fruit (less than ½ cup)
(3) 1 medium fruit (about ½ cup)
(4) 2 medium fruits (about 1 cup)
(5) More than 2 medium fruits (more than 1 cup)
(6) Choose not to answer

5) Over the last month, how often did you eat **lettuce salad (with or without other vegetables)?**
(1) never (go to question 7)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

6) Each time you ate **lettuce salad**, how much did you usually eat?
(1) Did not eat lettuce salad
(2) About ½ cup
(3) About 1 cup
(4) About 2 cups
(5) More than 2 cups
(6) Choose not to answer

7) Over the last month, how often did you eat **French fries** or **fried potatoes?**
(1) never (go to question 9)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**

(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

8) Each time you ate **French fries** or **fried potatoes,** how much did you usually eat?
(1) Did not eat French fries or fried potatoes
(2) Small order or less (About 1 cup or less)
(3) Medium order (About1½ cups)
(4) Large order (About 2 cups)
(5) Super-Size order or more (About 3 cups or more)
(6) Choose not to answer

9) 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.**
(1) never (go to question 11)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

10) Each time you ate **these potatoes,** how much did you usually eat?
(1) Did not eat these types of potatoes
(2)1 small potato or less (1/2 cup or less)
(3) 1 medium potato (1/2 to 1 cup)
(4) 1 large potato (1 to 1½ cups)
(5) 2 medium potatoes or more (1½ cups or more)
(6) Choose not to answer

11) 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.**

(1) never (go to question 13)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**

(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

12) Each time you ate **these beans,** how much did you usually eat?
(1) Did not eat cooked dried beans
(2) Less than ½ cup
(3) ½ to 1 cup
(4) 1 to 1½ cups
(5) More than 1½ cups
(6) Choose not to answer

13) 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

COUNT: All other vegetables—raw, cooked, canned, and frozen

(1) never (go to question 15)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

14) Each of these times that you ate **other vegetables,** how much did you usually eat?

(1) Did not eat these vegetables
(2) Less than ½ cup
(3) ½ to 1 cup
(4) 1 to 2 cups
(5) More than 2 cups
(6) Choose not to answer

15) Over the last month, how often did you eat **tomato sauce**? Include tomato sauce on pasta or macaroni, rice, pizza and other dishes.
(1) never (go to question 17)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

16) Each time you ate **tomato sauce,** how much did you usually eat?
(1) Did not eat tomato sauce
(2) About ¼ cup
(3) About ½ cup
(4) About 1 cup
(5) More than 1 cup
(6) Choose not to answer

17) Over the last month, how often did you eat **vegetable soups?** Include tomato soup, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetables.
(1) never (go to question 19)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

18) Each time you ate **vegetable soup,** how much did you usually eat?
(1) Did not eat vegetable soup
(2) Less than 1 cup
(3) 1 to 2 cups
(4) 2 to 3 cups
(5) More than 3 cups
(6) Choose not to answer

19) Over the last month, how often did you eat **mixtures that included vegetables?** Count such foods as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.
(1) never
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

APPENDIX D: INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

International Physical Activity Questionnaire (9 item)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal or make your heart beat much harder than normal. Think only about those vigorous physical activities that you did for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate.

1) During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

(1) 0 days (Skip to question 3)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

2) How much time did you usually spend doing vigorous physical activities on one of those days?

(1) Did not do vigorous physical activities
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)

(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal or make your heart beat somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate.
3) During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
(1) 0 days (Skip to question 5)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

4) How much time did you usually spend doing moderate physical activities on one of those days?
(1) Do not do moderate physical activities
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)
(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise or leisure.

5) During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

(1) 0 days (Skip to question 7)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

6) How much time did you usually spend walking on one of those days?

(1) Did not walk
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)
(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

This question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.

7) During the last 7 days, how much time did you spend sitting on a week day?

(1) 10 minutes
(2) 20 minutes
(3) 30 minutes
(4) 40 minutes
(5) 50 minutes
(6) 60 minutes

(7) 70 minutes (1 hr 10 min)
(8) 80 minutes (1 hr 20 min)
(9) 90 minutes (1 hr 30 min)
(10) 100 minutes (1 hr 40 min)
(11) 110 minutes (1 hr 50 min)
(12) 120 minutes (2 hrs)
(13) 130 minutes (2 hrs 10 min)
(14) 140 minutes (2 hrs 20 min)
(15) 150 minutes (2 hrs 30 min)
(16) 160 minutes (2 hrs 40 min)
(17) 170 minutes (2 hrs 50 min)
(18) 180 + minutes (3 hrs or more)
(19) Don't know/not sure
(20) Choose not to answer

Think about the time you spent doing any physical activities specifically designed to strengthen your muscles such as lifting weights, push-ups or sit-ups. Include all such activities even if you have reported them before.
8) During the last 7 days, how many days did you do any physical activities designed to strengthen muscles such as lifting weights, push-ups or sit-ups?
(1) 0 days (Skip to question 68)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

9) How much time did you usually spend doing strength training activities on one of those days?
(1) Did not do strength activities
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)

(18) 170 minutes (2 hrs 50 min)
(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

APPENDIX E: COLLEGE ENVIRONMENTAL PERCEPTIONS SCALE

100 points total

Policy Questions (10 points each; 20 points total):

1. There are policies (e.g. no cars on campus) that promote physical activity)
    a. Strongly Agree (10 points)
    b. Agree (7.5 points)
    c. Neither Agree nor Disagree (5 points)
    d. Disagree (2.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

2. There are policies on campus (e.g. limits on sizes of sodas, minimum healthy items in vending machines) that promote healthy eating.
    a. Strongly Agree (10 points)
    b. Agree (7.5 points)
    c. Neither Agree nor Disagree (5 points)
    d. Disagree (2.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

Food Questions (10 points each; 20 points total):

1. There are healthy foods available on campus
    a. Strongly Agree (10 points)
    b. Agree (7.5 points)
    c. Neither Agree nor Disagree (5 points)
    d. Disagree (2.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

2. There are healthy foods available where I usually eat in dining halls on campus
    a. Strongly Agree (10 points)
    b. Agree (7.5 points)
    c. Neither Agree nor Disagree (5 points)
    d. Disagree (2.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

Water Questions (4 points each; 12 points total):

1. The water in the water fountains on campus taste good
    a. Strongly Agree (4 points)
    b. Agree (3 points)
    c. Neither Agree nor Disagree (2 points)
    d. Disagree (1 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

2. The water/drinking fountains on campus look clean.
    a. Strongly Agree (4 points)
    b. Agree (3 points)
    c. Neither Agree nor Disagree (2 points)
    d. Disagree (1 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

3. Most buildings on campus have water/drinking fountains.
    a. Strongly Agree (4 points)
    b. Agree (3 points)
    c. Neither Agree nor Disagree (2 points)
    d. Disagree (1 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

Vending Questions (6 points each; 12 points total)

1. There are lots of healthy choices in vending machines on campus
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

2. There are signs telling me which foods are healthy in vending machines on campus.
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

Physical Activity Questions (6 points each; 24 points total)

1. There are plenty of exercise classes offered at the rec center on campus
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

2. The university's exercise facilities and equipment are in good condition
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

3. There are sports (intramural or club) available to play on campus
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

4. There are plenty of opportunities on campus to be moderately or vigorously active
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

Stress Questions (6 points each; 6 points total)

1. There are programs on campus that promote stress management
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

Sleep Questions (6 points each; 6 points total)

1. The campus living environment allows for quit and restful sleep
    a. Strongly Agree (6 points)
    b. Agree (4.5 points)
    c. Neither Agree nor Disagree (3 points)
    d. Disagree (1.5 points)
    e. Strongly Disagree (0 points)
    f. Choose not to answer – do not score

APPENDIX F: DEMOGRAPHICS

Demographics (10 item)

1) How old are you?
- (2) 18
- (3) 19
- (4) 20
- (5) 21
- (6) 22
- (7) 23
- (8) 24
- (9) More than 24 years old

2) What is your current gender identity?
- 1) Male
- 2) Female
- 3) Trans male/Trans man
- 4) Trans female/Trans woman
- 5) Genderqueer/Gender non-conforming
- 6) Different identity (please state): ___

3) Are you Hispanic or Latino?
- (1) Yes
- (2) No
- (3) Don't know / Not sure

4) Which one or more of the following would you say is your race?
- (1) White
- (2) Black or African American
- (3) Asian
- (4) Native Hawaiian or Other Pacific Islander
- (5) American Indian or Alaska Native
- (6) Other [specify]_____

5) What is your year in school?
- (1) Freshman
- (2) Sophomore
- (3) Junior
- (4) Senior
- (5) Graduate

6) Where do you live?
- (1) Campus residence hall
- (2) Sorority or fraternity
- (3) Other university/college housing

(4) Off campus housing
(5) Parent or guardian's home
(6) Other, specify ____

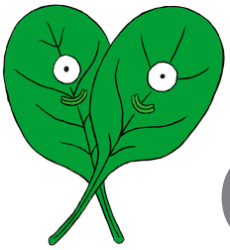
7) Where is the university you attend?
(1) Alabama
(2) Florida
(3) Maine
(4) Kansas
(5) New York
(6) Tennessee
(7) South Dakota
(8) West Virginia

8) How would you define your current relationship status?
(1) Single
(2) In a committed relationship

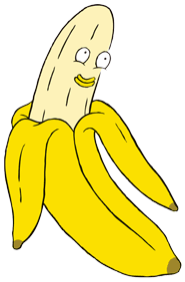
9) How many hours a week do you work for pay during the school year?
(1) I do not work
(2) 1 to 9 hours
(3) 10 to 19 hours
(4) 20 to 29 hours
(5) 30 to 39 hours
(6) 40 hours
(7) More than 40 hours

10) My overall GPA is
(1) 3.5-4.0
(2) 3.0-3.49
(3) 2.50-2.9
(4) 2.0-2.49
(5) Under 2.0
(6) Prefer not to answer

APPENDIX G: RECRUITMENT FLYER

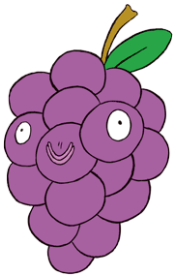


Get Fruved



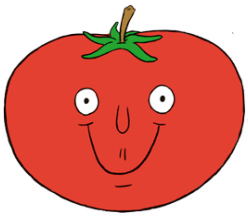
WHO UMaine students at least 18 years of age

WHAT 20 minute online survey about your health and the college environment.

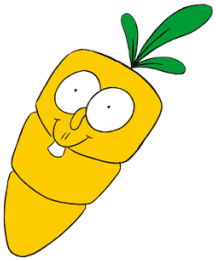


WHERE https://utk.co1.qualtrics.com/SE/?SID=SV_0OKn0NTIkGMV1Gt

WHY You get $5 in Bear Bucks for completing the survey and you will help us understand students' health habits so we can make recommendations to improve health promotion on campus!



WHEN Now through December 19 or until desired sample is met



For more information contact:
Dr. Adrienne White at awhite@maine.edu

This study has been approved by the Institutional Review Board (IRB) of the University of Maine.

Designed by Chelsea Rosenau of South Dakota State University

APPENDIX H: INFORMED CONSENT

Scroll through and read the consent form. If you interested in participating **you must select "accept" located at the bottom of the form**. If you choose not to participate, select the "decline".

Thank you for your interest in this research study about students' perception of the college environment. This online survey should take about 15-20 minutes. There are eight universities that are part of this study: Dr. Adrienne White, in the School of Food and Agriculture, is the principal investigator here at the University of Maine, and the other universities are Auburn University, Syracuse University, Kansas State University, South Dakota State University, University of Florida, University of Tennessee, and West Virginia University.

PURPOSE OF STUDY

You are invited to participate in this project to learn about the perceptions college students have of their campus environment. Your participation will help us learn more about factors affecting healthy behavior by taking a survey to assess college environment perceptions.

CAN I PARTICIPATE?

You are eligible to participate if you are:

- ✓ 18 years old or older
- ✓ a college student

WHAT WILL I BE ASKED TO DO?

You are asked to complete this online survey which was designed to take about 15-20 minutes. The survey includes questions about such things as campus recreational facilities, dining services, managing stress, demographics, weight, green eating behavior, personality traits, fruit and vegetable intake and physical activity. Example questions are "It is safe to bike around campus," "I use the university's exercise facilities and equipment," "How do you describe your weight" "What is your current gender identity" "Over the last month, how many times per month, week or day did you eat fruit" "When in season, how often do you shop at farmers' markets" "I see myself as dependable, self-disciplined" and "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics or fast bicycling?"

COMPENSATION

When you have completed the survey, you will be asked to provide your name and MaineStreet ID number. That number will be used to deposit $5.00 into your university Bear Bucks account within 3 weeks of completing the survey.

BENEFIT
While there are no direct benefits to you from participating, findings from this study may help researchers to understand college students' perceptions about the campus environment and health habits so recommendations can be made to improve the health-promoting aspects of college campuses.

RISKS
Risks to participation are minimal, primarily related to your time, inconvenience, perhaps feeling uncomfortable by some of the questions. You may contact the Counseling Center for any concerns (581-1392).

There may be minimal risk of data being intercepted during the completion and transmission of the online surveys. This risk will be reduced by using an encrypted transmission for online surveys.

VOLUNTARY
Participation is voluntary. You may refuse to answer any questions, skip questions, and stop at any time. If you leave the study for any reason, you will not be eligible for the $5.00 incentive.

CONFIDENTIALITY

- The survey is anonymous and will not be coded with personal ID numbers.
- The website is password protected for both the participants and researchers. The online survey you fill out will be stored in a database on the secured server maintained by the University of Tennessee.
- When data collection is complete, data will be removed from the server and transferred to disks and maintained at the University of Tennessee. To secure data and maintain confidentiality, an https encrypted website is being used for this study and data are encrypted when transmitted. Your confidentiality will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties.
- The de-identified data will be combined with de-identified data (from a variety of university locations) and will be available to a variety of researchers, potentially from many different locations, for other analyses on related topics for an indefinite period of time.
- When data are presented for scientific purposes, data will be reported in summary format, and no names or other identifiable information will be used.
- Identifiable information will be requested only for the purposes of providing the incentive. Your MaineStreet ID number will be requested at the end of the survey and it will be kept separate from the survey data to maintain anonymity. The University of Maine will maintain the information until incentives have been dispersed or no longer than 12 months after the survey is taken.

QUESTIONS
If you have any questions or concerns about what this study involves, please contact Dr. Adrienne White at awhite@maine.edu. Contact the human subjects' representative, Gayle Jones (gayle.jones@umit.maine.edu) if you have concerns about your rights as a research participant. This study has been approved by the Institutional Review Board (IRB) of the University of Maine.

SELECT THE BOTTOM TO INDICATE WHETHER YOU ACCEPT OR DECLINE PARTICIPATION IN THE STUDY.

I accept participation.
I decline participation.

APPENDIX I: TABLES NOT LISTED IN RESULTS

Table A.1: Mean±SD Scores for Green Eating (GE) Beliefs and Behavior by Gender

Green Eating Survey[1,2]	Males n=113	Females n=77
	Mean±SD	Mean±SD
Behavior Scale		
Green Eating Behavior[5] (n=171)	2.4±1.1	2.9±1.07[5]
Decisional Balance: Pros[6] (n=176)	3.55±1.03	3.77±0.89
Decisional Balance: Cons[6] (n=178)	2.96±0.91	2.95±0.79
Self-Efficacy at Home[7] (n=188)	2.62±0.94	2.66±0.82
Self-Efficacy at School[7] (n=187)	3.29±1.08	3.71±0.99[6]

[1] Green Eating Survey (Appendix A).
[2] Frequency of green eating behavior. Scale ranged from 1 (barely ever to never) to 5 (almost always).
[3] Pros and cons of green eating. Scale ranged from 1 (not at all important) to 5 (supremely important).
[4] Confidence in ability to eat green at home or at school. Scale ranged from 1 (not at all confident) to 5 (extremely confident).
[5] Significant main effect for gender (p=0.014), based on two-way ANOVA. Females had higher scores for green eating behavior than males.
[6] Significant main effect for gender (p=0.012), based on two-way ANOVA. Females had higher scores for self-efficacy at home than males.

Table A.2: Mean±SD Daily Cups of Fruits and Vegetables by Gender

NCI Fruit and Vegetable Screener[1]	**Males** n=56	**Females** n=129
	Mean±SD cups[2]	Mean±SD cups[2]
Tomato Sauce	0.31±0.42	0.11±0.21[4]
Potatoes (n=185)	0.31±0.56	0.10±0.14[5]
French Fries	0.18±0.31	0.09±0.22[6]

[1] NCI Fruit and Vegetable Screener (Appendix C).
[2] Fruit and vegetable intake reported as cup-equivalents.
[3] All vegetables other than those specified in fruit and vegetable screener.
[4] Significant main effect for gender (p=0.0001); females consumed fewer cups of tomato sauce than males.
[5] Significant main effect for gender (p=0.001); females consumed fewer cups of potatoes than males.
[6] Significant main effect for gender (p=0.002); females consumed fewer cups of French fries than males.

BIOGRAPHY OF THE AUTHOR

Moira Elizabeth Burke was born in Boston, Massachusetts on January 9, 1987. She was raised in Essex, Massachusetts and graduated from Manchester-Essex Regional High School in 2005. She attended Emmanuel College in Boston, Massachusetts, and earned her Bachelor of Arts degree with Distinction in History in May 2009. Moira worked as a paralegal until she discovered her passion for nutrition. She was accepted into the Didactic Program in Dietetics at Simmons College in Boston, Massachusetts in the spring of 2012 and graduated from Simmons College in with a post-baccalaureate certificate in May 2014. Prior to graduation, she was accepted into the Dietetic Internship and Food Science and Human Nutrition Master's program at The University of Maine and was appointed to a Research Assistantship for the Fruved research study under Dr. Adrienne White. Moira is a member of Kappa Omicron Nu, the Academy of Nutrition and Dietetics and the Maine Academy of Nutrition and Dietetics. She is currently a licensed dietitian in the State of Maine. Her future plans include sitting for the registered dietitian exam, working as a clinical dietitian, and continuing to be involved in research. She is a candidate for the Master of Science degree in Food Science and Human Nutrition from The University of Maine in May 2016.