2014

Examining the Relationship Between Environmental Concern, Exercise Habits, and Fruit and Vegetable Intake

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EXAMINING THE RELATIONSHIP BETWEEN ENVIRONMENTAL CONCERN, EXERCISE HABITS, AND FRUIT AND VEGETABLE INTAKE

A Thesis Presented

by

DANA M. HARRISON

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

February 2014

Department of Nutrition
EXAMINING THE RELATIONSHIP BETWEEN ENVIRONMENTAL CONCERN, EXERCISE HABITS, AND FRUIT AND VEGETABLE INTAKE

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ACKNOWLEDGMENTS

I would like to thank my advisor and chair, Dr. Elena Carbone, for her guidance, patient editing, and willingness to work on this project. I would also like to thank my committee members, Dr. Barry Braun and Dr. Lisa Troy. Dr. Braun provided me with the unique opportunity to contribute to a research project within the Energy Harvesting Lab. Dr. Lisa Troy’s insight and interest in this research project was extremely valuable.

I am truly grateful to have had the opportunity to conduct this research. This thesis challenged me in many ways, but most importantly, it challenged me to think differently. I would like to thank my committee members for teaching me how to think outside of the box.

Many thanks to Taylor Cronin for her help with data collection at focus groups. I would also like to thank Jennifer Siddall, owner of ENERGIA studios, for her interest in this project and allowing us to conduct focus groups within the ENERGIA community. Thank you to UMass Permaculture members for being open to participate in this study.

Lastly, I would like to thank my family, friends, and peers for their support throughout graduate school. Specifically, I would like to thank my mother for being my biggest cheerleader and providing me with perspective and wisdom throughout this entire process.
ABSTRACT

EXAMINING THE RELATIONSHIP BETWEEN ENVIRONMENTAL CONCERN, EXERCISE HABITS, AND FRUIT AND VEGETABLE INTAKE

FEBRUARY 2014

DANA HARRISON, B.A., VASSAR COLLEGE
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Directed by: Professor Elena Carbone

BACKGROUND: Recent epidemiological data indicate that one-third of the U.S. adult population is obese. As a result, healthcare professionals and policy makers are looking to identify creative methods to address this critical health concern. One way that may show promise to promote positive health changes is to convert mechanical energy produced through exercise into stored electricity via energy harvesting (EH) exercise. Previous research has linked pro-environmental attitudes with increased participation in sustainable behaviors. Other research has examined associations between consumption of fruits and vegetables and exercise participation. However, little research examines the association between exercise behavior and environmental concern. And more specifically, EH exercise. OBJECTIVE: To identify if EH exercise can act as a motivating factor to increase exercise participation. METHODS: Phase 1: Qualitative data were collected through a series of one-hour focus groups with ENERGIA Studio members who participate in EH exercise. Four focus groups were completed with 1-5 participants per group (n=12). Topics examined included: 1) perceived effect of EH exercise on the environment and its ability to act as a motivating factor to increase exercise participation; 2) participation in sustainable behaviors and attitudes toward energy conservation and environmental concerns; and 3) perceived benefits of and
barriers to fruit and vegetable consumption and exercise participation. Data were used to inform a survey to examine the relationship between how environmental concern influences exercise and dietary practices. Phase 2: Fifteen participants from UMass Permaculture who had irregular exercise participation and pro-environmental beliefs completed an online survey. RESULTS: Significant results were found for associations between: environmental concern and sustainable and organic fruit and vegetable purchasing (p=0.008; p=0.048) among non-exercisers; health concern and organic purchasing (p=0.015) among exercisers; and sustainable practices and fruit and vegetable intake ($X^2 (1, 12) = 5.285, p=0.022$) among non-exercisers. No significant results were found between environmental concern and EH exercise self-efficacy or exercise and fruit and vegetable intake. CONCLUSIONS: This study provides additional research examining how environmental concern may affect dietary and exercise habits. Using the threat of the environment may serve as a potential motivator to increase EH exercise participation and fruit and vegetable intake.
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CHAPTER 1
INTRODUCTION

**Problem:** With the staggering obesity statistics among all age groups within the United States, it is crucial for healthcare professionals and policy makers to identify ways to address the obesity epidemic. Approximately one-third of U.S. adults are obese, contributing to approximately $147 billion spent in obesity related medical costs in 2008, (Centers for Disease Control and Prevention, 2011b). With obesity comes increased risk of related diseases, such as diabetes, heart disease, hyperlipidemia, some cancers and other nutrition-related diseases (Centers for Disease Control and Prevention, 2011a).

Because obesity is a complex condition, it is necessary to identify all factors, including specific environmental changes that can help reverse the trend. This task is imperative in order to improve the health and well-being of the population.

Healthy People 2020 is a set of national objectives to guide the health of the population by addressing the most important public health concerns (United States Department of Health and Human Services, 2013). The public health nutrition and physical activity objectives encourage positive behavior. In particular, two health indicator examples include NWS 9: “reduce the proportion of adults who are obese” and PA 2.2 “increase the proportion of adults who meet the objectives for aerobic physical activity and for muscle-strengthening activity.” (United States Department of Health and Human Services, 2013).

Healthy dietary patterns and physical activity levels may provide the best approach for healthy weight status management. To decrease obesity and increase positive health
outcomes, people need to be knowledgeable and aware of their eating, exercising, and sustainability habits. Dietary and physical activity recommendations for individuals aged 2 and older found in the 2010 Dietary Guidelines for Americans involve increasing the consumption of nutrient dense foods, including fruits and vegetables and monitoring calories to achieve and sustain a healthy weight through healthy eating and increase physical activity levels (United States Department of Agriculture, 2010). In order to achieve a healthy, adequate, and balanced diet, MyPlate is a new visual tool used by healthcare professionals and the government to communicate dietary recommendations to individuals (United States Department of Agriculture, 2012a). Grains, protein, vegetables, fruit, and dairy portions are drawn to scale to illustrate healthy eating habits. Physical activity levels recommended by the 2008 Physical Activity Guidelines for Americans include 150 minutes of moderate intensity or 75 minutes of vigorous intensity aerobic activity plus muscle strengthening (all major muscle groups) activities two or more times a week for all U.S. adults (Centers for Disease Control and Prevention, 2011a; United States Department of Health and Human Services, 2008). In general, recommended levels of physical activity and healthy dietary consumption are not achieved by most people, in particular college students (Greaney et al., 2009; Grubbs & Carter, 2002; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Data from the 2009 Behavior Risk Factor Surveillance System (BRFSS) has found that 73.7% of adults do not consume at least 3 vegetable servings per day, and 67.5% of adults do not consume at least 2 servings of fruit per day (Centers for Disease Control and Prevention, 2011a). In addition, approximately 80% of Americans do not meet the federal physical activity guidelines for aerobic activity and muscle strengthening (United States Department of Health and Human Services, 2008).
Department of Health and Human Services, 2013). With a focus on improving healthy dietary and physical activity patterns, the combination of these two lifestyle changes attempts may improve obesity and overweight patterns seen among children, adolescents, and adults.

Healthcare professionals and policy makers have long been looking for creative ways to address the obesity epidemic. Increased participation in sustainable behaviors due to environmental and health concerns can promote increased dietary consumption of fruits and vegetables (Alaimo, Packnett, Miles, & Kruger, 2008; Litt et al., 2011; MacMillan Uribe, Winham, & Wharton, 2012; Russell & Zepeda, 2008). With climate change posing a threat to the population’s renewable resources, it is necessary to understand participation in sustainable behaviors and practices. One way that may show promise to promote positive health changes is to convert mechanical energy produced through exercise into stored electricity. Previous research has linked pro-environmental (environmentally friendly) attitudes with increased participation in sustainable behaviors. Other research has examined associations between positive health behaviors, such as consumption of fruits and vegetables, and exercise participation. However, there is little research exploring the association between exercise behavior and environmental concern. And more specifically, examining how concern for the environment may influence one’s dietary and exercise habits, and whether common motivational factors can be identified to promote these positive health behaviors.

Implications

Healthy dietary consumption and physical activity behaviors may prompt improvements in health and weight status, suggesting the need to address both behavioral
components together. Theory-informed frameworks are useful to monitor, and evaluate the success of behavioral interventions. In order to increase public health awareness and participation in healthy dietary and exercise behavior, people must be knowledgeable and aware of their eating, exercising, and sustainability habits. Increasing the public’s health awareness and benefits of healthy eating and exercise behavior involves establishing relationships among fitness, nutrition practitioners, and medical professionals, as well as local and federal governments in order to create various policies and interventions geared toward healthy behavioral change.
CHAPTER 2
THEORY-INFORMED FRAMEWORK

Health Belief Model

The Health Belief Model is a theory-informed framework used to predict health habits with the use of cognitive variables (Bandura, 2004). Use of such a framework can be beneficial by identifying and evaluating the success of an intervention program geared toward promoting positive health behaviors and outcomes. The Health Belief Model proposes that a person’s health-related behavior depends on perception (Glanz, Rimer, & Lewis, 2002). The theory explains the equation of likelihood of action, which is dependent on various constructs including perceived susceptibility, perceived severity of a disease, benefits and barriers of taking preventive action, cues to action, and self-efficacy (Glanz, Rimer, & Lewis, 2002). Perceived susceptibility refers to an individuals’ belief regarding the risk of getting a health condition, while perceived severity is an individuals’ belief of how serious a health condition and its consequences are. Perceived susceptibility and severity combined is defined as the perceived threat, which creates a force that produces action or a behavior change. The course of action of behavior change is dependent on the perceived benefits (beliefs regarding the effectiveness of actions for reducing the health condition’s threat/risk) and barriers (negative aspects of a health action) (Glanz, Rimer, & Lewis, 2002). Combined, the perception of benefits and barriers creates a favored path of action (Glanz, Rimer, & Lewis, 2002). Cues to action are important as they ‘trigger’ behavior change, while self-efficacy, or the confidence one has to successfully perform a behavior that is needed for a desired outcome, influences behavior change (Bandura, 1977; (Glanz, Rimer, & Lewis, 2002)). These components
create a link between attitude and behavior. Combined, attitudes and social norms (perceived social pressures) produce the intentions to participate in a behavior (Bandura, 2004). Figure 1 displays the constructs and linkages of the Health Belief Model (Glanz, Rimer, & Viswanath, 2008). One’s knowledge of health risks and benefits create the precondition for changing health behaviors, while benefits of and barriers to behaviors affect participation in the behavior. Hence, for a behavior to be carried out, the benefits of the behavior would have to outweigh the barriers. Another key component of the Health Belief Model involves self-efficacy, which is the confidence that an individual has that he or she can participate in a specified behavior. Personal self-efficacy involves making changes based on the knowledge of the problem, which creates the foundation for motivation and behavior change (Bandura, 2004). Self-efficacy can determine how barriers are viewed, with higher self-efficacy scores expected to produce favorable outcomes (increased chance of performing desired behavior), and low-self efficacy expected to produce poor outcomes (decreased chance of performing desired behavior).

The motivation an individual has is further enhanced by self-interest and valued goals (Bandura, 2004). Understanding the motivations for why individuals eat fruits and vegetables, exercise, or participate in pro-environmental behaviors can help identify overlapping goals, intentions, attitudes, beliefs, and values that connect these behaviors. Hence, through the Health Belief Model, we may gain further insight into the relationship between environmental concern and its relationship with dietary consumption and exercise behavior. By assessing attitudes and beliefs toward the problem (environmental threat) along with perception of barrier controls, it is possible to create tailored interventions toward a target population.
Application of the Health Belief Model:

Perceived Benefits, Barriers, and Self-Efficacy

Studies have utilized self-efficacy as a component to understanding an individual’s ability to participate in specific health-related behaviors. Perceived self-efficacy can have a direct influence on choice of activities and settings and is an accurate predictor of performance on tasks (Bandura, 1977). Hence, individuals with stronger perceived self-efficacy are more likely to perform their goals or performance tasks (Bandura, 2004). Self-efficacy, which can be shaped by one’s environment (specifically the benefits and barriers of performing a behavior), plays an important role in adherence to healthy dietary and exercise participation. Therefore, self-efficacy can shape how barriers and obstacles are viewed; with low self-efficacy scores indicating that there are more barriers to overcome, and high scores indicating that these barriers can be overcome more easily (Bandura, 2004).

Exercise self-efficacy may be mediated by perceived beliefs about benefits and barriers (Garcia et al., 2009). Measuring the benefits of and barriers to exercise participation helps shed light on understanding a person’s predicted success in an intervention. Various benefits documented with exercising include healthy aging, quality of life, and other health goals. (Segar, Eccles, & Richardson, 2011) in addition to life enhancement, social interaction, physical performance, and psychological outlook (Lovell, El Ansari, & Parker, 2010; Segar, Eccles, & Richardson, 2011). In contrast, barriers may include physical exertion, time expenditure, family discouragement, and exercise environment barriers (Lovell, El Ansari, & Parker, 2010). Identifying the
relationship between benefits, barriers, and performance is important to understand the participation in a desired behavior.

Higher physical activity self-efficacy levels have been associated with fewer perceived barriers to physical activity (Ayotte, Margrett, & Hicks-Patrick, 2010). Studies provide evidence that more perceived benefits compared with barriers would result in the performance of the desired exercise behavior (Abraham, Feldman, Nyman, & Barleen, 2011; Grubbs & Carter, 2002). For instance, in a self-reported survey among 147 undergraduate college students, Grubbs and Carter found that participants who exercised perceived more benefits of exercise than non-exercising participants (P<0.001) (Grubbs & Carter, 2002). Hence, participants perceiving higher benefits from exercise are more likely to exercise compared to participants perceiving higher barriers to exercise (Abraham, Feldman, Nyman, & Barleen, 2011; Ayotte, Margrett, & Hicks-Patrick, 2010; Grubbs & Carter, 2002).

Knowing there are more perceived benefits may not translate into exercise participation. For example, Lovell and colleagues found that among 200 non-exercising female undergraduate students, there were significantly higher perceived benefits (Mean=2.96, Standard Deviation= 0.44) than barriers (M=2.22, SD= 0.46) to exercise (p<0.001) (Lovell, El Ansari, & Parker, 2010). Hence, it is important to understand that with given benefits and barriers self-efficacy can contribute to the adoption and maintenance of physical activity behaviors (Sniehotta, Scholz, & Schwarzer, 2005).

Exercise self-efficacy is a predictor for exercise behavior (Abraham, Feldman, Nyman, & Barleen, 2011; Annesi, 2012; Ayotte, Margrett, & Hicks-Patrick, 2010; Teixeira et al., 2006). In addition, self-efficacy may act as a significant predictor of
intention to perform exercise behavior (Sniehotta, Scholz, & Schwarzer, 2005) and could be directly and indirectly related to physical activity through outcome expectancies and perceived barriers (Ayotte, Margrett, & Hicks-Patrick, 2010). Understanding how self-efficacy changes over the period of an exercise intervention program may shed light on the importance of self-efficacy in predicting exercise behavior change (McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003). Studies have found that changes in self-efficacy beliefs occurring in a short-term exercise intervention have been significantly and positively related to weight control and exercise participation (Annesi, 2012; Annesi, 2011; Teixeira et al., 2006). In addition, improvement in self-efficacy has been associated with positive effects on exercise and eating behaviors. A weight loss intervention study by Annesi found that improved self-efficacy scores for exercise predicted changes in self-efficacy for controlling one’s eating patterns in a 26 week weight loss intervention among 137 severely obese individuals (mean BMI of 42.2 kg/m²). Annesi (2011) examined the relationships between changes in exercise behaviors, eating behaviors, and psychosocial factors (self-efficacy, mood, and self-regulation) (Annesi, 2011). Participants in the study volunteered to complete a 26-week exercise-support and nutrition education treatment program. Exercise self-efficacy scores (Exercise Self-Efficacy Scale) and self-efficacy for controlled eating (perceived ability to overcome barriers to manage one’s eating) were collected at baseline and at 26 weeks. Authors found that exercise self-efficacy was significantly related to changes in self-efficacy to control emotional eating and overall self-efficacy for controlled eating (p<.001). In addition, independent t-tests indicated a significant improvement of self-efficacy scores from baseline to 26-weeks (p<0.001) [95% CI (2.00, 5.29) t= 4.25] (Annesi, 2011). With these results, Annesi suggests that
exercise may influence weight loss through psychological pathways as well as physiological pathways (Annesi, 2011). Limitations of this study revolve around the time span of data collection, at baseline and at 26 weeks, as no other data collection occurred in between these time frames.

Self-efficacy can also act as a mediator of acceptance of participation and adherence of diet (Horacek et al., 2002) and exercise intervention programs (Toft et al., 2007). In a self-reported cross-sectional study, Horacek and colleagues surveyed 1,438 participants across 10 states about their self-efficacy, perceived benefits, and weight satisfaction for both fruit and vegetable intake. They found that the action/ maintenance stage (fruit and vegetable intake meets target intake) was best predicted by self-efficacy ($p<0.001$ for both genders) and satisfaction with weight status ($p<0.01$ women, $p<0.001$ men) (Horacek et al., 2002). Perceived benefits also increased as participants improved their fruit and vegetable intake (Horacek et al., 2002). This suggests that increasing the number of benefits an individual perceives compares to barriers may increase individuals’ self-efficacy (Horacek et al., 2002).

Toft and colleagues found that self-efficacy predicted acceptance and adherence to diet and exercise intervention (Toft et al., 2007). Authors used baseline data from a randomized non-pharmacological clinical trial in Copenhagen (1999-2001). Of the 2,022 ischemic heart disease subjects offered to participate in a diet and exercise counseling intervention, 922 accepted, and 897 attended a group-counseling course with 15-20 people for 6 meetings (each 2 hours) over 6 months. Through logistic regression analyses, low self-efficacy scores, perceived susceptibility, and motivation toward lifestyle changes were found to be mediators of acceptance and participation in the
intervention program (Toft et al., 2007). The idea that low self-efficacy scores were associated with acceptance and adherence to the intervention was unexpected by authors and may be due to low self-efficacy scorers needing additional help/ intervention, while high self-efficacy scorers may drop out and perform these health promotion tasks on their own (Toft et al., 2007). Limitations of this study revolve around adding the self-efficacy item to the questionnaire midway through the study, and how authors measured self-efficacy, with self-efficacy measured in a general “changing diet and exercise” instead of measuring concrete facts about changing a specific behavior. Hence, results should be interpreted with some caution, as self-efficacy measures were not measured across the entire sample size and specific actions were not explored when examining self-efficacy.

**Implications**

The Health Belief Model can be used with obesity and health promotion strategies. Focusing on the self-efficacy component of the Health Belief Model is one of the many ways that the Health Belief Model has been applied in intervention research to increase physical activity levels and positive dietary consumption patterns. For the purpose of this project, self-efficacy was the behavioral construct used to help better understand non-exercisers’ belief that they are more able to exercise if they have the option to participate in energy harvesting exercise. Motivational factors to increase positive health behaviors may depend on the benefits and barriers to behavior change. Identification of the benefits of and barriers to fruit and vegetable consumption and exercise behavior were also informed by the Health Belief Model. Examining benefits and barriers may provide insight about variables affecting the performance of these behaviors. The literature examined provides evidence of the importance of the
perceptions of benefits of and barriers to access to positive health behaviors, and how these perceptions can affect self-efficacy levels. Identifying the benefits to and barriers of healthy dietary consumption and exercise behaviors can serve as areas that modify and adapt promotion intervention strategies to increase its successes.
CHAPTER 3
DETERMINANTS OF SUSTAINABLE PRACTICES AND BEHAVIORS

Defining Pro-environmental Behaviors

Pro-environmental or eco-friendly behaviors, are those that have a positive environmental impact. These behaviors, primarily aim to decrease carbon footprints and increase sustainable practices. Common examples include recycling, composting, purchasing eco-friendly or sustainable agricultural products (organic or local purchases), conserving electricity, and engaging in positive transportation efforts (carpooling, bicycling, walking, or using public transportation) (Thøgersen & Ölander, 2006; Whitmarsh & O’Neill, 2010).

Sustainable Food Behavior

Farmers Markets

Farmers markets provide consumers with the option to buy fresh fruits and vegetables and other items produced by local farms, such as dairy products, eggs, meats, beverages, crafts. The food is sold directly to consumers by local farms, typically in booths or stands within town or city communities, creating a direct marketing of farm products and personal relationships formed between consumer and the marketer (United States Department of Agriculture, 2013b). According to the 2012 National Count of Farmers Market Directory Listing, 7,864 farmers markets currently operate in the U.S. This represents a 9.6% increase since 2011 (United States Department of Agriculture, 2012b). This increased number of farmers markets has grown mainly due to an increased interest and demand among consumers to support their local communities and to obtain fresh food products (United States Department of Agriculture, 2012b).
Community Supported Agriculture (CSA) Membership

CSA membership allows individuals to buy local and seasonal products including vegetables, eggs, fruits, meat, cheese, flowers, and baked goods (Local Harvest, 2012; United States Department of Agriculture, 2013a). By purchasing a share in a farm, members receive produce weekly throughout the farming season. The variety of produce offered varies weekly USDA data collected in 2007 indicate that 12,549 farms in the U.S reported marketing through a CSA (United States Department of Agriculture, 2013a). It is important to note that CSA membership creates sustaining relationships between members and local farms, which is created by the idea of shared risk. Both members and farmers benefit from this relationship; members benefit from fresh produce and get exposed to seasonal produce, while farmers can market their food and receive payment early in the season to ensure cash flow (Local Harvest, 2012).

Organic Food

Consumption of local and organic foods is the fastest growing food trend in the U.S. Increased number of farmers markets, CSA memberships, and availability at general supermarkets has fueled this trend. The USDA defines the word ‘organic’ as a labeling term that indicates that a food has been produced by specific guidelines and approved methods, “integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance and conserve biodiversity.” (United States Department of Agriculture, 2013c). Specifically, synthetic fertilizers and pesticides, sewage sludge, irradiation, and genetic engineering cannot be used. Approximately $24.8 billion was spent by U.S. consumers on organic food in 2009, contributing to about half of global organic food sales (Organic Trade Association, 2011).
Implications

Identifying the motivations for participating in pro-environmental behaviors is imperative to increase our understanding of why individuals are attracted to participating in these behaviors. There may be a set of common motivational roots and causal factors concerning general conservation that drive participation in recycling, organic purchases, and environmentally friendly transportation efforts, such as bicycling (Stern, 2002; Thøgersen & Ölander, 2006). Identifying a set of common motivational roots may be useful to determine if participating in one behavior (catalyst behavior) causes individuals to adopt other pro-environmental behaviors, creating a “spill-over effect” (Whitmarsh & O’Neill, 2010).

Pro-environmental Identity

A pro-environmental self-identity, which is influenced by personal motivations, social interaction, and expectations (subjective norm), may be associated with participation in pro-environmental behaviors (Whitmarsh & O’Neill, 2010). In a cross-sectional study, a postal survey assessed if environmental behaviors were motivated by a common cause or demographic characteristics among 551 randomly selected participants within the UK public. Authors also examined the influence of pro-environmental self-identity on pro-environmental values, perceived behavior control, subjective norm, attitudes, demographic factors, knowledge, attitudes, and perception of climate change (Whitmarsh & O’Neill, 2010). Whitmarsh and O’Neill found that self-identity was a significant predictor of pro-environmental behaviors, including waste reduction (increasing recycling and decreasing waste production), water and energy conservation, eco-friendly shopping (purchasing energy efficient products), and eco-friendly food...
consumption (eating local foods and decreasing consumption of foods with high environmental impact). Self-identity was found to be a better predictor of behavior compared to pro-environmental values; awareness and concern for the environment did not translate into action of a pro-environmental behavior, which authors explained may be due to a knowledge-action gap about pro-environmental behavior, as none of the pro-environmental behaviors were influenced by knowledge about climate change (Whitmarsh & O’Neill, 2010). Limitations include self-reported response and response bias, along with a cross-sectional design.

Personality characteristics may contribute to defining one’s pro-environmental identity. A study by Markowitz and colleagues examined the relationship between broad personality traits and pro-environmental behaviors (Markowitz, Goldberg, Ashton, & Lee, 2012). One hundred fifteen undergraduate students from a public university in the northwest of the U.S. participated in a broader survey on “behavior explanation”, which included questions to assess personality attributes (Big Five Inventory), connections to nature (CNS), and environmental attitudes (New Ecological Paradigm). Sample demographics include 72% females with a mean age of 19 (age range: 18-31), and 68% of participants self-identified as “non-environmentalists.” Self-reported computer surveys were completed in a lab room consisting of groups of three or four students, with a physical separation from one another. Through regression analyses, “openness to experience” was the only personality trait found to have a statistically positive effect on predicting environmental behaviors (p=0.01), with individuals’ environmental attitudes (NEP, p=0.02) and connection to nature (CNS, p=0.001) most likely acting as the motivators for this relationship. The authors suggest that openness-related motives may
be responsible for driving the adoption or willingness to participate in pro-environmental behaviors, as they can be seen as new, exciting, important, and cutting-edge behaviors to participate in (Markowitz, Goldberg, Ashton, & Lee, 2012). Limitations for this study include its cross-sectional design completed with other participants in the room, which may put some social pressure on participants to answer a certain way. Another important factor to note is that the average environmental concern scales showed that participants had slightly high environmental concern (5-point scale ranging from strongly disagree (1) to strongly agree (5), with mean NEP scores being 3.71 (SD: 0.56) and CNS scores of 3.40 (SD: 0.62), indicating that this sample may not be generalizable.

**Altruism versus Egoism**

Several studies have examined the relationship between self-transcendent (selfless concern) and self-interested (for one’s own advantage or interest) reasons for participating in pro-environmental behaviors (Evans et al., 2012; Richetin et al., 2012). In the first study to test the effect of priming participants (receiving environmental information about carpooling) with different messages (self-transcending or self-interested) on recycling behavior, priming condition was a significant predictor of choice to recycle (p=0.005) (Evans et al., 2012). Eighty participants received course credit from Cardiff University and were randomly assigned to one of three experimental groups: self-transcendent (received environmental information about car-sharing), self-interested (received financial information about car-sharing) and a control group (received neutral information about car traveling). While participants were alone, priming information was given and filler tasks unrelated to the experiment were completed until the end of the study when participants were asked to discard their materials, with a choice to throw
them in a wastebasket or recycling bin. The authors found a significantly higher percentage of participants choosing to recycle within the self-transcendent condition (89%) as compared to the control condition (45%) (p=0.007). A strength of this study was its randomly assigned experimental conditions, which allowed authors to see how participants acted after receiving information dependent on their condition. Limitations may lie with the setup of the waste bins, with positioning of the bins located at different areas of the room--the wastebasket was close to the seat, while the recycling bin was farther away. In addition, the recycling bin had a recycling logo, which assumes that people know what the logo stands for, although this may not be the case.

Richetin and colleagues found that performing and not performing pro-environmental behaviors were influenced by different, not opposite motivations. Among 758 high school students aged 16-22 recruited from 6 high schools in Italy, authors aimed to understand motivations of performing ecological and non-ecological behaviors and the intentions to act on these behaviors (Richetin et al., 2012). In a two-session study, participants were surveyed in maximum groups of 25 (N=758); the first session surveyed goals related to reducing or not reducing resources and measures of Theory of Planned Behavior constructs (attitudes, norms, and perceived behavioral control); the second session involved behavioral measures, including hypothetical behavioral measure (reading two hypothetical scenarios and picking one of the two behaviors, either to reduce or not reduce resource consumption based on a 7-point Likert scale) and frequency of nine performed pro-environmental behaviors (N=409). The most common self-reported main goals for reducing resource consumption were selfless motivations related to the environment, including protect and respect nature (31.6%) and a better
future and well-being of future generations (30.2%). In contrast, many of reported goals for not reducing resource consumption were personal/ self-related, including maintaining lifestyle/ an easy life (54.4%) and seeking immediate pleasure (12.14%). Additionally, both attitudes toward reducing personal resource consumption predicted intentions to reduce and not to reduce resource consumption (p<0.001), while both intentions to perform an ecological and non-ecological behavior were significant predictors of hypothetical behaviors (p<0.001). Limitations of this study lie with the cross-sectional design that did not reflect the role of previous behaviors. Also, study conditions, such as completing the survey in a room filled with other participants, and study questions, which may have favored responses toward reducing behaviors based on the direction of the questions, act as limitations. Study questions may favor biased options due to the saliency of one behavioral option compared to the other (Richetin et al., 2012). Findings from this study suggest that goals of participating in pro-environmental behaviors are more “other” oriented, particularly involving protecting the planet versus self-oriented (Richetin et al., 2012).

Implications

Identifying key/common motivations for participating in pro-environmental behaviors is necessary in order to explore the complex relationship between environmental concern, dietary practices, and exercise behavior. Among these motivations are demographic variables, health concern, environmental concern, knowledge, awareness, and attitudes and belief variables. Understanding characteristics that contribute to the formation of a pro-environmental identity is crucial in order to target individuals who are more likely to participate in pro-environmental behaviors.
**Environmental Concern Predicting Pro-environmental Behaviors**

Environmental concern is one of the most common motivational factors for increased participation in pro-environmental behaviors. The reasons for participating in these behaviors are usually geared toward saving, protecting or respecting nature, to improve the future and well-being of future generations (Richetin et al., 2012) or selfless actions (Evans et al., 2012). In addition, personal responsibility toward protecting the environment has been identified as a motivating reason for participating in household recycling (Vicente & Reis, 2008). Consumers who are environmentally concerned are more likely to have supportive attitudes, beliefs, past behaviors, and future intentions to purchase sustainably produced foods (Nie & Zepeda, 2011; Robinson & Smith, 2002). Environmental concern has been associated with local and seasonal food preference (Lynn Wilkins, 1996) and motivations for joining CSAs (Brehm & Eisenhauer, 2008; Cone & Myhre, 2000). The next logical step is to determine if environmental concern is the common motivational root for participating in pro-environmental behaviors. Increased understanding of the environment and the effects that humans can have on themselves and their environment could serve as a determinant factor for choosing sustainable foods (Lynn Wilkins, 1996). It has also been suggested that increasing participation in pro-environmental behaviors can come from increasing concern about the environment and reflecting on the relevance that pro-environmental behaviors being applicable to everyone (Vicente & Reis, 2008). Hence, making environmental concern relevant to the general population may have the potential to improve participation rates of environmentally friendly behaviors.
Health Determinants Predicting Pro-Environmental Behaviors

Purchasing sustainable foods, particularly organic foods, has been positively associated with perceived benefits for health (Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2003; Schifferstein & Oude Ophuis, 1998). Magnusson and colleagues attribute this belief to previous research findings indicating that consumers view organically labeled foods as healthy, although there is currently no evidence that has clearly established organic food as healthier than other foods (Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2003). Data from 377 household surveys in Minnesota indicated that the main reason for joining a CSA was to gain access to healthy food sources, specifically, organic produce (91%) and fresh produce (90%) (Cone & Myhre, 2000). Health consciousness also affects attitudes toward organic purchases (Michaelidou & Hassan, 2008) and can be a more dominant motive for purchasing organic food than environmental concern (Schifferstein & Oude Ophuis, 1998).

Various studies have found an association between health and dietary intake as determinants for organic food purchases. For instance, in a cross-sectional study, Schifferstein and Ophuis recruited a random national sample of 576 participants and 271 customers of 30 different health stores in the Netherlands. Participants were primarily responsible for food purchases within their household and completed an interactive computer-aided personal interview (completed at participants’ homes) on health-related determinants of organic food consumption. First, the interview assessed consumer characteristics, behavior variables, personality traits, nutrition knowledge and the Health Locus of Control (degree to which a person believes he/she has control over their health), and second, the printed questionnaire surveyed lifestyle characteristics, which assessed
interests and activities, with examples including sports, naturopathy, healthy eating, and politics (Schifferstein & Oude Ophuis, 1998). The most common reasons for health food customers to buy organic foods were to be healthier (93%) and environmentally friendly (91%), indicating that health and environmental preservation were the most important motives for purchasing organic foods. “Alternatively grown” foods were used to indicate “organic” foods within the questionnaire and interview, while “reform” foods referred to food that had minimal industrial processing (Schifferstein & Oude Ophuis, 1998).

Findings from this study suggest that self-reported organic food consumers (responding to “do you ever buy alternatively grown food”? never defined as no; several times a year, several times a month, several times a week, and daily defined as yes) felt that they were more responsible for their health and were more likely to participate in preventive health behaviors as compared to people who do not purchase organic foods (Schifferstein & Oude Ophuis, 1998). In addition, organic consumers in this study were aware that their dietary intake affects their health and were more willing than non-consumers to eat something if it would improve their health, they believed that they know more about nutrition than non-buyers, and appreciated safe, healthy and natural foods (Schifferstein & Oude Ophuis, 1998). Although informative, findings from this study are limited by several factors, including study design (cross-sectional approach); definition of organic (“alternatively grown” was used to denote organic food); potential selection bias (although recruitment was random, it was from a convenience sample)’ and analytical issues (lack of adjustment for confounding, such as age).

The idea that people are purchasing sustainable foods to improve their health is an important construct within which to examine how health determinants can serve as a
common motivational root for participating in other sustainable behaviors. Purchasing sustainable foods and having access to these foods may increase positive health outcomes. Research on establishing farmers markets in new geographic areas examine the potential effects of increased access to these foods may have in lower-income communities where access to fresh produce is limited (Freedman et al., 2012). Through a needs assessment Freedman and colleagues explored the need for farmers markets at federally qualified health centers (n=20, representing 163 practice sites) in South Carolina and identified various indicators for readiness for establishing a market. Data were collected through electronic general interest surveys completed by the Executive Director determined interest in establishing a farmers market at one of their practice sites. Of the six health centers interested in establishing a market, five completed a second survey identifying potential practice sites for an intervention. On-site group interviews with 2-5 key informants were completed among four of the federally qualified health centers. Specifically, the interviews with key informants and staff members assessed the attitude and obstacles toward increasing access to fresh produce within the community, along with exploring the vision for having a farmers market. Five themes related to readiness for establishing farmers markets found include capacity, social capital, awareness of health problems and solutions, logistical factors, and sustainability. In particular, one of the main concerns that key informants discussed was the importance of increasing the health and quality of life of individuals through affordable and healthy foods that can act as a solution to some health problems. The major limitation of the study was the sample size (n=20), which decreases the generalizability of the results for other community health centers. In addition, the study did not examine the relative effect
of each indicator of readiness identified through statistical analyses, although authors hypothesized that each indicator is important and necessary for the success of the creation, establishment, and sustainability of producing a new farmers market within a community health center. Establishing a farmers market within one of these community health centers would not follow the trend of farmer’s markets tending to be located in neighborhoods serving white, middle-aged, middle to upper class, and well-educated individuals (Freedman et al., 2012). Farmers markets may provide an outlet to increase the health of individuals through affordable and healthy sustainable foods may also provide increased benefits for the local economy and environment.

**Associations Between Sustainable Practices and Other Healthy Behaviors**

Assuming that health determinants serve as a common predictor for consuming sustainable food, it is likely that individuals who consume sustainable foods engage in other healthy behaviors, such as exercising. However, few studies were found that examined the relationship between environmental concern, health, and fitness. Of the studies that were found, individuals purchasing sustainable food were more likely to be physically active or participate in exercise compared to non-consumers (Nie & Zepeda, 2011; Schifferstein & Oude Ophuis, 1998; Torjusen et al., 2010). In a study examining health determinants for purchasing organic food among 847 adults, organic buyers were more active in walking/bicycling \((p<0.05)\) and had lower body mass index (BMI) scores compared with non-buyer groups (Schifferstein & Oude Ophuis, 1998). In a research report exploring various lifestyle segmentations including motivations for purchasing organic and local foods, authors Nie and Zepeda examined US food shopping data from 956 individuals in 2003 who participated in a US food consumer survey. Cluster analysis
was used to identify four food-related lifestyle groups that capture general characteristics of consumers, such as attitudes and motivations, including rational, adventurous, careless, and conservative uninvolved consumers. Rational (29.2%) and adventurous (24.1%) consumers were most likely to be active organic food shoppers at supermarkets and farmers markets, value taste and healthiness of food, pay attention to labels on food, have interest in cooking and to follow diets to treat illness or keep fit (Nie & Zepeda, 2011). In contrast, careless (17.9%) and conservative uninvolved consumers (28.9%) were least likely to follow these behaviors and valued convenience. These differences may be due to lack of interest in food attributes, low income, or decreased or no access to these foods (Nie & Zepeda, 2011). These findings indicate that customers who are most likely to be active organic shoppers at supermarkets and farmers markets have higher fitness club membership compared with non-organic shoppers, suggesting that these individuals value the importance of exercise and positive health-related outcomes (Nie & Zepeda, 2011). It is important to note that although these consumers had a 23.89-35.48% (rational and adventurous consumers, respectively) fitness club membership, being a member of a fitness club does not necessarily translate into attending the club or exercise behavior. Additionally, environmental concerns, attitudes and knowledge (defining what organic means) were associated with local and organic food choices, referencing the adventurous and rational groups having higher scores or percentages and were more likely to actively participate in these behaviors (p=0.05). In contrast, conservative consumers had lower organic knowledge scores and participation in environmental groups. Limitations of this study include self-reported cross-sectional data, potential respondent bias, and the fact that authors never defined “active” organic shopping. Although the lifestyle groups
examined provide general observations of these clusters, it may serve as a limitation, as general categories can be specified to provide a more detailed analysis instead of broad groupings of consumers. Implications from this study include various ways to market and promote organic and local foods through emphasizing important qualities, such as taste, nutrition, health, fitness, freshness, and variety, and value.

In a study examining that organic food is healthier compared to conventional foods Torjusen et al. defined characteristics that were associated with organic food consumption during pregnancy in Norway. Data from this study were part of a large cohort (Norweigan Mother and Child Cohort Study; N= 107,000) of pregnant women, with 63, 561 women answering two questionnaires (General Health at gestational week 15 and Food Frequency Questionnaire at 17-22 weeks). The consumption of organic food was the outcome variable, with the sum index (0-18; 0 indicating ‘no use’ and 18 representing ‘mostly’) calculated based on the frequency of consumption (‘never or seldom’, ‘sometimes’, ‘often’, or ‘mostly’) of organic food from the following six food groups: milk and dairy products, bread and cereal products, eggs, fruits, vegetables, and meat (Torjusen et al., 2010). Approximately 9.1% (n=5,754) of the participants consumed organic food frequently, defined as having a sum index greater than 6, which is based on self-reported consumption of at least one organic food group in the “often” category (Torjusen et al., 2010). Women most likely to be frequent organic consumers included: lower (<25 years) and higher (>40 years) of age, normal or low BMIs, vegetarians, exercised regularly (≥ 3 times per week), and consumed alcohol and cigarettes during pregnancy (p<0.001 for all, except alcohol p=0.444) (Torjusen et al., 2010). These characteristics suggest that eating organic food is associated with healthy activities, such
as exercise, but it may also serve as a way to “make up for” engaging in negative health behavior (ex: alcohol and cigarette consumption). These findings are not consistent with previous research about typical “consumer segments”. However, the study is limited by self-selection bias explored and missing answered categories among the survey for respondents completing them, with 20.7% missing a value for one covariate.

Various sustainable food practices have increased individuals’ exposure to fresh produce, which in turn has increased their consumption of fruits and vegetables since enrolling in a CSA and Community Garden Programs (Alaimo, Packnett, Miles, & Kruger, 2008; Litt et al., 2011; MacMillan Uribe, Winham, & Wharton, 2012; Russell & Zepeda, 2008). Focus groups (n=23) and surveys (n=50) were used to examine diet-related attitudes and behaviors among adults in Wisconsin as a result of joining a CSA (Russell & Zepeda, 2008). Common changes included trying new foods and increased cooking knowledge, increased vegetable intake, and improved feelings of healthier eating patterns (Russell & Zepeda, 2008). Individuals participating in Community Gardens have also increased consumption of fruits and vegetables compared to non-participants (Alaimo, Packnett, Miles, & Kruger, 2008; Litt et al., 2011). In a cross-sectional random phone survey study of 766 adults in Flint, Michigan, Alaimo and colleagues found that households with one adult participating in a Community Garden were 3.5 times more likely to consume at least five servings of fruits and vegetables daily compared with non-participants (Alaimo, Packnett, Miles, & Kruger, 2008). Based on these results, it appears that individuals involved in sustainable behaviors have a higher consumption of produce as compared to those who do not participate in sustainable behaviors.
Determinants of Sustainable Food Purchases

Most of the primary research about sustainable food purchases focuses on consumer behavior regarding the purchases of organic and local foods, as well as the underlying motivation driving these purchases. Health reasons, taste, aroma, quality, and freshness are common reasons for purchasing these foods (Lynn Wilkins, 1996; Nie & Zepeda, 2011; Schifferstein & Oude Ophuis, 1998; Tobler, Visschers, & Siegrist, 2011). Shipping costs and burned fossil fuel needed in order to gain access to global foods at all times (in and out of season) increases negative impacts on the environment. Hence, environmental concern may predict sustainable food purchases, due to food production and various global warming impacts created by the demand for unseasonal produce, increasing fossil fuels and air pollution (Lynn Wilkins, 1996). Other reasons for purchasing organic food are linked to consumers’ positive perceptions and increased knowledge of organic production (Nie & Zepeda, 2011; Trobe, 2001). By specifically concentrating on which individuals are more likely to purchase sustainable foods it can be helpful to understand the reasons for such purchases. Identifying a set of common motivational factors that influence food sustainable behaviors, it will help predict sustainable food choices, which may explain differences in participation levels across other pro-environmental behaviors.

Other Reasons for Purchasing

In addition to concern for the environment and one’s health, other reasons cited for buying sustainable foods, such as organic and local foods, include superior flavor and taste, absence of chemical additives and naturalness of food, quality and freshness of produce (Schifferstein & Oude Ophuis, 1998; Svenfelt & Carlsson-Kanyama, 2010; Trobe, 2001). Reasons for participating in CSA memberships include support of local
food sources, creating a sense of community and involvement (Brehm & Eisenhauer, 2008; Cone & Myhre, 2000). Lastly, an additional motivational factor for purchasing products at farmers markets and CSAs is to increase direct contact with the farmer, to gain knowledge, recipes, and engage in social interaction (Brehm & Eisenhauer, 2008; Cone & Myhre, 2000; Svenfelt & Carlsson-Kanyama, 2010).

**Consumer Characteristics**

Typical consumers of sustainable foods are white females with higher income and education than the national average (MacMillan Uribe, Winham, & Wharton, 2012). Other characteristics of organic and local food consumers included people who paid attention to labels on food and follow diets to treat illnesses or keep fit (Nie & Zepeda, 2011). Evidence about age groups more likely to purchase sustainable food products varies. Studies have found middle-aged individuals to be typical consumers of sustainable food, with decreased participation in sustainable food consumption occurring as age increases past middle-aged years (Lockie, Lyons, Lawrence, & Grice, 2004; Lynn Wilkins, 1996; MacMillan Uribe, Winham, & Wharton, 2012; Nie & Zepeda, 2011). As sustainable food production and pro-environmental consumerism evolves, it is important to examine the shift in populations motivated to make such purchasing and how consumer patterns change over time in order to understand the dominant reasons for purchasing sustainable foods.

Women tend to more actively purchase and consume pro-environmental products than men. Mainieri and colleagues examined variables that predict “green buying.” In a cross-sectional survey mailed to middle-class communities in Los Angeles, California, 201 (116 women, 84 men, and 1 unidentified) randomly selected individuals self-reported
their awareness of environmental impact of products, pro-environmental behaviors, environmental beliefs and demographics. Findings were based on data from three attitudinal scales that showed statistically significant gender differences (p<0.02), (p<0.01), and (p<0.04) (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997). Based on reported frequencies of environmental behaviors, t-tests revealed that in comparison to men, women recycled materials more (p<0.01) and were more likely to purchase products they believed were environmentally friendly (p<0.03) (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997). Further evidence from other studies suggest that women are more likely to purchase pro-environmental products, which may be attributable to the fact that they are typically the primary household shopper (Bellows, Onyango, Diamond, & Hallman, 2008; Lockie, Lyons, Lawrence, & Grice, 2004; MacMillan Uribe, Winham, & Wharton, 2012).

Although it is important to focus on who is already buying sustainable foods, it is also crucial to identify those who are interested in buying the products, to understand the barriers that these individuals face and how these barriers can be addressed to increase sustainable food purchases. Bellows et al. (2008) explored consumers and non-consumers of organic food and identified various reasons for participant’s purchasing habits. In a cross-sectional study design, data were collected via telephone interview, and 1,201 participants self-reported their opinions, knowledge of, and awareness of foods and organic production, along with their attitudes toward health, safety, and environmental concern. Opinions and behaviors toward organic food were measured based on how often (never, rarely, sometimes, frequently, or always) respondents bought ‘organic’ labeled food products and a measure of importance of organic food production when deciding
what to eat. Organic purchasers were grouped as ‘always’ or ‘frequently’ purchasing, to create the category of ‘regular purchasers.’ Results add to previously mentioned research noting well-educated and primary household shoppers as primary consumers of organics. In opposition to the typical sustainable food consumer, Bellows and colleagues found that under-represented populations who value organic production (but do not buy organic food) include the religiously observant, less educated, lower income, older, and individuals for whom food plays an important role (bringing a sense of enjoyment or tradition) (Bellows, Onyango, Diamond, & Hallman, 2008). In addition, those with higher self-reported food product knowledge and older respondents tend to value organic products, but do not purchase these products (Bellows, Onyango, Diamond, & Hallman, 2008). Limitations include a cross-sectional study design, two versions of the survey given to half of the participants (identical split), and that data were weighted to reflect 2002 U.S. Census data, meaning the data shows an estimate of distribution of responses rather than a limited distribution based upon the sample. Findings from this study suggest that more attention should be given to those who value organic food production but are not purchasing these products in order to increase the understanding of perceived barriers inhibiting purchases (Bellows, Onyango, Diamond, & Hallman, 2008). In addition, Lockie and colleagues found that although motivations for purchasing organic food and environmental concern were present, it did not translate into participating in that behavior (Lockie, Lyons, Lawrence, & Grice, 2004). Barriers, such as income, accessibility, convenience, and decreased certainty in organic labeling may be among the reasons for not purchasing organic or local foods. Other reasons include the importance of having
selected groups of fruits and vegetables available year round instead of buying just seasonal produce (Lynn Wilkins, 1996; Russell & Zepeda, 2008).

**Knowledge and Sustainable Behaviors**

Knowledge of organic food production has been associated with positive attitudes toward organic food production and organic food consumption. Through a self-reported survey, Teisl and colleagues found that greater knowledge of three food technologies (organic production, biotechnology, and irradiation) was associated with positive attitudes about the technology among 2,186 participants. Selected participants within a household (based on the next-birthday method) completed a telephone-conducted USDA Food Safety Survey, which examined topics such as food safety and knowledge of food pathogens, with an additional section about awareness and attitudes toward food production technologies. Specifically, women were more supportive of organic production than men, and middle-aged participants were more positive about the productions than older or younger respondents (Teisl, Fein, & Levy, 2009). Another study examining farmers’ market consumers found that reasons cited for buying organic food were linked to consumers’ perceptions about and knowledge of organic food production. In a random sampling of 201 customers selected at a farmers market in Stour Valley Farmer’s Market (UK), participants completed self-reported surveys or face-to-face interviews examining reasons customers support farmers markets from an economical point of view (Troble, 2001). In particular, 66% of respondents reported buying organic food at least occasionally, of these 33% believing that organic food was healthier and more natural, and 22% believed it was more flavorful. These studies provide evidence that knowledge of sustainability production and its effects on the
environment may be linked to individuals’ participate in specific pro-environmental behaviors.

Perceptions and knowledge of organic food production can influence individuals’ organic purchases, with common reasons for purchasing including the belief that organic food is healthier and more natural and absence of chemicals and additives. On the other hand, knowledge deficit can lead to the opposite of participating in an environmentally positive behavior, when the information influencing the behavior is false. For instance, knowledge about environmentally-friendly behaviors may not always relate to intentions to perform the behavior, while belief that a behavior mitigates climate change (regardless of accuracy) has been shown to strongly relate to the intention to perform a particular behavior (Truelove & Parks, 2012). One example of a behavior that is environmentally friendly, but is not believed to have a large effect on the environment is decreasing meat consumption. Meat production reduces environmental impact by decreasing transportation pollution and greenhouse production (Tobler, Visschers, & Siegrist, 2011). Tobler and colleagues examined if willingness to consume environmentally-friendly foods and environmental benefits associated with pro-environmental food-related behaviors among 6,189 randomly selected participants in Switzerland. Organic food consumption and decreasing meat consumption were not considered to have a large environmental impact among participants; respondents were more unwilling to reduce their meat consumption or buy organic food, as they found that these behaviors were the least environmentally relevant (Tobler, Visschers, & Siegrist, 2011). Findings from this study suggest that the underestimation of environmental impact may influence participation in a pro-environmental behavior. Truelove and Parks (2012) also found that
knowledge about global warming mitigating behaviors (behaviors that decrease climate change) were not always related to participants’ intentions among 120 undergraduates who completed free-response surveys assessing perceptions and knowledge of behaviors that cause global warming. Belief that a behavior mitigated global warming (regardless of accuracy) was strongly related to participants’ intention to perform that behavior (Truelove & Parks, 2012). Finally, awareness and concern may not necessarily translate into applied behavior due to a knowledge-action gap (what is known and how it translates into an action or applied behavior change) in relation to pro-environmental behaviors (Whitmarsh & O'Neill, 2010). These findings are crucial because they provide evidence of the importance of knowledge and its effects on participating in a behavior that is dependent on individuals’ perceptions.

**Spill-Over Effect**

It is important to identify if participating in one pro-environmentally friendly behavior is associated with participating in other pro-environmental behaviors (known as the spill-over effect) in order to understand connections between sustainable behaviors. Identifying the commonalities between various pro-environmental behaviors may shed light on reasons for this spill-over effect. Pro-environmental values could increase the participation in many pro-environmental behaviors due to the fact that the behaviors may share the same values (Evans et al., 2012). Evans and colleagues suggest that positive spill-over of pro-environmental behaviors occur when selfless reasons for participation are the focus of the behavior (Evans et al., 2012). As mentioned previously, concern for health and the environment are the two most common motivations for participating in sustainable and pro-environmental behaviors (Magnusson, Arvola, Hursti, Åberg, &
Sjödén, 2003). Magnusson et al. found self-reported environmentally-friendly behavior (EFB), such as recycling different materials, saving electricity, purchasing environmentally-friendly products, refraining from driving, and composting, and health concern were statistically significant predictors of purchasing organic food. In a national mailed survey, 1,154 randomly selected participants self-reported their frequency of environmental beliefs and organic purchasing patterns of milk, meat, meat, and potatoes. Results of this study revealed significant correlations between EFB and attitude/behavior variables (p<0.001), with EFB predicting attitudes, the importance of organic production criteria, and frequency of organic purchases. In addition, authors note that health and EFB as predictors were equally important for predicting organic purchase frequency. Limitations of the study include a cross-sectional design and potential respondent bias from participants with interest in organic foods, which may have also decreased the participation rate in the study. Finally, the variables used for organic purchases, which include milk and meat (survey 1) and bread and potatoes (survey 2), although mentioned as staples within the Swedish diet, do not include all food groups and may not be representative of organic purchasing among participants; for example, if a vegan who primarily consumes organic food receives a survey asking questions about milk and meat purchasing, his/her answers will not accurately represent organic purchases of other foods.

In addition, Uribe and colleagues found that ecological sensitivity (attitudes toward ecological preservation and connection to nature) predicted sustainability-related behaviors, such as recycling, purchasing reusable products, using products with little packaging, composting, and using one’s own shopping bags (all p<0.05). The cross-
sectional study surveyed 115 Arizona CSA participants online to identify their attitudes and behaviors toward the environment along with their food consumption and purchasing habits and participation in other pro-environmental behaviors. Attitudes toward ecological preservation and the delicacy of the ecosystem were assessed via the New Ecological Paradigm (NEP) scale, measuring the perceptions of human’s relationship to nature (MacMillan Uribe, Winham, & Wharton, 2012). In particular, the NEP was a significant predictor of sustainable behaviors (p<0.001) in both regression analysis models used in the study. Limitations of the study include data collected from Arizona from a convenience sample, which may not be representative of other CSA communities and the use of some newly created non-validated questions (although pilot-tested). Also, the use of a cross-sectional study design did not capture any behavior changes since joining the CSA, which could identify the specific impact and changes that CSA involvement can have on individuals and families, which in turn can help target increased participation from the individuals who would be interested in joining a CSA program.

Although some research provides common motivating factors for environmentally-friendly behaviors (Schifferstein & Oude Ophuis, 1998; Thøgersen & Ölander, 2006; Whitmarsh & O'Neill, 2010), particularly with organic food consumption and the other consumption behaviors, most research found focuses on motivations for participating in one sustainable food behavior, separating behaviors from one another. It is necessary to find commonalities and differences among pro-environmental behaviors in order to understand reasons for participating in more than one of these behaviors. Attitudes and beliefs toward pro-environmental behaviors and subjective norm are influential predictors of pro-environmental behaviors (MacMillan Uribe, Winham, & Wharton, 2012;
Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2003; Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997; Robinson & Smith, 2002; Truelove & Parks, 2012; Vicente & Reis, 2008; Whitmarsh & O'Neill, 2010). For example, positive beliefs about environmental behavior are significantly associated with pro-environmental attitudes (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997). A number of psychosocial and personal determinants predict pro-environmental behavior. For instance, Vicente and Reis (2008) found that subjective norms had the strongest positive effect on recycling participation in a survey on household recycling (p<0.05) (Vicente & Reis, 2008). In a cross-sectional interview study in Lisbon, Portugal households were randomly selected to identify attitudes toward recycling, the importance of incentives for recycling, recycling participation and beliefs and information on recycling received via media, and demographic data. Authors found that households participated in recycling due to the fact that participants viewed recycling as a personal responsibility, with obligatory feelings towards recycling and guilt towards not recycling (Vicente & Reis, 2008). Households that were ‘indifferent’ to recycling had a negative tendency to participate in recycling. Direct media may increase participation rates as authors found that households that received information on recycling through direct media had a positive effect on their recycling participation (p<0.05) (Vicente & Reis, 2008). Although households were randomly selected, potential respondent bias may have occurred if participants felt any social pressure to respond due to the interview-based design of the study.

Although one determinant may be a stronger predictor than another, it is important to study the interaction among these determinants to identify the commonalities and differences between them to further understand participants of pro-environmental
behaviors. Identifying one common factor, such as environmental concern may not be enough, as Mainieri and colleagues found that although the average participant within their study had a moderate to strong environmental concern, the concern did not necessarily predict or spill over to their environmental purchasing habits and pro-environmental behaviors (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997).
CHAPTER 4
ENERGY HARVESTING EXERCISE

Need for Energy Alternatives

Recent climate change is primarily due to human practices, such as deforestation, some agricultural and industrial processes, and burning fossil fuels to create an energy source (Environmental Protection Agency, 2012). With a majority of greenhouse gas production coming from energy consumption, it has become a governmental and environmental priority to decrease greenhouse gases and our carbon footprint, as climate change affects current and future generations. In an effort to decrease our negative environmental impact, renewable energy sources have been proposed as an alternative to prevent future climate change. Energy alternatives may also have the potential to increase environmental sustainability through awareness of environmental impact and environmentally friendly behaviors. Practicing energy alternative behaviors may give individuals a sense of ‘power’, as they are participating in environmentally beneficial behaviors that will have a role in decreasing climate change (Wall Street Journal, 2007; Gibson, 2011). Hence, it is necessary to explore the various impacts that energy alternatives may have on the climate and individuals’ sustainable behaviors in the future.

Primary Principles of Energy Harvesting

Energy harvesting is the conversion of energy from low-grade ambient energy sources, including environmental vibrations, thermal sources, human, solar, and wind powers into electrical energy (Kompis & Aliwell, 2008) to drive the machine directly or can store it for future use (Dikshit et al., 2010). It is important to note that the energy provided by an energy harvesting source is dependent on how long the energy source (ex:
human) is in operation (Kompis & Aliwell, 2008). The human body can be used in an active manner to produce energy through energy harvesting, by using motion, vibrations, and heat to harvest energy that is otherwise ‘lost’ (Dikshit et al., 2010; A. Jansen & Stevels, 2006); hence the electrical energy created is a renewable resource that can alleviate some of the energy consumption that would come from other non-renewable sources that are harmful to the environment.

**Various Human Energy Harvesting Technologies**

The most promising use of human energy is through the use of techniques to decrease the reliance on charging batteries and electronic wireless devices through electrical energy, creating a longer shelf life of a product, such as MP3 players or cell phones (Dikshit et al., 2010; A. Jansen & Stevels, 2006; Kompis & Aliwell, 2008). Most human-powered devices focus on decreasing the dependence on batteries and external charges through the use of hand motion, such as pushing a button, squeezing a lever, and turning or cranking a handle to power small electronic devices such as controls, cellular phones, radios, and flashlights (A. Jansen & Stevels, 2006). Other promising technologies include using vibrations as an energy source through the piezoelectric effect, an effect where crystals gain voltage (electrical charge) when mechanical stress is applied between the surfaces (The Columbia Encyclopedia, 6th ed., 2012). The piezoelectric effect includes power generating sidewalks and shoes, gyms, workplaces, keyboards, floor mats, and powered dance clubs (Dikshit et al., 2010).

Many energy harvesting technologies take advantage of natural walking movement to create energy (Donelan et al., 2008; Rome, Flynn, Goldman, & Yoo, 2005). Rome and colleagues developed a suspended-loaded backpack that converts mechanical
energy from vertical movement of carrying loads (20-38 kg) into electricity while walking. The device was tested on four participants and generated up to 7.4 watts of electrical energy to power portable devices (Rome, Flynn, Goldman, & Yoo, 2005), which is close to the amount of watts needed to charge a Smart Phone for about an hour (Clean Technica, 2012). Although these findings are promising, the study involved only four participants; therefore, results must be interpreted with caution. Another notable study by Donelan and colleagues examined the energy harvesting performance of a knee-mounted energy harvester prototype. Tested among six male subjects, who wore a device on each leg while walking on a treadmill at a set speed of 1.5 ms\(^{-1}\), the biomechanical energy harvester technology mounted at the knee, aids muscles in performing negative work. The technology assists the deceleration of the joint, while generating electricity at the end of the swing phase (Donelan et al., 2008). Participants produced an average of 5 watts of electricity when walking with one device on each leg, which is approximately 10 times that of shoe-mounted devices. The cost of energy harvesting was less than one-eighth of that for conventional human power generation (p=0.001) (Donelan et al., 2008). Although the device can be improved through different control conditions, the electricity produced allows this method to be used in the future by charging powered prosthetic limbs and other portable medical devices (Donelan et al., 2008). Examples of harvesting technologies using walking to produce energy are limited based on their small sample size the inability to generalize results across the population.

In a review of eco-design and human-powered energy systems, Jansen and Stevels note that changing energy sources through human energy is low compared to other consumer effects of heating and cooling buildings, and transportation efforts to decrease
carbon footprints, but human power can create environmentally conscious products that can sell on the ‘green market’, such as electronics with rechargeable batteries (A. Jansen & Stevels, 2006). Although human powered energy harvesting is a small example, it may have the potential to decrease carbon footprints on a larger level with increased use of harvesting technologies. With this said, various businesses, including fitness gyms and night clubs, are increasingly interested in human energy that can be created by members or users of equipment (Jane Spencer, 2007; Well Home, 2011). In their natural setting, users of energy harvesting technologies can move or exercise naturally, producing usable renewable energy that can power electrical resources, such as lighting, used within the facility (The Green Revolution, 2012).

Greener clubbing can decrease carbon footprints and increase awareness of sustainability efforts. As part of their mission statement, Sustainable Dance Club hopes to create “personal experiences where sustainability and fun are combined” (Sustainable Dance Club, 2011). Released in 2008, Sustainable Dance Floor (SDF) brings awareness to electricity consumption by using renewable energy (human movement) to light up a dance floor within a club, a unique attraction that connects club-goers to sustainable behavior. The piezoelectric crystal dance floor has individual tiles (modules) that are separated into two parts, energy harvesting and lighting. When people step onto the floor to dance, voltage is generated (Paulides, Jansen, Encica, Lomonova, & Smit, 2009). Electric energy produced can be fed back into the electricity grid or into the local LED display on the floor, displaying a light show, where dancers are lighting up the floor beneath them through movement (Sustainable Dance Club, 2011). Specifically, authors Paulides and Jansen examined a small-scale generation system for a sustainable dance
club in Rotterdam, Netherlands. The club has a sustainable dance floor where energy reduction is achieved with the help of its club-goers who light up Light Emitting Diodes (LED) by dancing and jumping on a piezoelectric dance floor. The club has reduced its electrical energy consumption by 30%, due to use of LEDs, rainwater, and smart cooling systems (Paulides, Jansen, Encica, Lomonova, & Smit, 2009). Future improvements to the club’s decreased energy consumption include using harvesting energy for other lighting, sound and disc jockey materials. Hence, a sustainable dance club is a trendy idea that may have the potential to create sustainable behaviors in a fun and enjoyable way.

**Potential for Success**

The potential for success of energy harvesting technologies is dependent on the consumer and participants’ benefits from use of these technologies. Identifying the economic costs, energy output of machines, and comparability to other non-renewable sources are areas to be researched once products have been developed and implemented. From the manufacturers’ position, issues of importance include the cost of production and ownership, matching consumer’s expectations of the capability of the energy harvesting product, and system integrations of an energy harvester to successfully store and produce energy for powering electronics (Kompis & Aliwell, 2008). Noted benefits for the consumer/operator include producing clean and renewable energy, creating a positive environmental impact, and gaining new knowledge/ awareness of human harvested energy. Participation may give individuals a sense of ‘power’ as they decrease their carbon footprints while producing the energy used to power electricity from their own work (Gibson, 2011). From a marketing standpoint, a company’s products may be more attractive to the pro-environmental consumer. Identifying individuals who are more
likely to consume eco-friendly products or participate in pro-environmental behavior may be the best platform for marketing advertisements and campaigns to attract business.

New energy harvesting technologies have focused on producing equipment that is retrofitted to exercise machines, so that fitness facilities can use the energy of its members to decrease their carbon footprint on electrical energy consumption. Although this technology is not a primary source of decreasing energy footprints, the watts produced combined from members adds up to electrical power produced that would otherwise be wasted, with potential to increase in the future if the technology becomes more popular (Gibson, 2011). Citing the electrical power production created through energy harvesting as quite low, Gibson notes that it would take 4,600 people pedaling an entire day to light a home for a year (Gibson, 2011). Currently, there are three front-running companies selling equipment that are retrofitted to aerobic machines, such as stationary bicycles and elliptical machines (Gibson, 2011). These companies include ReRev, Human Dynamo, and Green Revolution. During vigorous exercise the average person can produce 50-150 watts during an hour period, with 100 watts being equivalent to producing 2 hours of laptop power or an hour of powering a fan (Gibson, 2011). Of specific interest is Green Revolution, a company founded in 2007, which produced a patent-pending generator retrofitted to stationary exercise bicycles. ENERGIA Studios, a partner in this project, is one of 70 facilities in the United States using Green Revolution’s energy harvesting technology. The energy created by a typical group exercise cycling class with 20 bicycles averages 3KW, which is equivalent to running central air for an hour (Well Home, 2011) if it runs four classes per day, has the potential to create approximately 300KW per month, equivalent to the amount of energy needed to
light an average home for half a year (The Green Revolution, 2012) and a carbon reduction of 420 pounds (Well Home, 2011). Energy produced is connected to an electrical power grid, putting energy back on the grid created by human exercise. The higher the resistance set on the bicycle, the more electric energy and calories produced. Riders should not notice many differences in the riding bike compared to a bike without the technology, except for the generator attached to the front of the bike at the flywheel. Other slight changes include a different monitor controlling resistance and calculating the number of watts produced by each member in a cycling class showing on each bike’s display (The Green Revolution, 2012). Energy output is also seen as a class, with an LED display showing how many watts the entire cycling class is producing as a total, with numbers fluctuating on a bar throughout the class. These displays may inspire or motivate exercisers to increase their performance in order to generate more energy.

In a gym setting, energy output of harvesting machines are quite low compared to the amount of energy gyms may use, yet the technology still creates an opportunity for gym members to produce energy and have some, even if considered small, environmental benefits. Although the economic costs to purchase equipment may not currently prove to be beneficial for the gym owner, energy harvesting exercise may serve as a marketing angle to make gym members feel even better after exercising, as their exercise produced usable and clean energy. Hence, the equipment may increase exercise participation based on personal and selfless benefits. Identifying gym members’ attitudes and beliefs toward this technology along with examining the effects that this technology may have on one’s exercise participation or performance is a particular area of interest. Examining the use of various conversions of watt equivalents, such as time spent exercising equaling powering
a fluorescent light, laptop, MP3 player, etc., that may be more applicable to participants in energy harvesting exercise could be a great marketing tool, targeting specific interests. It is important to identify reasons for attraction to energy harvesting products for those who participate in these exercise or other pro-environmental behaviors. Specifically, it is crucial to study the effects that energy harvesting may have on spill-over pro-environmental behaviors, as awareness efforts may increase through producing clean renewable energy sources.

Although no published data examining energy harvesting exercise as a pro-environmental behavior were found, unpublished grant research and feasibility projects have been completed by various universities, including California Polytechnic State University and Virginia Commonwealth University. For instance, Harris and colleagues examined the effect of energy harvesting equipment as a tool for increasing energy conservation education at Albion College (Environmental Protection Agency, 2012; Harris, et al., 2008). Through modifying bicycle and elliptical machines, researchers were able to increase the efficiency and utilization of energy created with their energy harvesters, while increasing participants’ knowledge and understanding of renewable resources. Authors created the Calories to Kilowatts (C2K) program and examined their educational program while evaluating awareness of energy conservation among college students. In the study by Harris and colleagues, researchers found an increase in knowledge and understanding of renewable resources along with an increase in the number of subjects who participated in positive environmental behavior as a result of the intervention. This research by Harris and colleagues explores the potential of energy
harvesting technology to act not only as an alternative energy resource, but also as an educational tool to increase knowledge and other pro-environmental behaviors.

**Future Implications**

Energy harvesting exercise is a fairly new concept; therefore, there are gaps in the literature examining the effects of energy harvesting on exercise performance along with the attitudes and beliefs about this form of exercise. Limitations of studies include small sample sizes and cross-sectional study designs, which limit the generalizability and knowledge of the long-term determinants of energy harvesting over time. Determining if there is a desire or a need for energy harvesting equipment will help shape the success of this new and innovative technology that can decrease one’s carbon footprint. Understanding the economic and environmental value of energy harvesting equipment is unknown, and the importance of environmental designs geared toward ‘green-marketing’ is fundamental to identifying the potential this form of exercise may have.

There is a need for increased exercise participation, so it is necessary to identify specific motivating factors that have the potential to stimulate exercise activity among general and specific populations. Segar and colleagues mention that it is crucial for healthcare professionals and providers to improve communications to the public to market exercise participation a desired act by the individual (Segar, Eccles, & Richardson, 2011). Marketing may be done by creating a “hook” to generate interest or by “rebranding” exercise as a way to enhance quality of life and decrease prevalence of disease (Segar, Eccles, & Richardson, 2011). No known studies examine energy harvesting exercise as a motivator to increase exercise participation specifically in the context of potential environmental threats. Energy harvesting exercise is a behavior that
can decrease an individual’s carbon footprint, which makes the benefit not just for the individual, but also for the environment and the population as a whole. Also, it is important to identify characteristics, such as sustainable behaviors and dietary consumption of fruits and vegetables, that define the people who are participating in energy harvesting exercise and to learn how this type of exercise has affected their personal activity habits. Finally, because it is beneficial to sustain physical activity habits, this study examined the effects of energy harvesting exercise on maximizing exercise participation and performance via a pro-environmental motivator.

**Conclusion**

Limited research has examined the demand for energy harvesting technology, the environmental impact of such technology, or the economic and environmental effects of energy harvesting and other green technologies. Future research identifying the feasibility of increasing access to energy harvesting technology and the success of such technology is needed.
CHAPTER 5

GAPS IN THE LITERATURE

In an effort to understand if energy harvesting exercise can be used as a motivating factor to increase exercise participation, it is necessary to explore the relationship between concern for the environment and participation in sustainable behaviors and practices and how it translates to involvement in dietary practices and exercise participation. Understanding this relationship will help guide future interventions targeting specified populations that value environmental concern to increase participation in energy harvesting exercise. Because few studies have examined the association between exercise behavior and environmental concern, this project will examine if energy harvesting exercise can serve as a motivator to increase exercise participation based on the proposed susceptible threat of the environment.

Common methodology in researching environmental concern, sustainable purchases, and fruit and vegetable consumption patterns focuses on cross-sectional data collection. Cross-sectional data captures behaviors surveyed at one point in time and does not involve any intervention methodology or measures of changed behaviors. The current study uses a cross-sectional design to be comparable to other studies. A gap in the literature that was filled is in defining purchasing consumption patterns, which vary across different studies examining eco-friendly behaviors and sustainable food consumption. Definitions of organic food consumption and purchasing patterns were based on standard USDA recommendations for organic and sustainable purchases.

This study will address the gap and identify the effects of energy harvesting exercise on exercise participation among those who participate in energy harvesting exercise and
other non-exercising individuals. It also will provide further information about the relationship between environmental concerns and how they translate into specific dietary (fruit and vegetable consumption) and exercise practices.
CHAPTER 6

PURPOSE

The purpose of this study was to assess the relationship between level of concern about the environment, sustainable practices (environmentally friendly behaviors), exercise habits and dietary (fruit and vegetable) intake among non-exercising adults. Few studies have examined how environmental concern may affect dietary and exercise habits. Therefore, this study provides additional insight about the relationship between these variables among exercising and non-exercising adults who may have a vested interest in environmental protection and concern. Energy harvesting exercise produces electrical energy from human exercise. Because it is new, the exercise equipment is not commonly found among regular fitness centers and facilities. By using environmental concern as a perceived threat by individuals, results from this study will examine the extent to which energy harvesting activities may act as a motivational factor to increase exercise participation among adults.
CHAPTER 7

RESEARCH QUESTION, SPECIFIC AIMS, AND EXPECTATIONS

Overarching research question: What is the relationship between environmental concern, fruit and vegetable intake, and exercise behaviors? Our central hypothesis is that exercise behaviors are associated with other healthy behaviors. Specifically, exercise behavior is associated with the concern for the environment, environmentally friendly and sustainable practices, and fruit and vegetable intake. Figures 2 and 3 illustrate the overarching research question and specific aims based on the relationship between environmental concern, exercise behavior, and fruit and vegetable intake. To address this central hypothesis, the following specific aims and specific expectations were posed:

Specific Aim 1: To investigate whether energy harvesting exercise related self-efficacy is associated with environmental concern among non-exercisers.

Expectation 1: Self-efficacy levels regarding participation in energy harvesting exercise will be higher among non-exercisers concerned about the environment compared to non-exercisers who are less concerned about the environment.

Specific Aim 2: To assess the association of environmental concern on sustainable fruit and vegetable purchasing habits among exercisers and non-exercisers.

Expectation 2: Sustainable fruit and vegetable purchasing habits, including environmentally sustainable, organic, and local purchases are associated with environmental concern.

Specific Aim 3: To assess the association of personal health on sustainable fruit and vegetable purchasing habits among exercisers and non-exercisers.

Expectation 3: Sustainable fruit and vegetable purchasing habits, including environmentally sustainable, organic, and local purchases are associated with personal health concern.

Specific Aim 4: To assess the association between fruit and vegetable intake and participation in sustainable practices among exercisers and non-exercisers.
**Expectation 4:** Consuming the recommended fruit and vegetable intake (defined as consuming ≥5 fruit and vegetable servings per day) is positively associated with sustainable practices.

**Specific Aim 5:** To assess the association between recommended fruit and vegetable intake and exercise behaviors.

**Expectation 5:** Consuming the recommended fruit and vegetable intake is associated with exercise behavior.
CHAPTER 8

METHODS

Overview of Study Design

Phase 1: A convenience sample of adult members of the ENERGIA Studio participating in energy harvesting exercise participated in focus groups. Members completed an informed consent prior to completing a demographic survey and participating in focus groups (See Appendix A for Focus Group Guide). Focus group guidelines were reviewed at the beginning of the focus group and written on a large poster board. Comfort level was assessed by the note taker and was based on study subjects’ verbal and non-verbal cues. Participants were reminded that all responses were appreciated and respected by researchers and participants within the room.

The demographic survey (Appendix B) assessed gender, age, education, and household income. In addition, the survey measured personal health ratings, exercise habits, and fruit and vegetable intake. Individuals reported sustainable behaviors from a checklist (twelve behaviors total). Personal health concern questions included health rating (excellent to poor); how much individuals worry about their health (‘not at all’ to ‘all the time’); how worrying about their health affects their eating habits (‘not at all’ to ‘all the time’); and smoking and supplement use (National Cancer Institute, 2013). Finally environmental concern (‘not at all’ to ‘all the time’) was measured.

Fruit and vegetable intake was also reported via demographic survey in response to questions asking how many ½ cup servings of fruits or vegetables were consumed daily (separately) (National Cancer Institute, 2013). Fruit and vegetable consumption was self-reported by participants within the focus group discussions, based upon serving size.
examples discussed within the focus groups. After reviewing the focus group guide used for focus groups one and two, the author noticed that there were no questions within the guide addressing the benefits of fruit and vegetable consumption. Changes were made to address this by asking participants what positive experiences or benefits that they have had from consuming fruits and vegetables. Benefits of fruits and vegetable consumption were added to the survey portion (phase 2) of this study to explore this issue more deeply.

Three main topics were examined in the focus groups: 1) perceived effect of energy harvesting exercise on the environment and its ability to act as a motivating factor to increase exercise participation; 2) participation in sustainable behaviors and attitudes toward energy conservation and environmental concerns; and 3) perceived benefits of and barriers to fruit and vegetable consumption and exercise behavior. In addition to examining these benefits and barriers among non-exercisers, a comparison of how Permaculture members (non-exercisers) and ENERGIA members (exercisers) view these benefits and barriers can be made to understand different contributors to exercise behavior and fruit and vegetable consumption. A graduate student (DH) facilitated the focus groups, and an undergraduate research assistant, who has worked in the area of energy harvesting exercise and its effect on exercise participation, observed and took notes. Both had been trained in focus group methodology. Each group discussion was audio-recorded using both a tape recorder and iPad (using the Super Note app) with permission. All focus group data were transcribed verbatim by the author and coded to identify emergent themes and selected quotes. After each focus group, data were reviewed and modifications to the interview guide were made as needed to clarify questions or enhance the flow of discussion. For example, barriers to consuming fruits
and vegetables were addressed in separate questions (rather than combined) for groups 3 and 4 to identify any differences between fruit and vegetable barriers. Data from the focus groups were used to inform phase 2—a survey examined the relationship between environmental concern, exercise habits and dietary practices.

**Phase 2:** Thirty-nine study subjects were purposefully recruited in August and early October from the UMass Permaculture Facebook group and Twitter page. Benefits of and barriers to consuming fruits and vegetables and engaging in exercise were assessed in addition to the demographic, personal health, environmental concern, sustainable behaviors, exercise habits, and fruit and vegetable intake questions previously mentioned in the ENERGIA survey. All questions examining benefits and barriers had a “check all that apply” answer format except for barriers to consuming organic fruits. Environmental concern was based on self-reported responses to the question “How concerned are you about environmental issues?” with response options including all the time, quite a bit, somewhat, a little, or not at all. Exercise habits were self-reported and determined by response to the following question, “In general, do you spend at least 150 minutes (2 hours and 30 minutes) participating in moderate physical activity per week? Moderate intensity activities make you breathe somewhat harder than normal and raise your heart rate.” For the purpose of this study regular exercise was based on the *Physical Activity Guidelines for Americans*, defined as completing 150 minutes of moderate aerobic exercise (United States Department of Health and Human Services, 2008). Any amount of exercise less than these recommendations was defined as irregular exercise. In addition, study participants could not have any pre-existing health conditions that would impede on their ability to exercise, which was defined as any perceived health condition
that may prohibit exercise. Participants completed an online informed consent before completing the online survey (Appendix C) via SurveyMonkey that examined the relationship between sustainable habits, fruit and vegetable intake, environmental concern, health concern, and exercise behavior.

**Setting and Participants**

ENERGIA Studios is a fitness club that offers strength and cardiovascular training classes. Specifically, ENERGIA provides SPINNING® classes on their energy harvesting bicycles. Focus groups were conducted at ENERGIA Studios to ensure comfort and convenience. Discussions 1, 2, and 4 were held in a quiet room at ENERGIA with closed doors in order to record participants clearly. Discussion 3 was held outside of ENERGIA, as the studio was unavailable for use at the scheduled focus group.

The UMass Permaculture program creates sustainable low-maintenance gardens from recyclable materials and grass lawns (UMass Dining, 2013). Because these individuals are interested in permaculture, it is possible they may be interested in environmental causes and sustainable practices as well. If so, they may also be interested in participating in energy harvesting exercise based on their individual perceptions of environmental concern. All research procedures were approved by the UMass Amherst School of Public Health and Health Sciences Institutional Review Board (Appendices D, E and F).

**Study Population and Recruitment**

The study population was drawn from convenience samples of ENERGIA and UMass Permaculture members. ENERGIA participants were recruited via email, Facebook, and by front-desk sign-up sheets for focus groups. Recruitment lasted from
June to July. Focus group dates were set in advance and participants signed up for a date most convenient for them. Participants were sent a reminder of their scheduled focus group date and time the day before the meeting. Reminder messages were sent by email. UMass Permaculture has approximately 3,000 Facebook members who have “liked” or “friended” UMass Permaculture on Facebook (UMass Amherst Permaculture, 2013). Participants were recruited to complete a 10-minute survey via SurveyMonkey, which was linked to UMass Permaculture’s Facebook and Twitter pages. Recruitment lasted from August to early October. All willing and eligible individuals completed an informed consent to participate in the focus group (ENERGIA sample) or online survey (UMass Permaculture members) portion of this study.

**Incentives**

Focus group participants received an ENERGIA t-shirt or a $10 UMass Campus Store gift card after completing the group discussions. Survey participants were invited to provide their email to be entered into a raffle for a chance to win a $10 UMass Campus Store gift card after completing the survey.

**Analysis**

**Qualitative Data**

Qualitative data collected from focus groups can be used to inform future studies and generate hypotheses. Focus groups were created in the 1950s to stimulate group discussions in a social context to inform consumer decisions based upon product preferences (Patton, 2002). Focus groups are often used in health-related studies to understand individuals’ experiences of health conditions and compliance with preventative-health recommendations (Bender & Ewbank, 1994; Kitzinger, 1995)
Findings gained are used to inform healthcare providers of various health promotion techniques. Using a semi-structured interview guide, facilitators can guide the discussion, but also leave room for unexpected and useful comments from participants (Patton, 2002). Participants can hear others’ responses and provide additional opinions about topics discussed, taking everyone’s view into consideration (Patton, 2002). Hence, shared opinions and differences of opinions can be discovered. Specifically to this study, participants may benefit by learning more about how they and others feel about and participate in diet and activity-related sustainability efforts. Other personal benefits include the potential for new awareness and knowledge about energy harvesting exercise. Qualitative methods were used to identify emergent themes (themes used to understand findings that may inform the explanation of patterns found in the discussion) based upon responses within focus groups (Patton, 2002). Qualitative data gathered informed the survey completed in phase 2. Transcriptions of focus group discussions were transcribed verbatim by the author and organized and coded to classify and label data (Patton, 2002). Data were reviewed after each focus group by the primary investigator and other members of the research team, with changes made after discussion 1 and 2 to ensure that the guide was clear and comprehensive for discussions 3 and 4.

**Quantitative Data**

Quantitative methods were used to evaluate demographic data and to address all specific aims. Survey data were reviewed from the SurveyMonkey poll. The author entered all data (from demographic and phase 2 surveys) into Microsoft Excel and imported it into SPSS 22 for analysis.
Descriptive statistics were run on demographic data. Kruskal-Wallis tests were performed to measure continuous outcome data with categorical independent variables. Fisher’s Exact tests were used to measure categorical outcome data with categorical independent variables. Significance was set at p < 0.05. Variables were defined with their corresponding specific aims and proposed analyses in Table 1.
Qualitative data were collected in July 2013 through a series of one-hour focus groups using a semi-structured interview guide. Three scheduled focus groups were cancelled due to lack of sign-ups. Overall, four focus groups (three female/one male) were conducted. Twelve participants completed the group discussions with the following distribution in each group: three females (group 1), three females (group 2), one male (group 3), and five females (group 4). Participants were between 18-70 years old and did not have any pre-existing health conditions that would impede their ability to exercise. The average completion time for focus groups was approximately 36 minutes and ranged from 27-42 minutes.

A majority (91.6%) of focus group participants were female (n=11). Ages ranged from 18 to 70 with half of study subjects aged 50-64. Nine participants self-identified as Caucasian, one participant identified as African American, and one participant identified as both Caucasian and Hispanic/Latino (other). Education level was self-reported as highest level of schooling completed. Two-thirds (66.7%) reported a graduate education, followed by a four-year degree (25%), and some college (8.3%). Household income ranged from $20,000 to $150,000 or more. Table 2 provides a summary of demographic data.

Seven people exercised in a SPINNING ® class prior to the focus group sessions. Although no one left the group nor refrained from speaking, levels of discomfort were found based upon body language cues, such as crossing arms. Disruptions due to focus
group settings, such as interfering noises from the telephone, or setting displacement, were noted in focus groups three and four.

The author was interested in understanding what drew participants to ENERGIA. Reasons mentioned included location, instructors, and recommendations from others. Exercise preferences were also measured, with a majority of participants favoring a group class (75%), followed by with a friend (16.7%), and alone (8.3%).

**Exercise versus Physical Activity**

Reactions to the words ‘exercise’ and ‘physical activity’ were noted at the beginning of the focus groups. For the purpose of this paper, the term “exercise” was used to describe all activity. Exercise was defined as something that took work and effort in order to complete for a specific goal, such as increased fitness. In contrast, physical activity was viewed as something that was fun or involved doing daily tasks, or being in motion. For instance, one participant stated, “I would probably say that exercise to me is something that I have to do and physical activity can be more fun”. Participants’ responses are shown in Table 3.

**Benefits of Exercise**

Benefits of exercise were discussed, including weight management or weight loss, increased fitness, increased muscle tone or mass, stress management, and enjoyment (topics initiated by the interviewer). When asked which of these benefits was most important, increased fitness (50%) was mentioned most often, followed by stress management (25%), weight management or weight loss (16.7%), and increased muscle tone or mass (8.3%). No participants noted enjoyment as the most important benefit of exercise. Other benefits initiated by participants included mind/body connection, feeling
better mentally and physically, and having a sense of accomplishment once exercise is completed (see Table 4).

**Barriers to Exercise**

Barriers to exercise were also discussed, including lack of time, access, interest, or encouragement from others; cost; feeling uncomfortable; and physical strain or work (topics initiated by interviewer). Additional barriers mentioned by participants focused on feelings of intimidation, discomfort and inability to make exercise a priority. One topic that generated much discussion focused on life-interfering events that caused participants to get off track from their exercise routine and the challenges of exercising again after a prolonged break. As one participant said, “I get totally discouraged and then I think “ohhh I can’t do this [exercise]” and then it takes me a while to pull yourself back into the “oh yes I can [exercise].” Other factors, including, injuries, illness, laziness, weather, distance to the gym, burnout, and lack of parking were also noted in focus groups but did not generate a large discussion. Barriers and selected quotes are shown in Table 5.

**Strategies to Overcoming Barriers to Exercise**

To understand how and why participants were exercising despite these barriers, personal strategies were also discussed (Table 6). Recurrent themes that emerged included creating a positive influence for others, setting up a routine and finding financial means to exercise. Recognizing that the benefits of exercise outweigh the barriers was also mentioned, as one participant said, “Sometimes it’s the last thing in the world that you want to do is like exercise, but then once you make the connection between how much it helps you that kind of helps you get over that.” Creating a social environment, such as working out with a buddy and knowing other members at the gym, helped decrease
feelings of intimidation. Finally, personal accomplishments, such as finding a mind/body connection were mentioned as a way to overcome barriers to exercise.

**Benefits of Fruit and Vegetable Consumption**

Half of exercisers met the daily recommendation of consuming greater than or equal to five servings of fruits and vegetables. Prompts (initiated by the interviewer) addressing benefits of fruits and vegetable consumption were added to the focus group guide after they were not discussed in focus groups one and two. Benefits of fruit and vegetable consumption did not generate much discussion within focus groups three and four, and as a result, ‘health’ and ‘feeling better’ were the only benefits mentioned to consuming fruits and vegetables.

**Barriers to Fruit and Vegetable**

Barriers to fruit and vegetable consumption included accessibility, ability to prepare/ cook them, taste, and shelf life (topics initiated by the interviewer). See Table 7 for themes. Cost, specifically related to organic fruits and vegetables, was the most often discussed barrier. One participant explained, “It’s so much more expensive to buy healthy,” and another participant stated “Sometimes [I purchase organic] but again, cost is a factor there, and though in our heads we can see the value it’s not always the easiest choice to make.” Taste also emerged as a significant barrier affecting participants’ fruits and vegetable purchasing habits in relation to specific seasonal selection. Another barrier (initiated by participants) was lack of desire to consume fruits and vegetables, as one participant noted that he “tires of vegetables.” Another talked about her struggle to try new selections before finding ones that she enjoys eating. Two individuals described having intestinal conditions that impeded their ability to consume produce, specifically in
raw forms. Finally, one participant mentioned high carbohydrate content and increased calories as a barrier to consuming fruit, because she felt they negatively influenced her weight management and weight loss techniques.

**Energy Harvesting**

Participants were asked why they engaged in energy harvesting exercise and in particular what their thoughts and opinions were toward energy harvesting. All focus participants had a positive reaction to the energy harvesting equipment and initiative. Common responses were that the technology was interesting, creative, and smart. As one participant said, “I just think it’s pretty smart to put the energy that we are making somewhere. And I just think it’s so smart because I’m just really interested in how… efficient this can be and it just made me think of how many other spinning classes I’ve been to and how creative this is.” Other participants expressed reactions to the technology this way, “And if it’s truly helping the electrical bill here… I think that’s great.” and “When I really think ‘oh I just created more energy’ that’s kind of cool.”

Some participants described how novel and innovative the energy harvesting technology was and its potential to help with the current energy crisis. One participant mentioned, “I find it to be really innovative… I see nothing impractical about this. So I like it,” while another stated, “The whole notion of, that we have limited resources and if there’s ways that we can cut back on our overall consumption, and if we’re all working hard and generating something… It’s great that we can harvest that and actually use it.”

In addition, one participant described the potential health promotion and energy conservation effects of energy harvesting exercise this way, “Well, it’s a great idea… I
mean just think we could solve the energy crisis and the obesity crisis in the United States.”

Interestingly, none of the participants knew about the energy harvesting technology/equipment before attending ENERGIA studio. Although the equipment produced positive responses and reactions, some participants mentioned that it was not a driving factor to get them to ENERGIA, nor was it a reason that they would choose ENERGIA over another studio. For instance, one participant mentioned that he had attended ENERGIA before and after the technology had been installed and said, “I think it’s kind of cool but… I don’t know if that would have, if there were a lot of options, would I have chosen this because of that? I doubt it.” Another participant mentioned, “It’s cool. It’s neat, but it’s not the reason why I come here.”

As illustrated in the following quote, many participants did not understand what the technology actually does, and how the energy created was being used: “In the grand scheme of things I would be interested to know what [the owner] gets out of all of this. You know we are working hard, is it paying off for [the owner]? And I’ve never gotten any of that feedback.” Misunderstanding or lack of knowledge about energy harvesting technology was a recurring theme mentioned in all focus groups. Although there was a lack of knowledge about energy harvesting technology, the general consensus was that participants enjoyed the features of the technology and valued the technology’s purpose of reducing carbon footprints.

**Visual Displays of Energy Produced**

ENERGIA provided two displays of energy production, which represents exercise effort and performance on both an individual and class level. Each energy harvesting bike
is equipped with a watts display that measures how many watts an individual produces during a SPINNING ® class. An LED screen (mounted on the wall facing exercisers) displays energy production based on the entire class’ performance. Participants were asked if they paid attention to the visual displays of energy produced during their energy harvesting workout. In three out of four focus groups (1, 2 and 4), participants initiated discussion about the watts display. All mentioned that they noticed the display on their bikes, with participants describing how it affects their personal workout in a positive manner. Participants described the individual watts display as a personal motivator, which challenged them to aim for a higher number of watts produced each class.

Monitoring energy production on these displays provided instant feedback and another metric to measure exercise performance. As one participant succinctly stated, “I just created more energy.” See Table 8 for participants’ reactions to the watts display and selected quotes.

The LED screen located at the front of the class also served as a motivator for some participants, although not as much as the watts display. As one participant stated, “If the instructor is making reference to the big display [LED], “You know, ‘okay as a class we want to hit this goal’ then okay I’ve gotta step it up a little with everybody else. But I generally don’t watch it.” In addition some participants expressed confusion about what it meant, with some wanting to know more about it and have instructors reference it more often. In summary, discussions found that energy harvesting displays were used by participants to monitor their exercise intensity.
Conversions Reaction

After participants discussed the visual displays of energy production, they were asked if it would be helpful to know some ecological unit conversions to show how their effort was paying off. For instance, knowing that exercising at a specific intensity for a certain time period (producing watts) could charge their laptop or their cell phone. This idea generated positive reactions and was deemed a “cool idea” in all four focus groups. As one participant said, “Yes! That’s how I think.”

Interestingly, one participant knew about a conversions paper provided by ENERGIA and Green Revolution (energy harvesting technology manufacturer), which are posted in a window at ENERGIA. Although most thought it was a good idea, one participant mentioned that converting watts into money was useless, as she stated “I like those [conversions] as long as you don’t covert it to how much you would pay for electricity because it ends up being nothing.” In general, the consensus among focus group participants was a desire to see unit conversions translated into something they could understand. In other words, feedback that is not based on a number (watts), but on an act performed using that energy.

Climate Change and Sustainability

Thoughts about climate change and renewable resources were discussed among participants. In general, there was a positive reaction toward conserving energy and promoting sustainable behaviors. Some participants mentioned climate change and spoke about the importance of sustainable behaviors. For instance, one participant said, “I think it’s important… We are now just destroying the planet you know…It’s just insane.” Another participant mentioned, “Fossil fuels. We just burn too much of them.” Other
statements addressed the fact that sustainable practices are more common now. As one participant stated, “I’m so glad it’s cool. When I was a kid it was really seen as though… it wasn’t mainstream, and I think it’s fascinating to see how it’s become so mainstream.” The discussion about climate change brought up some eco-friendly behaviors that participants engaged in to help the environment, such as solar power and purchasing local foods. In addition, some participants discussed small ways they contribute to decreasing their carbon footprint, such as recycling regularly.

Although most (n=11) participants expressed positive responses about the importance of energy conservation and renewable resources, the one individual who had mixed feelings put it this way, “I’m not 100% sure I’m on the whole green movement yet… I see that it can be a lot more efficient to use wind or solar, but it’s just not typical enough for me for me to really want to take in.” Finally, some participants discussed the fact that sustainable practices are popular because of the environment they live in, noting that western Massachusetts has a strong appreciation for sustainable practices, “I recycle. Composting is definitely big in Massachusetts. I’m from New York and it’s definitely not that big there because I didn’t know about it until I got here.”

**Participation in Sustainable Behaviors**

Environmental concern was examined to determine the effects this concern might have on exercise behavior, fruit and vegetable intake, and on participation in sustainable behaviors. Participants were asked how concerned they are about the environment. Eight participants (67%) answered ‘quite a bit’, three said ‘somewhat’ (25%), and one participant (8.3%) answered ‘a little.’ None of the study subjects answered ‘not at all’ or ‘all the time.’
Sustainable behaviors were discussed within the focus groups and self-reported on the demographic survey. Participants were asked to describe all the sustainable behaviors they participated in. Everyone (100%) said they recycled, nine participants (75%) purchased local foods from Farmers Markets, six (50%) purchased organic foods, and four participants (33%) owned a CSA share. Behaviors measured within transportation efforts to decrease carbon footprints included walking or bicycling (33%), taking the bus (16.7%), carpooling (33%), and owning a hybrid vehicle (16.7%). One-third (33%) used energy alternatives (such as wind or solar power) and composted. One-quarter (25%) owned or shared a garden and one participant volunteered in a community garden.

**Phase Two**

**Study Sample**

Through an online survey, phase two examined the relationship between how environmental concern translates into exercise and dietary practices among irregular exercisers. Thirty-nine members of UMass Amherst Permaculture participated in the survey portion of this study. Participants were between the ages of 18-70, and self-reported having irregular or no exercise routine and no pro-environmental beliefs. In addition, respondents did not have any pre-existing health conditions that would impede their ability to exercise. Individuals were excluded if they were not concerned about the environment or were regular exercisers. Of the 39 members, 16 qualified to complete the entire survey, a total of 15 completed the survey. All members answered the screener questions (environmental concern, academic major, and exercise participation) (Table 9) and demographic questions (Table 10).
Demographics

Participants were recruited from UMass Amherst Permaculture’s social media pages (Facebook and Twitter), which have approximately 3,000 followers. The majority of participants were white (94%) and female (80%). Almost one-third of participants were college students (30.6%) or had completed a four-year college degree (30.6%). Table 10 provides demographic information for participants’ age, race, gender, education and household income.

Benefits of and Barriers to Exercise

This study examined exercise behavior to understand responses to benefits and barriers among individuals who currently do not meet the physical activity recommendations presented by the Physical Activity Guidelines for Americans (United States Department of Health and Human Services, 2008). Positive or good experiences as a result of exercising included: increased muscle tone or mass (73.3%), weight management or weight loss (66.7%), increased fitness (66.7%), stress management (66.7%), and enjoyment (40%). Benefits of exercise are provided in Table 11. Barriers that discouraged or prevented participants from exercising were: lack of time (71.4%), not feeling comfortable (57.1%), lack of interest (50%), physical strain/ work (28.6%), lack of access (21.4%), cost (14.3%), safety (7.1%), feeling tired afterwards (7.1%), perspiration during exercise (7.1%), and lack of encouragement from others (7.1%). See Table 12 for barriers to exercise.

Benefits of and Barriers to Fruit and Vegetable Intake

Benefits of and barriers to consuming fruits and vegetables are not linked to a specific aim; however, this study examined participants’ responses to these benefits and
barriers in order to understand how they may influence fruit and vegetable consumption. Benefits of consuming fruits and vegetables included: make you feel healthy (93.3%), help you get more nutrients (93.3%), make you feel better (86.7%), give you energy (73.3%), weight maintenance (73.3%) and weight loss (33.3%). See Table 13 for benefits of consuming fruits and vegetables. Barriers to consuming fruits and vegetables were evaluated in separate questions examining both general and organic consumption of fruits and vegetables. Participants were asked if they consumed organic produce, which was defined based on USDA guidelines. Of the 15 respondents who answered, 14 respondents (93.3%) said that they consumed organic fruits and vegetables. When asked to identify barriers to consuming organic fruits and vegetables, responses included: cost, accessibility, ability to prepare/cook them, taste, shelf life, and quality (Table 14).

**Specific Aims**

**Specific Aim 1**

**Expectation 1:** *Self-efficacy levels regarding participation in energy harvesting exercise will be higher among non-exercisers concerned about the environment compared to non-exercisers who are less concerned about the environment.* Energy harvesting technology was defined as fitness energy that produces clean and renewable energy to be used for electrical power. Participants were asked if they would be interested in using this technology if it could be made available for their use on a bicycle at their fitness facility, with answer responses including yes (80%), no (6.7%), and not sure (13.3%). Three questions examined participants’ confidence level (on a scale of 1 to 5) regarding participation in energy harvesting exercise at moderate intensity for 30 minutes for one (EXSE1), two (EXSE2), and three (EXSE3) days per week, respectively.
Kruskal-Wallis tests were completed with energy harvesting exercise self-efficacy scores, ranging from “not confident” (1) to “very confident” (5), and environmental concern ratings, ranging from “a little” (2) to “all the time” (5). Average environmental concern was 4.0 (+/- 0.93). Mean (M) exercise self-efficacy scores for EXSE1 (M=4.5), EXSE2 (M=4.13), and EXSE3 (M=3.93) decreased as the number of days exercise was practiced per week increased. Values for EXSE1 ($X^2 (3, 14) = 6.909, p=0.051$), EXSE2 ($X^2 (3, 15) = 4.237, p=0.223$), and EXSE3 ($X^2 (3, 15) = 4.666, p=0.184$) yielded non-significant results. Hence, the distribution of exercise self-efficacy scores was the same across categories of environmental concern (Figures 4-6). Finally, when asked if it would be helpful to see how watt-hours translated into ecological impact (e.g., 50 watt-hours is equal to powering a laptop for an hour), 92.9% answered that this would be helpful. No associations were found with potential modifiers or mediators (age, gender, race, education, and income).

**Specific Aim 2**

**Expectation 2:** *Sustainable fruit and vegetable purchasing habits, including environmentally sustainable, organic, and local purchases are associated with environmental concern.* Binary sustainable fruit and vegetable purchasing habits were assessed in four ways: 1). purchasing sustainable fruit and vegetables (yes= farmers market, organic purchases, or CSA membership, no= no sustainable fruit and vegetable sustainable purchases), 2). farmers market, 3). organic purchasing, and 4). CSA membership. Environmental concern ratings ranged from “a little” (2) to “all the time” (5). Average environmental concern was 4.0 (+/- 0.93) for non-exercisers and 3.6 (+/- 0.67) for exercisers.
Associations between sustainable fruit and vegetable purchasing habits and environmental concern were assessed using Fisher’s Exact test among exercisers and non-exercisers. Significant results emerged for overall sustainable fruit and vegetable purchasing (p=0.008) and organic purchasing (p=0.048) among non-exercisers (Figure 7). All other tests, including farmers market (p=0.07) and CSA (0.703) were not significant among non-exercisers. No significant results were found among exercisers, including sustainable fruit and vegetable purchasing (p=0.33), CSA membership (p=0.321), and organic purchasing (p=0.061). No trend was observed for use of farmers market (p=1.00). Although CSA participation and organic purchasing did not produce significant results, everyone who belonged to a CSA or purchased organic food reported that they were concerned about the environment “quite a bit” (score of 4). Finally, significant results were found for the combined sample of exercisers and non-exercisers (Figure 8) for the association between environmental concern and sustainable fruit and vegetable purchasing (p=0.005), farmers market (p=0.036) and organic purchasing (p=0.001); belonging to a CSA did not produced significant results (p= 0.229). No associations were found with potential modifiers or mediators (age, gender, race, education, and income).

Specific Aim 3

Expectation 3: Sustainable fruit and vegetable purchasing habits, including environmentally sustainable, organic, and local purchases are associated with personal health. Sustainable fruit and vegetable purchasing was measured with four variables as previously reported in Specific Aim 2. Personal health ratings ranged from excellent (1) to poor (5). The average health rating was 2.71 (+/- 0.83) for non-exercisers and 1.9 (+/-
0.79) for exercisers. See Tables 15 and 16 for personal health responses for exercisers and non-exercisers.

Additional personal health questions regarding smoking habits and use of nutrition supplements were assessed. More exercisers had smoked 100 cigarettes in their lifetime compared to non-exercisers (58.3% vs. 20%), yet no exercisers reported being a current smoker (0% vs. 6.7%). Nutrition supplement use reported by exercisers and non-exercisers respectively, included multivitamin (58.3% vs. 46.7%), vitamin (33.3% vs. 46.7%), mineral (0% vs. 20%), herbal (16.7% vs. 13.3%), protein (33.3% vs. 13.3%), and other (33.3% vs. 13.3%). BMI calculations were calculated from self-reported height and weight measurements. Average BMI scores were 26.2 kg/m$^2$ (+/- 5.67) for exercisers and 25.3 kg/m$^2$ (+/- 5.74) for non-exercisers.

Associations between sustainable fruit and vegetable purchasing habits and health ratings were assessed using Fisher’s Exact test among exercisers and non-exercisers. All findings were not significant except the association of personal health ratings on organic purchasing (p=0.015) among exercisers (Figure 9). Values for fruit and vegetable purchasing (p=0.115), use of farmers market (p=0.860), CSA membership (p=0.329) and organic purchases (p=0.860) were non-significant among non-exercisers. Similarly, values for fruit and vegetable purchasing (p=0.250), use of farmers market (p=1.00), and CSA membership (p=0.758) were not significant among exercisers. In addition to personal health ratings, Fisher’s Exact tests were also used to examine fruit and vegetable purchasing and ‘worrying about one’s health’ and ‘changing eating habits due to worrying’. Tests completed for ‘worrying about one’s health’ were not significant among exercisers or non-exercisers for sustainable fruit and vegetable purchasing (p=1.00;
p=1.00), use of farmers market (p=1.00; p=1.00), CSA membership (p=1.00; p=0.775), or organic purchases (p=0.091; p=0.775). All tests performed for ‘changing eating habits due to worrying’ among exercisers and non-exercisers respectively for sustainable fruit and vegetable purchasing (p=1.00; p=0.835), farmers market (p=1.00; p=0.091), CSA membership (p=0.667; p=0.185) and organic purchases (p=0.827; p=0.880). Finally, No significant results were found for the combined sample of exercisers and non-exercisers between personal health and fruit and vegetable purchasing. Values for personal health variables (health rating, worry about health, and changing eating habits) include fruit and vegetable purchasing (p=0.33, p=1.00, and p=0.789); farmers market (p=1.00, p=0.856, and p=0.186); CSA membership (p=0.365; p=1.00; p=0.084); and organic purchasing (p=0.540; p=0.197; p=0.702). No associations were found with potential modifiers or mediators (age, gender, race, education, and income).

**Specific Aim 4**

**Expectation 4:** Consuming the recommended fruit and vegetable intake (defined as consuming ≥5 fruit and vegetable servings per day) is positively associated with sustainable practices. Participants were asked how many servings of fruits and vegetables (separately) they consume daily. Individuals met the recommendations if they had a score of eating ≥5 servings of fruits and vegetables combined per day. A sum of sustainable behaviors was created based on subjects’ responses to the sustainable behavior checklist, with a maximum score of 13 (including “other” behaviors). See Table 17 for participation in sustainable behaviors among non-exercisers.

Kruskal-Wallis tests were completed for achieving recommended fruit and vegetable intake (yes or no) and total number of sustainable behaviors subjects practiced.
(1-13) among exercisers (ENERGIA members) and non-exercisers (Permaculture members). Half of exercisers and one-third of non-exercisers met fruit and vegetable recommendations. Average sustainable practices were slightly higher among non-exercisers (M=5.53) compared to exercisers (M=4.75). Results for exercisers ($X^2 (1, 12) = 1.311, p=0.284$) were non-significant. Statistically significant results were found for non-exercisers ($X^2 (1, 12) = 5.285, p=0.022$), showing that the distribution of sustainable behaviors is statistically different across those who meet and do not meet fruit and vegetable recommendations (Figure 10). Finally, statistical differences were found for the combined sample ($X^2 (1, 27) = 4.054, p=0.045$) for the association between fruit and vegetable recommendations and total sustainable practices (Figure 11). Environmental concern was a significant mediator when testing the association between environmental concern and total sustainable practices within the combined sample ($X^2 (3, 27) = 9.700, p=0.010$). No associations were found with potential modifiers or mediators among exercising and non-exercising samples (age, gender, race, education, income, health concern and environmental concern).

**Specific Aim 5**

**Expectation 5:** Consuming the recommended fruit and vegetable intake is associated with exercise behavior. The relationship between meeting fruit and vegetable recommendations (yes or no) and exercise behavior (exercisers or non-exercisers) were examined. No significant results emerged ($p=0.452$) using the Fisher’s Exact test (Figure 12). Although not significant, exercisers were more likely to meet fruit and vegetable recommendations (50%) compared to non-exercisers (33.3%). Significant associations found for exercise include age ($p=0.034$) and education ($p=0.020$), although the causal
pathway is unknown due to the nature of Fisher’s Exact test. No other associations were found with potential modifiers or mediators (gender, race, income, health concern and environmental concern).

**Summary of Results**

Results of this study provide information about the relationship between environmental concern, exercise behavior, and fruit and vegetable intake among a convenience sample. Topics examined during focus group discussions included: 1) perceived effect of energy harvesting exercise on the environment and its ability to act as a motivating factor to increase exercise participation; 2) participation in sustainable behaviors and attitudes toward energy conservation and environmental concerns; and 3) perceived benefits of and barriers to fruit and vegetable consumption and exercise participation. The positive relationship between environmental concern and participating in pro-environmental behaviors found in this study is consistent with previous studies (Nie & Zepeda, 2011; Richetin et al., 2012, Robinson & Smith, 2002). Survey findings explored this relationship in more depth.

Most associations were not statistically significant, although significant results were found for Specific Aims 2, 3, and 4. We observed that environmental concern was associated with sustainable fruit and vegetable purchasing, and fruit and vegetable intake was associated with total sustainable practices. Also, health concern was significantly associated with organic fruit and vegetable purchasing.

The effect of energy harvesting technology on exercise performance and participation was also examined. Although the majority of exercisers were concerned about the environment ‘quite a bit,’ none of them participated in energy harvesting
exercise because of their concern for the environment. Many participants mentioned energy harvesting as an additional benefit of their exercise intensity and participation rates. Finally, reactions to the energy harvesting concept were positive among both exercisers and non-exercisers.
Benefits of and Barriers to Exercise

Benefits of exercise were discussed in focus groups in order to inform the survey and gain perspective from individuals who were meeting physical activity recommendations. It is important to note that enjoyment, although mentioned as a benefit and as a motivator for some in focus groups, was not viewed as one of the most important benefits. In addition, enjoyment was the least chosen benefit among non-exercisers. Finally, responses to the words exercise and physical activity included “fun” or “enjoyment,” suggesting that although it may not be most important, enjoyment is still important. Hence, identifying various exercises that create enjoyment may increase exercise participation.

All additional benefits discussed by participants centered around health improvement and importance of health. Therefore, personal health may influence how individuals view the benefits of exercise, which may in turn affect exercise behavior. The fact that all pre-determined benefits of exercise generated a response, most of them higher than 50% (except for weight loss), suggests that participants were aware of the benefits, despite the fact that they may not have been exercising regularly. This is in keeping with data from Lovell and colleagues showing that non-exercising women reported significantly higher perceived benefits than barriers, which suggests that barriers may impact individuals’ exercise behavior more than benefits (G. P. Lovell, El Ansari, & Parker, 2010). Therefore, future research is needed to understand strategies to overcome
barriers to exercise. In addition to strategies that were discussed in our focus groups, such
as time management and creating routines, other strategies to overcome barriers include
planning ahead, having social support and encouragement, participating in activities that
do not require fitness facilities, and trying a new skill or exercise that sparks one’s
interest (Centers for Disease Control and Prevention, 2011c). Further exploration of why
non-exercisers are not meeting physical activity recommendations is needed to
understand which barriers are outweighing the benefits.

Barriers to exercise participation were discussed in focus groups and assessed in
the survey. The belief that barriers would influence non-exercisers greater than
exercisers, is well supported in the literature (Abraham, Feldman, Nyman, & Barleen,
2011; Ayotte, Margrett, & Hicks-Patrick, 2010; Grubbs & Carter, 2002). Cost,
convenience, gender dynamics, and embarrassment generated the most discussion,
suggesting that these barriers were the most relevant to exercisers. Because feelings of
embarrassment and gender dynamics were barriers to exercise, niche fitness facilities
based on gender may help increase exercise participation. For instance, Curves for
Women, which was designed for women, is the largest international gym franchise
(Curves Weight Loss Centers, 2013). Reasons for attendance may be due to the sense of
community provided by Curves (O’Toole, 2009), or the comfortable environment that is
created by fitness facilities for women (Craig & Liberti, 2007). In addition, fitness
facilities designed for older and younger individuals may also promote increased exercise
opportunities, as research has found that older women perceive greater barriers to
exercise compared to younger women (El Ansari & Lovell, 2009). Findings from studies
examining barriers to exercise for women surrounding body image and psychological
factors (Myers & Roth, 1997b; Slater & Tiggemann, 2011) provide support for future research to examine the effects of niche fitness facilities on exercise participation among exercisers and non-exercisers.

Interestingly, lack of interest in exercise among non-exercisers (50%) was a barrier, while enjoyment (40%) was a benefit. This finding suggests the need to identify and focus on exercise that generates the most interest and enjoyment. Because Permaculture members had a high level of environmental concern, it is plausible to use the environmental benefits gained from energy harvesting exercise to produce interest among this sample of non-exercisers. Use of visual displays accompanying the energy harvesting technology, along with education about an individual’s decreased carbon footprint, may increase enjoyment.

**Benefits of and Barriers to Fruit and Vegetable Consumption**

Few benefits of consuming fruits and vegetables were discussed at ENERGIA, which may be due to the fact that the question assessing these benefits was added to the guide after the first two focus groups. Those benefits that were mentioned were related to health and feeling better. In addition, all health-related benefits generated large responses except for weight loss, which may imply a general consensus that eating fruits and vegetables is associated with health benefits. Examining the association between personal health ratings and meeting fruit and vegetable intake recommendations may provide further insight into this relationship and reveal differences among exercisers and non-exercisers.

Access, shelf life, and cost emerged as common barriers to consumption of both organic and non-organic fruits and vegetables. Access may be a barrier specific to
Permaculture members because most are college-based, which is a different environment compared to exercisers. Cost was one of the biggest barriers to consuming fruits and vegetables, and even more so when discussing consumption of organic produce. In fact, “healthier” food in general was viewed as more expensive. Examining the barriers to fruit and vegetable consumption reported by study subjects provides potential education and research opportunities to decrease these barriers. Promoting sustainable fruit and vegetable behaviors may combat decreased fruit and vegetable intake and climate change. In addition, some sustainable food behaviors, such as gardening (Blair et al., 2013) and farm-to-family programs (Hoffman et al., 2012) may increase educational opportunities about fruits, vegetables, and nutrition. Overcoming fruit and vegetable barriers may be possible through participating in environmentally friendly behaviors, such as increased access to farmers markets (Evans et al., 2012; Freedman, Bell, & Collins, 2011) or by gardening (Blair et al., 2013). In addition, sustainable food behaviors can help people overcome cost by promoting affordable fruits and vegetables through food buying clubs or co-ops that offer grocery items at discounted prices (Carroll et al., 2011). Suggesting realistic strategies to overcome multiple barriers at a time may further improve fruit and vegetable intake among both exercises and non-exercisers.

Taste and quality were reported as barriers for general fruit and vegetable consumption but not organic consumption. This suggests that taste and quality are reasons to purchase organic, which is supported by previous literature (Schifferstein & Oude Ophuis, 1998; Trobe, 2001). This study found differences in barriers to consuming fruits versus vegetables; Glasson and colleagues suggest targeting public health initiatives geared toward fruits and vegetables separately (Glasson, Chapman, & James,
Future research and nutrition education should examine ways to overcome barriers to fruit and vegetable consumption individually.

**Energy Harvesting**

Energy harvesting exercise generated positive responses from all participants, including those who were not attracted to ENERGIA for the technology. Focusing on this type of exercise may have potential as a marketing tool to increase exercise participation. This highlights the fact that the technology can be a positive addition to a fitness studio, but may not be a driving force to attract new membership. Some participants were very interested in knowing how ENERGIA was using their energy and what their specific impact was on ENERGIA’s energy production. This type of feedback may therefore serve as a motivating factor to further increase exercise participation and/or performance among energy harvesting exercisers. It also may attract those concerned about the environment. Among non-exercisers, energy harvesting exercise was seen as a creative technology that could influence exercise performance. Energy harvesting exercise self-efficacy scores from this study provide promising results for increased exercise participation if energy harvesting exercise were made available. Although qualified participants were considered irregular exercisers, some participants could be active but not meet the physical activity guidelines. Adding the option of energy harvesting exercise (whether it be once, twice, or three times a week for thirty minutes at moderate intensity) to participants’ current exercise behavior could redefine their exercise behavior and enable them to meet the guidelines. Hence, energy harvesting exercise may be a motivator to increase exercise behavior among those who are already exercising, but not meeting defined exercise recommendations.
Participants talked about how the watts measurement enhanced their exercise performance because it was a defined number against which they could compare each class’ effort and performance. Although watts displays were preferred more than the LED display, the LED display may be beneficial if instructors explained the effect that an entire class can have on energy production versus the individual. This difference may also be due in part to personal preference of metric feedback. Education and future explanation of the potential effects of energy harvesting exercise on the environment may also serve as a positive reinforcement for participants engaged in energy harvesting exercise. Identifying the potential impact that each individual and a class can have on the environment as a result of participating in energy harvesting exercise may also serve as a motivator to increase exercise participation and intensity.

Examining the use of various conversions of watt equivalents, such as time spent exercising equaling powering a laptop, light bulbs, dryer, etc., may also show promise as a way to advertise energy harvesting exercise. Because most participants expressed interest in these conversions, further education and promotion of energy harvesting’s impact on the environment is suggested, as it may increase membership and exercise performance, which in turn both benefit ENERGIA’s business. In addition, making these conversions relatable to consumers may serve as an innovative marketing tool and a way to gain understanding and support for energy harvesting exercise and technologies.

Although not statistically significant, the fact that participants had such a high level of environmental concern may provide a way to increase enjoyment, the least listed benefit of exercise within this study, through participation in energy harvesting exercise. Advertising energy harvesting exercise to those concerned about the environment using
environmental sustainability as a marketing tool and motivational factor may prove beneficial and as yet, it is an unexplored arena.

**Climate Change and Participation in Sustainable Behaviors**

Results from this study add to previous literature noting that the potential effects of climate change and levels of environmental concern may predict the number of sustainable behaviors one participates in (Brehm & Eisenhauer, 2008; Cone & Myhre, 2000; Evans et al., 2012; Lynn Wilkins, 1996; Richetin et al., 2012), including energy harvesting exercise. Although ENERGIA members participated in energy harvesting exercise, no presumed level of environmental concern was expected. In contrast, Permaculture members had high levels of environmental concern, which may in turn influence their responses in favor of having an interest in energy harvesting exercise. All participants were concerned about the environment at least “a little,” which may explain why energy harvesting was an interesting concept to participants in this study. In addition, Permaculture members had slightly higher participation in sustainable behaviors compared to ENERGIA members. The fact that Amherst, Massachusetts promotes sustainability and pro-environmental behaviors makes this study sample unique, as participants may have a higher awareness or understanding of climate change based on the environment that they live in (Sustaining Amherst, 2013). This factor is important to note because it could influence participants’ beliefs and attitudes about energy harvesting exercise.

Exploring the impact of eco-friendly marketing campaigns on individuals’ participation in sustainable behavior is needed to further understand motivational factors for behavior change and engaging in eco-friendly behaviors. Education and marketing
tools focusing on environmental benefits of eco-friendly products and behaviors to increase participation in sustainable behaviors poses promise, as it may make individuals feel good about their purchases or behaviors due to the positive environmental impact (Pickett-Baker & Ozaki, 2008). Because not all consumers are willing to pay more for pro-environmental products, it is necessary to promote cost-friendly strategies to increase in sustainable purchases (Royne, Levy, & Martinez, 2011).

Another strategy that shows promise to increase environmental behaviors is through normative advertising. The growing market of eco-friendly behaviors also increases environmental friendly practices supported by businesses, such as hotels. For instance, using messages such as “the majority of people re-use their towels” may have a greater influence and potential to increase participation in pro-environmental behaviors compared to focusing on environmental concern (Goldstein, Cialdini, & Griskevicius, 2008). Social norms can influence participation in sustainable behaviors by increasing an individual’s obligation to perform a behavior (Minton & Rose, 1997; Vicente & Reis, 2008). Messages targeting a specific pro-environmental behavior, such as recycling, may use a normative approach by stating “your neighbors recycle, do you?” In contrast, environmental concern messages focus on the benefits that a behavior may have on the environment, such as “recycling is good for the environment because it saves energy and reduces pollution.” Hence, using normative messages to increase sustainable behaviors and environmental concerns may be a way to advertise sustainable behaviors (Cialdini, 2003), such as energy harvesting exercise and recycling, for the general population.
Specific Aim 1

Energy harvesting exercise self-efficacy scores were collected in order to understand the reaction to this type of exercise among individuals with a vested interest in pro-environmental behaviors. No significant results were found when examining the relationship between environmental concern and energy harvesting self-efficacy (EXSE) scores. The distribution of all levels of EXSE was the same across categories of environmental concern, therefore suggesting that participating in energy harvesting exercise just once per week for 30 minutes at moderate intensity could be the exercise needed to make non-exercisers or irregular exercisers qualify as exercisers based on their current exercise patterns. High EXSE scores and interest levels in energy harvesting exercise show promise for future energy harvesting interventions to increase exercise participation, as exercise self-efficacy has been previously linked as predictor of exercise behavior (Abraham, Feldman, Nyman, & Barleen, 2011). In addition, these high EXSE scores may predict the intention to participate in exercise (Sniehotta, Scholz, & Schwarzer, 2005). Further theory informed framework surrounding energy harvesting exercise self-efficacy is needed to explore the potential that energy harvesting exercise may have on exercise participation. This study examined exercise self-efficacy scores excluding specific barriers to exercise. Future research exploring exercise self-efficacy statements incorporating relevant barrier to exercise, such as lack of time and interest, may provide further insight into the success of an energy harvesting exercise intervention. In addition, using scales such as Barriers Self-Efficacy Scale (BARSE) (McAuley, 1993) or examining self-efficacy and different stages of change with exercise (Marcus, Selby, Niaura, & Rossi, 1992), may provide a more in-depth analysis of energy
harvesting exercise self-efficacy scores and its potential to increase exercise participation among non-exercisers.

Finally, it is important to understand how EXSE scores can be increased. This may come with future energy harvesting interventions, as increased exercise self-efficacy scores have been found with the addition of exercise (Annesi, 2012; Teixeira et al., 2006). Offering other forms of exercise equipment with energy harvesting exercise may show promise. For instance, this study examined using energy harvesting exercise with a bicycle. Results from the survey demonstrate that walking (41.1%), running (25.6%), and elliptical (12.8%) were preferred forms of exercise among Permaculture members (N=39). Having energy harvesting technology available on other sources of exercise equipment may generate higher EXSE scores based upon the exercise itself. Future exploration of energy harvesting exercise self-efficacy scores is needed using different exercise equipment to understand the effects of energy harvesting exercise on exercise participation before and after an intervention occurs.

Specific Aim 2

Examining the relationship between environmental concern and sustainable food purchasing can identify consumer characteristics of sustainable food purchasing. Results from this study suggested an association between sustainable fruit and vegetable purchasing habits and environmental concern ratings among Permaculture members (fruit and vegetable and organic purchasing variables) and the combined sample of exercisers and non-exercisers (fruit and vegetable, farmers market, and organic purchasing). No significant results were found among ENERGIA members, which may be due to the fact that they were less concerned about the environment compared to Permaculture members.
Hence, the expectation that there would be an association between environmental concern and sustainable food purchasing was met by non-exercisers and the overall study sample. The fact that there was a significant association among the overall sample suggests that exercise behavior does not influence sustainable food purchasing and environmental concern; however, the small sample in this study highlights the need for further study before drawing definite conclusions.

In this study, no significant association was found between environmental concern and CSA membership. This finding is in contrast to previous literature showing a positive association between increased environmental concern and increased purchasing of sustainable produced foods (Brehm & Eisenhauer, 2008; Lynn Wilkins, 1996; Nie & Zepeda, 2011; Robinson & Smith, 2002), and specifically environmental concern being a motivating factor for purchasing a CSA share (Brehm & Eisenhauer, 2008; Cone & Myhre, 2000). This may be due to the fact that few participants in the current study belonged to a CSA. Finally, no significant results from the ENERGIA sample may be due to low levels of environmental concern overall in this group. Despite the lack of significant findings in this study, promising intervention techniques revolving around environmental concern may have potential to increase pro-environmental behaviors (Vicente & Reis, 2008), such as sustainable fruit and vegetable purchasing.

**Specific Aim 3**

The association between health and sustainable fruit and vegetable purchasing provides further information linking variables that connect environmental concern, exercise behavior, and fruit and vegetable intake. This relationship was examined in this study to determine if purchasing sustainable foods may also be associated with other
health-related behaviors, including meeting fruit, vegetable, and exercise recommendations. Although previous literature has shown an association between perceived health benefits and purchasing sustainable foods (Magnusson, Arvola, Hurst, Åberg, & Sjödén, 2003; Schifferstein & Oude Ophuis, 1998), the expectation that health concern variables were associated with sustainable fruit and vegetable purchasing habits was not fully met in this study. Significant results were only found between the association of organic purchasing and personal health ratings (p=0.015) among exercisers. Questions related to health benefits, specifically in relation to organic fruits and vegetables may provide further insight into reasons for purchasing organic. If eating sustainably-produced foods is related to higher levels of health consciousness (Schifferstein & Oude Ophuis, 1998), then an exploration of how health may impact positive health behaviors among individuals with high participation in sustainable food purchasing behaviors is warranted. Finally, although several variables in this study measured health concern (personal health rating, worrying about health, changing eating habits due to health worries) and health behaviors (nutrition supplement use and smoking habits), the only association found was between personal health and organic purchases among exercising individuals. This finding may be due to the questions asked. For instance, asking questions specifically related to fruit and vegetable eating habits or questions assessing health awareness and knowledge will further examine associations between health variables and sustainable fruit and vegetable purchasing habits. The literature suggests that eating sustainable foods (specifically organic) is associated with other healthy behaviors (Nie & Zepeda, 2011; Torjusen et al., 2010); therefore, future
research examining health awareness, knowledge, and benefits of sustainable food purchases may provide further insight into this relationship.

**Specific Aim 4**

Previous literature exploring the association between sustainable practices and other health behaviors prompted the expectation that there would be an association between fruit and vegetable intake and sustainable behaviors practiced in the current study. Specifically, exposure to sustainable food practices have been linked to increased consumption of fruits and vegetables (Alaimo, Packnett, Miles, & Kruger, 2008; Litt et al., 2011; Russell & Zepeda, 2008). In this study, total sustainable practices and consumption of recommended fruit and vegetable servings were positively associated, as expected, for non-exercisers and the total study sample. Although not mentioned in a specific aim in this study, the association between fruit and vegetable purchasing and meeting fruit and vegetable consumption recommendations may be an area of interest for future exploration, with the expectation that those participating in sustainable behaviors would have higher consumption of fruits and vegetables compared to those not participating in such behaviors (Alaimo, Packnett, Miles, & Kruger, 2008; Litt et al., 2011; MacMillan Uribe, Winham, & Wharton, 2012).

Examining the associations between potential modifiers and mediators with both dependent and independent variables did not produce significant results among separate samples. Interestingly, environmental concern was a significant mediator when testing the association between environmental concern and total sustainable practices within the total sample. This association was expected to be significant based on previous research examining environmental concern as a predictor for participation in pro-environmental
behaviors (Nie & Zepeda, 2011; Robinson & Smith, 2002; Vicente & Reis, 2008). Further examination of this relationship, specifically among Permaculture members is indicated. Increasing the perceived benefits of sustainable behaviors based on environmental concern may increase the applicability of sustainable behaviors to the general population (Vicente & Reis, 2008), which could help increase fruit and vegetable intake through sustainable food practices. Once again, identifying specific associations between health, environmental concern, and fruit and vegetable intake can help promote increased fruit and vegetable intake in future public health interventions.

**Specific Aim 5**

The association between meeting fruit and vegetable recommendations and exercise behavior produced no significant results. The fact that exercisers were more likely to consume recommended fruit and vegetable servings as compared to non-exercisers questions the association between personal health concern and the positive health behaviors studied. All health variables were tested for associations in an effort to find any common motivational factors between fruit and vegetable intake and exercise behavior. Specifically, personal health ratings were expected to be a mediator. However, lack of associations with other health variables, such as health concern (worrying about health and changing eating habits), supplement use, smoking habits, and BMI, suggests the need for further examination of the connection between fruit and vegetable consumption and exercise behavior. Future in-depth analyses of different health variables can provide insight into this relationship.
**Strengths and Limitations**

**Strengths**

This study collected both qualitative and quantitative data to examine the relationship between environmental concern, exercise behavior, and fruit and vegetable intake. Qualitative data from focus groups provided insight that informed development of the survey, while quantitative findings expanded on the relationship between all three variables.

In addition, this is the only known study to examine reactions to energy harvesting technology among energy harvesting exercisers as well as non-exercisers. Two specific gaps in the literature were addressed; namely, 1) linking the three variables of environmental concern, exercise behavior, and fruit/vegetable intake, and 2) exploring the benefits of and responses to energy harvesting exercise. Overall, all participants had positive reactions to energy harvesting technology and may have gained insight into the practice of other sustainable behaviors. Finally, this study provides information about a novel area of study regarding how energy harvesting exercise may serve as a potential motivator to increase exercise participation among both exercisers and non-exercisers who are concerned about the environment.

**Limitations**

Limitations of this study included recruitment, sample size, and survey assessment questions. Recruitment for focus groups was low and consisted of multiple drop-outs, which may be due to decreased members available in the summer months. The sample size of 12 for focus groups was lower than expected (16-24), and only one focus group met the suggested number of individuals to conduct focus group (4-6 people).
(Patton, 2002). The sample size of non-exercisers was particularly small. Low recruitment may also be due to the nature of recruitment paragraphs posted on UMass Amherst Permaculture Twitter and Facebook accounts, because survey link posts become less visible each time the organization posts new information. Also, recruitment links posted by UMass Permaculture Facebook administrators did not always include the full paragraph designed for the study. The demographics for both exercisers and non-exercisers are not generalizable because of the nature of the convenience sample of college and college-area participants, although they follow some trends noted in previous literature noting consumer characteristics of sustainable behavior, as most participants were female with high education levels (Lockie, Lyons, Lawrence, & Grice, 2004, Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997; Lynn Wilkins, 1996). Finally, potential selection bias from Permaculture members may have occurred because people may have had a vested interest in participating in the study based on the topics explored.

Although the author and note-taker were trained in focus group methodology, lack of experience may have contributed to limitations that occurred in focus groups, including creating a comfortable environment for data collection, exploring information further, and adjusting to unexpected situations. For example, benefits and barriers were discussed in focus groups to inform survey questions; however, no data were collected to quantify the number of exercisers who mentioned these benefits and barriers. Furthermore, although these issues were explored qualitatively, further examination of how benefits and barriers may be viewed differently by energy harvesting exercisers versus non-exercisers would have been informative.
Another limitation occurred in survey questions. One question on the ENERGIA demographic survey had an error, asking: “How many cups of fruit do you drink each day?” instead of: “eat and drink per day.” This limitation was minimized, however, because the error was identified early and corrected, and consumption of fruits and vegetables was also discussed in other portions of the focus groups. A technology error also occurred in the administration of a question on the Permaculture survey about barriers to consuming organic fruits. Although the question was originally designed with the option of choosing all answers that apply, participants were only able to select one answer. In response to this error, the “choose all that apply” text was deleted from the question for future participants. This error was found after two participants had taken the survey, and it was assumed that the participants answered the most important barrier to consuming organic fruits. Finally, the length of the survey may have been burdensome for some participants, causing them to skip some questions.

Some disruptions occurred during focus groups three and four. In focus group three, the interview took place outside ENERGIA because the fitness studio was occupied. In focus group four, disruptions included the phone ringing and an ENERGIA employee entering and leaving the studio. These factors interfered with the flow of the discussion and may have interrupted participants’ thoughts. Body language and comfort levels were assessed by the note taker who noticed that some participants showed signs of discomfort by crossing their arms, leaning back as they spoke, or decreasing their participation in the group. This occurred at times when one person had a different opinion than the majority of the group. In focus group four one participant was not only a member of ENERGIA but also an instructor, which may have put social pressure on
participants to withhold some thoughts or express similar opinions as the instructor. When discomfort levels were noticeable by the author she reminded participants that there were no right or wrong answers, and that all opinions and thoughts were respected and helpful for the author to know.

Overlapping limitations between both samples are related to age groupings and variables surveyed. The study was open to individuals 18 years and older; however, only two individuals aged 65+ participated. While the low number of older aged participants may reflect the trend noted by Lockie and colleagues that individuals aged 60 and older have decreased participation in sustainable food practices (Lockie, Lyons, Lawrence, & Grice, 2004), this limits generalizability of study findings.

**Future Implications**

Results from this study present information about the relationship between environmental concern, exercise behavior, and fruit/vegetable intake. Information about the benefits of and barriers to exercise participation and fruit and vegetable intake provide insight to better understand factors that influencing participation in these behaviors. It is important to note that cost was a universal barrier to exercise and consumption of fruits and vegetables, especially organic produce. Using a valid and reliable scale to identify benefits of and barriers to exercise (Steinhardt & Dishman, 1989) can help provide an in-depth analysis of the influences of benefits and barriers on exercise participation. In addition, assessing self-efficacy scores related to fruit and vegetable consumption and exercise should be researched further while incorporating popular barriers found in this study into the efficacy statements. In addition, feedback from participants about ways to overcome barriers to exercise may serve as potential
ways to increase exercise participation among non-exercising individuals. Identifying various benefits of and barriers to exercise behavior and fruit and vegetable intake may provide insight for public health officials of ways to increase perceived benefits of these healthy behaviors and overcome barriers that may discourage individuals from participating in these behaviors.

Other areas for improvement lie with variable groupings in survey questions. For instance, weight loss and weight management should be researched separately as benefits of exercise and fruit and vegetable consumption. Also for the purpose of this study, walking and bicycling represented modes of environmentally friendly transportation. Creating separate answers for these variables in the future may enhance our understanding of the effect that energy harvesting bicycles may have on increasing exercise if made available.

Significant results found between health and sustainable food purchases and environmental concern and sustainable food purchases provides further evidence examining health and environmental concern as dominant motivators for sustainable purchasing patterns. In addition, total sustainable practices were positively associated with fruit and vegetable consumption among non-exercisers and the combined sample. Implications from these results question the influence of exercise behavior in these associations. Further research is needed to identify the importance of exercise behavior in the relationship between environmental and health concerns and participation in sustainable practices. The next step in examining the strength of exercise behavior in this relationship is to conduct a study with a sample of exercisers and non-exercisers who
have high levels on environmental concern who have a vested interest in participating in pro-environmental behaviors.

Additional information gained about energy harvesting technology provides helpful implications for future intervention studies that may examine the potential increase in exercise participation and/or performance due to energy harvesting technology. Marketing energy harvesting exercise to promote participation may be possible if environmental sustainability or environmental threat is used as a motivating factor. In addition, education approaches focusing on defining watt-hours may increase how individuals perceive the energy harvesting exercise displays and energy conversions should be studied in further detail, as they may serve as potential motivators to increase exercise participation and performance.
APPENDIX A

FOCUS GROUP GUIDE

Can energy harvesting exercise increase exercise participation?

SUPPLIES:

- Tape recorder with tapes and extra batteries
- Name tags
- Large pad of newsprint, markers, and masking tape.
- 2 Consent forms for each participant (1 blank to give to participants + 1 signed copy for files)

NOTES TO FACILITATORS:

- **AHEAD OF TIME:** Have each of the following ready as people come in:
  - Post the Focus Group Guidelines, either on a wall or a board.
  - Set up some snacks and water for the participants.
  - The following will be included on the news pad:
    - Post four purposes
    - Sustainable behaviors (count how many people participate in each)

- Invite participants to put on name tags (first names only).

- **PAUSE AFTER EACH SENTENCE OR TWO, THIS IS A LOT OF INFORMATION TO COVER!!**

- **WAIT FOR FIRST RESPONSES BEFORE YOU OFFER THE PROBES. FIRST REACTIONS ARE THE MOST IMPORTANT.**

A. Purpose.

- Thank you very much for coming today.
• My name is Dana, and I will be leading this focus group, and this is Taylor, who is here to take notes and be another set of eyes. We’re from the University of Massachusetts and we’re working on a project about energy harvesting exercise. If you don’t already know, energy harvesting exercise involves fitness energy that produces clean and renewable energy to be used for electrical power. We will also be talking about sustainable practices, which are environmentally friendly behaviors.

• We’re interested in hearing about four main things: 1) Current dietary, exercise, and sustainable practices 2) Benefits of consuming a healthy diet and participating in exercise 3) Barriers to consuming a healthy diet and participating in exercise. 4) If energy harvesting exercise makes you want to exercise

• The information you give us today will help us with future research to see if energy harvesting exercise can help people want to exercise.

• There are three parts to this hour-long session today. First, we are going to review the informed consent. Then we will have our discussion, and lastly there will be a 2-3 minutes survey for you to complete, so that we can find out a bit more about you.

• So to start off, I just need to go over an informed consent.

Paraphrase informed consent

• You’ll probably notice that I will be reading from a “script.” I just use this to make sure I remember to say everything I want to say.

• Let’s start with a little ice-breaker. Please tell us your first name only, and your favorite food. [NOTE: You can start with yourself to get things going]
• Also, I’ll ask that you try to avoid moving around too much for the sake of our recording.

• This group discussion will take about an hour.

• What questions do you have before we begin?

Okay, let’s start!

START TAPE RECORDER: COUNT TO 10!!!!
STATE THE DATE, TIME, AND LOCATION OF THE FOCUS GROUP
Let’s start by talking about exercise!

What’s the first thing that comes to mind when you hear the word “exercise”? PARAPHRASE WHAT PEOPLE SAY

What about physical activity?

For today’s discussion, I’ll be using the word “exercise” to mean ALL types of activity.

- Let’s talk about what types of exercise you like to do most and why.
- Okay, so we have a good variety of exercises that you do. From a show of hands, Do you prefer exercising alone, with a friend/ significant other, or in a group class? Let’s go through these, please raise your hand if you prefer exercise….______ (say number aloud)
- There are lots of reasons for why we exercise. Some of us exercise to lose weight or because of health benefits associated with exercise. Why do you exercise?

- Ok, great. Thank you for your responses. They’re really helpful! Now let’s talk about the benefits of exercise. What positive or good experiences do you have as a result of exercise?

[Allow a few minutes for discussion; then use the following as prompts:]

Besides what has already been said, what other benefits apply to you, like:
- Weight management or weight loss
- Increased fitness
Increased muscle tone or mass
o Stress management
o Enjoyment

[Allow a few minutes for discussion.]

Now that we’ve discussed these benefits, which one is most important to you?

- **Most of us go through times when we don’t feel like exercising. Tell me about those times. What types of things discourage or prevent you from wanting to exercise?**

[Allow a few minutes for discussion; then use the following as prompts:]

Okay, so we’ve heard about (summarize key points). How about:

- Lack of time
- Costs
- Lack of access
- Not feeling comfortable
- Lack of encouragement from others in your life
- Lack of interest
- Physical strain/work
  - Feeling really tired afterwards

[Allow a few minutes for discussion.]

Anything else?

- Now that we have talked about the things that may be barriers to exercising, let’s talk about how you have overcome these barriers.
  - [Allow a few minutes for discussion.]

- Now, let’s talk about energy harvesting and why you participate in energy harvesting exercise. Remember that energy harvesting exercise is exercise that produces electrical energy. ENERGIA is unique because it offers this type of technology. Did this affect your choice about coming here?
- What are your thoughts and opinions about energy harvesting exercise?
- What do you think is important about the energy harvesting component that this studio offers?
- What made you choose this SPIN studio over another?
- How do you feel about the visual displays of energy produced throughout a SPIN class?
  - For example, do you notice or pay attention to the class displays or watts produced?
  - Watts are a unit of energy. I am wondering if it would be helpful to give some unit conversions to let you know how your effort is paying off from an ecological standpoint?
  - How does monitoring your energy production on these displays affect your workout?

What can you tell us about ways that may motivate people to exercise?

**CHECK TIME; Taylor, how are we doing on time? (aiming for 20 minute mark) see how long we have been meeting for. If we have spent too much time on the previous questions, SKIP THE NEXT (benefit questions)**

_________________ minutes have past. Skip next?______________ (YES/ NO)

Is there anything else that you’d like to tell us about your thoughts toward exercise that we didn’t discuss?

_________________ ____________________________________________

This is great! Only a few more questions. Now let’s talk about eating habits and beliefs, specifically fruits and vegetables. Let’s go around quickly and tell me how many servings of fruits and vegetables (on average) you have one a typical day. Let’s start with fruits—here is an example of a serving size of fruits. Now, let’s say how many servings of vegetables you have each day (define servings with props)

- Where do you purchase these items?

  - Okay. Now let’s talk about the barriers to consuming fruits and vegetables. What are some barriers that affect your ability to consume fruits and vegetables?
    
    [Allow a few minutes for discussion.]

- What about?
  - Accessibility
  - Ability to prepare/ cook
• Taste
• Shelf-life

• Are there any other thoughts about barriers to consuming fruits or vegetables?

Let’s switch gears now and talk about some things other than exercise and fruit and vegetable intake. Climate change and renewable resources (resources that can be replenished over time, examples for renewable energy sources include sun and wind power) are hot topics right now. What are your thoughts about these issues?

• Now, I’d like to talk about sustainable behaviors. What sustainable behaviors do you practice, like participating in energy harvesting exercising or consuming local produce?

[Allow a few minutes for discussion; then use the following as prompts:]

BRING POSTER BOARD OUT WITH DISPLAY OF SUSTAINABLE BEHAVIORS. COUNT HOW MANY PEOPLE RAISE THEIR HANDS IN RESPONSE TO PARTICIPATING IN EACH BEHAVIOR. ANNOUNCE HOW MANY PEOPLE RESPOND TO EACH BEHAVIOR (INTO MICROPHONE)

I’m going to read off a list of behaviors that you may participate in. I’d like to take a poll, please raise your hand, and I will count how many of you participate in the following:

Besides what has already been said, do any of you:

- Recycle regularly?
- Compost?
- Own a CSA share?
- Purchase organic foods?
- Purchase local foods from farms or the Farmer’s Market?
- Own or share a garden?
- Volunteer in a community garden?
- How about other specific ways that you decrease your carbon footprint, such as biking to work/school, taking the bus, carpooling, etc.?
[Allow a few minutes for discussion.]

We are coming to a close on our focus group.

*********************************
Okay, those are all the questions I have.

Before we move on to the brief survey, what else would be helpful for me to know?

Thank you very much! This has been really useful.

TURN OFF TAPE RECORDER!

➢ Because Energia Fitness Studios participates in energy harvesting, we’re interested in knowing more about the types of people (like you) who are going there.

Now, we will hand out the surveys and once you are done you can pick which incentive you would like—either an ENERGIA t-shirt or a UMass gift card!
APPENDIX B

DEMOGRAPHIC SURVEY (ENERGIA)

Demographic Information:
What is your sex identity?
  ○ Male
  ○ Female

Which best describes your age range?
  ○ 18-29 years
  ○ 30-39 years
  ○ 40-49 years
  ○ 50-64 years
  ○ 65 years and over

How would you describe your race/ethnicity? (Check all that apply)
  ○ American Indian/ Native American
  ○ Asian
  ○ Black/African American
  ○ White/Caucasian
  ○ Hispanic/Latino
  ○ Native Hawaiian or Other Pacific Islander
  ○ Other, (Please Specify) _________________________________

What is the highest level of education that you have completed?
  ○ Less than a high school degree
  ○ High school degree or GED
  ○ Associates college degree
  ○ Some college
  ○ A four year college degree
  ○ Graduate degree
  ○ Other, please specify _________________________________

What is your total household income?
  ○ Less than $10,000
  ○ $10,000 to $19,999
  ○ $20,000 to $29,999
  ○ $30,000 to $39,999
  ○ $40,000 to $49,999
  ○ $50,000 to $59,999
  ○ $60,000 to $69,999
  ○ $70,000 to $79,999
  ○ $80,000 to $89,999
$90,000 to $99,999
$100,000 to $149,999
$150,000 or more

**Personal Health Information:**

Please specify your height (in inches) ___________
Please specify your current weight (in pounds) ___________

In general, would you say your health is… (“X” one box)
- Excellent
- Very Good
- Good
- Fair
- Poor

How often have you worried about your overall health in the past year?
- Not at all
- A little
- Somewhat
- Quite a bit
- All the time

How much has worrying about your health led you to change the way you ate in the past year?
- Not at all
- A little
- Somewhat
- Quite a bit
- All the time

Are you taking any of the following supplements? Please check all that apply.
- Multivitamin
- Vitamins (other than a multivitamin)
- Minerals (other than a multivitamin)
- Herbal supplement
- Protein Powder
- Other (please specify) _______________________________________

Have you smoked at least 100 cigarettes in your entire life? One hundred cigarettes is equal to 5 packs. (“X” ONE BOX):
- Yes
- No
- Don’t know/Not sure
Do you now smoke cigarettes every day, some days, or not at all?
  o Every day
  o Some days
  o Not at all

**Physical Activity:**
What is your preferred type of aerobic (cardiovascular) exercise? Choose one.

  o Walking
  o Running
  o Bicycling
  o Swimming
  o Elliptical
  o Stair master
  o Other (please specify)

At what intensity do you usually exercise?

  o Light (examples: daily activities not requiring much physical effort, such as shopping and cooking)
  o Moderate (examples: walking fast, playing doubles tennis, water aerobics, bicycling on level ground)
  o Vigorous (examples: aerobics, running, fast bicycling, playing singles tennis, swimming laps)

On days that you do any physical activity or exercise of at least moderate intensity (moderate intensity activities make you breathe somewhat harder than normal and raise your heart rate), how much time do you spend participating in physical activity?

  __________ minutes per day
  __________ times per week

**Environmental Concern:**

How concerned are you about the environment?

  o Not at all
  o A little
  o Somewhat
  o Quite a bit
  o All the time
**Sustainable Practices:**

Do you participate in any of the following? Please check all that apply:

- Energy alternatives (ex: solar, wind power)
- Recycling
- Composting
  - Transportation efforts
    - Walking/ bicycling
    - Bus
    - Carpooling
    - Hybrid vehicle
- Food purchasing
  - Farmers market
  - Community Supported Agriculture (CSA)
  - Organic food
- Volunteer work in a community garden
- Owned/shared garden
- Other (please specify) ____________

**Fruit and Vegetable Intake:**

The following boxes provide some examples of how much counts as one cup:

<table>
<thead>
<tr>
<th>1 cup of fruit could be:</th>
<th>1 cup of vegetables could be:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 1 small apple</td>
<td>- 3 broccoli spears (5 in. long)</td>
</tr>
<tr>
<td>- 1 large banana</td>
<td>- 1 cup of cooked leafy greens</td>
</tr>
<tr>
<td>- 1 large orange</td>
<td>- 2 cups of lettuce or raw greens</td>
</tr>
<tr>
<td>- 8 large strawberries</td>
<td>- 12 baby carrots</td>
</tr>
<tr>
<td>- 32 seedless grapes</td>
<td>- 1 medium potato</td>
</tr>
<tr>
<td>- 1 medium pear</td>
<td>- 1 large sweet potato</td>
</tr>
<tr>
<td>- ½ cup of dried fruit</td>
<td>- 1 large raw tomato</td>
</tr>
<tr>
<td>- 1 cup (8 oz) of 100% fruit juice</td>
<td>- 1 cup of cooked beans</td>
</tr>
</tbody>
</table>
About how many cups of FRUIT (including 100% pure fruit juice) do you drink each day? (“X” one box)
  o  None
  o  ½ cup or less
  o  ½ cup to 1 cup
  o  1-2 cups
  o  2-3 cups
  o  3-4 cups
  o  4 cups or more

About how many cups of VEGETABLES (including 100% vegetable juice) do you eat or drink each day? (“X” one box)
  o  None
  o  ½ cup or less
  o  ½ cup to 1 cup
  o  1-2 cups
  o  2-3 cups
  o  3-4 cups
  o  4 cups or more
APPENDIX C
UMASS PERMACULTURE SURVEY

**Screener Questions: environmental concern, physical activity, and major**

**Physical Activity:**
1. What is your preferred type of aerobic (cardiovascular) exercise? Choose one.
   - Walking
   - Running
   - Bicycling
   - Swimming
   - Elliptical
   - Stair master
   - Other (please specify) ________________

2. At what intensity do you usually exercise?
   - Light (examples: daily activities not requiring much physical effort, such as shopping and cooking)
   - Moderate (examples: walking fast, playing doubles tennis, water aerobics, bicycling on level ground)
   - Vigorous (examples: aerobics, running, fast bicycling, playing singles tennis, swimming laps)

3. In general, do you spend at least 150 minutes (2 hours and 30 minutes) participating in moderate physical activity per week? Moderate intensity activities make you breathe somewhat harder than normal and raise your heart rate.
   - Yes
   - No

**Environmental Concern:**
4. How concerned are you about the environment?
   - Not at all
   - A little
   - Somewhat
   - Quite a bit
   - All the time
**Academic Major:**
5. Are you currently majoring or did you previously major in kinesiology (exercise science) or nutrition as an undergraduate or graduate student?

**Personal Health Information:**

6. Please specify your height (in inches) __________
7. Please specify your current weight (in pounds) __________

8. In general, would you say your health is… (please select one)
   - Excellent
   - Very Good
   - Good
   - Fair
   - Poor

9. How often have you worried about your overall health in the past year?
   - Not at all
   - A little
   - Somewhat
   - Quite a bit
   - All the time

10. How much has worrying about your health led you to change the way you ate in the past year?
    - Not at all
    - A little
    - Somewhat
    - Quite a bit
    - All the time

11. Are you taking any of the following supplements? Please check all that apply.
    - Multivitamin/mineral supplement
    - Vitamins (other than a multivitamin)
    - Minerals (other than a multivitamin)
    - Herbal supplement
    - Protein Powder
    - Other (please specify) ________________________________

12. Have you smoked at least 100 cigarettes in your entire life? One hundred cigarettes is equal to 5 packs (please select one):
    - Yes
    - No
    - Don’t know/Not sure
13. Do you now smoke cigarettes every day, some days, or not at all?
   - Every day
   - Some days
   - Not at all

**Sustainable Practices:**

14. Do you participate in any of the following? Please check all that apply:
   - Energy alternatives (ex: solar, wind power)
   - Recycling
   - Composting
   - Transportation efforts:
     - Walking/ bicycling
     - Bus
     - Carpooling
     - Hybrid vehicle
   - Food purchasing:
     - Farmers market
     - Community Supported Agriculture (CSA)
     - Organic food
     - Volunteer work in a community garden
     - Owned/shared garden
     - Other (please specify) ____________

**Fruit and Vegetable Intake:**

The following boxes provide some examples of how much counts as one cup:

<table>
<thead>
<tr>
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</tr>
<tr>
<td>- ½ cup of dried fruit</td>
<td>- 1 large raw tomato</td>
</tr>
<tr>
<td>- 1 cup (8 oz) of 100% fruit juice</td>
<td>- 1 cup of cooked beans</td>
</tr>
</tbody>
</table>
15. About how many cups of FRUIT (including 100% pure fruit juice) do you eat or
drink each day (please select one)?
   o None
   o ½ cup or less
   o ½ cup to 1 cup
   o 1-2 cups
   o 2-3 cups
   o 3-4 cups
   o 4 cups or more

16. About how many cups of VEGETABLES (including 100% vegetable juice) do you
eat or drink each day (please select one)?
   o None
   o ½ cup or less
   o ½ cup to 1 cup
   o 1-2 cups
   o 2-3 cups
   o 3-4 cups
   o 4 cups or more

For the following questions, please check all answers that apply:

**Barriers to fruit and vegetable intake**

17. What are some barriers that affect your consumption of fruits (check all that apply)?
   o Cost
   o Accessibility
   o Ability to prepare/ cook them
   o Taste
   o Shelf-life
   o Quality
   o Other _____________

18. What are some barriers that affect your consumption of vegetables (check all that
apply)?
   o Cost
   o Accessibility
   o Ability to prepare/ cook them
   o Taste
   o Shelf-life
   o Quality
   o Other _______________
Organic is a labeling term that indicates that foods have been produced by specific guidelines defined by the United States Department of Agriculture. These foods are free of synthetic fertilizers (including pesticides), sewage sludge, irradiation, and genetic engineering.

19. Do you consume organic fruits and vegetables?
   o Yes
   o No (skip to question 22)

20. What are the barriers that affect your consumption of organic fruits?
   o Cost
   o Accessibility
   o Ability to prepare/ cook them
   o Taste
   o Shelf-life
   o Quality
   o Other _____________

21. What are the barriers that affect your consumption of organic vegetables? Check all that apply.
   o Cost
   o Accessibility
   o Ability to prepare/ cook them
   o Taste
   o Shelf-life
   o Quality
   o Other ________________

**Benefits of fruit and vegetable intake**

22. What positive or good experiences do you have as result of eating fruits and vegetables (check all that apply)?
   o Weight maintenance
   o Weight loss
   o Make you feel better
   o Make you feel healthy
   o Give you energy
   o Help you get more nutrients (such as vitamins and minerals)
   o Other ______ (please specify)
**Barriers to physical activity**

23. What types of things discourage or prevent you from exercising (check all that apply)?
- Lack of time
- Costs
- Lack of access
- Not feeling comfortable
- Lack of encouragement from others in your life
- Lack of interest
- Physical strain/work
- Feeling tired afterwards
- Perspiration during exercise
- Safety
- Other ______ (please specify)

**Benefits of physical activity**

24. What positive or good experiences do you have as a result of exercising (check all that apply)?
- Weight management or weight loss
- Increased fitness
- Increased muscle tone or mass
- Stress management
- Enjoyment
- Other ______ (please specify)

**Energy harvesting**

Energy harvesting exercise involves fitness energy that produces clean and renewable energy to be used for electrical power.

25. If this energy harvesting technology could be made available for your use on a bicycle at your fitness facility, would you be interested in using it?
- Yes
- No
- Not sure
Please choose one answer for each of the following questions. Remember that moderate intensity activities make you breathe somewhat harder than normal and raise your heart rate. Examples of moderate activities include walking fast, playing doubles tennis, water aerobics, bicycling on level ground. This does not include activities, such as running, aerobics, fast bicycling, or any activities that cause large increases in your breathing or heart rate.

26. On a scale of 1 (not confident) to 5 (very confident), how confident are you that you could exercise at moderate intensity on an energy harvesting bicycle for 30 minutes for one day per week?

1   2     3         4   5
not confident        very confident

27. On a scale of 1 (not confident) to 5 (very confident), how confident are you that you could exercise at moderate intensity on an energy harvesting bicycle for 30 minutes for two days per week?

1   2     3         4   5
not confident        very confident

28. On a scale of 1 (not confident) to 5 (very confident), how confident are you that you could exercise at moderate intensity on an energy harvesting bicycle for 30 minutes for three days per week?

1   2     3         4   5
not confident        very confident

29. Watts are a unit of energy. Watts produced during exercise are displayed on energy harvesting bicycles while you are riding. Would it be helpful to give some unit conversions to let you know how your effort is paying off from an ecological standpoint?

For example:

- 50 watt hours = powering a laptop for an hour
- 115 watt hours = powering a television for an hour

  Yes
30. What else would you like to tell us?
________________________________________

Demographic Information:
31. What is your gender identity?
   o Male
   o Female
32. Which best describes your age range?
   o 18-29 years
   o 30-39 years
   o 40-49 years
   o 50-64 years
   o 65 years and over
33. How would you describe your race/ethnicity? (Check all that apply)
   o American Indian/Native American
   o Asian
   o Black/African American
   o White/Caucasian
   o Hispanic/Latino
   o Native Hawaiian or Other Pacific Islander
   o Other, (Please Specify) ____________________________
34. What is the highest level of education that you have completed?
   o Less than a high school degree
   o High school degree or GED
   o Associates college degree
   o Some college
   o A four year college degree
   o Graduate degree
   o Other, please specify ____________________________
35. What is your total household income?
   o Less than $10,000
   o $10,000 to $19,999
   o $20,000 to $29,999
   o $30,000 to $39,999
   o $40,000 to $49,999
   o $50,000 to $59,999
- $60,000 to $69,999
- $70,000 to $79,999
- $80,000 to $89,999
- $90,000 to $99,999
- $100,000 to $149,999
- $150,000 or more

36. If you would like to be entered into a raffle for a $10 UMass Bookstore gift card please provide the following contact information:
   - Name (optional):
   - Email:

Thank you!
APPENDIX D
INFORMED CONSENT FORM (FOCUS GROUPS)

INFORMED CONSENT FORM: FOCUS GROUPS

Study Title: Examining the relationship between environmental concern, exercise habits, and fruit and vegetable intake
Principal Investigator: Dr. Barry Braun
Student Researcher: Dana Harrison

1. WHAT IS THIS FORM?

This is a Consent Form. It will give you the information you need to understand why this study is being done, why we are asking you to participate, and what we will ask you to do. Please take some time to read this over with me and ask any questions you may have either now or later. If you decide to be part of this study, please sign this form. We will give you a copy of this form for your records.

2. WHO IS ELIGIBLE TO PARTICIPATE?

Individuals who are members of Energia Studio (Hadley, Ma).

3. WHAT IS THE PURPOSE OF THIS STUDY?

Our goal is to find ways to motivate people to increase exercise participation and drive positive health behavior change. We’re interested in hearing your thoughts about: 1). current dietary, exercise, and sustainable practices, 2). benefits of healthy diet and exercise participation levels, and 3). barriers to consuming a healthy diet and participating in exercise.

4. WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?

If you are willing to participate in a focus group, the session will last about one hour and will take place here and now (Energia Studio).

5. WHAT WILL I BE ASKED TO DO?

If you are participating in a focus group, you will be in a group of 6-8 people. We’re going to ask several questions about sustainable practices, exercise habits, consumption of fruits and vegetables, and attitudes and behaviors toward exercise. For example, we
will ask “What sustainable practices do you participate in and why?” We are also interested in your thoughts about energy harvesting exercise, exercise that produces stored electrical energy.

There are no right or wrong answers, and the information you give us will not be shared with anyone other than members of the study team. We will only use your first name during the group discussions.

6. WHAT ARE MY BENEFITS OF BEING IN THIS STUDY?

You may benefit by learning more about how you and others feel about sustainability efforts. Through group discussions, you may also increase awareness and knowledge about energy harvesting exercise and its potential effects on exercise participation levels.

7. WHAT ARE MY RISKS OF BEING IN THIS STUDY?

There are no known risks, discomforts or side effects of this project.

8. HOW WILL MY PERSONAL INFORMATION BE PROTECTED?

We will tape record the discussion that takes place in the focus groups, and someone will also take notes. The tapes will record all the comments made so we can capture and understand everything that is said. You can leave the group at any time. Once we collect all of the information, we will remove your name and use a code number instead, so no one will know your answers came from you personally. All information you give will only be heard or seen by members of the project team and the person who transcribes the tapes. Anything we report or publish will be in summary form with no names included. All information, including the tapes will be kept in a locked file cabinet at UMass during the project. The tapes will be destroyed after three years.

9. WILL I RECEIVE ANY PAYMENT FOR TAKING PART IN THE STUDY?

Compensation for participating in this study includes receiving an ENERGIA t-shirt or $10 UMass University gift card.

10. WHAT IF I HAVE QUESTIONS?

If you have further questions about this project or if you have a research-related problem, you may contact the principal investigator (Barry Braun, bbraun@kin.umass.edu) or student researcher (Dana Harrison, dharriso@nutrition.umass.edu). If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu.

11. CAN I STOP BEING IN THE STUDY?
You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

12. WHAT IF I AM INJURED?

There are no anticipated risks of injury related to this study. The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects research, but the study personnel will assist you in getting treatment.

13. SUBJECT STATEMENT OF VOLUNTARY CONSENT

I have read this form and decided that I will participate in the project described above. The general purposes and particulars of the study as well as possible hazards and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time.

Participant Signature: __________________________  Print Name: __________________________  Date: __________

By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

Signature of Person Obtaining Consent: __________________________  Print Name: __________________________  Date: __________
APPENDIX E
INFORMED CONSENT (DEMOGRAPHIC SURVEY)

INFORMED CONSENT FORM: DEMOGRAPHIC SURVEY

Study Title: Examining the relationship between environmental concern, exercise habits, and fruit and vegetable intake
Principal Investigator: Dr. Barry Braun
Student Researcher: Dana Harrison

1. WHAT IS THIS FORM?

This is a Consent Form. It will give you the information you need to understand why this study is being done, why we are asking you to participate, and what we will ask you to do. Please take some time to read this over with me and ask any questions you may have either now or later. If you decide to be part of this study, please sign this form. We will give you a copy of this form for your records.

2. WHO IS ELIGIBLE TO PARTICIPATE?

Individuals who are members of ENERGIA Studios.

3. WHAT IS THE PURPOSE OF THIS STUDY?

Our goal is to find ways to motivate people to increase exercise participation and drive positive health behavior change. We’re interested in hearing your thoughts about: 1). current dietary, exercise, and sustainable practices, 2). benefits of healthy diet and exercise participation levels, and 3). barriers to consuming a healthy diet and participating in exercise.

4. WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?

If you are willing to complete a survey, the survey will be administered here and will take approximately 3-5 minutes.

5. WHAT WILL I BE ASKED TO DO?

You will be asked about your current fruit and vegetable consumption, exercise participation levels, and sustainable behaviors.

6. WHAT ARE MY BENEFITS OF BEING IN THIS STUDY?
You may benefit by learning more about how you and others feel about sustainability efforts. Through group discussions, you may also increase awareness and knowledge about energy harvesting exercise and its potential effects on exercise participation levels.

7. WHAT ARE MY RISKS OF BEING IN THIS STUDY?

There are no known risks, discomforts or side effects of this project.

8. HOW WILL MY PERSONAL INFORMATION BE PROTECTED?

All information you give will only be seen by members of the project team. Anything we report or publish will be in summary form with no names included. All information will be kept in a locked file cabinet at UMass during the project.

9. WILL I RECEIVE ANY PAYMENT FOR TAKING PART IN THE STUDY?

There is no compensation for completing this survey.

10. WHAT IF I HAVE QUESTIONS?

If you have further questions about this project or if you have a research-related problem, you may contact the principal investigator (Barry Braun, bbraun@kin.umass.edu) or student researcher (Dana Harrison, dharriso@nutrition.umass.edu). If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu.

11. CAN I STOP BEING IN THE STUDY?

You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

12. WHAT IF I AM INJURED?

There are no anticipated risks of injury related to this study. The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects research, but the study personnel will assist you in getting treatment.

13. SUBJECT STATEMENT OF VOLUNTARY CONSENT

I have read this form and decided that I will participate in the project described above. The general purposes and particulars of the study as well as possible hazards and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time.
Participant Signature: ____________________ Print Name: ____________________ Date: __________

By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

_________________________    ____________________  __________
Signature of Person   Print Name:    Date:
Obtaining Consent
APPENDIX F
INFORMED CONSENT (PERMACULTURE SURVEY)

INFORMED CONSENT FORM

Study Title: Examining the relationship between environmental concern, exercise habits, and fruit and vegetable intake
Principal Investigator: Dr. Barry Braun
Student Researcher: Dana Harrison

1. WHAT IS THIS FORM?

This is a Consent Form. It will give you the information you need to understand why this study is being done, why we are asking you to participate, and what we will ask you to do. Please take some time to read this over with me and ask any questions you may have either now or later. If you decide to be part of this study, please sign this form. We will give you a copy of this form for your records.

2. WHO IS ELIGIBLE TO PARTICIPATE?

Members of UMass Permaculture community.

3. WHAT IS THE PURPOSE OF THIS STUDY?

Our goal is to find ways to motivate people to increase exercise participation and drive positive health behavior change. We’re interested in hearing your thoughts about: 1). current dietary, exercise, and sustainable practices, 2). benefits of healthy diet and exercise participation levels, and 3). barriers to consuming a healthy diet and participating in exercise.

4. WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?

If you are willing to complete a survey, the survey will be administered online and will take approximately 10 minutes.

5. WHAT WILL I BE ASKED TO DO?

You will be asked about your current fruit and vegetable consumption, exercise participation levels, and sustainable behaviors. Attitudes and behaviors toward fruit and vegetable consumption and participation in exercise will also be assessed.

6. WHAT ARE MY BENEFITS OF BEING IN THIS STUDY?
You may benefit by learning more about how you feel about sustainability efforts.

7. WHAT ARE MY RISKS OF BEING IN THIS STUDY?

There are no known risks, discomforts or side effects of this project.

8. HOW WILL MY PERSONAL INFORMATION BE PROTECTED?

All information you give will only be seen by members of the project team. Anything we report or publish will be in summary form with no names included. All information will be kept in a locked file cabinet at UMass during the project.

9. WILL I RECEIVE ANY PAYMENT FOR TAKING PART IN THE STUDY?

Participants will be entered into a raffle to receive a $10 UMass University gift card.

10. WHAT IF I HAVE QUESTIONS?

If you have further questions about this project or if you have a research-related problem, you may contact the principal investigator (Barry Braun, bbraun@kin.umass.edu) or student researcher (Dana Harrison, dharriso@nutrition.umass.edu). If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu.

11. CAN I STOP BEING IN THE STUDY?

You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

12. WHAT IF I AM INJURED?

There are no anticipated risks of injury related to this study. The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects research, but the study personnel will assist you in getting treatment.

13. SUBJECT STATEMENT OF VOLUNTARY CONSENT

I have read this form and decided that I will participate in the project described above. The general purposes and particulars of the study as well as possible hazards and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time.

________________________ ____________________  __________
By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

_________________________    ____________________  __________
Signature of Person   Print Name:    Date:

Obtaining Consent

_________________________    ____________________  __________
APPENDIX G

ENERGIA RECRUITMENT PARAGRAPH

You are invited to participate in a research study focused on finding ways to motivate people to increase exercise participation and drive positive health behavior change.

- We encourage you to participate in our focus group and survey to provide information about your physical activity, diet, and sustainable behaviors.

- Information will be used to identify potential benefits of exercise and consumption of fruits and vegetables, as well as barriers to these practices.

- You are eligible to participate if you are:
  
  o 18 or older

  o A member of ENERGIA Fitness

  o Not a nutrition or kinesiology major

- You will be asked to participate in a one-hour focus group and complete a brief demographic survey, which will take approximately 3-5 minutes.

- To thank you for your time, you will receive either an ENERGIA t-shirt or a $10 UMass University Book Store gift card.

- All data will be used for a graduate nutrition student’s Master’s thesis.

- If you have any questions, please contact Dana Harrison at: dharriso@nutrition.umass.edu.
You are invited to participate in a research study focused on finding ways to motivate people to increase exercise participation and drive positive health behavior change.

We encourage you to participate in our survey to provide information about your physical activity, diet, and sustainable behaviors.

Information will be used to identify potential benefits of exercise and consumption of fruits and vegetables, and barriers to these practices.

You are eligible to participate if you are:

- 18 or older
- A member of the UMass Permaculture community
- Not a nutrition or kinesiology major

You will be asked to participate in an online survey, which will take approximately 10 minutes to complete.

Upon completion of the survey, your name will be entered into a raffle with a chance to receive $10 UMass University Book Store gift card.

All data will be used for a graduate nutrition student’s Master’s thesis.

If you have any questions, please contact Dana Harrison at: dharriso@nutrition.umass.edu.
APPENDIX I

FOCUS GROUP SIGN UP SHEET

FOCUS GROUP SIGN UP SHEET

Tuesday, July 16th 7:00 – 8:00 p.m.

<table>
<thead>
<tr>
<th>Name</th>
<th>Preferred Contact (cell or email) for Reminder Message</th>
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Thursday, July 18th 7:00 – 8:00 p.m.

<table>
<thead>
<tr>
<th>Name</th>
<th>Preferred Contact (cell or email) for Reminder Message</th>
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Tuesday, July 23rd 7:30 a.m. – 8:30 a.m.

<table>
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<tr>
<th>Name</th>
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### Wednesday, July 24th 10:15 a.m. – 11:15 a.m.

<table>
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<tr>
<th>Name</th>
<th>Preferred Contact (cell or email) for Reminder Message</th>
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</table>
Hello,

This is a friendly reminder that you have signed up to participate in a focus group on ______, July ______th from ______-_______a.m/ p.m. at ENERGIA Studios. If you have any questions, please contact Dana Harrison at dharriso@nutrition.umass.edu.

We look forward to meeting you tomorrow!

Sincerely,
UMass Energy Harvesting Lab
Table 1: Summary of Specific Aims, Expectations, and Variables

<table>
<thead>
<tr>
<th>Specific Aim</th>
<th>Variables (Dependent/Independent)</th>
<th>Potential Modifiers and Mediators</th>
<th>Measures</th>
<th>Expectations</th>
<th>Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 To investigate whether energy harvesting exercise related self-efficacy is associated with environmental concern among non-exercisers</td>
<td><strong>Dependent:</strong> Energy harvesting self-efficacy (Co) <strong>Independent:</strong> Environmental concern (Ca)</td>
<td>Age (Ca) Gender (D) Race (Ca) Education (Ca) Income (Ca)</td>
<td>Exercise self-efficacy questions</td>
<td>Self-efficacy levels regarding participation in energy harvesting exercise will be higher among non-exercisers concerned about the environment compared with non-exercisers who are less concerned about the environment.</td>
<td>Kruskal-Wallis</td>
</tr>
<tr>
<td>#2: To assess the association of environmental concern on sustainable fruit and vegetable purchasing habits among exercisers and non-exercisers.</td>
<td><strong>Dependent:</strong> Fruit and vegetable purchasing (Ca) <strong>Independent:</strong> Environmental concern (Ca)</td>
<td>Age (Ca) Gender (D) Race (Ca) Education (Ca) Income (Ca)</td>
<td>Sustainable behavior checklist</td>
<td>Sustainable fruit and vegetable purchasing habits, including environmentally sustainable, organic, and local purchases are positively associated with environmental concern.</td>
<td>Fisher’s Exact Test</td>
</tr>
</tbody>
</table>
**#3:** To assess the association of personal health on sustainable fruit and vegetable purchasing habits among exercisers and non-exercisers.

<table>
<thead>
<tr>
<th>Dependent: Fruit and vegetable purchasing (Ca)</th>
<th>Independent: Health concern (Ca)</th>
<th>Sustainable behavior checklist</th>
<th>Sustainable fruit and vegetable purchasing habits, including environmentally sustainable, organic, and local purchases are positively associated with personal health.</th>
<th>Fisher’s Exact Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Ca) Gender (D) Race (Ca) Education (Ca) Income (Ca)</td>
<td>Personal health questions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**#4:** To assess the association of fruit and vegetable intake on participating in sustainable practices among exercisers and non-exercisers.

<table>
<thead>
<tr>
<th>Dependent: Sustainable practices (Co) Fruit and vegetable intake (Ca)</th>
<th>Independent: Fruit and vegetable intake (Ca)</th>
<th>Sustainable behavior checklist</th>
<th>Consuming the recommended fruit and vegetable intake (defined as consuming ≥5 fruit and vegetable servings per day) is positively associated with sustainable practices.</th>
<th>Kruskal-Wallis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Ca) Gender (D) Race (Ca) Education (Ca) Income (Ca) Health concern (Ca) Environmental concern (Ca)</td>
<td>FFQ Fruit and vegetable servings</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
#5. To assess the association between recommended fruit and vegetable intake on exercise behaviors among exercises and non-exercisers.

<table>
<thead>
<tr>
<th><strong>Dependent:</strong> Exercise behaviors (Ca)</th>
<th><strong>Independent:</strong> Fruit and vegetable intake (Ca)</th>
<th>Age (Ca) Gender (D) Education (Ca) Race (Ca) Income (Ca) Health concern (Ca)</th>
<th>Exercise Behavior</th>
<th>Consuming the recommended fruit and vegetable intake is positively associated with exercise behavior.</th>
<th>Fisher’s Exact Test</th>
</tr>
</thead>
</table>

**Key:** Independent variable= explanatory variable; dependent variable= outcome/response variable; Co= continuous variable, Ca= categorical variable, and D= dichotomous variable.

**Variable Definition:**

1. To measure the effect of environmental concern on the self-efficacy of “energy harvesting exercise”: Kruskal-Wallis test (non-parametric equivalent of ANOVA test)
   a. Outcome variable (Y): self-efficacy of “energy harvesting exercise”
   b. Independent predictor variable (X<sub>1</sub>): environmental concern

2. To measure the association of environmental concern on sustainable fruit and vegetable purchasing habits: Fischer’s Exact Test
   a. Outcome variable (Y): sustainable fruit and vegetable purchasing habits (sustainable behavior checklist)
   b. Independent predictor variable (X<sub>1</sub>): environmental concern

3. To measure the association of personal health on sustainable fruit and vegetable purchasing habits: Fischer’s Exact Test
   a. Outcome variable (Y): sustainable fruit and vegetable purchasing habits (sustainable behavior checklist)
   b. Independent predictor variable (X<sub>1</sub>): personal health (health concern)
4. To measure the effect of fruit and vegetable intake on participation in sustainable practices: Kruskal-Wallis
   a. Outcome variable (Y): total sustainable practices (sustainable behavior checklist)
   b. Independent predictor variable (X<sub>1</sub>): fruit and vegetable intake

5. To measure the association between recommended fruit and vegetable intake and exercise behavior: Fischer’s Exact Test
   a. Outcome variable (Y): exercise behavior
   b. Independent predictor variable (X<sub>1</sub>): fruit and vegetable intake
Table 2: ENERGIA Demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>Female</td>
<td>11 (91.7)</td>
</tr>
<tr>
<td><strong>Age Range</strong></td>
<td></td>
</tr>
<tr>
<td>18-29 years</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>30-39 years</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>40-49 years</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>50-64 years</td>
<td>6 (50)</td>
</tr>
<tr>
<td>65 years and over</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>9 (75)</td>
</tr>
<tr>
<td>Black/African American</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Less than a high school degree</td>
<td>0 (0)</td>
</tr>
<tr>
<td>High school degree or GED</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Associates college degree</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Some college</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>A four year college degree</td>
<td>3 (25)</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>8 (66.7)</td>
</tr>
<tr>
<td><strong>Total Household Income</strong></td>
<td></td>
</tr>
<tr>
<td>Less than $10,000</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$10,000 to $19,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$20,000 to $29,999</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>$30,000 to $39,999</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>$40,000 to $49,999</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>$50,000 to $59,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$60,000 to $69,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$70,000 to $79,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$80,000 to $89,999</td>
<td>1 (8.3)</td>
</tr>
<tr>
<td>$90,000 to $99,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$100,000 to $149,999</td>
<td>4 (33.3)</td>
</tr>
<tr>
<td>$150,000 or more</td>
<td>3 (25)</td>
</tr>
</tbody>
</table>
Table 3: Response to Exercise and Physical Activity

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPINNING ®</td>
<td>Muscles</td>
</tr>
<tr>
<td>Enjoyment/fun</td>
<td>Fun</td>
</tr>
<tr>
<td>Hard work</td>
<td>Outdoors</td>
</tr>
<tr>
<td>Uggg</td>
<td>Activities outside</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Exercise</td>
</tr>
<tr>
<td>Heart rate</td>
<td>Doing anything</td>
</tr>
<tr>
<td>Fitness</td>
<td>Being in motion</td>
</tr>
<tr>
<td>Music</td>
<td></td>
</tr>
<tr>
<td>Benefits of Exercise</td>
<td>Selected Quotes</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Fun/ enjoyment</td>
<td><em>I do enjoy exercise for the most part. You know in this kind of setting I do this because I’m not a very good self-motivator. So sometimes I don’t want to come but I do it.</em></td>
</tr>
</tbody>
</table>
| Feel better          | *I feel better [when I exercise] and I think that my head is clearer. I’m … better at work... I just feel better. Mentally and physically.*  
| | *And I feel better [when I exercise], I feel stronger. I feel straighter, I feel like my posture is better. Everything, it just feels better.*  
| | *I can do more and more every single day, so I feel good about that.*  
| | *I find when I exercise … I have more energy and I can move easier and stuff like that.*  
| | *I just feel stronger, you know my mind is just feeling much more positive... when I leave here I feel good.* |
| Weight maintenance/ Appearance | *I unfortunately can’t say that I think it’s fun. But I do it [exercise] because I am slowly getting a little bigger every year, and I don’t wanna be fat.*  
| | *Fitting good into the skinny jeans* |
| Stress Management    | *The kids say I’m nicer right now. It’s like I’m not yelling anymore.*  
| | *Cause then when you don’t do it you’re like crazed and you don’t realize you’re crazed. So then, when you do do it [exercise], you’re like “ohhh”.* |
| Health               | *I am trying to get healthy so I can live, ha, a lot longer… I would be fine with how I look, but there are just too many things in my family’s history that I need to get healthy for.* |
I have to admit that as I get older the health issue is so clear, that to stop makes no sense at all… the health aspect is undeniable.

<table>
<thead>
<tr>
<th>Sense of accomplishment</th>
<th>It’s challenging mentally… as well as physically, but definitely mentally.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It’s always a good feeling. Always. Even if I’m, sometimes I’ve over extended … but I still feel like I’ve done something good for myself.</td>
</tr>
<tr>
<td></td>
<td>But just the accomplishment, so enjoyment is a definite benefit. And plus, going a different route with enjoyment, you can enjoy it so much more when you’re healthy. So like things that I can do with my kids now that I haven’t been able to, so it goes to that part too.</td>
</tr>
<tr>
<td></td>
<td>You really have a sense of accomplishment when you’re up there and huffing and puffing until the end.</td>
</tr>
<tr>
<td>Barrier</td>
<td>Selected Quotes</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Convenience</td>
<td>There was a period where I didn’t spin because [there] just didn’t seem to be a convenient place.</td>
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<tr>
<td></td>
<td>I guess I would look back and I’d say it wasn’t so much; there probably always was time. It was a question of fitting it in and making it a priority.</td>
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<tr>
<td></td>
<td>And then once you stop going for a while it’s like ohhhhh... Yeah it’s hard to get back to it.</td>
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<tr>
<td></td>
<td>I get totally discouraged and then I think “ohhh I can’t do this” and then it takes me a while to pull yourself back into the “oh yes I can.” A little by little you start doing it again.</td>
</tr>
<tr>
<td></td>
<td>Something that I would say that I forgot is time. Because I think of exercising as something I put last because work has to come first. It has to.</td>
</tr>
<tr>
<td>Embarrassment</td>
<td>Being in a class is intimidating enough.</td>
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<tr>
<td></td>
<td>I was petrified to go into a class. And I thought everyone was going to be super fit and you know super toned.</td>
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<tr>
<td></td>
<td>But if you’re in the front row you better be performing really well. I’m not kidding. And I don’t want to be a part of that... I’m not in a clique... it’s awful, it’s awful.</td>
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<tr>
<td></td>
<td>Special people. I would prefer not to work out with them like I was never someone who wanted like any of my really dainty girlfriends to go with me. Because I sweat a lot I get really disgusting. I don’t want people to see me disgusting because maybe they don’t sweat as much as me.</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
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<td>-------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>But I get intimidated even if no one is looking, there’s mirrors absolutely everywhere. And I feel like okay, I can see every part of my body.</td>
<td>Gender dynamics: I remember being a young woman, 18 or 19, and you have all of the guys there so you have the gender dynamic… I don’t know maybe you guys don’t care, but now I don’t care. Cost: People probably don’t exercise as much as they could because it’s just kind of expensive. And… I would try to convince some people to come here and I think it’s a good price but for someone else it’s just like I’d rather spend ten dollars at Planet Fitness. If I definitely had more money I’d definitely avail myself of more. You know, I’d be like personal training three times a week or something more. But you know, I just can’t do that right now. Age: As I get older, it’s harder. I mean it’s really difficult for older women or whatever. They don’t want to go into a place you know where everybody looks like you guys (referencing the interviewers), and whatever. Physical strain: I probably don’t love it as much… but I’m getting better at it because it’s only been a week now, but it’s getting a lot easier to not cheat, and put the weight on my legs. Safety: I’m across the street from the bike path, but … I just don’t feel safe… especially on some sections of the path, so I don’t bike by myself. Social Support: I don’t have a lot of support from my husband… So it’s hard when you don’t have support from your family. I can deal with non-support from your friends but or um whatever, but when it’s your own family it’s hard.</td>
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Table 6: Strategies to Overcome Barriers to Exercise

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Selected Quotes</th>
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<tbody>
<tr>
<td>Role Modeling (for children)</td>
<td><em>I have young children, teenage children, and I want them to see my husband and I--he runs and it’s just something we want to instill in them.</em></td>
</tr>
<tr>
<td>Competitive (healthy competition)</td>
<td><em>Because if she’s next to me and she’s going faster, you know what I mean? I am motivated. Not that I want to compete with her but it motivates me.</em></td>
</tr>
</tbody>
</table>
| Routine                      | *But I also work with a personal trainer and I just need the consistency of that so I actually like being with a personal trainer and coming to classes.*  
*What works for me is having a routine... having a class and knowing that it starts at 9 o’clock then I’ll go. But by myself, I’ll keep putting it off and putting it off, and so establishing a routine for me is what works.* |
| Enjoyment                    | *Well, I think it also depends on the exercise too. You know, some of it is enjoyable and some of it is just not enjoyable...I mean if you’re doing something extremely enjoyable then that’s nice.*  
*I figured out that it has to be something I enjoy or I can’t force myself to do something. I can force myself to do something a few times.*                                                                 |
<p>| Cost                         | <em>I piece it together. I go to different places.</em>                                                                                                                                                                 |
|                              | <em>It’s changed what I’ve done.... But it’s never prevented me from like moving and working out or doing something different... I probably would do more yoga if I wanted to pay for more classes. But I don’t have to do yoga, it’s not the only thing I can do. So I just do other things.</em> |</p>
<table>
<thead>
<tr>
<th>Measuring the benefits</th>
<th>Sometimes it’s the last thing in the world that you want to do is like exercise, but then once you make the connection between how much it helps you that kind of helps you get over that.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embarrassment</td>
<td>But I just had to get my mindset back about like not caring about what people think, and they’re really not thinking like that, it’s really just your insecurity. So really just fighting against myself to overcome a lot of these… So for me it’s a lot of yelling at myself mentally to just do it, just do it.</td>
</tr>
<tr>
<td>Fruit/Vegetable Barriers</td>
<td>Selected Quotes</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Cost</td>
<td>That’s probably one of the bigger ones. Healthier foods tend to be more expensive.</td>
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<td></td>
<td>It’s so much more expensive to buy healthy.</td>
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<tr>
<td></td>
<td>Yeah probably a little tough. I just started living on my own so I’m still in the midst of acquiring everything to cook it. You know aggregately it’s a lot of money.</td>
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<td></td>
<td>Sometimes [I purchase organic] but again, cost is a factor there and though in our heads we can see the value it’s not always the easiest choice to make.</td>
</tr>
<tr>
<td></td>
<td>I think cost is an issue. Especially because people keep pushing the organic, and it’s very pricey for families. And it’s okay if you’re one or two family but if you’ve got a big family it’s very expensive.</td>
</tr>
<tr>
<td>Shelf life</td>
<td>It goes bad quicker too if I don’t like stay on top of it. I mean I just bought two packs of strawberries from Big Y and they somehow went bad in two days.</td>
</tr>
<tr>
<td></td>
<td>I’ve definitely thrown away fruits and vegetables.</td>
</tr>
<tr>
<td>Calories/ carbohydrates (fruits)</td>
<td>Only because, I mean I could eat a lot of fruit, but I find that there’s a lot of carbs in fruits, and unless I get to go to the gym then I try not to eat a lot of fruit.</td>
</tr>
</tbody>
</table>
| Taste Preference/ Tolerance | You know I would like to, but like I can’t eat this huge raw salad. I can’t eat too much raw stuff, which is a lot...so sometimes that probably keeps me away a little bit. A little bit for me. I’m trying to find what I like.

I’m a texture picky eater so I have a lot of problems with that.

I have a hard time finding good tasting fruits. Especially in the winter. And I’m not good at picking fruits sometimes and I don’t know why.

[I won’t eat them] Only if they don’t taste good otherwise I’ll eat them anytime. |
|---|---|
| Satisfaction/ Preference | Do I want to have fruit? Nah not right now. Probably the same with vegetables.

I think I tire of vegetables. So there will be times when I just don’t want to have a salad, I don’t want to have any more vegetables... but recognizing the importance of the diet, they are always there. But there are time periods where I just don’t want any more. And that’s probably the biggest barrier, it’s not that I don’t like them. I don’t find them very filling necessarily. So is it a satisfying meal? Not always. |
Table 8: Participants’ Reaction to Watts Energy Display

<table>
<thead>
<tr>
<th>Watts Reaction</th>
<th>Selected Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal motivator</td>
<td><em>I find it motivating… It makes me want to beat it each time.</em></td>
</tr>
<tr>
<td></td>
<td><em>I pay attention to the personal watts on the bike.</em></td>
</tr>
<tr>
<td></td>
<td>*Well you have a number in your head. What did I do last time? Can I do better this time?</td>
</tr>
<tr>
<td></td>
<td><em>It increases my workout.</em></td>
</tr>
<tr>
<td>Additional feedback</td>
<td><em>The thing that has been most motivating for me is that it provides another metric. I can compare, I can see this obvious sign of some accomplishment and I compete with myself so I have these goals that I have to, I have to have these amount of watts.</em></td>
</tr>
<tr>
<td></td>
<td><em>But I don’t know if it’s if people are thinking about creating electricity to run our fans, so much as… it shows the increased effort or decreased effort.</em></td>
</tr>
</tbody>
</table>
Table 9: Screener Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preferred Exercise</strong></td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>16 (41)</td>
</tr>
<tr>
<td>Running</td>
<td>10 (25.6)</td>
</tr>
<tr>
<td>bicycling</td>
<td>5 (12.8)</td>
</tr>
<tr>
<td>Swimming</td>
<td>3 (7.7)</td>
</tr>
<tr>
<td>Elliptical</td>
<td>5 (12.8)</td>
</tr>
<tr>
<td>Stair Master</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Exercise Intensity</strong></td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>12 (30.8)</td>
</tr>
<tr>
<td>Moderate</td>
<td>13 (33.3)</td>
</tr>
<tr>
<td>Vigorous</td>
<td>14 (35.9)</td>
</tr>
<tr>
<td><strong>Physical Activity Guidelines</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>23 (59.0)</td>
</tr>
<tr>
<td>No</td>
<td>16 (41.0)</td>
</tr>
<tr>
<td><strong>Environmental Concern</strong></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>0 (0)</td>
</tr>
<tr>
<td>A little</td>
<td>1 (6.3)</td>
</tr>
<tr>
<td>Somewhat</td>
<td>3 (18.8)</td>
</tr>
<tr>
<td>Quite a bit</td>
<td>6 (37.5)</td>
</tr>
<tr>
<td>All the time</td>
<td>6 (37.5)</td>
</tr>
<tr>
<td><strong>Kinesiology or Nutrition Major</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0 (100)</td>
</tr>
<tr>
<td>No</td>
<td>16 (100)</td>
</tr>
</tbody>
</table>

*N= 39 for preferred exercise, exercise intensity, and physical activity guidelines. N= 16 for environmental concern and major.
Table 10: Permaculture Demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (20)</td>
</tr>
<tr>
<td>Female</td>
<td>28 (80)</td>
</tr>
<tr>
<td><strong>Age Range</strong></td>
<td></td>
</tr>
<tr>
<td>18-29 years</td>
<td>24 (66.7)</td>
</tr>
<tr>
<td>30-39 years</td>
<td>4 (11.1)</td>
</tr>
<tr>
<td>40-49 years</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td>50-64 years</td>
<td>4 (11.1)</td>
</tr>
<tr>
<td>65 years and over</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>34 (94.4)</td>
</tr>
<tr>
<td>Asian</td>
<td>1 (2.7)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (2.7)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Less than a high school degree</td>
<td>0 (0)</td>
</tr>
<tr>
<td>High school degree or GED</td>
<td>3 (8.3)</td>
</tr>
<tr>
<td>Associates college degree</td>
<td>3 (8.3)</td>
</tr>
<tr>
<td>Some college</td>
<td>11 (30.6)</td>
</tr>
<tr>
<td>A four year college degree</td>
<td>11 (30.6)</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>8 (22.2)</td>
</tr>
<tr>
<td><strong>Total Household Income</strong></td>
<td></td>
</tr>
<tr>
<td>Less than $10,000</td>
<td>6 (17.1)</td>
</tr>
<tr>
<td>$10,000 to $19,999</td>
<td>4 (11.4)</td>
</tr>
<tr>
<td>$20,000 to $29,999</td>
<td>3 (8.6)</td>
</tr>
<tr>
<td>$30,000 to $39,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$40,000 to $49,999</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>$50,000 to $59,999</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td>$60,000 to $69,999</td>
<td>5 (14.3)</td>
</tr>
<tr>
<td>$70,000 to $79,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$80,000 to $89,999</td>
<td>0 (0)</td>
</tr>
<tr>
<td>$90,000 to $99,999</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td>$100,000 to $149,999</td>
<td>7 (20)</td>
</tr>
<tr>
<td>$150,000 or more</td>
<td>5 (14.3)</td>
</tr>
</tbody>
</table>

*N= 36 respondents, with an exception for income (N= 26 respondents).
Table 11: Benefits of Exercise Participation

<table>
<thead>
<tr>
<th>Benefit</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight management or weight loss</td>
<td>10 (66.7)</td>
</tr>
<tr>
<td>Increased fitness</td>
<td>10 (66.7)</td>
</tr>
<tr>
<td>Increased muscle tone or mass</td>
<td>11 (73.3)</td>
</tr>
<tr>
<td>Stress management</td>
<td>10 (66.7)</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>6 (40.0)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*N=15 respondents
Table 12: Barriers to Exercise

<table>
<thead>
<tr>
<th>Barrier</th>
<th>N*(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Not feeling comfortable</td>
<td>8 (57.1)</td>
</tr>
<tr>
<td>Safety</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Lack of time</td>
<td>10 (71.4)</td>
</tr>
<tr>
<td>Lack of access</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>Lack of encouragement from others</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Lack of interest</td>
<td>7 (50.0)</td>
</tr>
<tr>
<td>Physical strain/ work</td>
<td>4 (28.6)</td>
</tr>
<tr>
<td>Feeling tired afterwards</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Perspiration during exercise</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (7.1)</td>
</tr>
</tbody>
</table>

*N= 14 respondents
Table 13: Benefits of Consuming Fruits and Vegetables

<table>
<thead>
<tr>
<th>Benefit</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight maintenance</td>
<td>11 (73.3)</td>
</tr>
<tr>
<td>Weight loss</td>
<td>5 (33.3)</td>
</tr>
<tr>
<td>Make you feel better</td>
<td>13 (86.7)</td>
</tr>
<tr>
<td>Make you feel healthy</td>
<td>14 (93.3)</td>
</tr>
<tr>
<td>Give you energy</td>
<td>11 (73.3)</td>
</tr>
<tr>
<td>Help you get more nutrients</td>
<td>14 (93.3)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (6.7)</td>
</tr>
</tbody>
</table>

*N= 15 respondents
Table 14: Barriers to Consuming Fruits and Vegetables

<table>
<thead>
<tr>
<th>Barrier</th>
<th>N* (%)</th>
<th>Fruits:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cost</td>
<td>7 (58.3)</td>
<td>Accessibility</td>
<td>5 (41.7)</td>
<td>Ability to prepare/cook them</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taste</td>
<td>1 (8.3)</td>
<td>Shelf-life</td>
<td>7 (58.3)</td>
<td>Quality</td>
<td>7 (58.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality</td>
<td>7 (58.3)</td>
<td>Other</td>
<td>2 (16.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegetables:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost</td>
<td>4 (36.4)</td>
<td>Accessibility</td>
<td>5 (45.5)</td>
<td>Ability to prepare/cook them</td>
<td>4 (36.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taste</td>
<td>4 (36.4)</td>
<td>Shelf-life</td>
<td>6 (54.5)</td>
<td>Quality</td>
<td>4 (36.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality</td>
<td>5 (45.5)</td>
<td>Other</td>
<td>1 (9.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organic Fruits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost</td>
<td>7 (63.6)</td>
<td>Accessibility</td>
<td>3 (27.3)</td>
<td>Ability to prepare/cook them</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taste</td>
<td>0 (0)</td>
<td>Shelf-life</td>
<td>1 (9.1)</td>
<td>Quality</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality</td>
<td>0 (0)</td>
<td>Other</td>
<td>2 (18.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organic Vegetables</td>
<td>10 (100)</td>
<td>Accessibility</td>
<td>7 (70)</td>
<td>Ability to prepare/cook them</td>
<td>1 (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taste</td>
<td>0 (0)</td>
<td>Shelf-life</td>
<td>5 (50)</td>
<td>Quality</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality</td>
<td>0 (0)</td>
<td>Other</td>
<td>2 (20)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N=12 respondents for barriers to fruit consumption, while N=11 respondents for barriers to vegetable consumption. N=11 respondents for organic fruit consumption, while N=10 respondents for organic vegetable consumption.
Table 15: Personal Health Responses (Non-exercisers)

<table>
<thead>
<tr>
<th>Health Rating</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI</strong></td>
<td></td>
</tr>
<tr>
<td>Underweight (&lt; 18.5)</td>
<td>1 (6.7)</td>
</tr>
<tr>
<td>Normal (18.5-24.9)</td>
<td>8 (53.3)</td>
</tr>
<tr>
<td>Overweight (25-29.9)</td>
<td>2 (13.3)</td>
</tr>
<tr>
<td>Obese (≥30)</td>
<td>4 (26.7)</td>
</tr>
<tr>
<td><strong>General Health</strong></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Very Good</td>
<td>4 (28.6)</td>
</tr>
<tr>
<td>Good</td>
<td>7 (50)</td>
</tr>
<tr>
<td>Fair</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Poor</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Worrying About Health</strong></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>0 (0)</td>
</tr>
<tr>
<td>A little</td>
<td>6 (42.9)</td>
</tr>
<tr>
<td>Somewhat</td>
<td>5 (35.7)</td>
</tr>
<tr>
<td>Quite a bit</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>All the time</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Changed Eating as a Result of Worrying</strong></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>0 (0)</td>
</tr>
<tr>
<td>A little</td>
<td>4 (28.6)</td>
</tr>
<tr>
<td>Somewhat</td>
<td>5 (35.7)</td>
</tr>
<tr>
<td>Quite a bit</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>All the time</td>
<td>2 (14.3)</td>
</tr>
</tbody>
</table>

*N=14 respondents*
Table 16: Personal Health Responses (Exercisers)

<table>
<thead>
<tr>
<th>Health Rating</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI</strong></td>
<td></td>
</tr>
<tr>
<td>Underweight (&lt; 18.5)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Normal (18.5-24.9)</td>
<td>7 (58.3)</td>
</tr>
<tr>
<td>Overweight (25-29.9)</td>
<td>3 (25)</td>
</tr>
<tr>
<td>Obese (&gt;30)</td>
<td>3 (25)</td>
</tr>
<tr>
<td><strong>General Health</strong></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>4 (33.3)</td>
</tr>
<tr>
<td>Very Good</td>
<td>5 (41.7)</td>
</tr>
<tr>
<td>Good</td>
<td>3 (25)</td>
</tr>
<tr>
<td>Fair</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Poor</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Worrying About Health</strong></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>0 (0)</td>
</tr>
<tr>
<td>A little</td>
<td>7 (58.3)</td>
</tr>
<tr>
<td>Somewhat</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>Quite a bit</td>
<td>3 (25)</td>
</tr>
<tr>
<td>All the time</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Changed Eating as a Result of Worrying</strong></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>A little</td>
<td>5 (41.7)</td>
</tr>
<tr>
<td>Somewhat</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>Quite a bit</td>
<td>2 (16.7)</td>
</tr>
<tr>
<td>All the time</td>
<td>1 (8.3)</td>
</tr>
</tbody>
</table>

*N=12 participants*
Table 17: Sustainable Behaviors (Permaculture)

<table>
<thead>
<tr>
<th>Sustainable Behavior</th>
<th>N* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy alternatives (ex: solar, wind power)</td>
<td>2 (13.3)</td>
</tr>
<tr>
<td>Recycling</td>
<td>15 (100)</td>
</tr>
<tr>
<td>Composting</td>
<td>7 (46.7)</td>
</tr>
<tr>
<td>Walking/ bicycling</td>
<td>13 (86.7)</td>
</tr>
<tr>
<td>Bus</td>
<td>6 (40)</td>
</tr>
<tr>
<td>Carpooling</td>
<td>7 (46.7)</td>
</tr>
<tr>
<td>Hybrid Vehicle</td>
<td>2 (13.3)</td>
</tr>
<tr>
<td>Farmers Market</td>
<td>9 (60)</td>
</tr>
<tr>
<td>Community Supported Agriculture (CSA)</td>
<td>4 (26.7)</td>
</tr>
<tr>
<td>Organic food</td>
<td>9 (60)</td>
</tr>
<tr>
<td>Volunteer work in a community garden</td>
<td>4 (26.7)</td>
</tr>
<tr>
<td>Owned/shared garden</td>
<td>3 (20)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (13.3)</td>
</tr>
</tbody>
</table>

*N=15 respondents
Figure 1: Health Belief Model Components and Linkages from Health Behavior and Health Education Theory Research and Practice, 4th Edition, 2008.
Figure 2: Venn Diagram of Research Question

Central Research Question

Environmental Concern

Fruit & Vegetable Behaviors

Exercise
Figure 3: Venn Diagram of Specific Aims
Note: N=14. Environmental concern levels are defined as follows: 1 (not at all), 2 (a little), 3 (somewhat), 4 (quite a bit), and 5 (all the time). Exercise self-efficacy scores ranged from 1 (not confident) to 5 (very confident).
Note: N=15. Environmental concern levels are defined as follows: 1 (not at all), 2 (a little), 3 (somewhat), 4 (quite a bit), and 5 (all the time). Exercise self-efficacy scores ranged from 1 (not confident) to 5 (very confident).
Figure 6: Distribution of EXSE3 Scores and Environmental Concern Levels

Distribution of Exercise Self-Efficacy 3 Scores According to Environmental Concern Levels

Note: N=15. Environmental concern levels are defined as follows: 1 (not at all), 2 (a little), 3 (somewhat), 4 (quite a bit), and 5 (all the time). Exercise self-efficacy scores ranged from 1 (not confident) to 5 (very confident).
Figure 7: Association of Environmental Concern on Sustainable Fruit and Vegetable Purchasing Habits (Permaculture)

Note: N=15
Figure 8: Association of Environmental Concern on Sustainable Fruit and Vegetable Purchasing Habits (Combined Sample)

![Bar chart showing the association of environmental concern on sustainable food purchases.]

Note: N=27
Figure 9: Association of Health Concern on Organic Purchasing Habits (ENERGIA)

Note: N=12
Figure 10: Distribution of Sustainable Practices According to Fruit and Vegetable Consumption (Permaculture)

Note: N=15
Figure 11: Distribution of Sustainable Practices According to Fruit and Vegetable Consumption (Combined Sample)

Note: N=27
Figure 12: The Association between Fruit and Vegetable Consumption and Exercise Behaviors

Note: N=27
REFERENCES


Jane Spencer. (2007, March 1). While you’re at it, why not generate a little electricity: Harvesting the energy of Hong Kong gym rats; Lighting up dance floors. *Wall Street Journal*


