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## Green Eating and Dietary Quality in University Students

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GREEN EATING AND DIETARY QUALITY IN UNIVERSITY STUDENTS

BY

GARRICK BROWN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN

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UNIVERSITY OF RHODE ISLAND

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MASTER OF SCIENCE THESIS

OF

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2013

## **ABSTRACT**

**Objective:** To determine if environmentally conscious eating, also known as Green Eating (GE), was associated with dietary quality among university students.

**Design:** Non-randomized cross-sectional analysis at baseline.

**Setting:** A northeastern university.

**Participants:** University students (n=26) aged 18-24 years, with a campus meal plan, and a body mass index (BMI) greater than 18.5 kg/m<sup>2</sup>.

**Main Outcome Measures:** Healthy Eating Index (HEI) - 2005 score.

**Analysis:** GE Stage of Change (SOC) was assessed by an online survey administered to first and second year students. Subjects were eligible if they were in the precontemplation SOC (PC) (n=18) or the action/maintenance SOC (AM) (n=8).

Three 24-hour food recalls were collected using the 2012 Nutrition Data System for Research (NDSR) program and HEI scores were calculated.

**Results:** Mean BMI was 24.4±4.3 kg/m<sup>2</sup>, mean age was 18.3±0.5 y, and the majority were female (65%). The groups did not differ by HEI (PC=55.9±12.3; AM = 59.1±13.0). AM consumed significantly more dietary fiber per day than PC (PC = 13.6±4.7 g; AM = 18.8±7.7 g) and consumed significantly less processed meats compared to PC (p < 0.01). There were no differences between groups for intake of saturated fat, sodium, fruits, or vegetables.

**Conclusion and Implications:** Findings suggest better dietary quality among those practicing GE. Future research with larger sample sizes is needed as the promotion of GE may provide an opportunity to improve dietary quality in US university students.

**KEYWORDS:** Organic food, Local food, Sustainable agriculture, Young adult,  
University

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## **PREFACE**

This thesis was prepared in manuscript format following the author guidelines for the *Journal of Nutrition Education and Behavior*. After submitting this thesis, the manuscript may be submitted for publication.

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**MANUSCRIPT**

**Green Eating and Dietary Quality in University Students**

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## **INTRODUCTION**

The consumption of local and organic foods is a rapidly growing trend in the United States. In 2012 there were 7,864 farmers' markets, four and a half times as many as there were in 1994.<sup>1</sup> From 2010-2011 the organic food and beverage industry grew by 9.4% to \$29.2 billion and the fruit and vegetable category contributed nearly 50% of new sales.<sup>2</sup> Environmentally conscious eating, or Green Eating (GE), has been defined as: "eating locally grown foods, produce that is in season and limited intake of processed foods, consuming foods and beverages that are labeled fair trade certified or certified organic and consuming meatless meals weekly and (if consuming animal products) selecting meats, poultry and dairy that do not contain hormones or antibiotics."<sup>3</sup>

Limited evidence exists in the literature concerning demographic characteristics associated with GE behaviors. Higher educational achievement is the only demographic characteristic to be consistently associated with organic purchases.<sup>4,5</sup> Previous research has found greater healthy eating practices and higher dietary quality among GE young adults and university students.<sup>6,7</sup>

Consumers report purchasing organic foods for multiple reasons, including concerns about the effects of conventional farming practices on the environment, human health, and beliefs that organic foods taste better than their conventional alternatives.<sup>2,8-10</sup> Individuals with greater awareness of their personal impacts on the environment are more likely to practice environmentally conscious behaviors.<sup>11</sup>

On college and university campuses commitments to increase sustainability are increasing.<sup>12</sup> To date, 665 U.S. colleges and universities have signed the American

College and University Presidents' Climate Commitment.<sup>13</sup> Growing numbers of institutions formally pledging to increase sustainable efforts suggests a captive audience for influence of environmentally conscious behaviors.<sup>12</sup> Universities play a role in the establishment of their students' food environment, but students are responsible for food choices that affect their dietary quality.

University students between the ages of 18 and 24 years experience increased autonomy in decision-making.<sup>14</sup> During "emerging adulthood" they develop a sense of identity while in a critical stage for the establishment of long-term eating behavior practices.<sup>14,15</sup> Research indicates decreased overall diet quality during this transition from adolescence to adulthood.<sup>16-18</sup> Students are exposed to a food environment including processed foods high in energy, fat, and added sugar, and low in nutrient density.<sup>19</sup> Their poor dietary quality is well documented with over 42% of total caloric intake coming from added sugar, alcohol, and sources of saturated fats.<sup>20-22</sup> The majority of university students fail to meet dietary recommendations.<sup>23,24</sup>

The Dietary Guidelines for Americans (DGA) are the foundation of all federal nutrition guidance.<sup>23</sup> The USDA Food Patterns translate key recommendations from the DGA into specific, quantified suggestions for types and amounts of foods to consume.<sup>23</sup> The USDA produced the 2005 Healthy Eating Index (HEI-2005) as a measure of dietary quality in relation to the 2005 U.S. Food Patterns.<sup>25</sup> The mean HEI-2005 score for 18-30 year olds from the 2003-2005 National Health and Nutrition Examination Survey (NHANES) was 53 with a 95% confidence interval of 51-56.<sup>24</sup>

Greene and Weller developed and validated the GE survey with a university population to explore the constructs and relationships of GE. The GE survey measures

constructs of the Transtheoretical Model (TTM) of behavior change.<sup>3</sup> The TTM is a model of intentional change and the stage of change (SOC) construct is the key-organizing construct of the model.<sup>26</sup> The TTM interprets change as a process involving progress through a series of five stages: precontemplation, contemplation, preparation, action, and maintenance.<sup>26</sup> The GE survey provides a method for assessing stage of change (SOC) for GE and comparing dietary quality between those who are and are not practicing GE behavior. People in the action and maintenance SOC (AM) can be defined as actively GE, and those in the precontemplation SOC (PC) are not practicing GE and have no intentions of practicing GE in the foreseeable future.

Eating behavior change may be influenced by desire to reduce environmental impact. Existing evidence suggests that GE is associated with a wide range of generally healthy eating behaviors, despite whether foods consumed are from sustainable sources.<sup>6</sup> However, research exploring the relationship between GE and dietary quality is limited. None, to the knowledge of the author, have investigated the relationship using comprehensive dietary assessment methods such as multiple 24-hour recalls.

The purpose of this study was to explore university students' practice of GE and the association with measures of dietary quality. Through consideration of previous studies on adolescents and young adults,<sup>6,7,27</sup> it was hypothesized that individuals who were presently GE would have a higher dietary quality than those not practicing GE behavior. For further exploratory analysis on eating behavior it was hypothesized that GE students would report less consumption of processed meat, choosing food with lower sodium content, less consumption of fast food, and evaluate

their eating habits as healthier than those who are not GE. Identifying the extent to which university students practice GE and associations between these eating behaviors and healthful dietary intake may help to advise future nutrition education interventions targeted to university students.

## **METHODS**

### **Participants and Recruitment**

This cross-sectional study included data collected from 26 university students who participated in HeartStart II. HeartStart II is a substudy of HeartStart I, which was a whole grain and low-fat dairy nutrition intervention for students at dining halls of a large public Northeastern university. In the beginning of the 2012 fall semester, undergraduate students participating in HeartStart I (n=98) completed online questionnaires then anthropometric and blood lipid and glucose measurements in the laboratory. HeartStart II included three 24-hour dietary recalls, and venous blood draws. The scope of this study will include the analysis of dietary intake, eating behavior, and anthropometrics in HeartStart II participants.

This study explored the relationship between motivational readiness to adopt GE and dietary quality. Inclusion criteria included those of the parent study: university students aged 18-24 years; holding a campus meal plan; and with a body mass index (BMI) of greater than 18.5 kg/m<sup>2</sup>. In addition, HeartStart II participants needed to be in the GE SOC of PC or AM. This stratified the HeartStart II participants as not currently or intending to practice GE behavior and those currently practicing GE behavior.



The aim was to enroll an equal sample (n=15) from the two groups (total n=30). This study was an exploratory investigation to see if there were differences in GE and non-GE groups because the sample size that was feasible to obtain was less than needed for predicted statistical significance.

Potential participants were recruited from classroom announcements then sent an electronic demographic questionnaire to assess self-reported medical history and eligibility criteria. Trained staff screened participant eligibility electronically. They then invited university students eligible to participate in HeartStart I to a laboratory assessment visit in which baseline measures were completed to further assess eligibility related to weight status. They also screened participant eligibility for HeartStart II during this visit and if eligible, offered research participation in HeartStart II. The consenting participants enrolled in HeartStart II.

Of the parent study population who were eligible to participate in this study (n=56), 30 university students (53.6%) did not participate for various reasons. The primary reason was unwillingness to increase research participation by completing three 24-hour dietary recalls and venous blood draws (n=29) (Figure 1). The Institutional Review Board at the University of Rhode Island approved the study.

## **Measures**

This study included both measures in a laboratory assessment visit and completion of online surveys. Laboratory measures included height, weight and waist circumference, and an initial 24-hour dietary recall; two additional telephone recalls were collected. All participants of the study completed these measures.

### ***Weight status***

Standing height, weight and waist circumference were each assessed in duplicate after the participants had voided and the average of the two readings was used (unless the variance between the measurements exceeded the standard in which the measurement was repeated as often as needed).<sup>28</sup> Measurements were conducted after an overnight fast in light clothing without shoes.<sup>28</sup> Height was measured using a wall-mounted Seca 222 Stadiometer (Seca, Birmingham, United Kingdom) to the closest 0.5 cm. Weight was measured using a Healthometer 752KL electronic scale (Jarden Consumer Solutions, Boca Raton, Florida) to the closest 0.1 kg. Waist circumference was measured with a Gulick metal spring-tension tape with tensometer (Babeskin Bodycare Inc, West Vancouver, British Columbia) to the nearest 0.2 cm at the level of the iliac crest.<sup>28</sup> Body mass index was calculated as kilograms of body weight divided by body height in meters squared ( $\text{kg}/\text{m}^2$ ). Height and weight was classified using predetermined BMI categories; underweight =  $<18.5 \text{ kg}/\text{m}^2$ , normal weight =  $18.5\text{-}24.9 \text{ kg}/\text{m}^2$ , overweight =  $25\text{-}29.9 \text{ kg}/\text{m}^2$  and obese  $\geq 30 \text{ kg}/\text{m}^2$ .

### ***Dietary intake***

Three 24-hour dietary recalls were completed using the multiple-pass method<sup>29</sup> in conjunction with the 2012 Nutrition Data System for Research (NDSR).<sup>30</sup> The first dietary recall occurred during the laboratory assessment visit and the final two were completed on the phone on random, nonconsecutive days by trained

interviewers.<sup>31</sup> The dietary recalls included one intake on a weekend day and two on weekdays.

Participants are asked to disclose the foods and drinks they consumed the day before the recall in full detail. The first pass in the multiple-pass method involves the participant recalling a quick list of foods eaten in the previous 24-hour period.<sup>30</sup> The second pass is a review of the quick list with the participant for completeness and correctness.<sup>30</sup> The third pass is the collecting of detailed information for each food by asking probing questions about food type, amount, any additions to the food, and preparation methods.<sup>30</sup> Participants are also asked about meal time and location. Each of these details is entered into NDSR. Emphasis is placed on amount of food and preparation style, with questions guiding the participant to use detail. The fourth and final pass is the review and assessment of the compiled food list with the participant to ensure that the list accurately and completely reflects the foods and beverages consumed during the 24-hour period.<sup>30</sup>

Food models and household measures were used to aid in estimating portion size during the laboratory assessment visit. Additionally, participants were given a food amounts booklet to aid in describing portion sizes for recalls to be completed on the phone. The food amounts booklet is a visual guide for individuals to accurately record the detailed information required by NDSR.<sup>30</sup> Participants were asked to refer to the portion sizes booklet as they completed the telephone recalls. Recalls were conducted during the two weeks following the laboratory assessment visit.

***Dietary quality: scoring the HEI-2005***

Food consumption measured using the 24-hour dietary recall method and NDSR protocol was entered into a Statistical Analysis Software program to obtain dietary quality scores using HEI-2005.<sup>32</sup> Food and nutrient intakes on the HEI-2005 are expressed on a density basis, amounts per 1,000 calories of intake, in order to characterize dietary quality while controlling for diet quantity. Possible scores range from 0 to 100, with 100 points signifying the perfect diet. The 2005 HEI comprises 12 components. Five components represent the major food groups found in MyPyramid, that is, total fruit, total vegetables, total grains, milk, and meat and beans. Seven additional components were created to represent whole fruit; dark green and orange vegetables and legumes; whole grains; oils; saturated fat; sodium; and calories from solid fat, alcohol, and added sugar. Total HEI-2005 score can be categorized as “poor” ( $\leq 50$ ), “needs improvement” (from 51-80), and “good” ( $> 80$ ).<sup>33,34</sup> (Table 1).

### *Survey measures*

This study included three separate online surveys that were completed and collected before the laboratory assessment visit. Participants completed a GE stage of change measure as part of the GE survey.<sup>3</sup> One item from the Dietary Screener Questionnaire, a validated questionnaire composed of 26 items for frequency of consumption in the past month for selected foods and drinks to assess intakes of fruits and vegetables, dairy/calcium, whole grains/fiber, added sugars, red meat, and processed meat was completed to assess frequency of processed meat consumption.<sup>35</sup> Three items from the College Environment Perceptions Survey (CEPS), a brief food frequency questionnaire that assesses dietary intake, eating behaviors, and the participant’s perceived college environment, were completed to measure reported

frequency in choosing foods with lower sodium content, consumption of fast foods, and to evaluate the participant's perceived diet healthiness.

### ***GE stage of change***

Participants were provided with the following definition of GE: "eating locally grown foods, produce that is in season and limited intake of processed foods, consuming foods and beverages that are labeled fair trade certified or certified organic and consuming meatless meals weekly and (if consuming animal products) selecting meats, poultry and dairy that do not contain hormones or antibiotics."<sup>3</sup> They were then asked to choose one statement best reflecting their present situation, representing their perceived stage: (precontemplation) "No, and I do not intend to in the next 6 months"; (contemplation) "No, but I intend to in the next 6 months"; (preparation) "No, but I intend to in the next 30 days"; (action) "Yes, I have been, but for less than six months"; or (maintenance) "Yes, I have been for the past six months."

### ***Demographics and vegetarian status***

Gender, age, race/ethnicity, major and school level were based on self-report. Previous studies have found vegetarianism to be associated with better dietary quality, as well as environmentally conscious eating.<sup>7,36</sup> Vegetarian status was assessed by asking participants to respond "yes" or "no" following definition: "Do you consider yourself a vegetarian (one who does not eat meat)?"

### ***Eating behaviors***

To characterize processed meat consumption participants were asked to choose one of the following responses: “Never”; “1 time last month”; “2-3 times last month”; “1 time per week”; “2 times per week”; “3-4 times per week”; “5-6 times per week”; “1 time per day”; or “2 or more times per day”.

The frequency in which participants choose food with lower sodium content was assessed by asking: How often do you compare sodium (salt) in foods like soup, bread, and frozen meals – and choose the foods with lower numbers? Participants were instructed to choose one of the following responses: “Almost Always”; “Most of the time”; “Sometimes”; “Seldom”; “Never”; or “Choose not to answer”.

The frequency in which participants consume fast-food was assessed by asking: How often do you go out to eat at a restaurant or fast food place or order take-out? Participants were instructed to choose one of the following responses: “0”; “1-2 times per week”; “3-4 times per week”; “5-6 times per week”; “7 times per week”; or “Choose not to answer”.

The perceived healthiness of participants’ eating habits was assessed by asking: How would you rate the “healthiness” of your eating habits? Participants were instructed to choose one of the following responses: “Poor”; “Fair”; “Average”; “Good”; “Excellent”; or “Choose not to answer”.

### **Data Analysis**

In order to examine differences associated with motivational readiness to adopt GE, the sample was selected based on those who self-reported they were not GE (PC) and those who self-reported they were GE (AM). As the data was determined to be normally distributed, independent samples t-tests were used to examine pairwise

differences between PC and AM groups in mean total and subcomponent 2005 HEI scores and dietary measures from NDSR 24-hour dietary recalls. Eta-squared<sup>37</sup> was assessed as a measure of effect size. For categorical variables assessing eating behavior (items from the Dietary Screener Questionnaire and CEPS), chi-squared tests were used to examine differences between PC and AM groups. All analyses were conducted using SPSS, version 19.0 for Windows (version 19.0, IBM Corp. Summers, NY). A probability value of  $p < 0.05$  was utilized to determine statistical significance.

## **RESULTS**

### **Sample Characteristics**

Study participants had a mean age of  $18.3 \pm 0.5$  years and 65% of the sample was female (Table 2). Ninety-six percent of the sample lived on the university campus (data not shown). Racial/ethnic composition was 77% white, 8% Hispanic, and 11.5% other (including mixed race). (Table 2).

### **Green Eating Practice**

The majority of volunteers for this study (69%) reported they do not practice GE and do not intend to in the next six months. (Table 2). The percentage of GE participants was 31%. (Table 2). Of the GE group, two (25%) reported following a vegetarian diet and were the only participants to do so, therefore 7.7% of the sample was vegetarian.

### **Associations with Dietary Quality**

No significant pairwise differences were observed between PC and AM groups in mean total and subcomponent HEI-2005 scores (Table 3). However, a medium effect size ( $\eta^2$ )<sup>37</sup> was observed between PC and AM groups in the HEI dietary adequacy components for dark green vegetable and whole grain. A small effect size<sup>37</sup> was seen between PC and AM groups in total HEI-2005 score and the dietary adequacy components for total fruit, total vegetable, total grain, and milk. Finally, a small effect size was found between PC and AM groups in the dietary moderation component for oils.

Action/Maintenance university students consumed significantly more dietary fiber per day ( $p < .05$ ) than their PC peers. (Table 2). No other significant pairwise differences were observed between PC and AM university students in dietary measures. However, the mean intakes of GE university students meet the general adult dietary recommendations for fruits, vegetables, and calcium while their PC counterparts failed to do so.

### **Eating Behavior Responses**

Action/Maintenance students reported significantly less consumption of processed meats ( $p < .05$ ) than their PC peers in the Dietary Screener Questionnaire item. (Table 4). No differences were observed between PC and AM groups in the eating behavior items from the CEPS.

### **DISCUSSION**

This study is the first of its kind to examine how university students' practice of environmentally conscious eating behavior affects dietary quality using



comprehensive dietary assessment methods. Higher proportions of GE among women and vegetarians confirm previous findings for adolescents<sup>7</sup> and adults.<sup>38</sup> Previous research suggests that increased GE may be due to greater involvement in food preparation, stronger beliefs about the role and meaning of food, and greater knowledge of environmentally conscious eating practices<sup>38,39</sup>. As expected with a limited sample size, no differences were found by race/ethnicity, consistent with other studies.<sup>38,40</sup>

Findings suggest better dietary quality among those practicing GE. University students practicing GE consumed significantly more dietary fiber per day ( $p < 0.05$ ) and met the general adult dietary recommendations for fruits, vegetables, and calcium while their non-GE counterparts did not. Findings of moderate effect sizes between PC and AM groups in the HEI-2005 dietary adequacy components for dark green vegetable and whole grain indicates that with a larger sample size significance may be found.

Interestingly, and perhaps due to limited sample size, this study did not find reduced consumption of fast food, added sugars, sugar-sweetened beverages, and fat in GE students as has been found in previous research.<sup>6</sup> However, as has been found by others, a significant difference was also observed in dietary behavior<sup>6</sup>; participants who were GE consumed significantly less ( $p < 0.01$ ) processed meats than those who were not GE.

Both groups in the study had higher mean total HEI-2005 scores than 2003-2004 NHANES data for adults ages 18-30.<sup>24</sup> However, each groups' mean HEI-2005 score falls in the "needs improvement" category.<sup>33,34</sup> Additionally, the total sample's

consumption of fruits, vegetables, dairy, calcium and fiber were below that of recommended dietary intake levels.

Strengths of the study include validated dietary assessment methods and measure of GE behavior. Limitations include the following: First, a small sample size due partly to rigor of design. Second, results may not be generalizable, given the sample is from one Northeastern university and a convenience sampling approach, which might have resulted in a sample that was more interested in health than the general population. Third, the sample was limited to university students. It is possible that young adults who do not attend a university, or those who have already graduated, would have different GE behavior. Fourth, results should be interpreted with caution because the exploratory analysis did not control for multiple testing. Fifth, the HEI-2005 was used as a measure of dietary quality because the 2010 Health Eating Index remained unpublished until after study completion. Finally, the study used cross-sectional data, forbidding conclusions about causality. This study does not allow determination of whether increased GE behavior would result in higher dietary quality or whether young adults with healthy dietary behaviors prefer GE.

## **IMPLICATIONS FOR RESEARCH AND PRACTICE**

To further explore associations identified within the current study, future research with larger sample sizes is needed. Qualitative research exploring university students understanding of the GE definition and terms such as *genetically engineered*, *fair trade* and *organic* is also warranted, given that different perceptions and interpretations of these terms is likely.<sup>7</sup> Additionally, intervention research should examine the feasibility and effectiveness of university courses that incorporate

discussion about the food system and environmentally conscious eating behaviors. Finally, more research that is experimental is needed to identify whether education about environmentally conscious behaviors leads to better dietary quality.

National data reveal that only about 1% of 19-30-year-olds eat recommended amounts of fruits and vegetables.<sup>41</sup> Young adults also consume fast food and sugar-sweetened-beverages more than all other age groups.<sup>42,43</sup> Therefore, registered dietitians and nutrition educators should be aware that university students reporting GE behavior are still at risk for poor dietary quality, despite having a better dietary quality than their peers.

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Figure 1. Subject Distribution from Recruitment to Completion

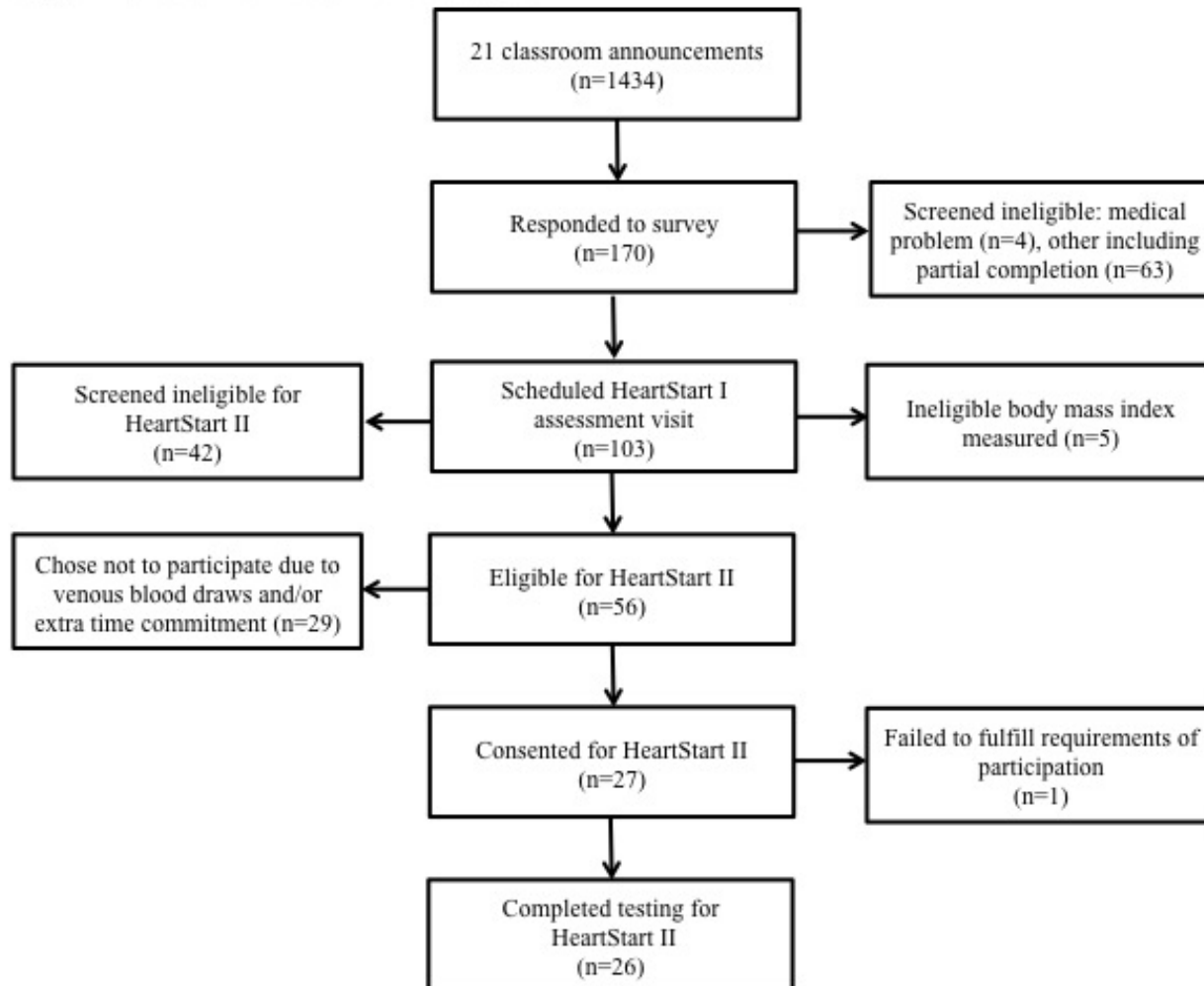


Table 1. Health Eating Index-2005 Components and Standards for Scoring <sup>a</sup>			
Component	Maximum Points	Standard for Maximum Score	Standard for minimum score of zero
Total fruit (includes 100% juice)	5	≥ 0.8 cup/1,000 kcal	No fruit
Whole fruit (not juice)	5	≥ 0.4 cup/1,000 kcal	No whole fruit
Total vegetables	5	≥ 1.1 cups/1,000 kcal	No vegetables
Dark-green and orange vegetables and legumes	5	≥ 0.4 cup/1,000 kcal	No dark-green or orange vegetables or legumes
Total grains	5	≥ 3.0 cups/1,000 kcal	No grains
Whole grains	5	≥ 1.5 oz/1,000 kcal	No whole grains
Milk	10	≥ 1.3 cups/1,000 kcal	No milk
Meat and beans	10	≥ 2.5 oz/1,000 kcal	No meat or beans
Oils	10	≥ 12 grams/1,000 kcal	No oil
Saturated Fat	10	≤ 7% of energy	≥ 15% of energy
Sodium	10	≤ 0.7 gram/1,000 kcal	≥ 2.0 grams/1,000 kcal
Calories from solid fat, alcohol, and added sugar (SoFAAS)	20	≤ 20% of energy	≥ 50% of energy
Note: oz is abbreviated for ounce.			
<sup>a</sup> Guenther PM, Reedy J, Krebs-Smith SM. Development of the Healthy Eating Index-2005. Journal of the American Dietetic Association. Nov 2008; 108(11):1896-1901.			

Table 2. Demographic and Dietary Variables of University Student Participants by			
Stage of Change (SOC) for Green Eating (n=26)			
	<b>Precontemplation SOC</b>	<b>Action/Maintenance SOC</b>	<b>Total</b>
	n (%)	n (%)	n (%)
	18 (69.2)	8 (30.8)	26
<b>Gender</b>			
Male	7 (38.9)	2 (25)	9 (34.6)
Female	11 (61.1)	6 (75)	17 (65.4)
<b>Ethnicity</b>			
White (non-Hispanic)	12 (66.7)	8 (100)	20 (76.9)
Hispanic/Latino	2 (11.1)	0 (0)	2 (7.7)
Asian	1 (0.1)	0 (0)	1 (3.8)
Mixed Race	1 (0.1)	0 (0)	1 (3.8)
Other	2 (11.1)	0 (0)	2 (7.7)
<b>Vegetarian status<sup>a</sup></b>			
Yes	0 (0)	2 (25)	2 (7.7)
No	17 (100)	6 (75)	23 (8.9)
<b>Age (y)</b>	mean±SD		
	18.3±0.6	18.3±0.5	18.3± 0.5
Height (cm)	167.5±8.2	166.9±7.3	167.3±7.8
Weight (kg)	68.3±13.1	68.6±9.6	68.4±11.9
Body Mass Index (BMI) (kg/m <sup>2</sup> )	24.4±4.9	24.6±2.7	24.4±4.3
Waist circumference (cm)	81.7±11.1	79.6±8.6	81.1±10.3
<b>Dietary Variables<sup>b</sup></b>			
Energy (kcal)	2030.7±823.3	1905.0±332.7	1992.0±703.8
Fat (% of kcal)	32.8±6.7	33±6.5	32.9±6.5
Saturated Fat (% of kcal)	10.7±3.2	12.2±3.6	11.1±3.3
Protein (% of kcal)	16.3±4.3	16.0±4.8	16.2±4.4
Carbohydrate (% of kcal)	49.5±8.1	49.8±7.4	49.6±7.8
Whole Grains (serving)	1.0±1.1	1.6±1.0	1.1±1.1
Refined Grains (serving)	5.4±3.3	3.3±3.2	4.7±3.9
Total Fruit (serving)	1.3±1.5	2.2±2.3	1.6±1.7
Total Vegetable (serving)	2.4±1.3	3.0±1.7	2.6±1.4
Sodium (mg)	2986.4±991.4	3009.2±948.7	3009.2±948.7
Calcium (mg)	1046.1±381.3	894.5±321.5	894.5±321.5
Added sugars (g)	88.6±55.7	75.7±25.9	84.7±48.3
Total dietary fiber (g) *	13.6±4.7	18.8±7.7	15.2±6.2
Total dairy (serving)	1.7±0.9	2.1±1.5	1.8±1.1
* P < 0.05			
<sup>a</sup> Sample sizes vary because of missing data.			
<sup>b</sup> Dietary variables are mean values derived from three 24-hour recalls using the Data System for Research (NDSR)			
Note: Asterisks indicate significant differences (t tests) between precontemplation and action/maintenance SOC groups for Green Eating.			

Table 3. Healthy Eating Index (HEI) - 2005 Scores of University Student Participants by Stage of Change (SOC) for Green Eating (n=26)				
	Precontemplation SOC	Action/Maintenance SOC	Total	$\eta^2$ <sup>a</sup>
	mean $\pm$ SD			
<b>Total HEI Score</b> <sup>b</sup>	55.9 $\pm$ 12.3	59.1 $\pm$ 13.0	56.9 $\pm$ 12.3	0.015
<b>HEI Dietary Adequacy Components</b> <sup>c</sup>				
Total Fruit	1.7 $\pm$ 1.5	2.1 $\pm$ 1.7	1.8 $\pm$ 1.5	0.019
Whole Fruit	1.9 $\pm$ 1.8	1.6 $\pm$ 2.1	1.8 $\pm$ 1.9	0.006
Total Vegetable	2.5 $\pm$ 1.1	3.0 $\pm$ 1.4	2.7 $\pm$ 1.2	0.034
Dark Green Vegetable	1.3 $\pm$ 1.4	2.3 $\pm$ 1.8	1.6 $\pm$ 1.6	0.089
Total Grain	4.4 $\pm$ 0.9	4.2 $\pm$ 0.7	4.3 $\pm$ 0.8	0.016
Whole Grain	1.6 $\pm$ 1.6	2.8 $\pm$ 1.6	2.0 $\pm$ 1.6	0.108
Milk	5.8 $\pm$ 2.3	6.5 $\pm$ 2.5	6.0 $\pm$ 2.3	0.019
Meats, Beans	7.7 $\pm$ 2.4	7.8 $\pm$ 3.0	7.7 $\pm$ 2.5	0.001
<b>HEI Dietary Moderation Components</b> <sup>d</sup>				
Saturated Fat	5.6 $\pm$ 2.9	5.2 $\pm$ 2.3	5.5 $\pm$ 2.7	0.005
Sodium	4.4 $\pm$ 2.1	4.0 $\pm$ 3.0	4.3 $\pm$ 2.4	0.005
Oils	7.3 $\pm$ 2.1	7.9 $\pm$ 1.6	7.5 $\pm$ 2.0	0.024
Calories from SoFAAS <sup>e</sup>	11.7 $\pm$ 5.5	11.6 $\pm$ 4.6	11.7 $\pm$ 5.1	0.000
<sup>a</sup> $\eta^2$ indicates effect size. <sup>b</sup> HEI scores are mean values derived from three 24-hour recalls using the 2012 Nutrition Data System for Research (NDSR). <sup>c</sup> Higher scores reflect higher intakes. <sup>d</sup> Higher scores reflect lower intakes. <sup>e</sup> SoFAAS=solid fats, alcoholic beverages, and added sugars. Note: Asterisk indicates significant mean difference (t tests) between precontemplation and action/maintenance SOC groups for Green Eating.				

Table 4. Eating Behavior Item Responses of University Student Participants by Stage of Change (SOC) for Green Eating (n=26)		
Eating Behavior Item	Precontemplation SOC	Action/Maintenance SOC
	n	n
How often do you compare sodium (salt) in foods like soup, bread, and frozen meals – and choose the foods with lower numbers? <sup>a</sup>		
Almost always	2	0
Most of the time	4	2
Sometimes	4	2
Seldom	3	2
Never	3	1
Total	16	7
How often do you go out to eat at a restaurant or fast food place or order take-out? <sup>a</sup>		
0	3	0
1-2 times per week	13	5
3-4 times per week	0	2
Total	16	7
How would you rate the “healthiness” of your eating habits? <sup>a,b</sup>		
Poor	0	1
Fair	3	1
Average	4	4
Good	9	1
Excellent	0	0
Total	16	7
During the past month, how often did you eat any processed meat, such as bacon, lunch meats, or hot dogs? <sup>**</sup>		
Never	0	4
1-4 times last month	7	2
2-4 times per week	6	2
More than 4 times per week	5	0
Total	18	8
<sup>**</sup> P < 0.01 <sup>a</sup> Sample sizes vary because of missing data. <sup>b</sup> Dietary Screener in the NHANES 2009-10. Risk Factor Monitoring Methods <a href="http://riskfactor.cancer.gov/studies/nhanes/dietscreen/nhanes_dtq_en.pdf">http://riskfactor.cancer.gov/studies/nhanes/dietscreen/nhanes_dtq_en.pdf</a> . Note: Asterisk indicates significant difference ( $\chi^2$ tests) between the precontemplation and the action/maintenance group for Green Eating.		

## **APPENDIX A. LITERATURE REVIEW**

### **1. Introduction**

The purpose of this literature review is multi-dimensional; first, it will report the damaging environmental impacts associated with the current food system specifically related to animal products, and processed foods. Next, it will identify specific dietary behaviors that have been associated with reduced environmental effects such as a plant-based diet and consuming local, organic and fair trade food products to represent the term “Green Eating”. Also explored, will be the growing interest in sustainability among the university population. It will also report food consumption of university students, describe general U.S. dietary recommendations and methods for assessing dietary compliance. Finally, this paper will report previous research on environmentally conscious eating and dietary quality of university students.

### **2. The Environmental Impacts of the Food System**

The study of ‘food sustainability’ has become essential due not only to environmental degradation that occurs because of the modern, food and nutrition system, but also issues of population growth, poor dietary quality, and climate change.<sup>1-3</sup> The food and nutrition system is defined as: “the set of operations and processes involved in transforming raw materials into foods and transforming nutrients into health outcomes, all of which functions as a system within biophysical and sociocultural contexts.”<sup>4</sup> The food system is composed of more than human and natural resources; its operation is affected by technology, socio-cultural trends and research.<sup>5</sup>

In the last four decades, the increasingly industrialized food system has doubled its world food production to keep up with population growth.<sup>6,7</sup> The increased yield, in an effort to maximize economic gain, is associated with harmful environmental effects.<sup>2,6,7</sup> Developed nations are responsible for 75% of fossil fuel use and 17% of their share is used for production, processing, and packaging of food.<sup>8</sup> The Stern report calculated that modern agriculture is responsible for approximately 14% of greenhouse gas emissions (GHGE).<sup>9</sup>

The modern food system requires many resources worldwide. Global agriculture accounts for 70% of all freshwater extracted for human use<sup>10</sup>. Nearly half of the world's arable land is used by agriculture, and through land degradation, there is a steady decline in arable land worldwide.<sup>7,11</sup> Environmental impacts include loss of crop and soil biodiversity<sup>12</sup>, water pollution<sup>13</sup>, and cross-contamination from unsanitary methods in animal farming.<sup>14</sup>

These negative environmental effects associated with the globalized food system have affected food resources in the U.S. Upstream runoff of mass crop production byproducts such as fertilizers, soil erosion, animal wastes and sewage in the Mississippi River Valley have washed down the Mississippi River, creating a hypoxic "dead zone" in the Gulf of Mexico.<sup>15</sup> Hypoxic water supports fewer organisms and has resulted in massive fish kills.<sup>16</sup> In 2007, this dead zone covered more than 6,600 square miles in the Gulf of Mexico, once an abundant source of seafood. An additional 146 dead zones have been identified and continue to expand across the globe.<sup>17</sup>



## *2.1 Animal Products*

Agriculture releases substantial amounts of carbon dioxide, methane and nitrous oxide.<sup>1</sup> Carbon dioxide is released from fossil fuel use and microbial decay. Methane is produced when organic materials decompose under anoxic conditions including fermentative digestion by livestock and stored manures. Nitrous oxide is produced by microbial transformation of nitrogen in soils and manures.<sup>1</sup> The total contribution of agriculture to GHGE considers direct emissions (from soil and livestock) and indirect emissions (fossil fuel use, agrochemicals production and land conversion to agriculture).<sup>18</sup> These gases are trapped into the atmosphere and gradually warm the planet.<sup>19</sup>

The rising demand for meat and dairy increases production of GHGE.<sup>15,17,19</sup> While meat and dairy currently represent 15% of the total global diet, they are the most significant source of food-related GHGE and other environmental impacts.<sup>20,21</sup> There are both direct and indirect effects. An indirect example is land use; approximately half of all cereals grown in the world are fed to animals.<sup>21</sup> The conversion efficiency of plant into animal matter is approximately 10%.<sup>20</sup> There is an average input of 25 kcal fossil energy per 1 kcal of protein produced.<sup>22</sup> Methane gas released from the 33 trillion pounds of manure from livestock worldwide is equal to the environmental impact of carbon monoxide released from 33 million automobiles.<sup>15</sup> Additionally, the United Nations' World Economic & Social Survey 2011 concluded: "intensive livestock production is probably the largest sector-specific source of water pollution."<sup>9</sup>

European researchers investigated the regional differences in dairy, beef, pork, poultry and egg production, and related GHGE in the 27 Member States of the European Union (EU-27).<sup>23</sup> Sources of GHGE included were enteric fermentation, manure management, direct and indirect nitrous oxide soil emissions, cultivation of organic soils, liming, fossil fuel use, and fertilizer production.<sup>23</sup> The dairy sector had the highest GHGE in the EU-27 followed by the beef sector.<sup>23</sup> Enteric fermentation was the main source of GHGE in the European livestock sector (36%) followed by nitrous oxide soil emissions (28%).<sup>23</sup> Beef had by far the highest GHGE on a per kilogram basis.<sup>23</sup> However, there were large variations in GHGE among the EU countries, which the authors explained by differences in animal production systems, feed types and nutrient use efficiencies.<sup>23</sup>

## *2.2 Processed Foods*

The globalization of the food system has resulted in production of energy dense, nutrient poor foods that are a major contributor to environmental and health issues.<sup>2</sup> Processing is responsible for approximately one-third of the energy use in the U.S. food system, and each calorie of processed food requires 1,000 calories of energy.<sup>24</sup>

Cardiovascular disease has been the main cause of death in the U.S. for almost a century and hypertension is the leading risk factor.<sup>25</sup> The positive relationship between sodium intake and blood pressure is well established as well as the need to reduce sodium intake to lower blood pressure.<sup>25,26</sup> One third of dietary sodium is derived from packaged and restaurant foods.<sup>27</sup>

Between 1970 and 1996, there was a 22% increase in the amount of fats and oils in the U.S. food supply, and a 23% increase in consumption of sugars and sweeteners.<sup>28</sup> Today, the average American consumes 30 teaspoons of added sweeteners and sugars per day, almost triple the recommended amount.<sup>29</sup> The consumption of high-fructose corn syrup (HFCS), a cheaper alternative to sucrose, increased by 1000% between 1967 and 1990.<sup>30</sup> HFCS now represents 40% of caloric sweeteners in food and beverages.<sup>30</sup> A diet high in HFCS may encourage overconsumption through mechanisms that cause a reduction in insulin and leptin release, hormones that inhibit food intake.<sup>29</sup>

Over the last decade, the number of fast-food restaurants in the U.S. have doubled.<sup>31</sup> In 1998, a large nationally representative study discovered 30% of its adolescent sample reported eating fast foods on a typical day. Additionally, those who consumed fast foods had higher energy and total fat intakes, drank more sweetened beverages and less milk, and ate fewer fruits and non-starchy vegetables than those who did not consume fast food.<sup>32</sup> Energy-dense fast foods may also reduce consumer's normal satiety mechanism and prompt passive overconsumption.<sup>33</sup>

The current, globalized food system that promotes competitiveness, discourages connections with nature and with food producers, causes significant environmental costs and cannot remain sustainable.<sup>2</sup> No environmental cost associated with production and transport of food is included in the price of food for the consumer. Future generations will be forced to manage the consequences of present agricultural production methods.<sup>6,34</sup>

### 3. Environmentally Conscious Eating Behaviors

Environmental psychology was developed in the U.S. in the 1960s to study the complex human-to-environment relationship. Numerous studies have attempted to rationalize why people choose to adopt environmentally conscious behaviors, and in addition the barriers that may prevent them from doing so. Environmentally conscious behaviors are explained in the literature as: “any behavior that consciously seeks to minimize resource and energy consumption and minimize the use of toxic substances and reduce waste.”<sup>35</sup>

#### 3.1 Plant-Based Diet

One proposal to reduce GHGE is to reduce intake of meat and dairy products.<sup>36</sup> Moving towards a more plant-based diet could be beneficial for health and the environment. High consumption of plant foods has been found to decrease the risk of heart disease and certain cancers.<sup>37-41</sup> However, changing well-established dietary habits dominated by animal-based products is a challenge.<sup>42</sup> In the U.S., the average adult male consumes 154% of the recommended daily allowance (RDA) for protein (97 g vs. an RDA of 63 g), and the average adult female consumes 127% of the RDA (63.5 g vs. an RDA of 50 g)<sup>43</sup>. The average American consumes 67% of protein from animal sources, compared to a 34% average worldwide.<sup>8</sup> Numerous studies have investigated attitudes toward reducing meat consumption and much of the resistance towards this relates to the pleasure people experience from eating meat and the opinion that a ‘proper’ meal should contain meat.<sup>44,45</sup>

Secondarily, people report a lack of knowledge about food that could be eaten in place of meat or that a plant-based diet would not contain enough protein.<sup>42</sup> Despite

higher than adequate intakes there is a perception among a significant part of the population that they should be eating more protein. In the U.S., 49% of respondents of a recent national survey reported they were trying to increase the amount of protein in their diet.<sup>46</sup>

Reducing consumption of meat and meat products would lower GHGE, but the level of reduction in GHGE depends on the foods that replace them in the diet. Researchers from the UK created a number of dietary scenarios that showed a reduction of 18-31% in GHGE could be achieved by replacing meat with a variety of different foods.<sup>47</sup> Notably, the diet with the lowest GHGE had almost a third more ‘added sugar’ than the other diet scenarios because sugar tends to have lower emissions than many other foods. It was also the least expensive diet. This study demonstrates the importance of considering the whole diet rather than single food items and the nutritional and environmental impact of substituted foods.<sup>42</sup>

### *3.2 Eating Local*

The incorporation of local food systems to improve the sustainability of the entire food system is a developing area of research.<sup>48-51</sup> It remains to be seen whether local food systems can effectively address the environmental, social and health needs of the global food system. A local food system is defined as: “a collaborative effort in a particular place to build more locally based, self reliant food systems and economies – one in which sustainable food production, processing, distribution and consumption is integrated to enhance the economic, environmental and social health of a particular place.”<sup>52</sup>

The intention of local food systems is not to completely stop trade, but instead modify local food production and markets to meet the environmental and health priorities of a community.<sup>53</sup> They offer an alternative to the traditional globalized food system allowing local ecology, culture, trusting relationships and access to healthy food to grow.<sup>54-56</sup> Examples of local food system models are farmers' markets, community-supported agricultural enterprises (CSA), roadside stands, box schemes, pick-your-own enterprises and community gardens.<sup>53,57-59</sup> Community-supported agricultural enterprises were established in Japan and Switzerland in the 1960s and designed to share the risks and benefits of food production between the farmer and consumer.<sup>60</sup> Community gardens are often allotment gardens, where individuals own or share spaces and food production is pooled among the community.<sup>61</sup>

The preliminary research on the role of local food systems is qualitative.<sup>6,53,59,62</sup> Common themes found are that local food systems offer access to nutritious food for all; they help to develop relationships between farmers and their customers; allow community members to increase their participation in the food system and contribute to social cohesion; encourage satisfying social and cultural interactions around food; develop social responsibility and stewardship of local land; support biodiversity; and boost a community's economic vitality.<sup>6,53,59,62</sup>

Local food system research offers evidence to support these views.<sup>48-51,63-68</sup> Farmers are motivated to join these systems for many reasons including a motivation to oppose power of the overriding globalized food system and to model a successful, alternative community food system.<sup>49,51,68</sup> Additional reasons include improving farm diversity, producing fresh and organic foods, reducing 'food miles' and building

relationships with customers.<sup>51,62,67,69</sup> Conversely, customers are motivated to participate in local food systems to purchase fresh, organic and seasonal produce, support farmers and form trusting relationships with them, and enjoy the social interactions that take place.<sup>49,50,66,67,70,71</sup> One of the few studies to examine any nutritional benefits for users of local food systems found that participants reported eating more and a greater variety of vegetables and prepared more home-cooked meals than prior to joining the CSA.<sup>50</sup>

There is a good understanding of the motivations of those participating in local foods systems, which includes a desire to reduce the environmental impact of food systems, but full life-cycle analyses of foods sold through these systems are needed to measure any associated changes in carbon emissions.<sup>2</sup> Weber and Matthews systematically compared the life cycle GHGE associated with long-distance distribution, also known as “food-miles”.<sup>72</sup> They found the average food in the U.S. food system travels 1,019 miles for delivery and has a life cycle supply chain distance of 4,201 miles.<sup>72</sup> Despite discovering these large travel distances, their findings indicate the most significant phase in terms of GHGE is production, which contributes 83% of U.S. household’s food consumption footprint.<sup>72</sup> Transportation as a whole represents only 11% of life cycle GHGE, and final delivery from producer to retail contributes only 4%.<sup>72</sup> They also found a wide range in GHGE-intensity among different food groups; on average, red meat is around 150% more GHGE-intensive than chicken or fish.<sup>72</sup> Weber and Matthews results suggest a dietary shift may be a more effective method of lowering a household’s food-related climate footprint than “buying local”.<sup>72</sup> Shifting less than one day per week’s worth of calories from red

meat and dairy to chicken, fish, eggs, or a plant-based diet achieves more GHGE reduction than buying all locally sourced food.<sup>72</sup>

### *3.3 Organic*

The growth of the organic foods industry in the U.S. has been notable in the past two decades. From 1997 to 2011, U.S. sales of organic foods increased from \$3.6 to \$29.2 billion and now represent 4.2% of all U.S. food sales.<sup>73</sup> While prices vary, consumers can pay as much as double the amount for organic than conventional foods.<sup>74,75</sup>

Organic farming practices and certification requirements vary worldwide, but organic foods are generally grown without synthetic pesticides or fertilizers or routine use of antibiotics or growth hormones.<sup>76,77</sup> Organic livestock are fed organically produced feed that is free of pesticides and animal byproducts and are provided access to the outdoors, direct sunlight, fresh air, and freedom of movement.<sup>76</sup> Furthermore, organic regulations often require that organic foods are processed without irradiation or chemical food additives and are not grown from genetically modified organisms.<sup>77,78</sup> The International Federation of Organic Agriculture Movements (IFOAM) supports principles of health, ecology, fairness, and care.<sup>79</sup>

Many organic companies have made the decision to advertise their “NO-GMO” pledge while working activists lobby for the consumer’s right to know what is in their food.<sup>80</sup> Approximately 65% of foods in U.S. supermarkets contain genetically modified (GM) ingredients.<sup>81</sup> There has been a 250% increase in GM agriculture since 1997.<sup>15</sup> The production of GM foods remains controversial and the long-term effect of consumption remains unknown. It has been suggested that part of the reason for



consumer's unwillingness to consume GM foods is due to no specific benefits from choosing GM products are perceived.<sup>82</sup> Currently, the U.S. Food and Drug Administration (FDA) does not require labeling of GM foods.

Consumers purchase organic foods for multiple reasons, including concerns about the effects of conventional farming practices on the environment, human health, and animal welfare and beliefs that organic foods taste better than their conventional alternatives.<sup>73,83-85</sup> Notably, higher educational achievement is the only demographic characteristic to be consistently associated with organic purchases.<sup>86,87</sup> An interesting observation is presented by Winter and Davis: "while initial organic food production primarily involved small farms and local distribution of fresh produce, today's organic food system is a complex combination of small and large food producers, local and global distribution networks, and a wide variety of products, including fruits, vegetables, meats, dairy and processed foods."<sup>75</sup>

Smith-Spangler et al. reviewed evidence from January 1966 to May 2011 comparing the health effects of organic and conventional foods.<sup>88</sup> The researchers selected reports that compared organically and conventionally grown food or populations consuming these foods.<sup>88</sup> They found 17 human studies and 223 studies of nutrient and contaminant levels in food that met inclusion criteria.<sup>88</sup>

They found all estimates of differences in nutrient and contaminant levels in food to be highly heterogeneous except for the estimate for phosphorus; phosphorus levels were significantly higher than in conventional produce, although this difference was not clinically significant.<sup>88</sup> The risk for contamination with detectable pesticide residues was lower among organic than conventional produce, but difference in risk

for exceeding maximum allowed limits were small.<sup>88</sup> *Escherichia coli* contamination risk was no different between organic and conventional produce.<sup>88</sup> Bacterial contamination of retail chicken and pork was common but unrelated to farming method.<sup>88</sup> However, the risk for isolating bacteria resistant to three or more antibiotics was higher in conventional than in organic chicken and pork.<sup>88</sup> The results of Smith-Stangler et al.'s review suggest that the present literature lacks strong evidence that organic foods are significantly more nutritious than conventional foods.<sup>88</sup> However, consumption of organic foods may reduce exposure to pesticide residues and antibiotic-resistant bacteria.<sup>88</sup>

### *3.4 Fair Trade Certified*

Fair trade is: “a global trade model and certification that allows consumers to identify products that were produced in an ethical manner.”<sup>89</sup> Fair trade products are marketed as a method to reduce poverty through everyday purchases. Fair Trade USA is a non-profit organization that certifies and promotes fair trade products in the U.S.<sup>89</sup> Fair Trade USA is the leading third-party certifier and works with more than 800 U.S. companies to audit and certify that the products they offer comply with international fair trade standards.<sup>89</sup> Certified products carry the fair trade certified label.

Worldwide, the fair trade network certifies coffee, tea and herbs, cocoa, fresh fruit and vegetables, sugar, beans and grains, flowers, nuts, oils and butters, honey and spices, wine and apparel, and certified ingredients are now used in ready-to-eat drink beverages, body care products and alcoholic beverages.<sup>89</sup> In the U.S., fair trade certified products are available in more than 50,000 retail locations. Fair trade certified products are also not genetically modified, but not all are organic.<sup>89</sup>

The research literature suggests that more studies of the causal effects of fair trade certification are needed. Blackman and Rivera completed a review of fair trade certification and found that evidence to support beliefs that certification benefits the environment or producers is limited.<sup>90</sup> They concluded that more evidence could be created by the use of rigorous, independent evaluation in the design and implementation of projects promoting certification.

### *3.5 Green Eating*

Greene and Weller from the University of Rhode Island defined Green Eating (GE) as: “eating locally grown foods, produce that is in season and limited intake of processed foods, consuming foods and beverages that are labeled fair trade certified or certified organic and consuming meatless meals weekly and (if consuming animal products) selecting meats, poultry and dairy that do not contain hormones or antibiotics.”<sup>91</sup> They also developed and validated the GE Survey to explore the constructs and relationships of environmentally conscious eating. The GE Survey measures constructs of the Transtheoretical Model of behavior change: stage of change, decisional balance, behavior and self-efficacy for GE.<sup>91</sup>

The Transtheoretical Model (TTM) is a model of intentional change. The model focuses on the decision making of the individual and involves emotions, cognitions, and behavior. This model relies on self-report. In smoking cessation, self-report has been shown to be very accurate.<sup>92</sup>

The stage of change construct is the key-organizing construct of the model.<sup>93</sup> The TTM interprets change as a process involving progress through a series of five stages: precontemplation, contemplation, preparation, action, and maintenance.

Precontemplation is the stage in which people are not intending to take action in the near future, usually measured as the next six months. People may be in this stage because they are uninformed or under-informed about the consequences of their behavior. Alternatively, they may have tried to change previously and become demoralized about their ability to change. Contemplation is the stage in which people are intending to change in the next six months. They are more aware of the pros of changing but also not completely aware of the cons. Preparation is the stage in which people are intending to take action in the immediate future, usually measured as the next month. They have typically taken some significant action in the past year. Action is the stage in which people have made specific overt changes in their life-styles within the past six months. Maintenance is the stage in which people are working to prevent relapse but they do not apply change processes as frequently as do people of action.<sup>93</sup>

The GE Survey provides a method for assessing stage of change (SOC) for GE and comparing dietary behavior between those who are and are not practicing GE behaviors. People in the action and maintenance SOC (AM) can be defined as actively GE, and those in the precontemplation SOC (PC) are not practicing GE and have no intentions of practicing GE in the foreseeable future.

Consumer choice dictates food system production. If consumption patterns changed, the food system would be forced to adapt methods to meet consumer demands. A recent consumer study examining household purchases in the U.S., found more companies are developing “greener” products to meet the needs of environmentally conscious shoppers.<sup>94</sup> Individuals with greater awareness of their

personal impacts on the environment are more likely to practice environmentally conscious behavior.<sup>95</sup> The majority of individuals are unaware of how their daily lifestyle impacts the environment.<sup>96</sup> If the aim is to increase environmentally conscious behavior, an intervention must increase awareness of individual's impact on the environment.

#### **4. Growing Interest in Sustainability Among the University Population**

On college and university campuses local, organic, and sustainable eating behaviors are increasingly popular.<sup>97</sup> Additional environmentally conscious efforts on campuses include the use of alternative transportation, community gardens, and energy efficient buildings.<sup>97</sup> To date, 665 U.S. colleges and universities have signed the American College and University Presidents' Climate Commitment, pledging to improve campus-wide sustainability.<sup>98</sup> Growing numbers of institutions formally committing to sustainable food purchases demonstrate higher education's ability to have an economic impact on the conventional food system.<sup>97</sup>

Both scientific literature and public media sources have reported the significant environmental interest among the university population. The Princeton Review, a student guide to college selection, published a guide to "322 Green Colleges."<sup>99</sup> The book highlights institutions of higher education in the U.S. and Canada with notable commitments to sustainability in their academic offerings, campus infrastructure, activities, and career preparation.<sup>99</sup>

The growing environmental conscious support across U.S., universities suggests a captive audience for interventions to increase environmentally conscious. Eating behavior change may be influenced by desire to reduce environmental impact.

Increasing environmentally conscious eating behaviors could result in benefits to the environment and health.

## **5. Food Consumption of University Students**

University students between the ages of 18 and 24 years experience increased autonomy in decision-making. During “emerging adulthood” they develop a sense of identity while in a critical stage for the establishment of long-term eating behavior practices.<sup>100,101</sup> Research indicates decreased overall-diet quality during this transition from adolescence to adulthood.<sup>102-104</sup> Students enrolled in university dining plans are exposed daily to a food environment characterized by foods high in energy, fat, and added sugar, and low in nutrient density.<sup>105</sup> Their poor dietary quality is well documented with over 42% of total caloric intake coming from added sugar, alcohol, and sources of saturated fats.<sup>106-108</sup> The majority of this population fails to meet the U.S. Dietary Guidelines for fruits, vegetables and calcium.<sup>109,110</sup> Findings from national survey data also indicate fast-food restaurant use and soft drink intake is highest in young adulthood.<sup>111,112</sup>

### *5.1 Dietary Guidelines for Americans*

The Dietary Guidelines for Americans (DGA) are the basis of nutrition policy for the U.S. government and the foundation of all federal nutrition guidance.<sup>109</sup> The U.S. Department of Agriculture (USDA) and U.S. Department of Health and Human Services issue the DGA every 5 years. The accompanying USDA Food Patterns translate key recommendations from the Dietary Guidelines into specific, quantified recommendations for types and amounts of foods to consume at 12 calorie levels with

limits on calories from solid fats and added sugars.<sup>109</sup> Several key messages were developed to help people make more healthful food choices, including phrases such as “Don’t give in when you eat out,” “Mix-up your choices within each food group,” “Make half your grains whole,” “Limit intake of saturated and *trans* fats, cholesterol, added sugars, salt, and alcohol.”<sup>113</sup> Also included was the vague recommendation to consume “adequate nutrients within your caloric needs.”<sup>114</sup>

Kolodinsky et al. completed a cross-sectional study investigating self-reported eating patterns of 200 college students.<sup>105</sup> An internet-based survey was used to identify how closely respondents followed the 2005 DGA and whether their eating patterns were related to their knowledge of dietary guidance.<sup>105</sup> They observed that, for fruit, dairy, protein, and whole grains, increased knowledge was related to increased likelihood of meeting Dietary Guidelines.<sup>105</sup> Greater understanding of dietary guidance appeared to be positively correlated to more healthful eating patterns.<sup>105</sup>

The 2010 DGA included themes of sustainability and lower intake of processed foods high in sodium, solid fats, and added sugars. The DGA contain clear language about the need for multiple sectors, including industry, to take part in effort to help Americans improve their health. This includes recommendations to “develop and expand safe, effective, and sustainable agriculture and aquaculture practices to ensure availability of recommended amounts of healthy foods to all segments of the population.”<sup>114</sup> Also, “initiate partnerships with food producers, suppliers, and retailers to promote the development and availability of appropriate portions of affordable,

nutritious food products (including, but not limited to, those lower in sodium, solid fats, and added sugars) in food retail and food service establishments.”<sup>114</sup>

### *5.2 Healthy Eating Index*

The USDA produced the 2005 Healthy Eating Index (HEI-2005) as a measure of dietary quality in terms of conformance to the DGA.<sup>115</sup> The USDA Food Patterns are used to set the scoring standards for the HEI. The algorithm assesses adherence to 2005 USDA dietary recommendations for food groups and components which include: total fruit, whole fruit, total vegetables, dark green and orange vegetables and legume, total grains, whole grains, milk, meat and beans, oils, saturated fat, sodium, and calories from solid fats, alcoholic beverages, and added sugars.<sup>115</sup>

Ervin’s report provides HEI-2005 scores for adults 20 years and older in the 2003-2004 National Health and Nutrition Examination Survey (NHANES).<sup>116</sup> The included sample consisted of 4,448 adults and the Day 1 dietary recall was used to estimate HEI-2005 scores.<sup>116</sup> Adults were below all the maximum component scores except for total grains and meat and beans.<sup>116</sup> Females and the oldest age group were most successful in meeting the recommendations for the fruit and vegetable components and discretionary calories with a slightly higher overall dietary quality score.<sup>116</sup> This investigation did not include a representation of the entire university student population (<20 y) and utilized just one 24-hour dietary recall.<sup>116</sup> Additional study of participants aged 18-24 years with multiple 24-hour dietary recalls to score HEI-2005 would be superior in assessing dietary quality in university students.<sup>116</sup>

Hiza et al. also used 2003-2004 NHANES data to measure HEI-2005 scores, and they focused on describing the dietary quality of Americans by varying



sociodemographic characteristics in order to provide further insight as to where diets need to improve.<sup>110</sup> Children and older adults had better dietary quality than young and middle-aged adults.<sup>110</sup> Women had better dietary quality than men. Dietary quality of adults generally improved with income level, except for sodium.<sup>110</sup> The diets of Americans, regardless of socioeconomic status, were found to be far from ideal.<sup>110</sup>

The release of the 2010 Dietary Guidelines and revised USDA Food Patterns demanded an update to the HEI-2005 to capture key changes, such as the addition of recommendations for seafood (fish and shellfish) and limitations on refined grains.<sup>117</sup> The 2010 Healthy Eating Index was published recently, in 2013.<sup>117</sup> Changes to the index include: (1) Greens and Beans replaces Dark Green and Orange Vegetables and Legumes; (2) Seafood and Plant Proteins has been added to capture specific choices from the protein group; (3) Fatty Acids, a ratio of poly- and mono-unsaturated to saturated fatty acids, replaces Oils and Saturated Fat to recognize the recommendation to replace saturated fat with mono- and polyunsaturated fatty acids; and (4) a moderation component, Refined Grains, replaces the adequacy component, Total Grains, to assess over-consumption.<sup>117</sup>

However, key features of the HEI-2005 were continued in the HEI-2010: (1) diet quality is assessed from two perspectives: adequacy (dietary components to increase) and moderation (dietary components to decrease); (2) the scoring standards are density-based such that the relative mix of foods is evaluated; and (3) the standards for the maximum scores are the easiest to achieve recommendations among those that vary by energy level, sex, and/or age. For the adequacy components, this means that increasing levels of intake receive increasingly higher scores; while for the moderation

components, increasing levels of intake receive decreasingly lower scores. For all components, higher scores indicate closer conformance with dietary guidance.<sup>117</sup>

### *5.3 Environmentally Conscious Eating Behaviors and Dietary Quality*

Several sources have presented potential relationships between food consumption and the environment. Recent studies have found greater support for organic, local, non-genetically modified, and nonprocessed food among racial minorities and lower-income populations.<sup>118-120</sup> No consistent differences among age, race, income, or family composition have been found for these environmentally conscious.<sup>86,87</sup>

Hekler et al. conducted a quasi-experimental non-randomized controlled trial to compare changes in eating behaviors among students taking a food and society course (n=28) versus students taking health-related human biology courses about obesity, health psychology, and community health assessment (n=72).<sup>121</sup> All participants were undergraduates at an upper tier academic institution in the U.S.<sup>121</sup> A food frequency questionnaire (FFQ) was administered at the beginning and end of the four courses taught from January through March 2009.<sup>121</sup> Students in the food and society course read portions of popular books and essays and watched documentaries highlighting the environmental, ethical, social justice, cultural, political, and agricultural issues associated with food and production.<sup>121</sup> They were also assigned to write an Op-Ed article and create a brief YouTube video based on themes discussed in the course.<sup>121</sup> The students who took the food and society course reported significantly improving their healthful eating with greatest improvements in increased vegetable and decreased high fat dairy intakes relative to the comparison group.<sup>121</sup> The results of

Hekler et al. suggest that it may be possible to change dietary behaviors in college students by focusing on social, ethical, cultural, and environmental issues related to food and food production.<sup>121</sup>

Robinson-O'Brien et al. examined characteristics of adolescents who value eating locally grown, organic, nongenetically engineered, and/or processed food and whether they are more likely than their peers to meet Healthy People 2010 dietary objectives.<sup>120</sup> The study was a cross-sectional analysis using data from a population-based study in Minnesota (Project EAT: Eating Among Teens).<sup>120</sup> Participants were male and female (n=2516), ages 15-23 years.<sup>120</sup> They completed a mailed survey and FFQ in 2004.<sup>120</sup> The percentages of adolescents who reported that it was somewhat or very important that their food be locally grown, organic, nongenetically engineered, and nonprocessed were 20.9%, 23.2%, 34.1%, and 29.8%, respectively.<sup>120</sup> Those who valued each practice were more likely than their peers to be nonwhite and have low socioeconomic status.<sup>120</sup> Adolescents who valued greater than two practices more likely than their peers to have a dietary pattern consistent with the Healthy People 2010 objectives for fruit, vegetable, and fat intake.<sup>120</sup> The findings of Robinson-O'Brien et al. indicate it may be beneficial to discuss alternative food production practices as part of nutrition education programs for adolescents.<sup>120</sup>

Tobler et al. conducted a large-scale survey in the spring of 2010 with a Swiss population to examine consumers' beliefs about ecological food consumption and their willingness to adopt such behaviors.<sup>94</sup> They also investigated consumers' willingness to reduce meat consumption and to buy seasonal fruits and vegetables.<sup>94</sup> They found consumers believed avoiding excessive packaging had the greatest impact

on the environment, while they rated purchasing organic food and reducing meat consumption as least environmentally beneficial.<sup>94</sup> The researchers observed that respondents appeared to be most unwilling to reduce meat consumption and purchase organic food.<sup>94</sup> Taste and environmental motives influenced consumers' willingness to eat seasonal fruits and vegetables, while preparedness to reduce meat consumption was influenced by health and ethical motives.<sup>94</sup> Women and respondents who preferred natural foods were more willing to adopt ecological food consumption patterns.<sup>94</sup>

Pelletier et al. conducted a cross-sectional study to examine the characteristics and dietary behaviors of young adults who reported placing low, moderate, or high importance on alternative food production practices.<sup>122</sup> The participants mean age was 21.9±5 years and 53% of the sample was female.<sup>122</sup> They were a diverse sample of students (n=1,201) at a 2-year community college and 4-year public university in the Twin Cities, Minnesota.<sup>122</sup> The participants completed the Student Health and Wellness Study survey in the spring of 2010.<sup>122</sup>

Approximately half (49%) of young adults placed moderate to high importance on alternative production practices, and few demographic differences across attitudes were found.<sup>122</sup> Young adults who placed high importance on alternative production practices consumed 1.3 more servings of fruits and vegetables, more dietary fiber, fewer added sugar, fewer sugar-sweetened beverages, and less fat than those who placed low importance on these practices.<sup>122</sup>

The study also found that young adults who placed high importance on alternative production practices consumed breakfast approximately one more day per

week and fast food half as often as those who placed low importance on these practices.<sup>122</sup> Findings suggest that preferences for alternative production practices are associated with a wide range of generally healthy eating behaviors, regardless of whether the foods consumed are from alternative or conventional sources.<sup>122</sup> The results of this study also suggest that nutrition messaging around social and environmental implications of food production practices may be well received by this age group.<sup>122</sup> However, environmental studies are needed to explore whether attitudes toward alternative production practices can be influenced to improve dietary quality.<sup>122</sup>

## **6. Conclusion**

In conclusion, this body of evidence suggests that environmentally conscious attitudes and eating behaviors are associated with decreased environmental impacts. Cross-sectional studies have found more healthy eating practices and higher dietary quality among young adults and university students.<sup>120,122</sup> However, limited study exists exploring this relationship between Green Eating and dietary quality. None, to the knowledge of the author, have investigated the relationship using comprehensive dietary assessment methods such as multiple 24-hour recalls.

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## APPENDIX B. INSTRUMENTS

**Heart Start Baseline**

**1. Eligibility Screener**

**1. How old are you?**

Under 18

18

19

20

21

22

23

24

Over 24

**2. Do you have a URI meal plan?**

Yes

No

**3. Do you have any of the following conditions?**

Type I or Type II diabetes

cancer

coronary heart disease

liver disease

a bleeding disorder

disordered eating

a disorder that affects energy balance

none of the above

**4. Are you pregnant or lactating?**

Yes

No

**5. Are you currently on lipid-lowering medication?**

Yes

No

## Heart Start Baseline

### 2. Brief Online Consent

Thank you for your interest in the HeartStart Study. The purpose of this study is to determine if a campus-wide nutrition intervention will improve health status by decreasing heart disease risk.

If you choose to participate, here is what will happen:

-you will complete online surveys  
-you will come to the lipid lab for a total of 3 assessment visits. Your height, weight, waist circumference, and blood pressure will be measured and a few drops of blood will be collected (by a finger prick) for blood lipids and glucose measurement.

**Benefits:** You will increase your dietary knowledge and learn about your health status.

**Risks:** Although experienced personnel will obtain the blood droplets, there is a chance of discomfort from the finger prick.

Your participation is voluntary and you may decide to quit at any time.

**Confidentiality:**

All information that you provide will be kept confidential and your privacy will be protected to the maximum extent allowable by law. The website is password protected for both the researcher and subjects. The data will be stored on a disk in the Lipid Lab at the University of Rhode Island. Printouts of the data will be stored in locked offices at The University of Rhode Island for up to 5 years (as required by law) and then destroyed. Data will be reported in summary format, and no names will be used.

**Questions:**

If you have any questions or concerns, please contact the researchers listed below. If you have concerns regarding your rights as a research participant, please contact the human subjects representative listed below.

**Researchers:**

Jen Arts  
email: heartstart2012@gmail.com

Ingrid Lofgren  
email: ingridlofgren@uri.edu

**Human Subjects Representative:**  
Vice President for Research and Economic Development  
70 Lower College Road  
University of Rhode Island  
Kingston, RI 02881 Phone:(401) 874-4328.  
email: robind@uri.edu

This project has been reviewed and approved by the human subject review board of the University of Rhode Island.

Thank you for your time and interest in this study.

If you would like a copy of this form, please print it now.

## Heart Start Baseline

**1. Continuing in this study indicates that you have read and understand the above information.**

- I am ready to begin the online surveys.
- I am not interested in this study.



## Heart Start Baseline

### 3. Demographics and Health History Questionnaire

#### 1. Please answer the following questions.

Name:

Date of birth:

#### 2. What is your gender?

- Male  
 Female

#### 3. If you are a female, what was the date of your last menstrual cycle? (MM-DD-YYYY)

#### 4. What is your race or ethnic group?

- White (non-Hispanic)  
 Black or African American (non-Hispanic)  
 Hispanic/Latino  
 American Indian/Alaska Native  
 Asian  
 Native Hawaiian or other Pacific Islander  
 Mixed Race  
 Other (please specify)

#### 5. Where do you live?

- On-campus  
 Off-campus (with family)  
 Off-campus (not with family)

## Heart Start Baseline

### 6. What year in school are you in?

- First year
- Sophomore
- Junior
- Senior
- Graduate student
- Not a student

### 7. What is your enrollment status?

- Full-time
- Part-time
- Non-traditional part-time
- Not a student

### 8. What is your major?

### 9. Do you take any prescribed or over-the-counter medications? (please specify)

### 10. Have you had your cholesterol levels checked?

- Yes
- No
- Don't know

### 11. Do you use tobacco products?

- Yes
- No

## Heart Start Baseline

### 4. Dietary Screener

These questions are about foods you ate or drank during the past month, that is, the past 30 days. When answering, please include meals and snacks at home, at work or school, in restaurants, and anyplace else.

**1. During the past month, how often did you eat hot or cold cereals? Choose one.**

- Never (Go to question 4)
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**2. During the past month, what kind of cereal did you usually eat?**

**3. If there was another kind of cereal that you usually ate during the past month, what kind was it? If none, leave blank.**

## Heart Start Baseline

**4. During the past month, how often did you have any milk (either to drink or on cereal)?**

**Include regular milks, chocolate or other flavored milks, lactose-free milk, buttermilk.**

**Please do NOT include soy milk or small amounts of milk in coffee or tea. Choose one.**

- Never (Go to question 6)
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

**5. During the past month, what kind of milk did you usually drink? Choose one.**

- Whole or regular milk
- 2% fat or reduced-fat milk
- 1%, 1/2%, or low-fat milk
- Fat-free, skim or nonfat milk
- Soy milk
- Other kind of milk - type milk.

## Heart Start Baseline

**6. During the past month, how often did you drink regular soda or pop that contains sugar? Do NOT include diet soda. Choose one.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

**7. During the past month, how often did you drink 100% pure fruit juice such as orange, mango, apple, grape and pineapple juices? Do NOT include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to. Choose one.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

## Heart Start Baseline

**8. During the past month, how often did you drink coffee or tea that had sugar or honey added to it? Include coffee and tea you sweetened yourself and presweetened tea and coffee drinks such as Arizona Iced tea and Frappuccino. Do NOT include artificially sweetened coffee or diet tea.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

**9. During the past month, how often did you drink sweetened fruit drinks, sports or energy drinks, such as Kool-Aid, lemonade, Hi-C, cranberry drink, Gatorade, Red Bull, or Vitamin Water? Include fruit juices you made at home and added sugar to. Do NOT include diet drinks or artificially sweetened drinks.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2-3 times per day
- 4-5 times per day
- 6 or more times per day

## Heart Start Baseline

**10. During the past month, how often did you eat fruit? Include fresh, frozen, or canned fruit. Do NOT include juices.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**11. During the past month, how often did you eat a green leafy or lettuce salad, with or without other vegetables?**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**Heart Start Baseline**

**12. During the past month, how often did you eat any kind of fried potatoes, including french fries, home fries, or hash brown potatoes?**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**13. During the past month, how often did you eat any other kind of potatoes, such as baked, boiled, mashed potatoes, sweet potatoes, or potato salad?**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



## Heart Start Baseline

**14. During the past month, how often did you eat refried beans, baked beans, beans in soup, pork and beans or any other type of cooked dried beans? Do NOT include green beans.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**15. During the past month, how often did you eat brown rice or other cooked whole grains, such as bulgur, cracked wheat, or millet? Do NOT include white rice.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**16. During the past month, not including what you just told me about (green salads, potatoes, cooked dried beans), how often did you eat other vegetables?**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**17. During the past month, how often did you have Mexican-type salsa made with tomato?**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**18. During the past month, how often did you eat pizza? Include frozen pizza, fast food pizza, and homemade pizza.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**19. During the past month, how often did you have tomato sauces such as with spaghetti or noodles or mixed into foods such as lasagna? Do NOT include tomato sauce on pizza.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**20. During the past month, how often did you eat any kind of cheese? Include cheese as a snack, cheese on burgers, sandwiches, and cheese in foods such as lasagna, quesadillas, or casseroles. Do NOT include cheese on pizza.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**21. During the past month, how often did you eat red meat, such as beef, pork, ham, or sausage? Do NOT include chicken, turkey or seafood. Include red meat you had in sandwiches, lasagna, stew, and other mixtures. Red meats may also include veal, lamb, and any lunch meats made with these meats.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**22. During the past month, how often did you eat any processed meat, such as bacon, lunch meats, or hot dogs? Include processed meats you had in sandwiches, soups, pizza, casseroles, and other mixtures.**

**Processed meats are those preserved by smoking, curing, or salting, or by the addition of preservatives. Examples are: ham, bacon, pastrami, salami, sausages, bratwursts, frankfurters, hot dogs, and spam.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**23. During the past month, how often did you eat whole grain bread including toast, rolls and in sandwiches? Whole grain breads include whole wheat, rye, oatmeal, and pumpernickel. Do NOT include white bread.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**24. During the past month, how often did you eat chocolate or any other types of candy?**

**Do NOT include sugar-free candy.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**25. During the past month, how often did you eat doughnuts, sweet rolls, Danish, muffins, pan dulce, or pop-tarts? Do NOT include sugar-free items.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**26. During the past month, how often did you eat cookies, cake, pie, or brownies? Do NOT include sugar-free kinds.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

**27. During the past month, how often did you eat ice cream or other frozen desserts? Do NOT include sugar-free kinds.**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day

## Heart Start Baseline

**28. During the past month, how often did you eat popcorn?**

- Never
- 1 time last month
- 2-3 times last month
- 1 time per week
- 2 times per week
- 3-4 times per week
- 5-6 times per week
- 1 time per day
- 2 or more times per day



## Heart Start Baseline

### 7. Green Eating Survey College Edition

#### 1. Green Eating

**Green eating includes participating in most of the following behaviors:**

- Eating locally grown foods, produce that is in season and a limited amount of processed foods,
- Consuming foods and beverages that are labeled fair trade certified or certified organic,
- Consuming meatless meals weekly and (if consuming animal products) selecting meats, poultry and dairy that do not contain hormones or antibiotics.

**Based on the definition of green eating, which of the following best describes you now:**

- I do not regularly practice green eating and do not intend to start within the next 6 months
- I am thinking about practicing green eating within the next 6 months
- I am planning on practicing green eating within the next 30 days
- I regularly practice green eating and have been doing so for less than 6 months
- I regularly practice green eating and have been doing so for 6 months or more
- Choose not to answer

## Heart Start Baseline

### 2. Green Eating Behavior

Please select the answer that BEST describes your usual behavior.

	Hardly ever	Rarely 25%	Sometimes 50%	Often 75%	Almost always
How often do you buy meat or poultry products labelled "Free Range" or "Cage Free"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you choose foods labeled Certified Organic?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you select food or beverages labeled Fair-Trade Certified?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How often do you select meats, poultry, and dairy products that are raised without antibiotics or hormones?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Locally grown foods are grown within 100 miles (anywhere in RI and nearby MA or CT). Based on this, how often do you eat locally grown foods?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When in season, how often do you shop at farmer's markets?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Heart Start Baseline

### 3. Decisional Balance

Here are some advantages and disadvantages to Green Eating. Please indicate how important each one is in your deciding to eat green.

	Not at all important	Somewhat important	Neutral	Very important	Extremely important
Eating green is not practical in my life right now	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating green can be too expensive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By eating green, I can help protect the planet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating green would be too difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating minimally processed foods is better for my health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By eating green I can improve the quality of my diet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By eating green I can support the local economy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sustainably produced foods aren't available to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am proud that I can help the environment by eating green	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can't find green foods where I shop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Heart Start Baseline

**4. REMINDER: Green eating includes participating in most of the following behaviors:**

- Eating locally grown foods, produce that is in season and a limited amount of processed foods,
- Consuming foods and beverages that are labeled fair trade certified or certified organic,
- Consuming meatless meals weekly and (if consuming animal products) selecting meats, poultry and dairy that do not contain hormones or antibiotics.

**Please rate HOW CONFIDENT you feel that you could eat green under each of the following circumstances?**

	Not at all confident	Not very confident	Somewhat confident	Very confident	Extremely confident
When I am busy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I am at school during the semester	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When it is inconvenient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I go out to eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I eat in the dining halls or cafeterias	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I am at home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I am with my family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Over the summer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Heart Start Baseline

### 5. Eating Behaviors

As per the US Dietary Guidelines recommendations, one serving of fruit or vegetables is equal to one cup. Below are some examples that are equivalent to a "1 cup" serving:

**1 cup cooked or raw fruits or vegetables**

**2 cups garden salad**

**One medium-sized piece of fruit**

**1/2 cup dried fruit**

**8 fl oz (1cup) of 100% fruit or vegetable juice**

**In total, approximately how many cups of fruits AND vegetables do you consume per day?**

- Less than 1 cup
- 1 cup
- 2 cups
- 3 cups
- 4 cups
- 5 cups
- 6 cups
- 7 or more cups

**6. Which of the following best describes the MAJORITY of your meals during the academic year?**

- I eat meals prepared at home
- I purchase frozen or ready-to-eat meals
- I eat at dining halls/restaurants
- I get fast food / take out

**7. On average how many times per week do you consume red meat?**

- Never
- 1-3 times/ week
- 4-6 times/ week
- 7 or more times/ week

## Heart Start Baseline

### 8. How often do you eat fast-food/ take-out?

- Never
- 1-2 times/ month
- 3-4 times/ month
- 2-3 times/ week
- 4-5 times/ week
- 6 or more times/ week

### 9. Do you consider yourself a vegetarian (one who does not eat meat)?

- Yes
- No

### 10. Were you on the campus meal plan last semester?

- Yes
- No

## Heart Start Baseline

### 8. College Environment Perceptions Survey

Please answer the following questions as accurately as possible.

**1. How many servings of grains do you eat on average per day?**

**NOTE: Any food made from wheat, rice, oats, cornmeal, barley or another cereal grain is a grain product. Bread, pasta, oatmeal, breakfast cereals, tortillas and grits are examples of grain products. Examples: 1 serving = 1 slice of bread; 1 cup of ready-to-eat cereal; ½ cup cooked rice or pasta**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

**2. How many servings of WHOLE grains do you eat on average per day?**

**NOTE: All grains begin as whole grains; however, if after milling they keep all the parts of the original grain in their original proportions they are still considered a whole grain. Whole grains should be the first ingredient listed on the label. Examples: 1 serving = 1 slice whole wheat bread; 5-6 whole grain crackers; ½ cup cooked brown rice; ½ cup oatmeal**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

## Heart Start Baseline

**3. How many servings of milk or milk products do you eat on average per day?**

**NOTE: All fluid milk products and many foods made from milk are considered part of this food group. Examples: 1 serving = 1 cup of milk; 1 cup of yogurt; 1 ½ ounces of natural cheese or 2 ounces of processed cheese**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

**4. How many servings of LOW-FAT (1% fat or less) milk or milk products do you eat on average per day?**

**NOTE: All fluid milk products and many foods made from milk are considered part of this food group. Examples: 1 serving = 1 cup of 1% or skim milk; 1 cup of low-fat yogurt; 1 ½ ounces of low-fat natural cheese or 2 ounces of processed low-fat cheese**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer



## Heart Start Baseline

**5. How many servings of meat and/or eggs do you eat on average per day? NOTE: All foods made from meat, poultry or eggs. Examples: 1 serving = 3 ounce of meat or poultry (looks like a deck of cards); 1 egg**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

**6. How many servings of nuts, beans, or tofu do you eat on average per day? NOTE: All foods made from dry beans or peas, nuts and seeds Examples: 1 serving = ¼ cup cooked dry beans; 1 tbsp. of peanut butter; ½ ounce of nuts or seeds (give example of tofu)**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

## Heart Start Baseline

**7. How many servings of fish, seafood or shellfish do you eat on average per day?**

**Examples: 1 serving = 1 ounce of fish; 3 shrimp**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

**8. How many servings of sweet snacks do you eat on average per day?**

**NOTE: Includes cookies, cake, muffins, donuts, candy, candy bars, etc Examples: 1 serving = 1 2-inch diameter cookie; 1 ounce candy; 2 square inch of cake; ½ of a regular size candy bar**

- Less than 1
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Choose not to answer

## Heart Start Baseline

**9. On average, how often in the past month did you consume a non-diet, sugar-sweetened soft drink (pop)?**

**Examples: Coke, Sprite, Dr. Pepper, Pepsi, Mountain Dew, Orange Crush, Mr. Pibb, 7-Up, Fanta, Root Beer**

- Never or less than one per month
- One to four per month
- Two to six per week
- One per day
- Two per day
- Three per day
- Four per day
- Choose not to answer

**10. On average, how often in the past month did you consume fruit drinks or other sugar sweetened beverages? Examples: Hawaiian Punch, Hi-C, Kool-Aid, Ocean Spray Cranberry Juice Cocktail, Snapple, Sunny Delight, Country Time Lemonade, Sobe, Arizona Ice Tea, sugar sweetened tea, etc.**

- Never or less than one per month
- One to four per month
- Two to six per week
- One per day
- Two per day
- Three per day
- Four per day
- Choose not to answer

## Heart Start Baseline

**11. On average, how often in the past month did you consume non-diet (NOT sugar-free) energy drinks/sports drinks? Examples: Gatorade, Powerade, RockStar, Red Bull, Monster, Full Throttle**

- Never or less than one per month
- One to four per month
- Two to six per week
- One per day
- Two per day
- Three per day
- Four per day
- Choose not to answer

**12. On average, how often in the past month did you consume sugar-sweetened specialty coffee drinks? Examples: frappuccino, flavored latté/cappuccino**

- Never or less than one per month
- One to four per month
- Two to six per week
- One per day
- Two per day
- Three per day
- Four per day
- Choose not to answer

**13. How often do you compare sodium (salt) in foods like soup, bread, and frozen meals – and choose the foods with lower numbers?**

- Almost Always
- Most of the time
- Sometimes
- Seldom
- Never
- Choose not to answer

## Heart Start Baseline

### 14. How often do you add salt to your food?

- Almost Always
- Most of the time
- Sometimes
- Seldom
- Never
- Choose not to answer

### 15. How often do you eat low-fat foods?

- Almost Always
- Most of the time
- Sometimes
- Seldom
- Never
- Choose not to answer

### 16. How often do you eat fried food?

- Almost Always
- Most of the time
- Sometimes
- Seldom
- Never
- Choose not to answer

### 17. How often do you consume alcoholic beverages?

- Never
- Special Occasions
- Less than once per week
- Once per week
- Twice per week
- More than three times per week
- Choose not to answer

## Heart Start Baseline

**18. How often do you go out to eat at a restaurant or fast food place or order take-out?**

- 0
- 1-2 times per week
- 3-4 times per week
- 5-6 times per week
- 7 times per week
- Choose not to answer

**19. How would you rate the "healthiness" of your eating habits?**

- Poor
- Fair
- Average
- Good
- Excellent
- Choose not to answer

APPENDIX C. HEARTSTART STUDY FLYER

# HOW HEALTHY ARE YOU?

- Is your diet heart healthy?
- Do you know your cholesterol, triglyceride, and glucose levels?
- Do you know your blood pressure?



Earn **\$30** and learn about your health status by participating in the **HeartStart** study!

Contact us: [heartstart2012@gmail.com](mailto:heartstart2012@gmail.com)

874-2785

Questions? Dr. Lofgren 874-5706  
Department of Nutrition and Food Sciences

## APPENDIX D. INFORMED CONSENT FORM

The University of Rhode Island  
Department of Nutrition and Food Sciences  
301 Ranger Hall  
Campus-Wide Nutrition Intervention

### CONSENT FORM FOR RESEARCH

You have been invited to take part in a research project described below. The researcher will explain the project to you in detail. You should feel free to ask questions. If you have more questions later, Dr. Ingrid Lofgren (401-874-5706 or [ingridlofgren@uri.edu](mailto:ingridlofgren@uri.edu)) or Jennifer Arts (401-874-2785 or [jarts@my.uri.edu](mailto:jarts@my.uri.edu)), will discuss them with you. You must be 18-24 years old, have a URI meal plan, and have a body mass index  $\geq 18.5 \text{ kg/m}^2$  to be in this research project. You are not eligible for this study if you have diabetes (Type 1 or Type II), cancer, coronary heart disease, liver disease, a bleeding disorder, are pregnant or lactating, have disordered eating or any health conditions that may influence energy balance, or if you are on lipid-lowering medication. If your body mass index is  $<18.5 \text{ kg/m}^2$  you will be referred to health services.

#### *Description of the project:*

The purpose of the study is to determine if a campus-wide dietary intervention will improve health status by decreasing coronary heart disease risk factors in college students. The intervention will consist of nutrition messages and education materials displayed around campus.

#### *What will be done:*

All students with meal plans will be exposed to the intervention in the dining halls. The study will involve the completion of questionnaires, two brief assessment visits, and a follow-up visit in Ranger Hall. If you decide to take part in this study here is what will happen:

#### **Baseline Assessment:**

##### *Day prior to your first assessment visit (overnight)*

- For the twelve hours prior to the first assessment visit, you will be asked to refrain from eating or drinking anything except for water. We encourage you to drink as much water as you would like. For example, if your screening visit is scheduled for 8 am on a Tuesday, you will be asked to not eat or drink anything (except for water) after 8 pm on Monday evening.

##### *First assessment visit (approximately 30 minutes)*

- Your height, weight, waist circumference and blood pressure will be measured.



- A finger prick will be performed to collect a few drops of blood for analysis of blood lipids and glucose.

**3 Month Post-Intervention Assessment:**

*Prior to your second assessment visit (approximately 30 minutes)*

- You will complete online questionnaires to assess dietary intake, eating behaviors, your college environment and physical activity.

*Day prior to your second assessment visit (overnight)*

- As with the day prior to the first assessment visit, you will be asked to refrain from eating or drinking anything except for water twelve hours prior to the second assessment visit.

*Second assessment visit (approximately 30 minutes)*

- Your height, weight, waist circumference and blood pressure will be measured.
- A finger prick will be performed to collect a few drops of blood for analysis of blood lipids and glucose.
- You will receive \$20 upon completion of this visit.

**6 Month Follow-Up Assessment:**

*Prior to your follow-up visit (approximately 30 minutes)*

- You will complete online questionnaires to assess dietary intake, eating behaviors, your college environment and physical activity

*Follow-up visit (approximately 30 minutes)*

- Your height, weight, waist circumference and blood pressure will be measured.
- A finger prick will be performed to collect a few drops of blood for analysis of blood lipids and glucose.
- You will receive \$10 upon completion of this visit.

*Risks or discomfort:*

There are no known risks for the completion of questionnaires and the measurement of height, weight, waist circumference and blood pressure. Even though experienced personnel will obtain the blood samples there is a chance of discomfort from the finger stick.

*Benefits of this study:*

This study will improve understanding of behavioral and environmental factors that influence coronary heart disease risk and obesity. The direct benefits to you include increasing your dietary knowledge and learning about your health status. You will receive the results from your assessment visits (height, weight, body mass index, waist circumference, blood lipids and glucose).

*Confidentiality:*

Your participation in this study is confidential. None of the information will identify you by name. All records will be stored in a locked office that is only accessible to study personnel.

*In case there is any injury to the subject:*

If this study causes you any injury, you should notify Dr. Ingrid Lofgren at 401-874-5706 or [ingridlofgren@uri.edu](mailto:ingridlofgren@uri.edu). You may also contact the office of the Vice President for Research, 70 Lower College Road, University of Rhode Island, Kingston, Rhode Island, telephone: 401-874-4328.

*Decision to quit at any time:*

The decision to take part in this study is up to you. You do not have to participate. If you decide to take part in the study, you may quit at any time. If you wish to quit, simply inform Jennifer Arts at 401-874-2785 or [jarts@my.uri.edu](mailto:jarts@my.uri.edu) or Dr. Ingrid Lofgren at 401-874-5706 or [ingridlofgren@uri.edu](mailto:ingridlofgren@uri.edu) of your decision.

*Rights and Complaints:*

If you are not satisfied with the way this study is performed, you may discuss your complaints with Dr. Ingrid Lofgren, anonymously, if you choose. In addition, if you have questions about your rights as a research participant, you may contact the office of the Vice President for Research, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, Rhode Island, telephone: (401) 874-4328.

You have read the consent form. Your questions have been answered. Your signature on this form means that you understand the information and you agree to participate in this study.

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

\_\_\_\_\_  
Signature of Researcher

\_\_\_\_\_  
Typed/printed Name

\_\_\_\_\_  
Typed/printed name

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

I consent to be contacted for future research related to this project or other projects.

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

\_\_\_\_\_  
Signature of Researcher

\_\_\_\_\_

\_\_\_\_\_

Typed/printed Name

Typed/printed name

\_\_\_\_\_

Date

\_\_\_\_\_

Date

*Please sign both consent forms, keeping one for yourself*