

**SUSTAINABLE DIETS:  
UNDERSTANDING NUTRITION EDUCATOR'S PERCEPTIONS**

By

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## ABSTRACT

**Background** As the world population grows to 9.1 billion people, there is a need to feed all of these people. Agriculture will need to produce more food to feed the world. Agriculture is pressured by climate change with droughts and changes in seasonal patterns and needs to adapt to these changes.

For nutritionists, there is a need to address non-communicable chronic diseases, such as obesity and diabetes. These diseases are highly problematic in the developed parts of the world. Additionally, addressing food security is also an issue as part of the world, a large portion of developing countries, experience hunger and diseases related to not having adequate nutritious foods.

Sustainable diets are working to address the issues mentioned above. This idea of having a sustainable diet is not new and dates back to a 1986 commentary by Gussow and Clancy. However, it was later in 2010, that a definition was developed by the Food and Agriculture Organization of the United Nations (FAO). This general definition has provided research with a focus on what a sustainable diet is and which food groups are parts of a sustainable diet.

**Purpose** The purpose of this study was to learn about the current knowledge of sustainable diets through conducting a search of peer-reviewed literature about what sustainable diets are and what foods are included. Finally, this study assessed what nutrition educators know about and what their perceptions are of sustainable diets.

**Methods** A literature search was conducted using several databases, including PubMed and EBSCO Host, yielding a few thousand results. After reviewing the literature, questions were developed for a focus group (n=8 participants), interviews (n=9 participants), and a short survey (n=54 participants). The project participants were from the University of Arizona's Department of Nutritional Sciences, Supplemental Nutrition Assistance Education Program (SNAP-Ed) and the Expanded Food and Nutrition Education Program (EFNEP). Participants were asked to participate in one of the session: focus group, interview, or short survey.

**Results** Participants from the focus group and interviews indicated that there was potential for people to be healthy by participating in sustainable diet activities. There also was concern about cost of sustainable diets. Sustainable diets need to be culturally acceptable to get consumers to practice them. Finally, eating seasonally was important component of a sustainable diet. If nutrition educators were asked to teach sustainable diets to others many felt they need more information or resources on sustainable diets or need to research the topic.

Participants in the short surveys indicated concerns about costs, nutritional adequacy and showed mixed results when asked about what foods would be part of a sustainable diet. Educators who took the survey also showed great interest in having more education to learn about sustainable diets.

**Conclusions** Nutrition educators have concerns about sustainable diets, such as being nutritionally adequate and affordable to all people. Educators in the focus group and interviews reported that there is potential for people to be healthy by following sustainable dietary practices, like gardening. However, there seemed to be a need for more education on sustainable diets. Nutrition educators have limited knowledge of sustainable diets. Some have an idea of what sustainable diets are, while others have stated that they have not heard of sustainable diets. Nutrition educators surveyed show a great interest in attending a seminar, if offered, on this topic. In summary, sustainable diets are gaining attention of nutrition educators, especially if sustainability and food become part of the new dietary guidelines. A need for providing sustainable diet education to nutrition educators will be part of the future. Further research on knowledge of nutrition educators on different components of sustainable diets and development of an educational curriculum is necessary.

## INTRODUCTION

In recent decades, interest in how food choices of the consumer may impact the environment has increased by researchers in various fields, including natural resources, public health, agriculture, and nutrition. In 1986, Gussow and Clancy wrote a commentary article about the relationship of consumer food choices and the environmental impacts (1). In the article, they developed the idea of having dietary guidelines that address nutrition recommendations and environmental sustainability of the diet, and proposed teaching consumers about sustainable food choices within the framework of dietary guidelines.

In 2010, the Food and Agriculture Organization of the United Nations (FAO) developed a definition of sustainable diets (2): *“Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to a healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair, and affordable; nutritionally adequate, safe, and healthy; while optimizing natural and human resources”*. The FAO argued that it was necessary to develop a definition in order to develop research and policy for implementation and development of sustainable diets and to guide actions of people in the world to make food choices that support sustainable diets.

Sustainable diets can foster future health promotion and access to food for the future (2). It is important for nutritionists to understand the current knowledge, trends and perceptions of sustainable diets. Additionally, it is important to learn about nutrition educator’s knowledge and perceptions because they disseminate nutrition information to the general population and have the potential to incorporate sustainable diets. As sustainable diets gain more attention and might

appear in the 2015 dietary guidelines, nutritionists may want more information on sustainable diets.

### **Purpose and Objectives of the Study**

The purpose of this study was twofold: 1) examine the current understanding and trends of sustainable diets and 2) assess the current level of knowledge of sustainable diets among the Supplemental Nutrition Assistance Program (SNAP), Extension Food and Nutrition Program (EFNEP) nutrition educator and the University of Arizona Department of Nutritional Science faculty nutritionist populations. It was hypothesized that the concept of sustainable diets may be new to faculty nutritionists and educators who may desire more information/training on the topic.

Specific objectives of this project were to: 1) Develop a questionnaire to assess current level of understanding of a sustainable diet, 2) Assess nutrition educator's knowledge of a sustainable diet, 3) Identify if nutrition educators would desire training on sustainable diets to help them understand what they are and what a sustainable diet is.

To examine the current understanding about sustainable diets, a literature review was conducted. The primary search term used was "sustainable diets" to look for peer-reviewed research that was specific to sustainable diets. Other search terms were used and included "sustainable food", a broader search term that yielded hundreds of peer-reviewed sources on EBSCO Host and over 1000 peer-reviewed sources on PubMed. This search term included a diverse number of sources that focused more on individual foods than whole diets. Articles from these searches were assigned to one of three general categories: food production, human consumption, and policy. Articles that were selected for references were selected based on direct impact on nutrition, health, and environmental sustainability. The selected articles often discussed foods or food groups that were considered sustainable. Two articles that focused on how sustainability of foods

is measured were included for background information. The article by Gussow and Clancy was cited by several sources as a foundation article for the concept of sustainable diets. The publication from the FAO on the scientific symposium that defined sustainable diet was selected because of the definition and the number of citations by other authors.

After reviewing the literature, some important themes regarding sustainable diets emerged including three notable examples: lowering meat consumption, eating seasonally, and consuming more fruits, vegetables and whole grains. These themes formed the base for developing questions for the focus group/interview questions and the short survey questions.

The next step was to recruit nutrition educators for the focus group, the interviews, or take a short survey. Recruitment was done through Cooperative Extension by contacting Extension Agents about scheduling a focus group and coordinating the distribution of surveys. Research and instructional faculty from the University of Arizona were recruited through email contact and appointments were set up to conduct one-on-one interviews. More details on this are discussed in a later section.

Finally, to identify if there is an interest for sustainable diet education by nutrition educators analysis of focus group responses and survey data was performed and is discussed in the Thesis Research Project results section.

## LITERATURE REVIEW

### I. Sustainable Diet Concept & Definition

Current literature looks to two primary sources for learning about where the concept of a sustainable diet has come from and what the definition is. The concept of sustainable diets dates back to a commentary written in 1986 by Joan Gussow and Katherine Clancy in the Journal of Nutrition Education. The authors state that information on health and food choice is not enough for nutrition education. There needs to be a component about how food choice impacts the environment. They point out that food guidelines have focused on food and health, but do not consider the link between environment and food choice. However, Gussow and Clancy do not provide a definition of sustainable diets. They do provide information on sustainable practices that should be included in the dietary guidelines. They have seven points in which sustainable food choices can be achieved (1).

Eating a variety of food is the first point. They discuss having a diverse range of foods to be included in a diet. The focus is on biological variety of foods and they note that while many grocery stores have a large selection of foods, many of those foods have similar ingredients and therefore do not qualify as a variety. They promote having a genetic variety of foods in the diet. Point two is aimed at maintaining an ideal body weight. Considering that this was published in 1986, the idea was good for the time. Obesity rates in the 1980s were not as high as they are now. The message focuses on weight and maintaining a normal weight. They tie this idea to gasoline usage, using the concept of the more you weigh, the more fuel is needed by a vehicle to move forward. Message three discusses consumption of too much fat, saturated fat, and cholesterol. Animal products and meat are the focal point of this message. Animal products and

meat contribute greatly to intake of fats and cholesterol. The sustainable diets argument continues to include the large amount of resources used in production of meat and animal products, specifically beef.

To contrast this point the fourth point discusses eating adequate fiber and starch. It is pointed out that grains need to be whole grains, not refined, and that fruits and vegetables need to be included, too. It is noted, though, that not all fruits and vegetables are equal in the environment. It is argued that local is better than imported produce, in the example given: California where fruits, vegetables, and nuts are produced cheaply because of cheap energy and water. Point five is an extension to point four by stating sugar intake should be limited. Sugar intake is often associated with refined grain intake. Once again the authors link sugar production to energy costs. In the case of sugar beets it was estimated that it takes 6,000 kilocalories of energy to supply about 3,800 kilocalories to consumers. To add to these estimates diet sodas are not considered to be good alternatives either. The can that the soda is packaged in, takes an estimated 1,600 kilocalories to produce. The consumer does not get any nutritive value from the artificial sweeteners in diet sodas. The sixth point made discussed avoiding too much sodium. Achieving this point the authors recommend choosing fresh or minimally processed foods. Finally, the recommendations end with alcoholic beverage consumption. Moderate consumption of alcoholic beverages is recommended. The energy costs for alcoholic beverage production is the reason behind moderate consumption. The authors point out that producing the alcoholic beverages is does not require large amounts of energy. Packaging that the alcoholic beverages goes in is cited as having high energy costs (1).

This commentary ends with a discussion that brings home the point that the consumer needs to be educated on the food system and its lack of sustainability. They justify this statement through the six points discussed earlier. The authors state that controversy will arise with the promotion

of sustainable diets, namely the reduction of fat consumption (point 3) has already caused objections from some producers of animal products. In the end, it is up to the consumers to make dietary changes because agriculture responds to market demands. Change in the agriculture sector will not happen if policy does not promote sustainable practices. That is the reason the authors emphasize the consumer as a point for change (1).

In 2010, the Food and Agriculture Organization of the United Nations (FAO) held an international scientific symposium and subsequently published the proceedings in a document titled “Sustainable Diets and Biodiversity: directions and solutions for policy, research and action.” Proceedings from the symposium are voluminous. They were printed as a book and are available as a PDF that has 309 pages. The information contained relates to policy, research and suggested actions to be taken. The preface of the book discusses that the sustainable diet concept was developed in the 1980s and was largely ignored until more recently. Reducing hunger was a main priority for years and the sustainability was not considered. The FAO still views hunger as a major issue in the world and the FAO estimates 1 billion people in the world are hungry. Additionally, the FAO also realizes that another world issue is the obesity epidemic that needs to be addressed, too. The preface also noted the need to educate the people which can produce change within the food chain. The issues aforementioned are becoming worse. Goals of the symposium were to develop a definition of a sustainable diet and tie in food security using the Millennium Development Goals as objectives (2).

Until the symposium convened, there had not been a universally accepted definition of a sustainable diet. A definition is essential to guide policy, research, and action. The definition developed out of the 2010 FAO symposium is: “Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to a healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and

ecosystems, culturally acceptable, accessible, economically fair, and affordable; nutritionally adequate, safe, and healthy; while optimizing natural and human resources” (2). This is often cited in various scholarly articles as a basis for what sustainable diets are. It is a broad definition. The FAO uses this definition for purposes of adaptability across the world. The benefit of a broad definition like this is that it can be molded to work at a smaller level at a cultural or local community level with dietary patterns. At the same time, it also gives structure to the concept of sustainable diets. And it is important to understand how sustainable diets are measured.

## **II. Measuring Sustainable Diets**

The sustainability of a food product is measured by greenhouse gas emissions (GHGEs). GHGEs are emitted during production, processing, and transportation of food products. GHGEs are made up of five gases: carbon dioxide, methane, water vapor, nitrous oxide, and ozone. Measuring GHGEs has been a way to look at what foods could be inclusive in the diet (3). It is important to note that depending upon location GHGEs can vary. Macdiarmid *et al.* mention that GHGEs in production vary from country to country. The United Kingdom (UK) is not able to produce a large variety of foods so importation of many different foods is common. This shows that GHGEs are variable based on location and can influence the sustainability status of a food. It is important to not only measure GHGEs in determining sustainability of a food, but to consider other environmental factors in the sustainability of a food.

Life Cycle Assessment (LCA) is another more comprehensive method to measuring sustainability. This assessment analyzes resource inputs and outputs and their environmental impacts. The process tracks a product from production, processing, transport, and consumption (4). The LCA requires data on many different processes that occur during the creation of a product (energy is used to emissions) that are emitted into the air, land or water. This is a more

comprehensive look at the sustainability of a food; however, not all data may be available for this type of analysis for each product.

Based on the information presented, nutritionists can be guided to make more sustainable food choices. Some sustainable foods include a variety of fruits, vegetables, grains, dairy, and egg products. Animal products, including meats, are generally considered less sustainable due to intense resource needs. The sustainability of food products can vary from location to location (3).

The LCA measurements are a good indicator of sustainable foods and food products. LCA's could lead nutritionists to understand what is considered in sustainable food choices. Data for conducting the LCA is not as comprehensive as it could be. Additionally, nutritionists should take into account nutrient values of foods. To determine how nutrient valuable a food is, it is important to know if the food is nutrient dense. A nutrient dense food is, "relatively rich in nutrients for the number of calories contained" (5). Knowing the nutrient density of foods as well as the LCA of food is important for an overall assessment of sustainable food choices. To assist nutritionists in knowing about nutrient density of foods, there are indices that have been established, including Nutrient Rich Food Index (NRF) and Overall Nutritional Quality Index (ONQI) (4,6). Both the NRF and ONQI use a quantitative scoring system with nutritional criteria that characterize foods and look at the food's contribution to the balance of the diet. Specifically, the NRF looks at the arithmetic mean of the percent of recommended daily intakes of nutrients. The index divides nutrients into two categories: nutrients to encourage and nutrients to limit. Nutrient values are based on 100 kcal of the food of interest or a reference serving size. The NRF includes nine nutrients to encourage intake of: protein, fiber, Vitamins A, C, and E, and Ca, Fe, Mg, and K; and nutrients to limit are saturated fat, added sugar, and sodium (4).

The ONQI index uses an algorithm that is used commercially, called NuVal, and includes more than 30 micro- and macro-nutrients. The algorithm is weighted on positive and negative nutrients on health outcomes. Positive nutrient examples include: fiber, vitamin A, vitamin C, potassium, and total flavonoids (6). Scores are calculated on a ratio of nutrient density, based on nutrients per kcal, and the recommended daily intakes. Nutrients associated with positive health outcomes are placed in the numerator and those associated with the negative health outcomes are placed in the denominator. It has been shown that a high ONQI score is associated with reduced chronic disease, calorie and alcohol intake and increased exercise (6). This type of information needs to be combined with LCA information to give perspective of both health and environmental benefits of foods. At present it is difficult to combine the nutrient profiling scores and the LCA, especially with the ONQI data due to the proprietary nature of the software (4).

### **III. Sustainable Dietary Patterns**

Understanding the definition of sustainable foods and how they are measured can aid in identifying foods that are considered to be part of sustainable dietary patterns. It is also important to understand which food patterns are considered to be sustainable. Current research has focused on two diet patterns: the Mediterranean diet and the New Nordic Diet. Another consideration in the literature is just to focus on eating a healthy diet that follows the dietary guidelines set forth by the government. In general, fruits, vegetables, and grains are considered to be the most sustainable food sources (3,4,7,8). These food groups often take fewer resources to produce than animal products (4,9,10). It is important to know that there is not one sustainable diet pattern (2). Since there is more than one sustainable diet pattern, this section will focus on only some notable diets that have been highly promoted as examples of sustainable diet patterns: the Mediterranean and New Nordic diets.

### *The Mediterranean Diet*

The Mediterranean diet has been touted for its many health benefits. It is noted for prevention of several chronic diseases including diabetes, cancer, and heart disease (11,12,13).

While benefits of following this diet pattern have been observed, the Mediterranean diet has been investigated as a sustainable diet model. The Mediterranean diet is a dietary pattern with recommendations for food groups as well as recommended frequencies of consumption, incorporating physical activity every day, and social interactions. Food groups included in the Mediterranean diet are discussed below.

The base of the pyramid includes physical activity and conviviality. Consumption of water is highly important and was added to the base of the pyramid instead of being in the rectangle with the wine. Individuals who follow this dietary pattern incorporate foods highlighted in green into every meal consumed. Fish and seafood section (above the base of the pyramid) are incorporated a couple times per week. Dairy, eggs, and poultry section (above fish and seafood) are incorporated daily followed by sweets and meats (top of the pyramid) as occasional treats.

The Mediterranean diet uses fruits, vegetables, and whole grains as a base for daily food consumption. This coincides with research that has shown the Mediterranean diet to have protective effects against chronic diseases (11). Del Chierico and colleagues have published a review paper that discusses the Mediterranean diet and the protective effects on several diseases and then focuses on gut microbiota (11). The article began by discussing what the Mediterranean diet is and research on different components of the diets, including olive oil, fruits and vegetables, whole grains, and nuts. These food products have individual characteristics that make them beneficial. Fruits and vegetables provide fiber, vitamins, minerals, and bioactive components, such as flavonoids. These nutrients provide anti-inflammatory effects and

antioxidant effects that help reduce oxidative stress, which reduces incidence for cardiovascular disease. Olive oil adds additional protective effects for cardiovascular disease. Olive oil provides a higher monounsaturated to saturated fatty acid ratio that improves lipid profiles, and once again, it has an anti-inflammatory effect. Fish provide polyunsaturated fatty acids and promote positive outcomes by reducing risk for heart disease and stroke. They also provide positive benefits for brain health. Whole grains provide fiber and are associated with a lower risk of developing diabetes, heart disease, and cancer. The authors continue to discuss gut microbiota as this is an emerging area of research. Additional benefits of the Mediterranean diet are listed in figure two (11). As gut microbiota are being studied extensively, there have been more links to their role in health.

The latter portion of the article focuses exclusively on the Mediterranean diet and gut microbiota. As gut microbiota are studied extensively, there have been more links to their role in health. There have been a few studies that have looked at diet and gut microbiota. Microbes populate the gastrointestinal tract (GI tract). The number of microbes in the average adult in the millions and have been estimated to be close to  $10^4$  microbes in the GI tract. Recent research has shown that microbiomes can change within a 24 hour period based on dietary intake. Type of diet plays a role in gut microbiota health and microbial gene expression. Plant based diets, which are high in fiber from fruits and vegetables, showed a change in how gut microbiota were processing food compared to a “Western” diet that is generally higher in processed foods, meats and sweets. Changes in gut microbiota have downstream effects that can impact the overall health of an individual.

The Mediterranean diet has shown positive health outcomes for a variety of chronic diseases. More research is needed to examine gut microbiota impacts of the Mediterranean diet. Knowing

there is a strong link to health, it is important to understand if this diet pattern is considered sustainable.

The symposium held by the FAO on sustainable diets has a section that discussed the Mediterranean diet (2). Discussion of the health benefits and sustainability of the diet were main points of the section. Evaluating the sustainability of the Mediterranean diet was a goal of the symposium. The symposium determined that the Mediterranean diet was sustainable and focused on key factors that make the diet sustainable. Sustainability of the Mediterranean diet is based on several key factors: ecology, nutrition, economy, and society.

Ecology looks at the environment and its health. Agricultural practices seen in the Mediterranean diet promote the natural ecology of the landscape. Small farms and grazing lands are interspersed between areas of natural habitats where wildlife can be found. Additionally, farmers in the Mediterranean region have a diverse group of crops being grown with 80 species of plants that include vegetables, tree crops, and grains (14,15).

Nutritional content of the diet has been discussed previously and the Mediterranean diet has been shown to promote health by consuming of fruits, vegetables, nuts, and whole grains and few animal products. This same food pattern is also linked to sustainable diets. The sustainability of a food item is measured by GHGEs. Plant products generally have lower emissions than animal products. Adding to GHGEs, production of animal products has shown to reduce biodiversity, promote deforestation, and degrade the land (2). This is a focus point for the argument of good nutrition and sustainability.

However, authors of various articles do point out the United States dietary guidelines do not meet the same standard as the Mediterranean diet when it comes to meat consumption (2,15). The United States generally has a higher intake of meat (37). Serra-Majem and colleagues

suggest that a 50% reduction in meat consumption can decrease the land needed for grazing and crops related to livestock production. This allows for the generation of carbon through increased vegetation. Additionally, a reduction in deforestation could be accomplished because there is not a need for land for pasture and crops related to livestock production. Therefore, there would be a decrease in methane and nitrogen emissions further reducing GHGs. For the world population there would be a beneficial health impact by reducing meat consumption (15). To help with illustrating how diet and sustainability are interconnected there has been the development of a double pyramid scheme. It has one pyramid that indicates dietary guidelines and a second pyramid that shows the environmental impact of the food groups on the first pyramid (39).

Economy and society are highly interconnected. This shows how the Mediterranean diet plays a role in these two areas. Socially, in the Mediterranean region, culture and tradition are highly valued. Traditions are passed down from generation to generation. While this has been a way of life for centuries, modernization is threatening this practice. On top of that, agriculture has shifted in some of the Mediterranean regions. Small family farms are becoming large-scale agriculture operations that are more resource intensive. Findings of the FAO symposium state that there is a need to protect local and traditional food systems to promote local agriculture that preserves biodiversity and cultural tradition (2,15).

The Mediterranean diet receives attention for many positive factors from health and nutrition perspectives to sustainability and to the many different categories that go into assessing sustainable diets. However, it may also be important to think about some of the general trends that the Mediterranean diet has to offer.

The Mediterranean diet fits into the sustainable diet model because it provides safe, healthy, and nutritious food that is culturally acceptable and protects biodiversity. All of the aforementioned

elements are part of the FAO definition of sustainable diet. However, there has been a shift in how research evaluates diet and dietary components. Research has often evaluated single foods and nutrients. More recently there has been a move to research dietary patterns, which look at the overall picture, instead of focusing on single foods or nutrients (11). The Mediterranean diet pattern is considered important because it generalizes the diet and can be adapted in different regions. The Mediterranean diet pattern focuses on a base of foods: fruits, vegetables, nuts, legumes, and grains. Additions of moderate portions of other food groups such as dairy, eggs, poultry, fish, and seafood allow for additional diversity in the diet. Finally, this pattern allows for meat and sweets consumption, but on a limited scale. This general pattern can be adopted into other regions of the world. An example of adaptation of the Mediterranean diet to a different region of the world is the New Nordic Diet (NND).

### *The New Nordic Diet*

The NND is based off the principles of the Mediterranean diet with a base of foods grounded in fruits, vegetables, nuts, legumes, and whole grains. However, the NND focuses on foods indigenous to the Nordic region of the world, which includes Finland, Sweden, Norway, and Denmark. The NND focuses on traditional foods in the region, which includes root vegetables, native berries (i.e. bilberry), nuts, fish, seaweed, game, and edible wild foods (8,17). Studies conducted on the NND have shown that there are health and environmental benefits of following it compared to the Average Danish Diet (ADD). The ADD is similar to the Western diet (8).

Mithril and colleagues investigated whether the NND can be palatable diet that promotes health. The study looked at the “Optimal well-being, development and health for Danish children through a healthy New Nordic Diet” (OPUS). This project looked specifically at regional foods that would promote health and protect the environment (40).

The OPUS project stemmed from the NND, developed in 2003 and later adopted in 2005 by the Nordic Council of Ministers. The NND was shaped by experts in various fields which included nutrition, gastronomy, environmental studies, food culture and history, and sensory science.

While this project focused on regional foods that provide safe, healthy, and nutritious foods to the Nordic population, palatability was a focus. OPUS focused on children. They investigated mouthfeel and how taste plays a role in acceptability of the foods in the NND. The dietary guidelines of the NND are rooted in the Mediterranean diet pattern. Plant-based foods became the base of the diet with recommendations for moderate consumption of fish, poultry, dairy, and game. Other meats and sweets are consumed in limited quantities.

Knowing that the NND provides culturally acceptable, nutritious food, another group of researchers investigated if the NND is affordable, since affordability is part of a sustainable diet. Jensen and Poulsen worked on a six month dietary intervention where participants were asked to follow the NND (8). The study aimed to learn about the economic impacts of the NND versus the ADD. Participants in the intervention shopped a “store” set up by the researchers. The store did not charge for the food. Participants were able to choose what foods they wished as long as it aligned with the prescribed diets that the researchers had in place. If foods did not fit into the diet, the participant was told by research staff to make an alternate selection. By tracking the foods and food quantity, the researchers could estimate prices based on data from a national Danish survey of consumers. This survey tracked foods purchased at stores, prices, and store type, among other information. Food items that were not part of this data had prices determined by researchers collecting pricing information directly from food stores in Denmark or online. Wild foods that were not found in stores were estimated to have a cost similar to cabbage to be able to include the food in the cost analysis.

Results show that the NND differed by several Danish Kroner (DKK) from the ADD cost. The NND average daily expenditure was 52.11 DKK and the ADD was 45.06 DKK, which is about \$7.85 and \$6.78 respectively. The authors noted that some of the foods in the study that were organically produced. Organic produce is generally more expensive than conventionally raised foods. Consumers could choose cheaper products thus the estimated cost would decrease for the NND. This showed that it could be economically feasible for the average Danish consumer to start following the NND.

Once again the NND reiterated dietary patterns found in the Mediterranean diet. There is a high consumption of plant-based foods and low meat and animal product consumption. Additionally, it also emphasized tradition by including foods found only in the Nordic region such as wild plants found in the forests. This shows a unique feature of the NND that is not found in the Mediterranean diet because of a regional difference. It also illustrates that the Mediterranean diet pattern is adaptable to different parts of the world. But, what about just eating a healthy diet as defined by government dietary guidelines? Is it sustainable?

### ***Consuming a Healthy Diet and Other Sustainable Dietary Practices***

With the knowledge that a sustainable diet is built around high levels of plant-based food and lower animal product consumption; would eating a healthy diet using the government dietary guidelines would be sustainable?

Macdiarmid and colleagues worked to answer the question if eating a healthy diet could be sustainable in the United Kingdom (UK) (3). To measure sustainability in this case, they measured GHGEs of food. The study used a mathematical model to develop a diet-based on the dietary guidelines for an adult woman in the UK- that would reduce GHGEs. The goal was to develop a diet that would reduce GHGEs to UK 1990 levels. Researchers were able to develop

this diet; but it did not have variety. The diet consisted of seven food types. Lack of a variety prompted the researchers to add acceptability constraints that allowed additional foods into the diet. In the end the study found that a diet could be developed where GHGEs were reduced by 30% and the food choices were realistic and palatable. The researchers developed and prepared a sample 7-day menu to test the diet. Meals from the menu included egg salad sandwich and yogurt for lunch and chicken curry and rice with pita bread for dinner. Costs for the meals from the 7-day menu were affordable for the consumer because foods used in the meals are already being purchased by consumers. Lastly, the authors showed that if the British population made a shift to a more plant-based diet, then it could reduce GHGEs. They demonstrated this by comparing current dietary intake levels from a national survey of UK adult women and compared it to the sustainable diet which they developed. They concluded that a shift from current to more sustainable patterns, climate change would be mitigated through GHGE reduction (3).

This answered the question that it is possible to follow a more sustainable diet pattern that still contains foods that are included in the dietary guidelines. Other researchers are interested in looking at current consumer patterns and identifying what would be considered sustainable based on lower GHGEs.

Masset and colleagues have been concerned with development of a sustainable diet and cultural acceptability (18). Research objectives were to determine if existing consumer-based diet patterns are sustainable and highly nutritious. These diet patterns would be culturally acceptable because consumers were practicing them. Data for the study was collected from the Individual and National Survey on Food Consumption (INCA) and included 2624 adults in the French population. Seven day food records from the survey were used to determine dietary intakes of the study population. Foods consumed were categorized into 8 groups and 27 subgroups and each

participant had total weight and energy intake calculated from the data. They also determined food cost using data from the 2006 Kantar-World Panel purchase database. Researchers determined the nutritional adequacy of dietary intake for participants through a probability of adequate nutrition intake (PANDiet) score. The PANDiet score has sub scores. One is called the adequacy sub score and includes nutrients that are considered positive. The second is a moderation sub score includes nutrients to limit. PANDiet focuses on 24 nutrients: protein, total carbohydrate, fiber, total fat, saturated and polyunsaturated fatty acids, cholesterol, thiamin, riboflavin, niacin, folate, vitamins A, B-6, B-12, C, D and E, calcium, magnesium, zinc, phosphorus, potassium, iron and sodium (19). This dietary scoring system takes into account, the number of days that diet was recorded, average intake, intake variability, nutrient reference values, and inter-individual variability. Reference values for this study were the French nutritional recommendations for adults and the European Union nutrition recommendations. Actual scores range from 0-100 and the higher the score the more nutritionally adequate the diet is.

The researchers were also interested in learning about how the diets from the data related to sustainability. Determination of sustainability was based on GHGEs. To calculate GHGEs for the foods in the diets of participants, researchers used a consulting firm called Greenext Service out of France to designate the GHGE values for the foods.

There were four diet categories: Lower-Carbon, Higher Quality, More Sustainable, and Average. Lower-Carbon diets were defined as diets with overall lower GHGEs than the gender-specific median value. High Quality diets had a PANDiet score higher than the median gender-specific score. More Sustainable diets had a PANDiet score higher than the median and dietary GHGEs lower than the median value. The results showed that Lower-Carbon diets had a daily GHGEs < 4511 g CO<sub>2</sub> equivalents for men and < 3437 g CO<sub>2</sub> equivalents for women, a Higher

Quality and More Sustainable diet was a diet with a PANDiet score greater than 62 for both genders. More Sustainable diets were compared to the Average diet.

Lower-Carbon diets reduced GHGEs by 20% for men and 21% for women and had lower food content and a lower energy intake compared to the Average diet. Higher Quality diets contained more food, had an increased energy intake, and had higher GHGEs compared to the Average diet. The More Sustainable diets showed a reduced energy density intake compared with the Average diet with men having an 8% reduction and women a 10% reduction. Overall 23% of men and 20% of women in the study consumed a More Sustainable diet as defined by the research parameters. Diet composition also was shown to be different between the different diet types. The Lower-Carbon diet showed an equal or lower intake of all food groups and subgroups when compared to the Average Diet with reductions in meat, fish and eggs. The High Quality diet showed a higher intake of fruits, vegetables, nuts, starchy foods, fresh dairy products, margarine and oils, vegetarian mixed dishes, and breakfast cereals compared to the Average Diet. In contrast to the Lower-Carbon diet, the High Quality diet had the same amount of meat, fish and eggs as found in the Average Diet. More Sustainable diets showed an increased intake of starchy foods, fruits, vegetables, and nuts, and lower meat and egg consumption compared to the Average Diet. Intake of fish was higher in men but not different for women when compared to the Average Diet. Dairy product consumption was no different from the Average Diet. Other categories of food that were lower in the More Sustainable diet include butter, cream, alcoholic drinks, salty snacks, desserts, and mixed dishes with animal ingredients. These results show that the researchers could find high nutrient quality diets that are sustainable, thus culturally acceptable to the French population. Additionally, they compared the More Sustainable diet to the French dietary recommendations and found that this diet closely aligned with the recommendations, suggesting that lower GHGEs can be achieved by following the existing

dietary guidelines. The cost of the More Sustainable diet was lower than the Average Diet, showing that it can be affordable (18). These findings reinforce what Macdiarmid and colleagues found in their study that following a healthy diet can reduce GHGEs while being palatable to the population.

Evidence from Masset, *et al* and Macdiarmid, *et al.* suggests that following a healthy diet can reduce GHGEs (3,18,37). While this is important, some research considered consumer attitudes toward sustainable food choices. In Belgium, Vanhonacker and colleagues wanted to understand consumer perceptions of sustainable food choices. Researchers surveyed 221 adults ages 18-30 in Flanders, Belgium via an online survey. The survey was split into two sections; section one had questions about ecological footprint and Section two was about ecologically sustainable food choices. In the first section participants were asked if they knew what the concept of ecological footprint based on a given definition (21). The latter portion of the questionnaire section one asked participants to self-evaluate their ecological footprint and then evaluate the GHGEs of different industries using a 5-point Likert scale. For section two of the questionnaire, participants were asked about sustainable food choices and were given carbon dioxide emissions for animal production. They were asked to evaluate their awareness of carbon dioxide contribution by food production on a 5-point Likert scale. The last portion of the survey asked participants to evaluate alternative food choices using the same 5-point scale (20).

Results from the study showed over two-thirds of respondents claimed to have ecological awareness (68.6% of respondents). Underestimation of the impact of animal production and meat consumption was found among a majority of respondents. Many respondents believed that their ecological impact was too high or much too high (42.3%). Ratings of the human impact of carbon dioxide emissions and climate change showed industry, transport, energy use, consumption society, and waste as the top five areas where humans have the biggest impact.

About two-thirds of respondents stated that they were concerned about ecological footprint, climate change, and carbon dioxide emissions. There were only 8.4% of the respondents that stated that they were not concerned and 28% were neutral. Environmentally friendly behaviors, most prevalent among the respondents, included recycling and sorting waste, energy conservation-through monitoring energy use, adjusting the thermostat setting, purchasing high-quality insulation, and purchasing environmentally friendly appliances. Responses for sustainable diet alternatives included reduced meat consumption and amount of meat per meal, consuming sustainable farmed fish, and organic meat. Evaluation of meat substitutes ranked lower being almost neutral on the Likert scale. The authors asked about substitution of meat for protein from insects. Insects got a negative response. When asked for an evaluation of long term effectiveness of a reduction of meat and using hybrid meat products, elicited information suggested that this could not be a long term sustainable solution. However, there was a negative willingness score to consuming plant-based meat alternatives by respondents. These results show that consumers are not aware of how meat and animal product consumption ecologically impact the environment. Still many consumers are aware of the idea of an ecological footprint. The results also show consumer skepticism of meat alternatives derived from plants. Finally, authors suggest that there needs to be more consumer awareness of how meat and animal product consumption impacts the environment (20).

Vanhonacker and colleagues suggested another topic in their research: insect protein. In Western cultures, it is not common for insects to be consumed as a food source. However, this is common in other parts of the world, namely Africa and Asia. To some researchers, the idea of using insects as a food source looks appealing. It has potential to reduce or eliminate meat from the dinner table, thus reducing GHGEs. Insects are everywhere and can be more efficient protein source in terms of GHGEs. Schösler and colleagues looked to answer if the Western world

would be accepting of a reduction of meat by substituting meat for plant-based and insect-based alternatives.

The researchers surveyed 1083 adults in the Netherlands via an online survey. Participants were sent a temporary link to the online survey. The survey asked about consumer meal practices, food choice motives, and demographic information. After those questions were answered, consumers were shown 13 photographs of various vegetarian meals and each consumer was asked to evaluate it in two ways: attractiveness of the product and likelihood of preparing the product at home. Each of these evaluations occurred on a 7-point Likert scale with 1 being very attractive and highly likely to prepare.

Results from the survey showed that consumers eat meat as part of the main meal about 5.4 days out of the week. The sample of consumers also showed to have few vegetarians (1.2% of the respondents). Those that ate meat less than 5 days per week were asked if they substituted the meat for something else. They were asked what they used as a substitute for meat. Substitutes for meat included: eggs, fish, cheese, lentils, nuts, and soy substitutes.

Survey results for the 13 photographs of substitutes were compared to a base response to an omelet, which rated low on the attractiveness scale (2.4-attractive) and low on the likelihood of preparing it at home (2.4-likely to prepare). All of the substitutes were compared to this omelet. The substitution options ranged from pasta with pesto to a salad with fried meal worms. Attractiveness for the pasta with pesto, Tivall minced-meat, made from soy, in tomato sauce, Moroccan couscous with chick peas and vegetables, stir-fry with seitan (made from soy and vegetables), and Tivall steak (instant meat substitute made from vegetables and soy) were seen as attractive to consumers (scores for these meals were below 4). These products also had a higher likelihood of preparation at home with scores of 4 or below. The next seven products

were not rated to be as attractive (scores of 4 or greater) or likely to be prepared at home (scores of 4 or greater). These products were Asian stir-fry with tofu and vegetables, a tofu snack, pizza containing protein derived from insects, Indian lentil meal, fried locusts with chocolate coating, locust salad, and salad with fried mealworms. The latter three dishes all rated with a 5 or 6 on the attractiveness rating. However, all had a low likelihood of being prepared at home with a score of 6. This research shows that consumers may not be willing to make substitutions to meat and that cultural acceptability is an important factor when considering making dietary substitutions. Meals that had visible insects were rated as unattractive. It is important to note that the pizza that contained protein derived from insects was more attractive to consumers and more likely to be prepared at home. The authors believe this is because the consumer cannot see the insect so that may have a gateway into introducing this type of alternative protein source (7).

All of these studies have shown some important insights into what foods constitute a sustainable diet. Dietary patterns like the Mediterranean diet and New Nordic diet have similar characteristics that can be adapted to other locations in the world. Eating a healthy diet while following dietary guidelines could be a solution. It is also important to point out limitations for these studies.

One main limitation for several studies discussed above is that they focus on GHGEs. This is only one measurement of environmental impact. It focused on the gases that contribute to climate change and global warming. These measurements did not consider cultural impacts, and ecosystem health (23). It is important to have more than one metric for determining sustainability of a diet. For example, does meat production really have the large impact on the environment that is often stated (26, 27)? When one measures the GHGEs of meat production, it is easy to say “yes”. However, if livestock were raised in a more environmentally-friendly way that promotes ecosystem health, would the impact be the same? Would the amount of GHGEs

associated with livestock production be as high as it is currently? There is a need for multiple assessments of sustainability as it relates to food production.

A second main limitation is that many studies have been done abroad. Literature cited above is from European countries and is not fully translatable to the United States culture. Each paper cited focused on a different area where the research was conducted from England to Belgium. Research that examined consumer preferences for meat consumption and substitution were not found for the United States. More research in this area needs to be done to look at the US consumer population.

Despite the lack of specific research on consumer attitudes towards a sustainable diet, the United States is addressing sustainability as part of the national dietary guidelines. The Scientific Report of the 2015 Dietary Guidelines Committee has a chapter discussing sustainability of diets. The chapter discusses that there are dietary patterns that could be followed to allow diets to be more sustainable in the US compared to current trends. These dietary patterns are the Healthy U.S.-style, Healthy Mediterranean, and Healthy Vegetarian. While the report provides guidance for the actual recommendations, it will be interesting to see how sustainable diets may be integrated in to the recommendations (22).

#### **IV. Applications**

On a global level, applications of research findings using the FAO definition of sustainable diets and can be molded to any region of the world. Organizations like the FAO, United Nations, and World Health Organization can help by giving some general guidelines to help with policy changes. Policy changes can be made a smaller level than the global level. Several studies suggest ideas for policy change.

Policy for increased implementation of sustainable diets has been a sensitive subject with varying interests pushing policies in different directions (23). However, it is necessary to consider what groups of people would need to be involved in a discussion for sustainable diet policy. Johnston and colleagues had a, which is redesigned to portray the complexities of the many components involved in a sustainable diet (23).

Ideas for policy have been given by Lang and Barling, who suggest four key areas to focus on. Food waste, meat and dairy consumption, fish consumption, and the sustainable diet itself were the four hot spots discussed in their article (24).

Dealing with food waste has been a goal of food policy since the 1930s (24). The issue of waste is large and spans across the whole food system from farm to plate to consumer. The authors suggest that some waste might be unavoidable and should be considered. An example they provide is mass food composting or feeding food scraps to animals. This had been done previously before animal food products, like dog food, came into being. Regardless, the authors state that this issue needs to be revisited and new ideas, which investigate ways to use the waste.

Meat and dairy consumption are topics of the second “hot spot.” While nutrition guidelines have supported the consumption of these products, as mention previously, there are environmental concerns around this issue. The authors suggest developing an upper limit for intake of these products as a policy solution. Another possible solution would be to have prices set to reflect realistic costs. The third “hot spot” discusses fish. Nutritional recommendations often promote eating fish regularly. This topic is considered important because of overfishing of wild stocks of fish (24).

The final “hot spot” discussed by Lang and Barling is the sustainable diet. Merging sustainability and dietary guidelines have been worked on by several international countries with varying

levels of success. In the United Kingdom (UK), an effort was made to include sustainability into the dietary guidelines in 2008. The results from their literature search prompted the UK government into conducting more research in the topic. Sweden had developed a document for the environmentally conscious consumer in 2009. This information was later withdrawn after there was concern about violating European Union regulations. Germany has a history of promoting sustainability in policy, dating back to the 1990s. Germany has since developed a consumer oriented ‘shopping cart for sustainability’ as a way to guide consumers on how to shop sustainably (22). France has offered consumer advice that mimics what Sweden published in 2009; eat seasonal, local food.

The Netherlands has more ambitious goals regarding sustainable food (24). Currently, they have a sixteen page document that guides consumers to make sustainable and healthy food choices. However, the government is working to set national goals for sustainable food production and wants to lead the world in sustainable food production in fifteen years. There has been interest in the Netherlands’ largest company Unilever. This company has launched a sustainable living plan as part a commitment to the government’s plan.

Lastly, Australia worked on revising their dietary guidelines in the late 2000s (24). This revision included sustainability as a core factor and focused on reduced meat consumption as the research suggests. There was so much backlash from industry that the sustainability portion was removed and then the guidelines were approved. This example really shows that industry has influence and that there is a need to have conversation about recommendations between stakeholders in order to avoid conflict and total rejection of nutrition policy. Policy has to work on multiple levels and include a variety of disciplines to produce the best policy that will work for everyone. However, achieving the inter-disciplinary nature of this type of policy can be difficult to accomplish. Perhaps, policy should be re-thought about in terms of: “what would farming and

food supply chain look like if it was based around human physiologic/nutritional needs, and if policy makers pursued a better match between global food systems, ecosystems, and human pursuit of sustainable food security” (24)?

This question is echoed in the thoughts of Dubé *et al.* The authors state that policy will require novel forms of innovation, organization, and governance. This is a large undertaking to rewrite policy because it involves many stakeholders. Single policy actions will not work to answer the issues surrounding sustainable diets, health and agriculture. While they discuss national policy and various factors, it is interesting to note that the authors believe research in agriculture is important, especially integrating small famers into the larger food system either on the national or global scale (25).

One point in agricultural research is related to animal production. A lot of research has discussed the negative impact that animal production has on the environment. However, it is important to consider an alternative to the common production methodologies. Allan Savory has been working on desertification of grasslands across the world. His work has focused on determining the underlying cause of desertification. From decades of work and research, Savory and his team have found that desertification has been caused, not by overgrazing, but by a lack of properly managed grazing (26,27). Savory and colleagues suggest attempting to mimic nature when it comes to grazing. This approach allows the animals to graze in a particular area for a relatively short length of time and then moving the animals on to another piece of land to graze. After each grazing session of different pieces of land, the land is allowed to rest and this rejuvenates the soil that allows it to store more carbon (26). Savory believes that if this more holistic approach was used around the world climate change could be mitigated due to carbon being taken out of the atmosphere and put back into the soil. The carbon rich soil can hold more water and have fewer problems with flooding. Additionally, this holistic approach is not resource intensive, like

traditional pasture grazing (26). This alternative approach to traditional livestock rearing could potentially show that there is an environmental benefit to livestock grazing and could be a local level approach to providing a sustainable diet.

## **V. Summary**

Sustainable diets have been defined by the FAO in a broad manner so they can be adapted for different parts of the world. Measuring sustainable diets involves GHGEs and using the LCA approach to determine environmental impacts of foods. Several dietary patterns have emerged as sustainable which includes eating a healthy diet that is lower in animal product consumption and rich in plant-based foods. Consumers do not necessarily link food choice to sustainability. However, with the growing importance in developing sustainable diets, it is increasingly important to understand what consumers know and or think about this topic. Consumers include nutrition educators that teach nutrition information to the community. Understanding nutrition educator thoughts and perceptions of a sustainable diet are important to help learn what they know, if they want to know more, and where knowledge deficits may be. This can lead to nutrition educators integrating sustainable diet information into nutrition education for the community.

## **THESIS PROJECT RESEARCH**

### **INTRODUCTION**

#### **Population Increase, Climate Change, and Agriculture**

By 2050 the world population is expected to reach 9.1 billion people (36). This population growth requires agriculture to increase production to feed the population adequately. The Food and Agriculture Organization of the United Nations (FAO) predicts that need for a 70 percent increase in food production for the future population to survive. However, climate change is putting pressure on agriculture that can reduce production and yields if not properly managed. Currently, agriculture is experiencing the pressure of climate change. The major droughts in California and the Midwestern United States are two examples (30). Additionally, the increase in global temperature has altered growing seasons for fruits and vegetables, such as cranberries (31). Agriculture needs to adapt to the changing climate (32, 33). While agricultural production has been and currently is sufficient, the pressures on agriculture from climate change have caused food prices to increase (34). Increased food prices can lead to a variety of outcomes, namely food insecurity and subsequent health issues.

#### **Non-communicable Diseases and Food Insecurity**

Nutritionists often are concerned with nutrients and food as it relates to health. Food is considered a tool to promote prevention and management of diseases, i.e. cancer, obesity, and liver disease. Health promotion and disease prevention is a core focus of people who study nutrition (11, 12, 13). Currently, there has been an increase in the proportion of the world population that experiences affliction with non-communicable diseases of diabetes, obesity, etc. Nutritionists often focus on certain nutrients to help manage the aforementioned diseases and advise people about the foods they can eat to get needed nutrients. However, another major issue

for nutritionists is food insecurity. Food insecurity affects approximately 805 million people across the globe (28). Additionally, parts of the world are experiencing issues with food security with a growing population puts additional pressures on agriculture to increase food production. Agriculture is pressured by climate change as temperatures rise and seasons change. Global leaders in nutrition, health, and agriculture are pressured to think about how to make positive changes to ensure the generations of the future will have the basic necessities of water and food. Food choice plays a role in bringing about a sustainable future. Are consumers aware or thinking about sustainable diets and dietary choices?

### **Definitions of Sustainable Diets**

Sustainable diets strive to answer the issues mentioned above. The idea of sustainable diets is not new and dates back to Gussow and Clancy, in a commentary where they state that food choices can impact the environment and more attention needs to be given to this fact (1). Decades later, in 2010, the FAO developed a structured definition of sustainable diets. The FAO's definition of what sustainable diets consists of is as follows: "sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to a healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair, and affordable; nutritionally adequate, safe, and healthy; while optimizing natural and human resources" (2). Development of this definition was to help drive research of sustainable diets, guide policymakers and provide a framework so people can take action to develop a more sustainable diet for their health and environmental health. Using the definition developed by the FAO as a guide, the goals of this study to begin to understand what nutrition educators may know, what they think about sustainable diets, and to determine if there is a need to create educational materials on sustainable diets that can be used to teach nutrition educators.

## METHODS

Data in this study were collected through interviews and surveys with nutrition educators from Arizona. Nutrition educators are any nutrition professional or paraprofessional that teaches nutrition information to a target audience. Being a registered dietitian or register dietitian nutritionist was not required. It was important to understand what nutrition educators currently know and what their perceptions are on the topic of sustainable diets. Participants in this study included paraprofessionals of the Arizona Cooperative Extension system who teach nutrition information people in the Supplemental Nutrition Assistance Program (SNAP) Education Program and Expanded Food and Nutrition Program (EFNEP). Additionally, faculty members from the University of Arizona's Department of Nutritional Sciences were also interviewed.

Before conducting the research project, study materials (questionnaires and recruitment materials) were developed (See appendices). Once developed, an application was submitted to the human subjects institutional review board (IRB) for approval.

The IRB of the University of Arizona approved all of the study procedures (focus group, interview and survey), and each participant provided written informed consent to participate (Appendix 5). The recruitment email was sent to department faculty (Appendix 4). Once participants responded to the email, an appointment was made to interview the participant. On the date of the appointment, the interviewer and one note taker met with the participant. In the interview, the participant was given a definition of sustainable diet based on the FAO definition. The participant was asked answer the 11 questions based off the given definition. A total of 9 interviews were conducted.

The recruitment email (Appendix 4) was also sent to an Extension Agents to see about setting up a focus group of SNAP-Ed and EFNEP educators. One focus group was set up with 8

participants. The focus group was given the definition and questions that was used in the interviews (Appendices 1 and 3). One interviewer and two note takers were present at the focus group to collect data.

Contact was made with another Extension Agent to coordinate distribution of a short, 9-question survey to SNAP-Ed and EFNEP educators at their annual in-service training held in December (Appendix 2). The short survey was printed out and placed into the in-service packets that educators received as they entered the training. The training lasted a day and had several breaks. Announcements were made before each break reminding them to fill out the survey and return it to me. The questionnaire consisted of 9 questions total. The survey did not provide a definition for a sustainable diet. Participants just answered the questions with the knowledge they had.

The short survey was completed by 54 nutrition educators and collected limited demographic data: number of years as an educator and the county the educator was from. Eleven of the fifteen Arizona counties participated in the survey. The mean number of years served was 7.08 out of 49 responses from the 54 people completing the survey.

Data analysis occurred in two ways. The qualitative data was thoroughly reviewed to determine themes that were reoccurring. Quantitative data from the surveys was analyzed using the Mann-Whitney U test using STATA Statistical Software package. The Mann-Whitney U test was chosen because it is a nonparametric test that works with the type of data in the surveys. This test assumes that the samples are independent, responses are ordinal, and that the distribution is continuous. The Mann-Whitney U test was used to evaluate if there was a relationship between how participants responded to question 1 (yes or no) and the other questions in the survey (excluding question 9).

## RESULTS

### Focus Group and Interview Results

Analysis of the focus group and interview responses showed five main themes across all responses. Theme 1 was a potential for improved health while following a sustainable diet. Theme 2 was concerned with affordability of sustainable diets. Theme 3 was about culture as a major influence on dietary practices and food acceptability. Theme 4 showed a need for education on the topic of sustainable diets. Theme 5 was about sustainable diets incorporating seasonal foods. Each theme will be discussed separately.

Theme 1, participants in both the focus group and interviews talked about behaviors that are would promote sustainability and health for individuals following sustainable diets. The behaviors mentioned are in response to a question asking “what a person might enjoy about following a sustainable diet”:

- “learn more about cooking, gardening, composting and trying new foods”
- “Sociability of it; I like to get together with friends at my house, their houses, or at a restaurant.”
- “Gardening for sure, good to get hands in the soil. Gardening can be good for recreation and get fresh fruits and vegetables.”
- “teaching kids how to grow their foods”
- “It is nice to go to the [farmer’s] market and talk to the vendors and it is a nice social aspect of it.”
- “the amazement from kids learning how to garden is rewarding”

- “owning chickens for fresh eggs”

These responses show a sample of some of the ways that healthy eating can be promoted while following a sustainable diet. It shows a mix of ideas from gardening to cooking and shopping at farmer’s markets. However, participants did question the cost of partaking in some of these activities, such as shopping at the farmer’s market.

Theme 2 showed a concern about affordability of sustainable diets. Question 3 in the focus group and interviews asked for barriers for following sustainable diets and concerns about cost were brought up:

- “economics are what permits these [sustainable] decisions”
- “It is important to promote diets that have low costs to consumers”
- “Cost”
- “finances”
- “You have to spend time with it [garden] and can cost lot of money and water.”

The cost of sustainable diets was a concern that was also observed in the survey responses. This will be discussed later. However, since this topic came up in different ways, it is a topic that needs to be emphasized when providing education on sustainable diets to educators. Cost is a limiting factor for a portion of the population.

While cost was a concern for many, Theme 3 saw universal agreement from the focus group and interviews. Cultural appropriateness of sustainable diets was considered to be a large factor in acceptability for different cultures. Question 8 asked participants about cultural acceptability:

- “Absolutely”
- “if you do not make it culturally sensitive – you lose a lot of people that way”
- “Yes definitely, it should be culturally acceptable.”

- “Depends on where you live. Tucson is diverse and Iowa is not so diverse. Reflect local, healthy and culture and healthy habits.”
- “Yeah, culture is important. There is family culture and people eat a certain way”
- “You want to be culturally sensitive.”

Theme 4 was about knowledge of the topic. Participants were asked about barriers related to teaching sustainable diets to an audience (question 5) and tools needed to teach sustainable diets to an audience (question 6). Responses to these questions showed that nutrition educators felt that they did not have the knowledge level necessary to be comfortable to about teach sustainable diets:

- “Lack of knowledge. Currently, I would need to do more research on the topic before I would be able to teach it.”
- “Curriculums that we already have and use [do not discuss sustainable diets]. Lack of knowledge”
- “Instructors educating themselves of the ins and outs of the topic”
- “Lack of familiarity”
- “first-hand knowledge – canning conference – she didn’t have any prior knowledge, now she will begin canning”

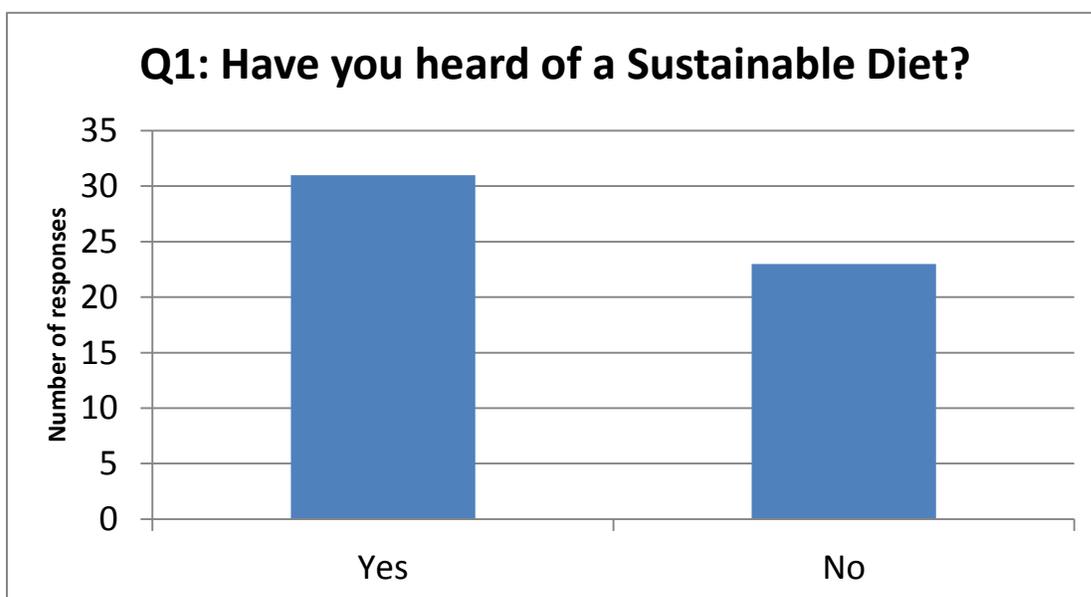
More training on the topic of sustainable diets is necessary. One additional response to a different question in the interview reinforces the need for additional education about sustainable diets. “I am not against teaching about sustainable diets, but if a goal is to just increase a person’s fruit, vegetable, and whole grain intake and you start promoting a sustainable diet, it is too much for people,” stated one educator. Consuming increased amounts of fruits, vegetables and whole grains is part of following a sustainable diet. Knowing about what foods are included in a sustainable diet would be part of the base knowledge learned. The themes presented show

different aspects of sustainable diets and have provided four areas where there is a need for additional knowledge and training. It was accepted that cultural appropriateness is necessary to make teaching sustainable diets appealing to a wide audience.

Theme 5 discussed having seasonal foods as part of a sustainable diet. Several educators commented that eating seasonal foods is the ideal scenario, but living in the desert can make it difficult to do so. Others looked at the need to have seasonal foods in the diet because they do not travel as far and reduce environmental impact. Lastly, some educators believed that seasonal food is only part of a sustainable diet, especially if canned and frozen food is incorporated.

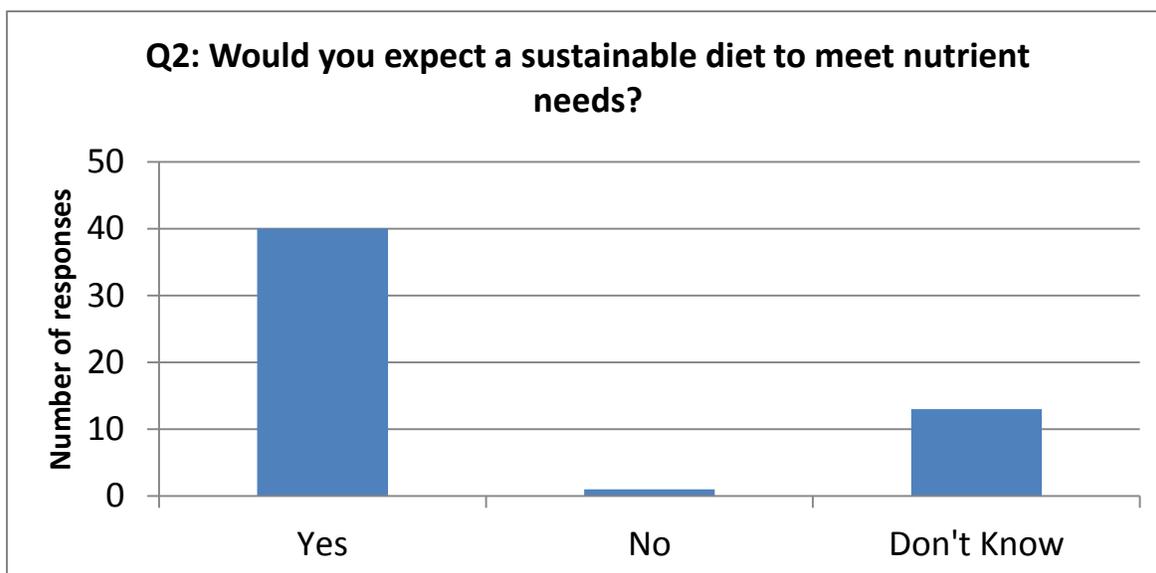
The short survey that was taken by SNAP-Ed and EFNEP educators had 9 questions (Appendix 2). The first question asked: “Have you heard of a sustainable diet?” Participants were allowed to choose from ‘yes’ or ‘no’ as their response. The following six questions had responses of ‘yes’, ‘no’, or ‘don’t know’. Question 8 asked about types of foods and food sources that participants would expect to have in a sustainable diet. There were a total of 12 sub-sections for this question. Responses were on a 5-point Likert scale with 1 being very unlikely to 5 being very likely. The final survey question asked participants to describe a sustainable diet. Only 30 of the 54 educators who completed the survey responded to this question.

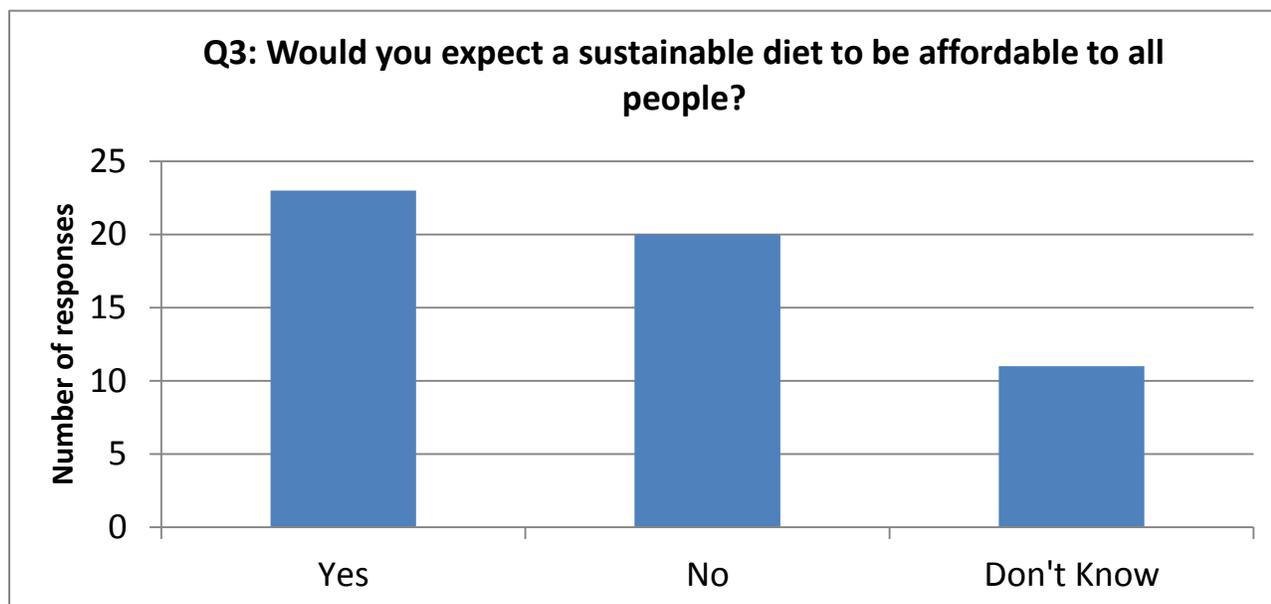
The short survey questions were designed to ask about sustainable diets and components of the definition and what types of foods would fit into sustainable diets. The survey did not define sustainable diets; the questions were evaluating the knowledge base of the educators. The figure below summarizes the response to, “have you heard of a sustainable diet?” Thirty-one nutrition educators indicated they had heard of a sustainable diet and the other twenty-three did not (Q1).



The next two questions asked about specific parts of the sustainable diet definition. Part of sustainable diets as defined by the FAO is that sustainable diets provide safe, healthy, and nutritious food to all.

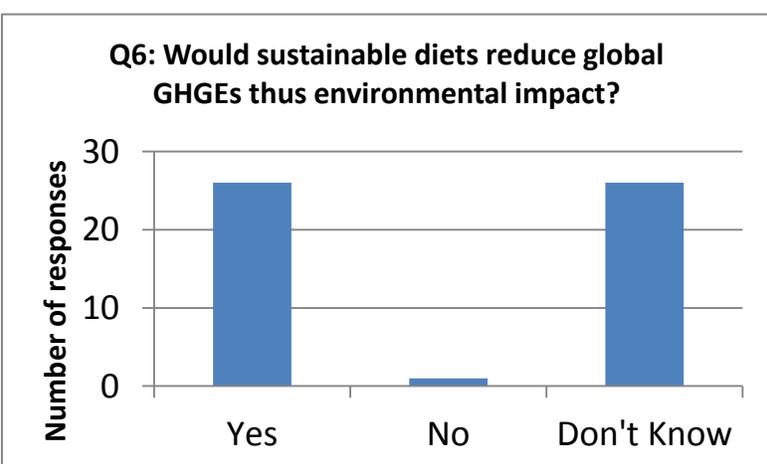
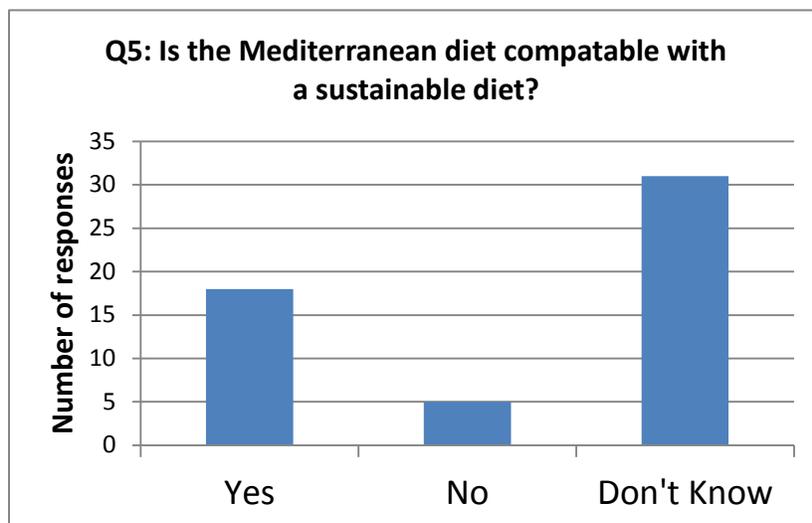
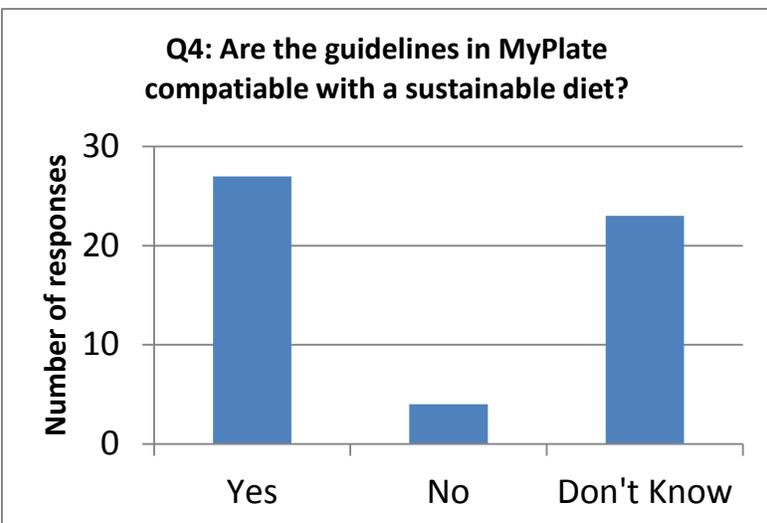
The second question in the survey asked about nutritional adequacy of the diet for all (Q2). Forty educators stated that sustainable diets would provide adequate nutrients. One stated no and 13 educators selected 'don't know'.





The third survey question targeted the part of the FAO sustainable diet definition that states sustainable diets should be affordable. Educator responses are found below. Twenty-three educators selected yes to sustainable diets being affordable to all and 20 stated it would not be affordable and 11 were unsure (Q3).

Questions four and five asked about if certain dietary patterns are compatible with sustainable diets. Consuming a healthy diet or a diet based on the Mediterranean diet food pattern can reduce environmental impact by reducing GHGEs (2,3,8). Question four asked about sustainability and MyPlate- current dietary guidelines, until the new guidelines are released (Q4). Half of the educators believe that the MyPlate guidelines are compatible with a sustainable diet. Close to half (43%) of the educators were not sure if the MyPlate guidelines are compatible and the rest state that the MyPlate guidelines are not compatible. Question 5 asked if the Mediterranean diet was compatible with a sustainable diet (Q5). The majority of educators (n=31) were unsure if the Mediterranean diet was compatible with a sustainable diet. Another 18 stated that the Mediterranean diet is compatible with a sustainable diet and 8 stated it is not.



Question six of the survey focused on a reduction of GHGEs as a way for sustainable diets to reduce the impact on the environment. This is once again part of the FAO definition and it has been demonstrated that sustainable diets can reduce GHGEs and environmental impacts (2,3,8). Figure 6 shows the educator responses to sustainable diets reducing GHGEs question. Half of the educators agreed and the other half were uncertain. One educator stated no and there was one educator that did not circle a response.

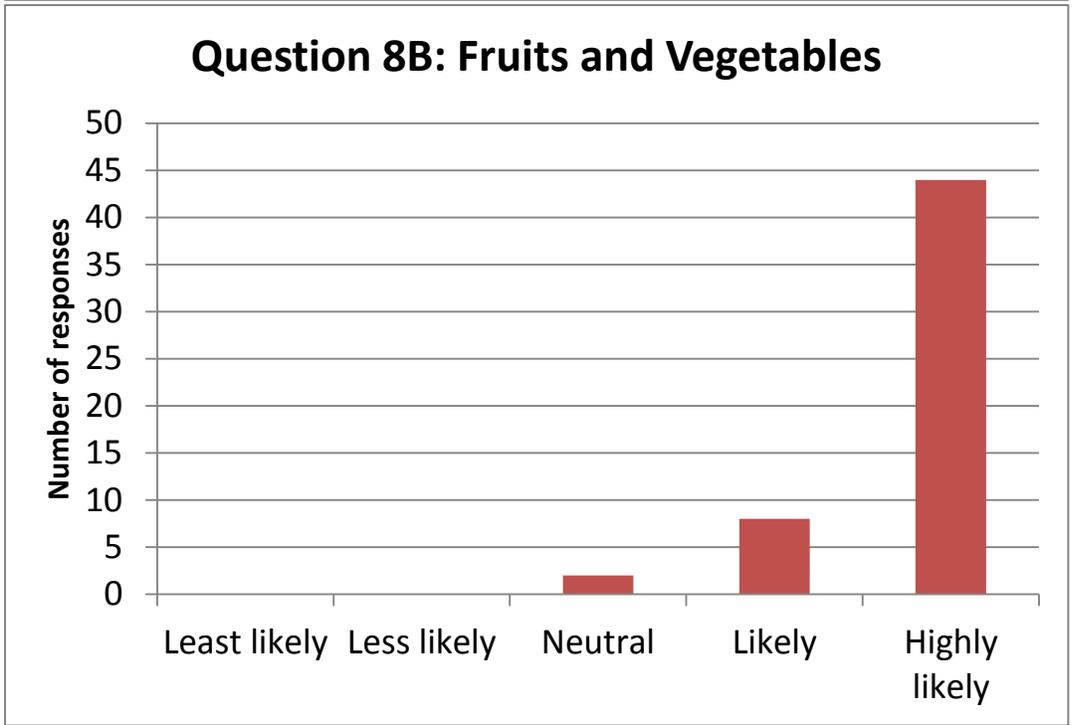
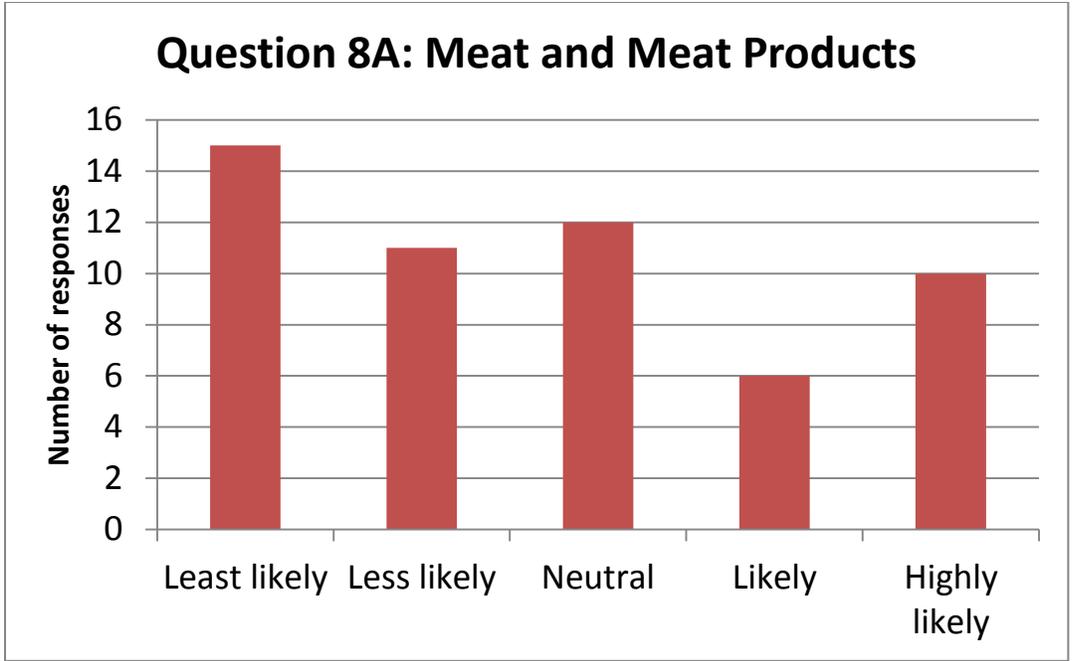
Question seven directly asked about attending a seminar to learn more about sustainable diets.

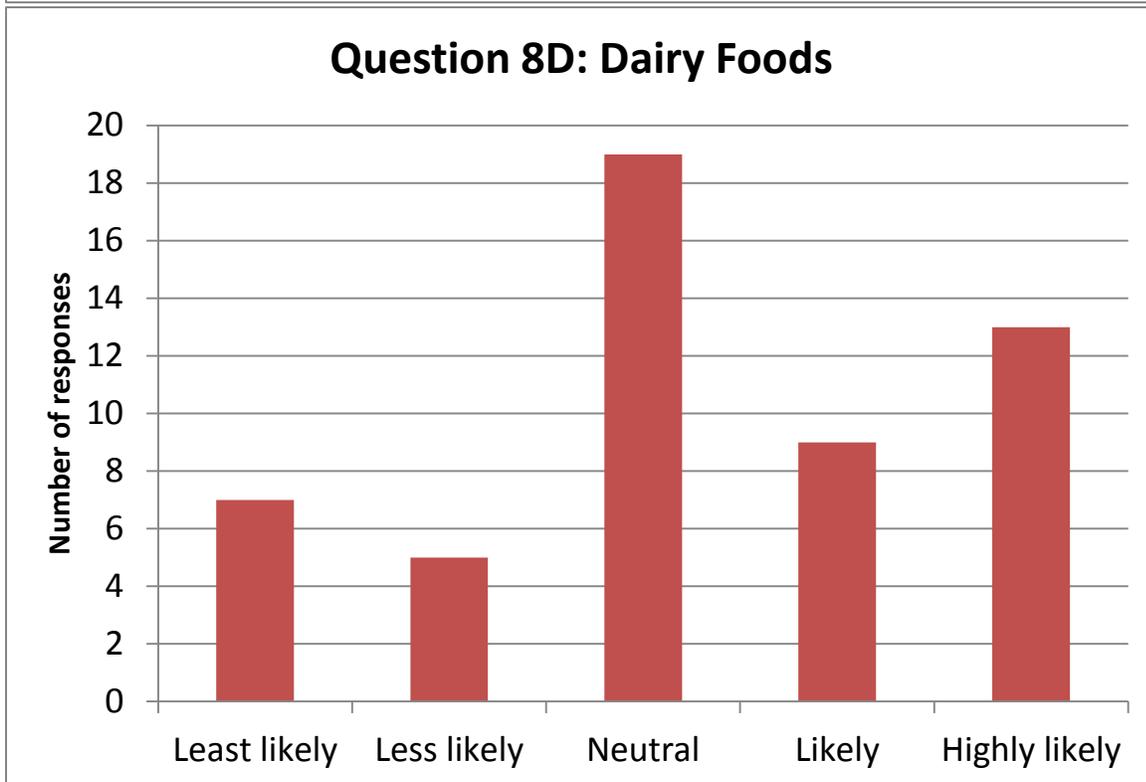
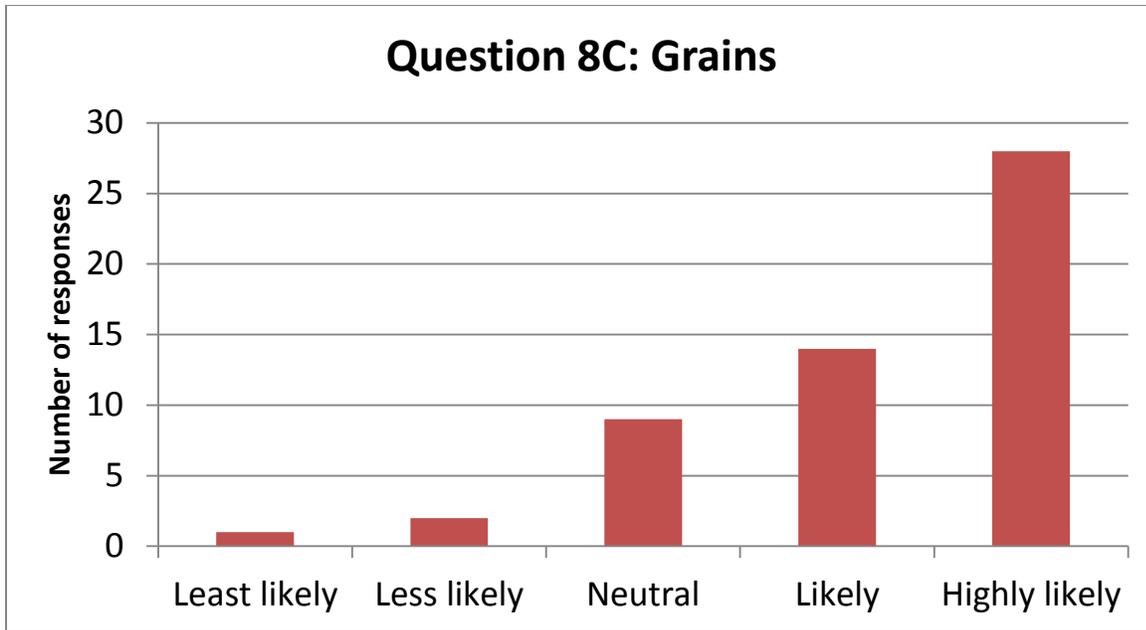
Q7 shows the educators responses. There was an overwhelming majority (80%) that stated they

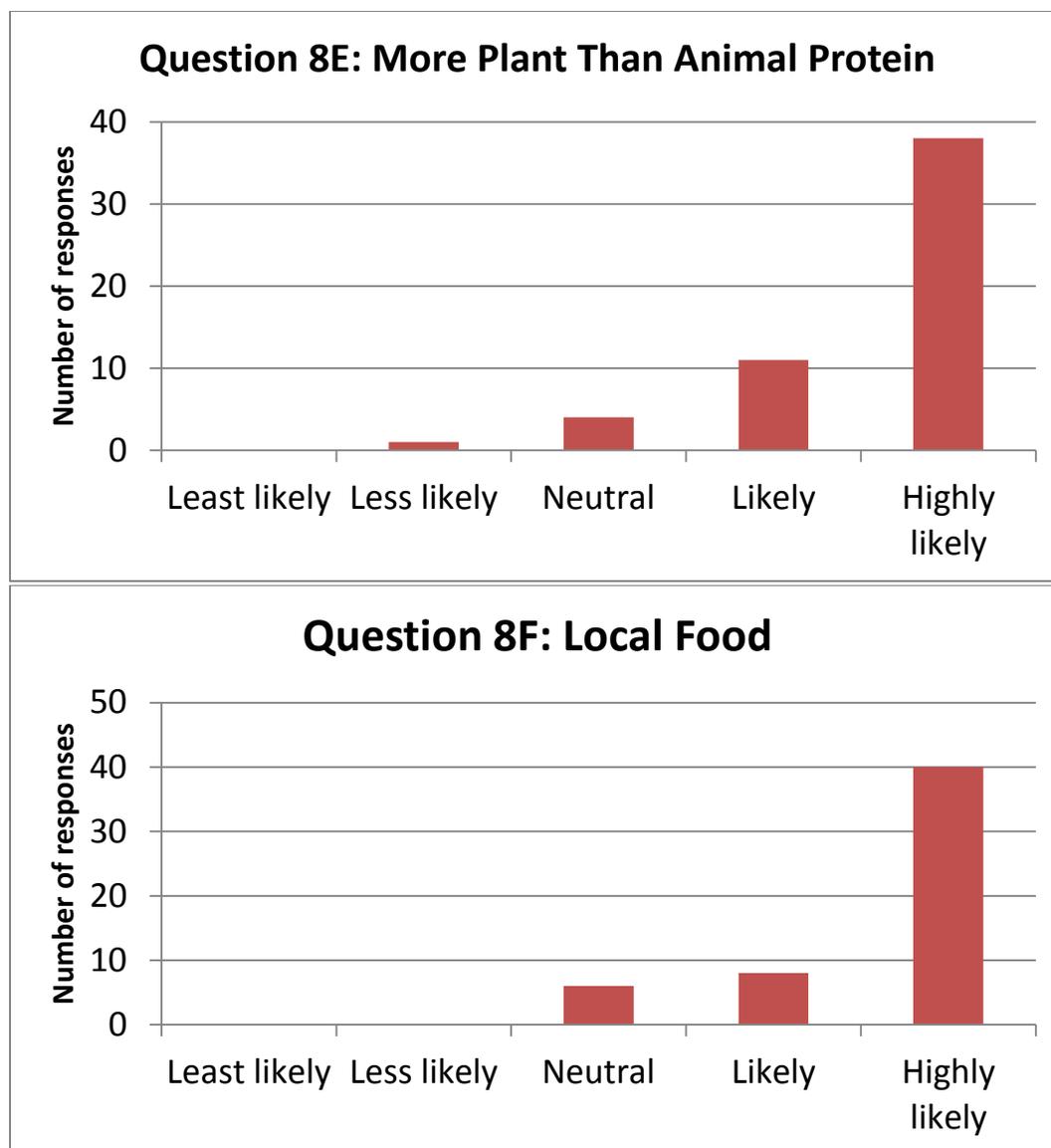
would like to attend a free seminar talking about sustainable diets. Six educators stated they were unsure and five stated that they did not wish to attend a free seminar about sustainable diets.

Question eight asked about food types and ways to purchase food (i.e. fast food, sit-down restaurants, or convenience foods, such as pre-packaged meals and deli sandwiches). The foods included in the question had been discussed in the literature review, such as meat (9). Other food sources, such as restaurants and convenience foods did not appear in the literature review, but were included to get thoughts on what types of food sources would educators believe to be part of a sustainable diet. Other questions asked about food as it is produced: it is conventional, organic, local or regional. Answers to the 12 parts of question eight were scored on a 5 point Likert scale with 1 being the least likely to have as part of a sustainable diet, 3 is neutral, and 5 is highly likely to be part of a sustainable diet.

The first six subparts of question eight asked about the likelihood of having the different food groups as part of the diet. Part A asked about the likelihood of having meat and meat products (Figure 8A). Many educators ranked this as neutral or below, while 16 educators ranked inclusion of meat and meat products at likely or higher. Part B looked at the likelihood of consuming fruits and vegetables (Figure 8B). For fruits and vegetables 44 educators ranked this category as a 5-highly likely and there were 10 educators that ranked fruit and vegetable consumption as a 4-likely or 3-neutral. Part C asked about grains being part of a sustainable diet (Figure 8C). The majority of educators ranked grains to be highly likely (n=28) or likely (n=14) included in a sustainable diet. The rest of the educators ranked grains as neutral or below (n=12). Part D asked about dairy and eggs (Figure 8D). Twenty-two of the educators ranked inclusion of dairy and eggs as likely or highly likely and 19 rated it as neutral and 12 ranked it less likely or below.



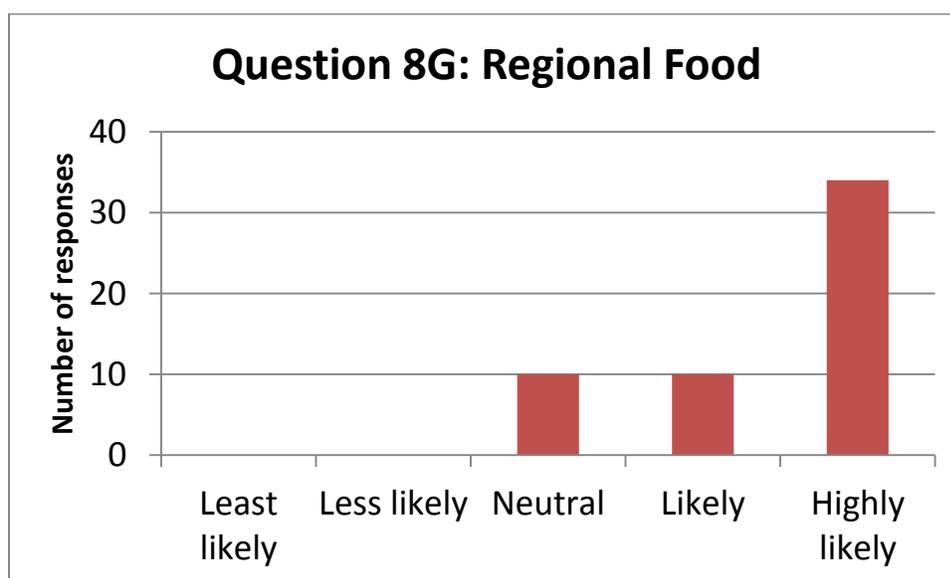


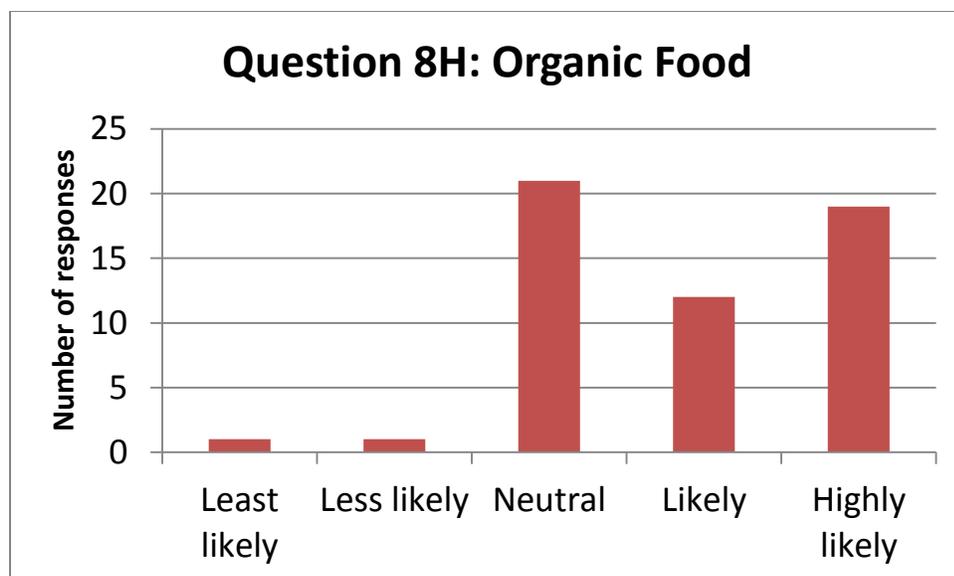


**Figures 8A-F: Question 8: As part of a sustainable diet, I would expect to consume?**

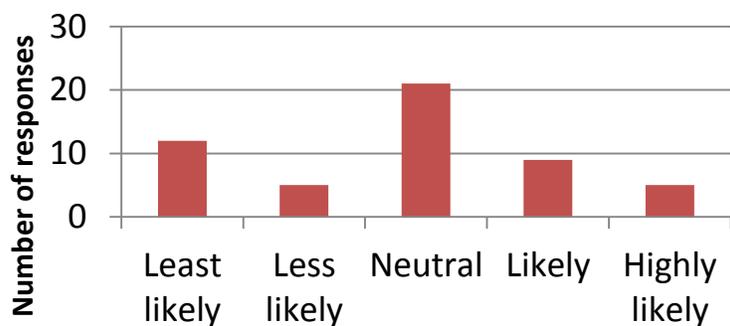
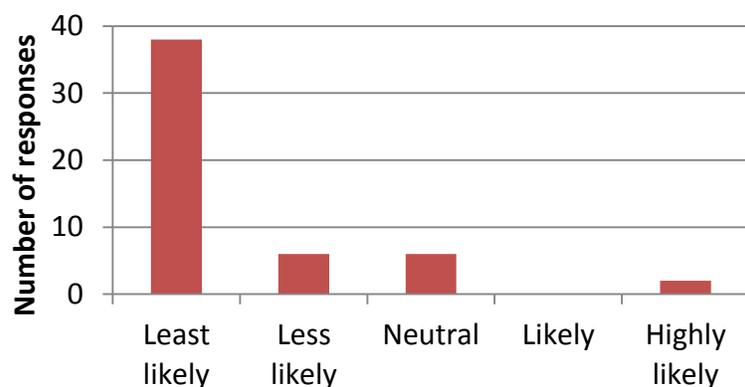
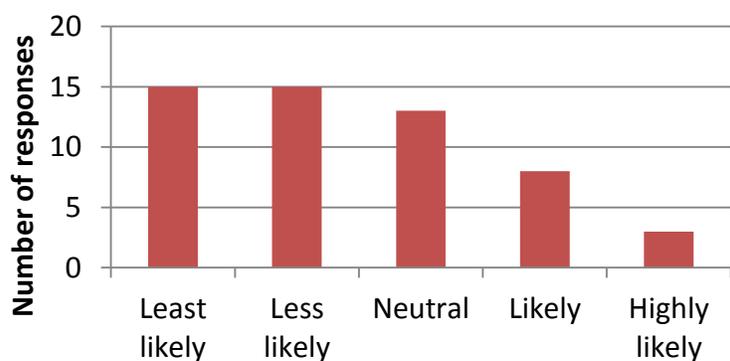
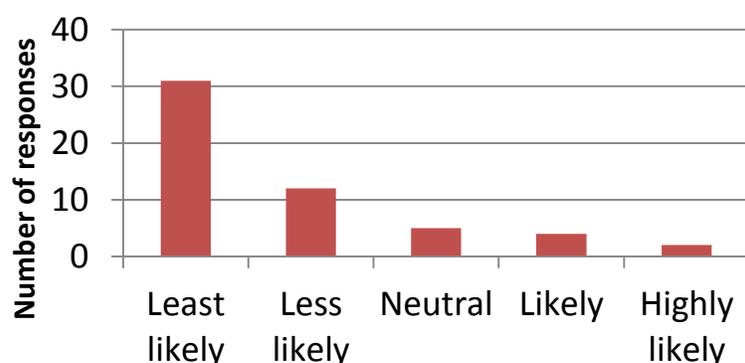
Part E does not focus on a food group, but addresses consumption patterns of plant protein versus animal protein. The literature review supports a lower meat and meat product consumption in favor of increased in plant-based food sources as part of a sustainable diet (4,9,35). A majority of educators ranked part E as likely (n=11) or highly likely (n=38). Also, a majority of educators ranked part F either likely (n=8) or highly likely (n=40) and only six were neutral. Part F addressed likelihood of consumption of local foods. Local food is part of the

Mediterranean and New Nordic diet patterns and these patterns can be adapted to different locations (2, 8, 15). Parts G-I addressed regional food (Figure 8G), how food is grown organic (Figure 8H) versus conventional (Figure 8I). Educators ranked regional food as highly likely (n=34), likely (n=10), or neutral (n=10). Organic foods had a more mixed response with 19 educators ranking as highly likely to be included in a sustainable diet, 12 ranked it as likely, 21 ranked it neutral and 2 educators ranked it as less likely and least likely. Conventionally raised food received a mixed rating from educators as well, with 5 educators ranking it as highly likely, 9 as likely, 21 as neutral, 5 as less likely, and 12 as least likely.





The last three parts of question eight (J-L) focused on how food is obtained. There was no discussion in the literature that was reviewed regarding fast food, sit-down restaurants, or convenience food (i.e. pre-packaged meals and deli sandwiches) as being part of a sustainable diet or not. However, since fruits, vegetables, and whole grains are highly promoted, it can be argued that fast food and sit-down restaurants are excluded due to the lack of a variety of foods from the aforementioned food groups. Overall the ranks were mixed, but leaned toward being least likely to be part of a sustainable diet. The fast food part (Figure 8J) showed 38 educators ranking as least likely, 6 with less likely, 6 were neutral, and 2 ranked it as highly likely. Sit-down restaurants (Figure 8K) showed a mixed response with 15 ranking least likely, 15 at less likely, 13 were neutral, 8 ranked it as likely, and 3 ranked it as highly likely to be included in a sustainable diet. Finally, convenience foods (Figure 8L) overall got a low rating with 31 educators stating least likely, 12 less likely, 5 were neutral, 4 stated likely, and 2 stated convenience food was highly likely to be part of a sustainable diet.

**Question 8I: Conventional Foods\*****Question 8J: Fast Food\*****Question 8K: Sit-down Restaurants****Question 8L: Convenience Foods****Figures 8G-L. Question 8: As part of a sustainable diet, I would expect to consume?**

\*These two graphs have 52 responses. Two educators did not mark an answer for these questions.

The final question in the short survey was an opened question asking participants to define what sustainable diets mean to them. Twenty-seven responded to the question and the answers varied from person to person. The results are in Table 1 below.

**Table 1: Responses to Survey Question 9**

- A diet that does not depend on outside [sourced] (i.e. grocery stores, restaurants) for continuation, but depends on local, organically grown food to sustain itself

- A diet consisting of foods that are grown and raised in a way that is not just [sensitive] to minimal impact on the environment but that can provide sufficient nutrition and calorie intake for humans across the globe while also respecting the earth by not acting deliriously on its resources.
- Sustainable means [self-sufficient], continuous supply with minimal waste.
- That which meets dietary needs and sustains bodily needs for energy and growth
- Grow yourself or close by. Least damage to the earth.
- One which is able to accommodate the MyPlate on a budget
- Sustainable throughout lifetime? i.e. not a "fad" diet. Environmentally sustainable diet?
- One that helps the environment/is environmentally friendly and is also [sustainable] in a person's life i.e is a lifestyle not a short term diet.
- A diet that provides optimal nutrition while having a low impact on the climate globally and environmentally.
- An idea - vague. What is sustainable for the environment - like not using pesticides is not necessarily sustainable for farm workers who are paid poverty wages.
- A variety of crop foods, that are sustainable within their climate. A reduction an animal factory farming (c.AFO's) not over fishing.
- Diet source from regionally grown/raised sources that provides a balanced, lowfat/reduced salt & sugar options, with focus on fruits & veggies and whole grains.
- Eating organic, non-GMO, local foods that are easily replaced when consumed.
- Available foods, food that is beneficial to our bodies
- I am guessing it consists of foods that are grown or raised for food - commercially or individually.
- A well-rounded diet that is budget friendly

- Diet maintained.
- Foods that are renewable, grow easily and are available without long distance transport.
- A diet that will last with a person for life, not a fad.
- Environmentally friendly diet - sustainable meaning we will be able to continue using farming practices into the future with minimal negative impact on the environment.
- one that is affordable, easily duplicated and sustainable for the economy and the environment.
- A diet of foods that are produced, procured and packaged in a way that minimizes damage to the environment, communities and ensures survival of the earth.
- A diet that supports and can be supported by the natural world, would also help maintain health of individual.
- Something you can grow on your own or with chickens
- ? Maybe food that is readily available to environment you live in and that [is] affordable.
- I am guessing that it is easy to keep up, affordable.
- Sustains the health a person and the environment also sustainable from workforce and food system point.

These responses show a wide range of thoughts on the topic from raising/growing your own food to reduction of certain types of agricultural production, such as factory farming of animals and consuming non-GMO foods.

Additionally, it was hypothesized that nutrition educators who answered “yes” to the question of having heard of sustainable diets may answer the questions “correctly” compared to those who have not. Answering the questions “correctly” means if a participant has heard of a sustainable diet, they would answer the rest of the survey based in the FAO definition. The Mann-Whitney

test was used to determine if there was a relationship between the answers given in question versus the subsequent questions (2-8L). The results of the analysis are shown in Table 2.

Sustainable diets meet nutrient needs (Q2)	p = 0.24	No relationship
Sustainable diet affordable to all (Q3)	p = 0.67	No relationship
Sustainable diet is compatible w/ MyPlate (Q4)	p = 0.02	Relationship*
Sustainable diet is compatible w/ the Mediterranean diet (Q5)	p = 0.59	No Relationship
Sustainable diets reduce GHGEs (Q6)	p = 0.01	Relationship*
Free Seminar offered on Sustainable diets (Q7)	p = 0.30	No Relationship
Meat and meat products (8A)	p = 0.99	No Relationship
Fruits and Vegetables (8B)	p = 0.52	No Relationship
Grains (8C)	p = 0.71	No Relationship
Dairy products & eggs (8D)	p = 0.38	No Relationship
More plant than animal protein (8E)	p = 0.75	No Relationship
Local Foods (8F)	p = 0.93	No Relationship
Regional Foods (8G)	p = 0.94	No Relationship
Organic Food (8H)	p = 0.67	No Relationship
Conventional Foods (8I)	p = 0.85	No Relationship
Fast Food (8J)	p = 0.27	No Relationship
Sit-Down Restaurants (8K)	p = 0.02	Relationship*
Convenience Foods (8L)	p = 0.60	No Relationship
*Significance at p < 0.05. The question numbers are listed beside the topic of the question. Question 8 asked if educators would expect to have certain foods as part of a sustainable diet.		

It is expected that if a nutrition educator has heard about a sustainable diet that answers to the survey questions would be consistent with the definition of a sustainable diet. The majority of the questions did not show a relationship between how question 1 was answered and answers to subsequent questions. Questions 4, 6, and 8K show significant relationships between how question 1 was answered and how those questions were answered. Further stratification of the

data shows that of those who answered question 1 with 'yes' 68% of educators answered that MyPlate is compatible with a sustainable diet (question 4) and 65% of educators answered that yes GHGEs will be reduced by following a sustainable diet.

The peer-reviewed research has not discussed types of access to food in terms of restaurants whether fast food or sit-down establishments. However, it is interesting to note that of the educators who answered 'yes' to question 1, 16% thought that getting food from sit-down restaurants would be least likely to be part of a sustainable diet, 26% thought it would be less likely to be part of a sustainable diet, 32% were neutral, 23% thought it would be likely to have sit-down restaurant food as part of a sustainable diet and 3% thought it would be highly likely.

Overall, the focus group and interviews showed five themes. Theme 1 highlighted the potential for improved health for individuals following a sustainable diet. Theme 2 discussed concerns of affordability to all. This concern was also observed in the survey results. Theme 3 illustrated that cultural acceptability of a sustainable diet is highly important. Theme 4 showed educators need to have more knowledge to be comfortable teaching sustainable diets. Again, the survey results showed a desire to learn more about sustainable diets. Theme 5 discussed seasonal eating as part of a sustainable diet.

Survey results support some of the findings found in the focus group and interview results as discussed previously. Additionally, the majority of participants stated they have heard of a sustainable diet. Responses to question two show that the majority of educators do believe that sustainable diets are nutritionally adequate. Questions three through six showed mixed results with almost half of responses being "yes", "no", or "don't know". Question seven showed that educators are interested in learning more about sustainable diets.

Question eight of the survey asked educators to rank food groups, types of food production, and types of food access as what they believe would be part of a sustainable diet. For most of the questions the results were mixed. Part 8B, fruits and vegetables, showed a clear response that this food group would be part of a sustainable diet. Parts 8C, grains, and 8E, higher intake of plant-based protein had similar results. Finally question nine in the survey showed that individuals have different definitions of sustainable diets.

## **DISCUSSION**

As the world works to address climate change, the growing population and diseases, sustainable diets will become part of the conversation. The Scientific Report by the Dietary Guidelines committee is an example of sustainable diets becoming part of the solution for improved health of people and the planet (22). As sustainable diets are becoming more widely incorporated into dietary guidelines, it is important to learn and understand the knowledge and perceptions of sustainable diets.

This study was designed to improve understanding of the knowledge and perceptions regarding sustainable diets of nutrition educators. The results from this study show the thoughts and perceptions of nutrition educators regarding sustainable diets. The focus group and interviews indicated that there is potential for improved health of individuals by participating in the different activities that are part of following a sustainable diet. Benefits include: socializing, growing your own food to get fruits and vegetables, involving children in the gardening process, and shopping to the farmer's market. The Mediterranean diet emphasizes the social aspect, particularly when sharing a meal and it develops community (2,14). There was a concern about how much money can be spent on a garden in a desert environment because of the need to water

plants frequently. While this was a minor concern related to sustainable living activities, there was a greater concern about costs of sustainable diets.

Concern held by educators about the cost of a sustainable diet is not surprising as people generally want to know how much a different type of diet costs. Research has shown that a sustainable diet does not necessarily cost a whole lot more than current diets (3,20). Results from this study show that cost would need to be part of a sustainable diet education curriculum. The results from the survey reinforce this, 37% of educators selected 'no' sustainable diets would not be affordable to everyone and 20% stated they did not know if it would be affordable to all.

While affordability of sustainable diets was not clear to educators, one component of a sustainable diet was stated with certainty: cultural acceptability. Results from this study show that sustainable diets need to be culturally acceptable. This belief directly aligns with a component of the FAO's definition of sustainable diets (2).

Cultural acceptability for promoting a sustainable diet was a must for all educators. Many educators stated that they would not be comfortable teaching information about sustainable diets to others. Interviews highlighted the reason for this was due to "lack of knowledge" and a "need to do more research." Educators that filled out the short survey were interested in a free seminar on sustainable diets. This response came from most everyone regardless of if they had stated that had heard of a sustainable diet before or not. The desire to learn more about sustainable diets is present among nutrition educators.

This study has begun to investigate what nutrition educators know and think regarding sustainable diets. However, this study does have some limitations. The group of study participants was relatively small with only 17 participants either being interviewed or part of a focus group and another 54 participants were given the short survey. Another limitation is the

amount of information collected. This study focused on a small portion of sustainable diet components. Food waste is also a topic that is mentioned in the literature (29). Food waste was not included in a question in the interviews or survey questions. Another topic that sustainable diets encompass is seasonal foods. While the focus group and interview questions addressed seasonal foods, this question was not asked directly in the survey. Seasonality can be part of getting foods locally, which was part of the sustainable diet. Future surveying needs to ask separate questions about local and seasonal food. Finally, this study collected minimal demographic information from participants. Future surveys and interviews may want to collect more demographic information to analyze data in respect to demographic characteristics.

## **CONCLUSIONS**

This study has highlighted what nutrition educators know and think about sustainable diets. Some nutrition educators have a general idea of what a sustainable diet. Many educators wish to gain more knowledge on sustainable diets. Need for education was evident from responses in the interviews, concern about costs, and in the survey where educators demonstrated an interest in participating in a free seminar about sustainable diets.

Future directions would include additional research to gain more knowledge from educators on different sustainable diet components, such as food waste. Development of an education curriculum to train educators about sustainable diets is important. The curriculum could be developed as a separate curriculum or as additional training that would be integrated into existing training. The curriculum could be delivered online or in a classroom environment and would encourage nutrition educators to learn about sustainable diets and how to share that knowledge with their audiences.

## SUMMARY

The idea of sustainable diets is not new. In the past five years, the FAO has developed a broad definition of a sustainable diet. This definition is complex. It involves agriculture, the environment, nutrition, food safety, public health, economy, culture, and individuals to follow a sustainable diet.

Sustainable diets are more important today than before. The world population grows to 9.1 billion people, it is important to consider how to feed the population adequately and achieve food security. However, pressures from climate change create challenges for agriculture to continue producing food using the methods that have been used for decades. Sustainable diets work toward addressing these issues. By addressing these issues, there is not one sustainable diet that can be followed by the whole world. Sustainable diets need to provide affordable, safe, health, and nutritious food that produced in a way that protects the environment and is culturally acceptable. Cultural acceptability is of high importance to successfully getting individuals of a community involved. Nutrition educators and other research supports cultural acceptability.

As sustainable diets gain more ground it is important to conduct research to learn about nutrition educator knowledge and thoughts on the topic. Educators may have some idea of a sustainable diet, but might not have knowledge on what a sustainable diet involves for food groups, costs, culture, etc. More research is needed to target to learn more about what nutrition educators may or may not know. Development of an educational curriculum is important to help nutrition educators learn what sustainable diets are and how they can teach sustainable diet concepts to their communities.

## APPENDIX 1

### Focus Group/Interview Questions

Today we are asking questions about sustainable diets and we are defining sustainable diets as “diets that contain culturally acceptable, safe, healthy, and nutritious foods that are minimally processed and packaged and, when possible, be purchased locally to support regional agriculture that is less energy intensive.”

1. How important is it to you as a nutritionist to practice sustainable diets? Why are sustainable diet important (not important) to you to teach?  
Probe: What effects do you think sustainable diet have on you or your family?
2. How important do you think sustainable diets are for other nutritionists you know? Why you think this is so? Probe: Do you talk about it?
3. What prevents you or other nutritionists you know, from practicing sustainable diets? Probe: What could you do to overcome the things that prevent you from practicing?
4. What are some things that someone may enjoy doing while practicing sustainable diets? Probe: Fun or unique things someone can do?
5. What prevents you or other nutritionists from teaching sustainable diets? Probe: what tools would you need to teach about sustainable diets?
6. If you or some nutritionist wants to teach sustainable diets, what helps nutritionists teach sustainable diets? Probe: practicing sustainable diet and discussing with colleagues.
7. Nutritionists in community or school teach nutrition using the MyPlate guidelines. How do you think MyPlate guideline affects people’s sustainable dietary habits? Probe: Eat fruits and vegetables....
8. Do you think that sustainable diets must be culturally acceptable? Probe: Promoting fruits and vegetables that are culturally acceptable (Mexico: squash, beans, etc.)
9. Can processed foods be a part of a sustainable diet? Probe: Canned vegetables and fruits versus frozen prepackaged meals.
10. Do you think that a sustainable diet relies on seasonal and local foods? Probe: having access to all fruits and vegetables all the time (grocery store) versus local farm grown, seasonal foods (farmer’s market).
11. Reducing the distance food has to travel from a field to a consumer is beneficial to our environment. How important is it to you to teach this concept as a nutritionist? Probe: Can food choice protect our environment?

**APPENDIX 2**  
**Short Survey Questionnaire**

Your County: \_\_\_\_\_ Number of Years as Educator: \_\_\_\_\_

**Please Circle one answer for each question below:**

1. Have you heard of a *sustainable diet*? Yes No
  
2. Would you expect a sustainable diet to meet nutrient needs? Yes No Don't Know
  
3. Would you expect a sustainable diet to be affordable to all people? Yes No Don't Know
  
4. Are the guidelines in MyPlate compatible with a sustainable diet? Yes No Don't Know
  
5. Is the Mediterranean diet compatible with a sustainable diet? Yes No Don't Know
  
6. Would sustainable diets reduce the impact on global greenhouse gas emissions and thus environmental impact? Yes No Don't Know
  
7. Would you like to learn about sustainable diet, if you have free seminar to attend? Yes  
No Don't Know
  
8. As part of a sustainable diet I would expect to consume:

<b>Category of Food</b>	<b>circle one answer</b>				
	<b>1 = Less likely to consume in a sustainable diet</b>				
	<b>5 = Highly likely to consume in a sustainable diet</b>				
Meat and meat products	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Fruits and Vegetables	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Grains	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Dairy products and eggs	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
More plant protein than animal protein	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Local Food	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Regional Foods	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Organic Foods	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Conventionally Raised Foods	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Food from fast food eateries	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Food from sit-down restaurants	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Convenience foods (i.e. pre-packaged meals, pre-made deli sandwiches, etc.)	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

9. Please describe what a *sustainable diet* is to you.

### APPENDIX 3

#### Focus Group/Interview Script

Say: “Good (morning or afternoon). We are conducting a study on sustainable diets. The goal of this study is to learn more about what your thoughts are on sustainable diets. First, I would like to walk you through our consent form. (Read through consent form). If you still wish to be part of the study, please sign the consent form.”

Say: “Today we are asking questions about sustainable diets and we are defining sustainable diets as “diets that contain culturally acceptable, safe, healthy, and nutritious foods that are minimally processed and packaged and, when possible, be purchased locally to support regional agriculture that is less energy intensive”.”

1. How important is it to you as a nutritionist to practice sustainable diets? Why are sustainable diets important (not important) to you to teach?  
Probe: What effects do you think sustainable diet have on you or your family?
2. How important do you think sustainable diets are for other nutritionists you know? Why you think this is so? Probe: Do you talk about it?
3. What prevents you or other nutritionists you know, from practicing sustainable diets? Probe: What could you do to overcome the things that prevent you from practicing?
4. What are some things that someone may enjoy doing while practicing sustainable diets? Probe: Fun or unique things someone can do?
5. What prevents you or other nutritionists from teaching sustainable diets? Probe: what tools would you need to teach about sustainable diets?
6. If you or some nutritionist wants to teach sustainable diets, what helps nutritionists teach sustainable diets? Probe: practicing sustainable diet and discussing with colleagues.
7. Nutritionists in community or school teach nutrition using the MyPlate guidelines. How do you think MyPlate guideline affects people’s sustainable dietary habits? Probe: Eat fruits and vegetables....
8. Do you think that sustainable diets must be culturally acceptable? Probe: Promoting fruits and vegetables that are culturally acceptable (Mexico: squash, beans, etc.)
9. Can processed foods be a part of a sustainable diet? Probe: Canned vegetables and fruits versus frozen prepackaged meals.
10. Do you think that a sustainable diet relies on seasonal and local foods? Probe: having access to all fruits and vegetables all the time (grocery store) versus local farm grown, seasonal foods (farmer’s market).
11. Reducing the distance food has to travel from a field to a consumer is beneficial to our environment. How important is it to you to teach this concept as a nutritionist? Probe: Can food choice protect our environment?

Say: “Thank you for participating in this study. Do you have any comments or questions?”

## APPENDIX 4

### Recruitment Email

Subject Line: Participants wanted for study on Nutritionist Perceptions of Sustainable Diets

The Nutrition and Physical Activity Lab at the University of Arizona, Department of Nutritional Sciences is looking for volunteers to participate in small focus group meetings to learn about nutritionist perceptions of sustainable diets.

A focus group meeting is a small group meeting consisting of 3-4 participants and takes about 1 hour to complete. During the meeting participants will be asked questions about their perceptions on sustainable diets. The responses will be recorded by a note taker.

Eligible participants must be 18 years or older, are a nutritionist or nutrition educator, being a registered dietitian is not required.

Please forward this email to any persons you think would be interested.

If you are interested in participating and would like more information on the project, please contact Melissa Wyatt at [melb2@email.arizona.edu](mailto:melb2@email.arizona.edu)

## APPENDIX 5: The University of Arizona Consent to Participate in Research

**Study Title:** Sustainable Diets: Understanding Nutrition Educator Perceptions

**Principal Investigator:** Melissa Wyatt, Graduate Student

**Sponsor:** None

**This is a consent form for research participation.** It contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

**You may or may not benefit as a result of participating in this study.** Also, as explained below, your participation may result in unintended or harmful effects for you that may be minor or may be serious, depending on the nature of the research.

### 1. Why is this study being done?

This goal of this study is to understand nutritionist and nutrition educator perspectives on sustainable diets. Sustainable diets promote environmental responsibility, cultural acceptance, and general health. The US in particular suffers from high rates of obesity and other diseases including diabetes; sustainable diets can promote better health and promote better health outcomes in the long-run. Additionally, sustainable diets would allow future generations to have access to the foods of the current generation.

The outcome of this study would be to gain current understanding on the nutrition educator's knowledge of sustainable diets.

We hope that this information can help us to improve surveys and develop educational materials about sustainable diets.

### 2. How many people will take part in this study?

A mix of 65 male and female nutrition educators from the State of Arizona will be accepted in this study.

### 3. What will happen if I take part in this study?

The study will have you participate in a small focus group session or a short survey questionnaire session.

The focus group session consists of 3-4 participants. These participants are asked a series of questions regarding sustainable diets. The session lasts about 1 hour and answers are recorded by a note taker. Answers will remain anonymous.

The short survey is self-administered. The survey will take 15 minutes to complete. Each participant will fill out his or her survey on their own. Results will remain anonymous.

**4. How long will I be in the study?**

Your participation in this study will last for the duration of one session (focus group or short survey).

**5. Can I stop being in the study?**

**Your participation is voluntary.** You may refuse to participate in this study. If you decide to take part in the study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your usual benefits. Your decision will not affect your future relationship with The University of Arizona. If you are a student or employee at the University of Arizona, your decision will not affect your grades or employment status.

**6. What risks, side effects or discomforts can I expect from being in the study?**

Participating in this study has no more risks than what you encounter in everyday life.

**7. What benefits can I expect from being in the study?**

There may be no direct benefit to you from participating in this study, but the knowledge that you receive about sustainable diets may be valuable to you in the future.

**8. What other choices do I have if I do not take part in the study?**

You may choose not to participate without penalty or loss of benefits to which you are otherwise entitled.

**9. Will my study-related information be kept confidential?**

Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law.

Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies
- The University of Arizona Institutional Review Board or Office of Responsible Research Practices

**10. What are the costs of taking part in this study?**

Aside from your time, there will be no costs for taking part in this study.

**11. Will I be paid for taking part in this study?**

There is no payment given to participants for this study.

## **12. What happens if I am injured because I took part in this study?**

If you suffer an injury from participating in this study, you should seek treatment. The University of Arizona has no funds set aside for the payment of treatment expenses for this study.

## **13. What are my rights if I take part in this study?**

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

You will be provided with any new information that develops during the course of the research that may affect your decision whether or not to continue participation in the study.

You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled.

An Institutional Review Board responsible for human subjects research at The University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

## **14. Who can answer my questions about the study?**

For questions, concerns, or complaints about the study you may contact the Principal Investigator, Melissa Wyatt via call (520) 204-6003 or e-mail [melb2@email.arizona.edu](mailto:melb2@email.arizona.edu).

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at <http://ocr.arizona.edu/hssp>.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Principal Investigator, Melissa Wyatt via call (520) 204-6003 or e-mail [melb2@email.arizona.edu](mailto:melb2@email.arizona.edu).

## **Signing the consent form**

I have read (or someone has read to me) this form, and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

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Printed name of subject

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Signature of subject

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Date and time

AM/PM

### **Investigator/Research Staff**

I have explained the research to the participant or the participant's representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or to the participant's representative.

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Printed name of person obtaining consent

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Signature of person obtaining consent

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Date and time

AM/PM

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