Pilot test of the Validity of a Novel Animal-based Food Frequency Questionnaire

By

Evajean Alpine

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Graduate Supervisory Committee:

Christopher Wharton, Chair
Carol Johnston
Jessica Lehmann

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ABSTRACT

A large amount of research associates the lack of fruit and vegetable consumption and the intake of animal-based foods with poor health outcomes. Making shifts towards a plant-focused diet could benefit the health of individuals. Individuals who show the highest long-term adherence to the avoidance of animal-based foods are those who value animal welfare.

PURPOSE: The primary purpose of this study is to explore the validity of a novel animal food frequency questionnaire (AFFQ) in relation to dietary animal food intake using 3-day dietary food logs and measuring potential renal acid load (PRAL). PRAL is the amount of acid that is produced by the body after digesting food. Fruits and vegetables produce a lower acid load, which is reflective of positive health outcomes. A secondary aim of this study is to explore the relation between AFFQ scores and measures of empathy. METHODS: Participants complete a 10-minute survey including the AFFQ and the BES-A. The Basic Scale of Empathy for adults will be viewed based on the 2 factor and 3 factor analysis assessing: Affective empathy, Cognitive empathy, Emotional contagion, and Emotional Disconnection. The AFFQ will be scored and correlated with the 3-day food log and PRAL to explore validity of the new AFFQ scale. Secondarily, the AFFQ will be scored and correlated with the BES-A to explore an association.

RESULTS: The null hypotheses $H_0 1$ and $H_0 2$ were rejected. $H_0 1$ showed that AFFQ correlates significantly with percentage of dietary protein coming from animal-based products ($r=.676$, $p=.016$). $H_0 2$ showed AFFQ has a significant correlation to PRAL ($r=.831$, $p<.001$). PRAL and the percentage of protein in the diet coming from

animal-based products have a significant correlation (r=.725, p=.008). The null hypothesis $H_0$3 was accepted with AFFQ and BES-A 2 factor and 3 factor's correlations showing (r= -.412, p=.183) and (r= -.307, p=.332). CONCLUSION: The AFFQ was able to reflect differences in frequency of animal-based food intake among the convenience sample. The AFFQ and individuals' food choices were not related to their empathy levels.

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CHAPTER 1

INTRODUCTION

Statement of the research problem

Large-scale research focused on dietary patterns of Americans has shown that, generally, dietary quality in the US is poor (Krebs-Smith et al., 2010). For instance, 2001-2004 NHANES data, including 16 thousand Americans' 24 hour diet concluded 90% of Americans overconsume 'empty' calories, while 75% fail to consume adequate servings of vegetables, fruits, and whole-grains (Finkelstein et al., 2009; Krebs-Smith et al., 2010). Based on this, and following a long-standing pattern of dietary recommendations, the 2015-2020 Dietary Guidelines for Americans (DGAs) recommended individuals consume more nutrient-dense vegetables, fruits, and grains in order to optimize a healthy diet (*2015-2020 Dietary Guidelines for Americans*, n.d.). Consequences of poor dietary patterns have been broadly felt: a majority of the US population suffers from excess weight or obesity, and for every three adults, two will be either overweight or obese (*2015-2020 Dietary Guidelines for Americans*, n.d.). For every three children, one will be overweight or obese (*2015-2020 Dietary Guidelines for Americans*, n.d.).

One possible issue driving poor diet quality and resulting health issues may be in relation to protein consumption; specifically, higher meat consumption might be cause for concern while lower meat consumption may be related to improved health outcomes. Studies have found that individuals who consume high quantities of red meat and other processed meats in comparison to individuals who consume lower quantities of red meat

and other processed meats have higher rates of total mortality, cancer, and cardiovascular disease (Sinha et al., 2009). Similarly, research comparing vegans to omnivores has found that there is a statistically significant decrease in mortality by 15% (Radnitz et al., 2015). Other studies have shown plant-based diets to be correlated to a lower body mass index (BMI), blood pressure, prevalence of diabetes, obesity, and heart disease (Tuso, n.d.). Studies have also connected risk factors for chronic disease with plant-based diets: one such study that included the implementation of a plant-based diet over the course of 4 weeks found reductions in systolic and diastolic blood pressure, serum lipids, total medication usage, and other risk factors of CVD such as decreases in weight, waist circumference, heart rate, insulin, glycated hemoglobin, and copeptin (Najjar et al., 2018b).

Although meat consumption is a key area of inquiry related to health outcomes, the production of meat also relates to other concerns, such as food systems and environmental impact. Protein production, specifically in relation to livestock, comprises some of the most resource-intensive aspects of the global food system. For example, livestock agriculture requires 11 times more fossil energy than plant-based agriculture (Dyett et al., 2014; Tuso, n.d.). Further, livestock waste increases the possibility for contaminated food and water due to ground and water pollution; it also can result in considerable greenhouse gas emissions due to the production, transportation, processing, and packaging of livestock products (Dyett et al., 2014; Tuso, n.d.). In addition to this, methane emissions from cattle and other livestock are major contributors to greenhouse

gas emissions and climate change. By 2050, the Food and Agriculture Organization of the United Nations predict milk and meat consumption to double (Rosenfeld, 2019).

Despite some research on motivations for adopting more plant-based diets as well as evidence pointing to positive health and environmental benefits of such diets, Americans continue to consume meat-heavy, generally unhealthy dietary patterns. As such, questions remain about how to best evaluate interventions designed to promote more plant-rich diets over time. Specifically, to the authors' knowledge, no tool has yet been developed to score and estimate changes in animal food consumption itself quickly and accurately. Currently, measures of dietary intake, such as 24-hour recalls, food frequency questionnaires, and diet logs are in common use, but these can be burdensome for participants in studies. It might be helpful to create a tool that lowers respondent burden while providing a valid assessment of animal food intake.

Purpose

The purpose of this pilot study is to develop and test the validity of a brief animal-based food frequency questionnaire (AFFQ) with a 3-day food log and PRAL. PRAL stands for potential renal acid load. This is the amount of acid produced by the body after digesting food. Foods such as meat and dairy produce more acidity in the body, therefore a higher PRAL. Fruits and vegetables have an alkalizing effect and produce a basic pH in the body. A secondary aim of this study will be to explore whether an association may exist between animal food intake frequency and empathy level (BES-A).

Null Hypotheses

- $H_0$1 = There will not be a relationship between the AFFQ score and the percentage of grams protein from animal-based products collected from the 3-day food log.
- $H_0$2 = There will not be a relationship between AFFQ score and PRAL
- $H_0$3 = There will not be a relationship between AFFQ score and BES-A score

Operational Definitions

For the present study, the following operational definitions applied:

1. PRAL referred to potential renal acid load or the net amount of acid produced after digesting food.
2. Vegan means that the individual never consumes animal flesh or other animal products such as dairy or eggs.
3. Vegetarian means the individual never consumes animal flesh, but sometimes consumes other animal products such as dairy or eggs.
4. Flexitarian means that the individual eats food made from animals but is consciously reducing the intake of animal flesh.
5. Plant-based means that the individual eats foods made from animals, but is consciously reducing the intake of animal flesh, and other animal products such as dairy or eggs.
6. Omnivore means that the individual consumes all combinations of animal flesh, seafood, and other animal products such as dairy and eggs

Delimitations

The following delimitation applies to this study

1. Had participants who self-identified as vegan, vegetarian, flexitarian, and omnivore
2. Site of study: Qualtrics

Limitations

The following limitations applied to this study:

- Convenience sample
- Using a measurement tool that has not been tested for reliability
- Self-reported answers
- 3 dropouts due to incomplete 3-day food logs

CHAPTER 2

REVIEW OF LITERATURE

The 2015-2020 Dietary Guidelines for Americans (DGAs) recommend that individuals should be consuming more nutrient-dense vegetables, fruits, and grains (*2015-2020 Dietary Guidelines for Americans*, n.d.). To optimize healthy diets, Americans are also counseled to simultaneously consume less saturated fat, sugar, and sodium. These guidelines were created to provide Americans a roadmap for diet planning to reduce risk of chronic diseases and conditions, such as overweight, obesity and cardiovascular disease (*2015-2020 Dietary Guidelines for Americans*, n.d.).

American Diets Do Not Meet Dietary Recommendations

Krebs-Smith et al. used the National Cancer Institute's method to determine the percentage of the U.S population that does not meet federal dietary recommendations based off the 2001-2004 NHANES data (Krebs-Smith et al., 2010). The data were taken from over 16 thousand individuals over the age of 2 years old. Through the 24-hour diet recalls that were evaluated through the MyPyramid database, the researchers found that most of the population failed to meet recommendations for all food groups besides grains, meat, and beans. They found that most of the population exceeded recommendations for solid fats, added sugars, and alcoholic beverages. Over 90% overconsumed empty calories. The data also found that family income influenced consumption quality (Krebs-Smith et al., 2010).

Recent research from the US Department of Health and Human Services showed similar dietary trends among Americans. Data suggested that Americans overconsume solid fats, added sugars, refined grains, sodium, and saturated fats as well as foods that are high in calories and low in healthful nutrients. In particular, Americans' consumption of sodium is excessive: 90% consume more sodium than recommended. On average, American adults consume roughly 3,400 mg of sodium per day. Americans also lack adequate intake of vegetables, fruits, whole-grains, dairy, and oil servings. A large factor of poor food choices is not having access to healthful foods and the ability to choose to purchase them at accessible prices. From 2005 to 2009, food insecurity grew from 11% to 15%. In 2008, about 49.1 million people had minimal access to nutritionally adequate food (Finkelstein et al., 2009).

The 2015-2020 Dietary Guidelines for Americans reported that these trends continued: 75% of the US population failed to meet the recommended intakes of vegetables and fruit. Over 50% met or exceeded the recommended grain and protein intakes, while most of Americans exceeded the recommended sugar, saturated fat, and sodium intakes (*2015-2020 Dietary Guidelines for Americans*, n.d.). Most Americans are also overconsuming calories, and likely relatedly, much of the adult population suffers from overweight or obesity (*2015-2020 Dietary Guidelines for Americans*, n.d.). By 2030, it is estimated that 115 million adults will be obese (Finkelstein et al., 2009). Although individuals are meeting and exceeding the protein and grain intakes, it is likely that they are overconsuming calories due to choosing foods that are not nutrient-dense. The typical choices that fall into the grain and protein categories have fewer nutrients and

extra calories. (2015-2020 Dietary Guidelines for Americans, n.d.). For example, refined white bread in comparison to whole wheat bread.

As it relates to protein, a common protein source for Americans is animal protein. Sinha et al. analyzed data from a large 10-year prospective cohort study consisting of half a million men and women in the US (Sinha et al., 2009). The individuals ranged from the ages of 50-71 years old. The researchers examined the relationship between high intakes of red, white, and processed meat in relation to mortality. At the 10-year follow-up about 48 thousand men and 23 thousand women passed away. The researchers found that individuals who consumed high quantities of red and processed meats were at greater risk for total mortality, cancer, and cardiovascular disease than those who consumed lower quantities. These individuals were also more likely to be Caucasian; married; a current smoker; overweight or obese with a high daily calorie intake; less physically active; less educated, and likely to consume fewer servings of fruits, vegetables, fiber, and vitamins (Sinha et al., 2009).

Benefits of a Plant-based diet

A number of dietary strategies exist to counter current poor dietary patterns of Americans. Once such strategy is consuming a plant-based diet, which can be reflective of MyPlate and the DGAs (Sabaté & Soret, 2014). By consuming a diet that promotes plant-based foods and reduces animal-based foods, individuals can potentially experience fewer negative health outcomes and reduce the need for medication or treatment for lifestyle-related diseases (Najjar et al., 2018b). Multiple studies have found similar results stating that the adherence to a plant-based diet is positively correlated to a lower BMI,

blood pressure, chances of diabetes, obesity, and heart disease (Najjar et al., 2018a, 2018b; Radnitz et al., 2015; Sinha et al., 2009; Tuso, n.d.) The diet may look different depending on the person, but it should be the first step that is altered based off the needs of the patient (Tuso, n.d.).

A plant-based diet would benefit the health of society. Plant-based diets require more attention and action from the industry, politics, and health professionals. Tuso created an update on the advocacy of plant-base diet use and benefits for physicians to recommend for their patients at large. He acknowledges that rising health care costs are a national concern. Obesity can result in other issues related to health that can cause increased medical care spending for the individual. It is estimated that obese individuals will spend 42% more on medical costs than individuals who are at a normal weight (Finkelstein et al., 2009). Tuso stated that plant-based diets can be the first step in building healthier lifestyles in scalable ways to address such (Tuso, n.d.).

Animal based products are not only difficult on the individual's health, the methods to produce animal-based products also negatively affect the health of the environment. Sabaté and Soret warn of the unsustainability of the current system which uses nonrenewable resources and causes poor environmental outcomes to meet society's high demands of meat and dairy products. When it comes to livestock agriculture in comparison to plant-based agriculture, there is: a negative energy output, 11 times greater fossil energy required, livestock waste, and significant greenhouse gas emissions. The livestock waste leads to the possibility of contaminated food and water. Due to the process of producing, transporting, processing, and packaging livestock agriculture,

greenhouse gas emissions are significantly greater than with plant-based agriculture (Sabaté & Soret, 2014).

The population is expected to increase by 28% by 2050. Since 1963 meat consumption has increased by 62% worldwide. Within the western countries, meat has been seen as a primary source of protein. This narrative has been pushed to other cultures, yet meat has also been tied to poor health outcomes, while plant-based diets show preventative, positive outcomes. In the past, large populations of the world have experienced positive outcomes from plant-based diets. By using the past approach by pursuing a dietary shift from a meat and dairy focused diet to a plant-based diet, there could be an environmentally sustainable future (Sabaté & Soret, 2014).

Plant-based diets and Health Outcomes: the role of PRAL

It might be the case that plant-based diets produce health outcomes in part in relation to the acid load of the diet in comparison to animal-based diets. Such a concept has been explored using a measure termed PRAL, or potential renal acid load (Remer & Manz, 1995). PRAL can be measured by using Remer's calculation (Remer, 2001). Remer's calculation incorporates data related to actual dietary intake of protein, phosphorus, potassium, magnesium, and calcium (Remer, 2001). PRAL can also be measured by looking at the pH level of the urine. A higher PRAL value would show that there is a high level of acidity in the body which is most commonly associated to poor health outcomes such as osteoporosis and hip fractures (Deriemaeker et al., 2010; Frassetto et al., n.d.; Remer, 2001). Bone is thought to have an alkalizing effect, but bone

alone cannot buffer the high net acid that is produced by western diets (Frassetto et al., n.d.). High acidity can be due to a high intake of meat and dairy products with a low intake of fruits and vegetables (Deriemaeker et al., 2010). During long periods of exposure to high acidity, due to the diet, bone can act as a long-term buffer by releasing calcium carbonate from the bone (Bushinsky, 2011).

Early research on PRAL was conducted by Remer and Manz, who viewed the potential renal acid load (PRAL) of foods in relation to urine pH. Their main finding was that basic foods such as cheese, produced urine higher in acidity than urine from alkalizing foods such as fruits or vegetables. Fruits and vegetables were found to result in urine with a basic pH level (Remer & Manz, 1995). Meat and dairy products produce the highest PRAL values while fruits and vegetables produce the lowest PRAL values. Other researchers have noted that the American diet reflects a high consumption of animal proteins with a low consumption of fruits and vegetables, resulting in a high production of acid (Deriemaeker et al., 2010). The alkaline-forming fruits and vegetables can buffer the acid load, but with a low intake, the buffer is not there, resulting in a high production of acid (Deriemaeker et al., 2010).

Similarly, Welch et al. examined PRAL by urine pH based on food groups (fruit and vegetables, meats, cereal, and dairy foods) for 25,000 men and women from the UK ranging from the ages of 40-79 years old. They concluded that the more alkaline a diet was, the more alkaline the urine was. This means that the more fruits and vegetables and lower meat intakes in the diet, the lower the PRAL was (Welch et al., 2008).

In 1968, Wachman and Bernstein predicted that dietary intake due to PRAL could be related to the development of osteoporosis. They believed that eating foods that produced a higher PRAL in the body could lead to the brittleness of bones. In addition to this, there was a multi-country study on women that found a positive relationship between a high PRAL and hip fracture incidence (Deriemaeker et al., 2010). High PRAL values, due to high consumption of acid-forming products, such as meat and dairy products, was associated with the weakening of bones in the form of women's hip fractures (Deriemaeker et al., 2010).

Asthma is another issue that may be related both to obesity as well as PRAL. Cunha, et al. noted that obesity has continuously been linked to asthma (Cunha et al., 2019). The researchers noted that the lungs play a critical role in pH and acid-base regulation. The hypothesis that PRAL could be associated with asthma in children was explored in a recent study. Researchers stated that lungs play a role in systemic pH, acid-base regulation, and are the organ involved in asthma development. They hypothesized that a high PRAL could result in the development of asthma due to the increase of inflammation which would affect the airways. Results showed positive and significant associations between asthma and PRAL (Cunha et al., 2019).

Another association between PRAL and health could occur with diabetes. Gæde et al. examined the relationship between PRAL and incident diabetes in 54,651 individuals from the Danish Diet, Cancer, and Health cohort (Gæde et al., 2018). The 15 year follow-up study led researchers to conclude that a higher PRAL had been significantly related to a higher incidence of diabetes (Gæde et al., 2018). This means that

higher quantities of foods that increase PRAL such as meats and dairy were related to the incidence of diabetes (Gæde et al., 2018).

In addition to negative physical outcomes due to a high PRAL, Bühlmeier et al. conducted a prospective study that viewed about 2,350 children at age 10 and then 2,061 at age 15 due to dropouts. This study used a food frequency questionnaire covering the past 12 months and the Strengths and Difficulties Questionnaire (DSQ). This specific study found that the individuals with a higher PRAL had more emotional problems. (Bühlmeier et al., 2018).

Factors influencing plant-based diet adherence

Multiple studies have been conducted looking at different diet choice categories and their motivations or reasons for adherence. There have been many ways of categorizing individuals such as vegan, vegetarian, flexitarian, and so on. The term 'plant-based' is similar to flexitarian, since the goal is not to completely avoid a group of food, but rather to limit it. A flexitarian is the flexible version of a vegetarian, with a focus on, but not strict adherence to, the avoidance of meat products, whereas a plant-based diet is one that is a flexible version of a vegan, aiming to limit egg, dairy, and meat product consumption (Tuso, n.d.). Studies exploring these populations sometimes break the diet categories into their motivational reasoning for adherence to further identify and explore the groups. This is often done by individually evaluating the group who is adherent out of the hopes for improvement in health to a group who would feel the diet aligns with their ethics and value system (Rosenfeld & Burrow, 2017).

Rosenfeld ran two studies comparing psychological differences between vegetarians. In one study he found that environmentally motivated and animal-motivated vegetarians adhered to their diets out of prosocial and moral commitments whereas health-motivated vegetarians adhered to their diets in hopes of achieving personal goals (Rosenfeld & Burrow, 2017). In the second study, Rosenfeld found that animal-motivated vegetarians reported more disgust towards meat; this disgust might have contributed to long-term adherence. Health-motivated and environmentally motivated vegetarians showed less disgust towards meat and were less likely to adhere as strictly to the diet as animal-motivated vegetarians (Rosenfeld, 2019).

Cramer et al. explored characteristics of American vegetarians and vegans who adhered to diets for health reasons (Cramer et al., 2017). Researchers ran a cross-sectional study based on the 2012 National Health Interview Survey. His study consisted of a nationally representative sample of 34,525 individuals. He found that 4% had tried one of the plant-based diets within their lifetime and 1.9% had adhered to one of the plant-based diets for the past year (Cramer et al., 2017). This was a large increase from 2002, yet lower than other studies reports. The researchers believed this was due to the specification of health-related plant-based dieters. Researchers found that these individuals were likely to be middle aged, female, from the western US region, high school educated, chronically ill, and physically active (Cramer et al., 2017).

Vizcaino et al. conducted an online survey which examined what contributed to adherence towards plant-based eating in university students (Vizcaino et al., 2020). The adherent group consisted of 33 students who were either vegan, vegetarian, or pescatarian

for at least 12 months. The non-adherent group consisted of 63 students who were currently trying to adhere to a plant-based diet but did not experience long-term success. The results showed that individuals who were adherent to a plant-based diet were seventeen times more likely to be treating or managing a medical condition, but 94% less likely to be maintaining or working towards improving their health in comparison to the non-adherent group. Another large component of the adherent group was that they were seven times more likely to be adherent due to the diet aligning with their ethical beliefs in comparison to the non-adherent group. In conclusion, it can be stated that individuals who were adherent to a plant-based diet were likely doing it because it was either helping them to treat or manage a medical condition, or it aligned with their moral and ethical beliefs, whereas adhering to a plant-based diet in the hopes of improving health, might not have lead to long-term adherence as seen in the non-adherent group (Vizcaino et al., 2020).

Another study concluded that most individuals adhered to vegan diets for ethical reasons or health reasons (Radnitz et al., 2015). It is important to note that there is a chance that adhering to a vegan diet could be related to engaging in other behaviors that improve health. Not all vegan options are healthy; by comparing the ethically driven vegans to the health-driven vegans, the researchers hoped to see how the individuals differed. The results showed that the health-driven vegans consumed more fruit and fewer sweets, but the ethically driven vegans consumed more supplements and soy-based products and reported adhering to the diet for a significantly longer period of time than the health-driven vegans (Radnitz et al., 2015).

Janssen et al. conducted an open question face-to-face interview on consumer motivations for adhering to a plant-based diet. This interview took place in Germany in 2014 at seven vegan supermarkets and involved 329 participants (Janssen et al., 2016). Researchers focused on whether all vegans, regardless of ethically or health driven, were concerned for animal agriculture. They found that unlike other studies done in the past, that majority of vegans mentioned more than one motive. A vegan was not distinctly only ethics or health-driven. The most common motives, ranging in order of popularity, were animal-related, personal well-being/health, and environment-related. The attitudes towards animal agriculture differed significantly among consumer segments. A common theme was that some vegans did not completely disapprove of animal agriculture, but they hoped for the animal welfare standards to improve (Janssen et al., 2016).

Rosenfeld and Burrow identified that some plant-based dieters adhere to their diets out of reasons rather than motivations (Rosenfeld & Burrow, 2017). Researchers identified those reasons as related to two groups focused on either aversions and constraints. Individuals who chose to consume plant-based foods out of the hope to support animals, the environment, or achieve personal goals would be adhering due to motivation. Those individuals often found a sense of purpose through the choice to adhere and adopt the diet as a part of their identity. There is a choice involved for them whereas individuals who only have access to plant-based foods and do not have the choice or access to animal-based products would be considered adherent to the diet out of constraint. Disgust is a large factor influencing food choice. Plant-based dieters who report the longest period of adherence are often those who experience disgust to meat.

These individuals would be considered aversion plant-based dieters (Rosenfeld & Burrow, 2017).

Lea, Crawford, and Worsely created a mail survey to evaluate individuals' perceived benefits and barriers to consuming a plant-based diet (Lea et al., 2006b). They found that the majority believed that there were health benefits to consuming a plant-based diet and for those that saw benefits, they did not see many barriers. The main barrier that did come up was the lack of information on plant-based diets which brings the importance of the topic into the industry and health professionals' realm. Although most respondents saw benefits with little to no barriers to the plant-based diet, most did not consume a plant-based diet. This led the researchers to conclude that it is most likely due to lack of information, accessibility, and societal acceptance of the diet. When comparing the views of a plant-based diet to a vegetarian diet, many showed less negativity and acceptance of the plant-based diet due to the criteria not being the complete rejection of animal-based products, but the rather the avoidance (Lea et al., 2006b).

Lea, Crawford, and Worsley conducted an exploratory study where they mailed surveys throughout Australia to obtain results on perceived readiness to eat a plant-based diet of consumers based off the transtheoretical model of change (Lea et al., 2006a). Through this approach they found significant differences between age and vegetarian status for the different stages, but no significant demographical differences. There were also different perceived benefits and barriers among the different stages. This study concluded that the majority of consumers were in the precontemplation stage of change

with a little to no understanding of the term plant-based. Raising the awareness on the term plant-based and highlighting the benefits associated is necessary to bring more individuals from the precontemplation to the contemplation stage (Lea et al., 2006a).

Based off of the findings of Crawford et al. it should be noted that most individuals self-identify as omnivore, vegetarian, or vegan without being aware of the term plant-based. This might result in an all-or-nothing type of attitude perpetuating in the general population. Most individuals are unaware of the plant-based diet and the approach associated with it. It is not an exclusionary diet choice, but an avoidant one that minimizes animal-based products (Tuso, n.d.). By raising awareness of this diet choice, more omnivores who occasionally eat animal-based products may feel it could be manageable to attempt to reduce their animal-based product consumption to benefit from the positive outcomes associated to the plant-based diet.

Empathy in relation to plant-based diets

Kunst and Hohle conducted a 5-part study viewing the relationship between subjects' empathy and disgust to the degree of state dissociation. State dissociation refers to not connecting the live animal with the animal-based product. For example, an individual may feel uncomfortable being seated in front of a pork roast, but comfortable being seated in front of a plate of bacon. The first situation would elicit a low degree of state dissociation, whereas the bacon would elicit a high degree of state dissociation (Kunst & Hohle, 2016).

In study #1 they viewed how state dissociation allowed subjects to feel less empathy towards highly processed meat. In study two they viewed how having the head

in comparison to no head on a pork roast affected the subjects. This study found that state dissociation had an inverse relationship to empathy. With the head, subjects felt more empathy and disgust, and less state dissociation (Kunst & Hohle, 2016). The researchers believe it was potentially due to the individuals having trouble downplaying the animal's mental capacity when the head was present. In study #3 the subjects showed a higher level of empathy and lower level of state-dissociation when an image of the live animal was placed near the meat-based product on the menu. In study #4, word-framing allowed the subjects to elicit less empathy and more state dissociation when using the term harvested, and the opposite when using the terms killed and slaughtered. In study #5, when words such as pig and cow were used rather than pork and beef within a menu, empathy was increased, state dissociation was decreased, and the subjects were more willing to order vegetarian (Kunst & Hohle, 2016).

The ability to recognize an animal as something that is living, that can feel relaxed and pain, similar to a human, may be influenced by upbringing. For someone who had a family pet, they may view that pet as being a family member. Rothgerber and Mican compared the relationship between childhood bonds with animals to adulthood meat consumption (Rothgerber & Mican, 2014). The backing for this study was based off the notion that having pets during childhood would bring about more empathy, affective and cognitive, towards animals which would then decrease meat consumption in adulthood. The study had positive results that were conclusive with their hypothesis. By having a positive experience with an animal throughout childhood, that individual was likely to empathize with the feelings of the beloved animal. They were able to draw a

connection, seeing the similarity between animal and human experiences, which contributes to their view on other animals. By being able to see animals as intelligent creatures with emotions similar to humans, it disables the ability to fall into the meat paradox, which therefore could contribute to the decrease in meat consumption from those individuals (Rothgerber & Mican, 2014). The meat paradox is when individuals do not agree with the treatment and slaughtering of animals, but still enjoy meat and other animal-based products.

From this study, it is plausible to take away that from the early memory of a bond with an animal, individuals were able to empathize with different conspecifics other than their own. By doing this, they were able to find similarities and identify with the animal, and for some, they saw the animal as an extension of the family, like their mother, father, sister, or brother. Since they saw this animal early on as an equal, taking care of that animal became a part of their ethics and values, and possibly made it easier to put themselves in the place of other animals which led to the desire to also take care of them and internalize their diet choice with their values and identity.

In a detailed review of the social neuroscience of empathy, Singer and Lamm explained that most social neuroscience studies looking at empathy observed it through others' pain with the intention to cause an empathetic response within ourselves (Singer & Lamm, 2009). These studies found that when observing another in pain, it stimulates the observer's neural network so that they themselves also experience the pain (Singer & Lamm, 2009). This could possibly be why ethical vegans who are exposed to the flawed

ethics behind the animal-based products industry, internalize their eating habits to be a part of who they are, their values, and their identity.

Although fMRI's are a new way of identifying brain activity and measuring empathy, there have also been multiple empathy scales created. New ones often replaced the old ones to attempt to account for empathy's multidimensional qualities. One empathy scale that accounts for multidimensional qualities is the Basic Scale of Empathy for Adults (BES-A).

The Basic Scale of Empathy for Adults is a scale that consists of 20 questions. This scale can calculate empathy using a 2-factor structure which accounts for affective and cognitive empathy. It can also calculate empathy using a 3-factor structure by assessing emotional contagion, cognitive empathy, and emotional disconnection (Carré et al., 2013). In both structures, the questions are dispersed differently depending on the factor. For example, Question #1, "My friend's emotions do not affect me much" can help determine affective empathy in the 2-factor structure, as well as emotional disconnection in the 3-factor structure (Carré et al., 2013).

Empathy is a skill that can increase and decrease over time and using fMRI scans, it has been found that the skill of empathy can be measured and viewed. New studies have found that individuals who self-report adherence to specific diets show similar areas of activated activity within their brain scans. Filippi et al. acknowledged that the ability to empathize with animals relies on the activity of different brain regions which could be identified throughout an fMRI. The results found no correlation between empathy quotient score and human negative valence picture view but did find a significant

correlation of $p<0.001$ between Empathy Quotient (EQ) score and animal negative picture view. They found that among the different groups, different areas of the brain were activated and at different rates which drew different conclusions about the separate groups and their relationship to their diet choice and how it affects their view of self. Omnivores showed higher levels of empathy when viewing human suffering whereas vegetarians and vegans showed higher levels of empathy when viewing animal suffering (Filippi et al., 2010).

Pending Relationship Between Diet choice, Health, and Empathy

Different studies tend to categorize diet groups differently. A flexitarian is someone who aims to reduce meat consumption from their diet but does not completely avoid meat products. This person is a flexible vegetarian. One study may allow a flexitarian to be categorized as a vegetarian or vegan, whereas a different study would have categorized that individual as an omnivore. When categorizing individuals or allowing individuals to self-identify their diet type, there are possible errors within the research. As such, it might be useful to create a tool that allows for scoring animal food consumption rather than categorizing individuals by diet type.

This study was developed in order to accomplish the above. Researchers created an animal-based food frequency questionnaire (AFFQ) scale, which allowed for the scoring of an individual's animal-food intake, resulting in scores falling between 0 to 132 to fully identify their diet and level of adherence or lack thereof to a plant-based diet. A

zero would indicate a purely plant-based diet, whereas 132 would indicate someone who regularly consumed animal-based products.

The scale was explored for initial validation in relation to a 3-day food record. Further, the scale's relations with empathy and PRAL were studied by means of the Basic Scale of Empathy for Adults (BES-A) score and PRAL calculations based on actual dietary intake.

CHAPTER 3

METHODS

The primary purpose of this pilot study was to validate a simple, easy to use, animal-based food frequency questionnaire (AFFQ). This AFFQ was validated against a 3-day food log from which actual protein intake, as well as PRAL, were measured. The secondary purpose was to view the relationship between plant-based adherence score (AFFQ) and empathy score (BES-A). This chapter presents the participants, study design, variables, procedures, and statistical analyses.

Participants

Twelve healthy adults were selected through a snowball effect. The participants consisted of 5 individuals who ranged from ages 18-24 and 7 individuals who ranged from ages 25-34. 2 participants identified themselves as vegan, 3 as vegetarian, 4 as flexitarian, and 3 as omnivore. Prospective study participants were excluded if they had not maintained the same dietary pattern for at least a year and if they did not have access to a smart phone and internet.

Approval for this study was obtained from the Arizona State University Institutional Review Board (Appendix A). All subjects signed an informed consent form before participating in the study (Appendix B).

Study Design

In this pilot study, there was not an intervention. Twelve subjects were recruited from a convenience sample. All 12 subjects completed a 10-minute survey where they completed the animal food frequency questionnaire (AFFQ) and the basic scale of empathy for adults (BES-A). After this was completed, they were sent instructions for completing the 3-day food log.

The participants self-identified differently. Some were vegan, vegetarian, flexitarian, or omnivore. This allowed the researchers to view if the new, simple to use, AFFQ could accurately score the individual when validated with the 3-day food log to measure PRAL. The AFFQ was created as a simple, easy to use food frequency questionnaire that could score the frequency of daily animal-based product intake. The 22 question AFFQ was derived from the 139 question NHANES food frequency questionnaire. The researcher started to simplify the FFQ by first eliminating any question that did not relate to animal-based consumption. The researcher and the Radical Simplicity Lab worked together to narrow down the list with the attempt to fully encompass all animal-based intakes from the diet, while keeping the list concise. The research and team were able to do this by having questions such as, “how often did you eat beef” in addition to “how often did you eat a mixed dish that contained beef”. The questions had examples to ensure that specific items were not being recorded multiple times, for example the consumption of a chicken pot pie would be recorded for the question related to mixed dishes involving chicken and not in the question related to

"how often do you eat chicken". For the later question, only foods such as chicken breast, fried chicken, and chicken nuggets would be included.

PRAL stands for potential renal acid load. PRAL can be measured using Remer's calculation. First, 0.49 is multiplied by total protein intake, 0.037 is multiplied by phosphorus intake, 0.021 is multiplied by potassium intake, 0.026 is multiplied by magnesium intake, and 0.013 is multiplied by calcium intake. Next, the new value for total protein intake will be added to the new value of phosphorus intake. Lastly, the new values for potassium, magnesium, and calcium are subtracted (Remer, 2001). PRAL measures the net acidity in the body after the digestion of food. Some foods have an alkalizing effect such as fruits and vegetables and others increase acidity such as meats and dairy (Deriemaeker et al., 2010; Frassetto et al., n.d.; Remer, 2001).

Empathy was measured using the Basic Empathy Scale for Adults (BES-A), which included 20 questions. This scale included two subscales, with 9 questions for cognitive empathy and 11 questions for affective empathy. It was flexible in that it had also been validated as comprising three subscales within the same 20 questions. In this case, 6 questions relate to emotional contagion, 8 relate to cognitive empathy, and 6 relate to emotional disconnection (Carré et al., 2013). All questions were answered on a 5-point Likert type scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree. Eight of the questions are reversed items and therefore reverse-scored (1, 6, 7, 8, 13, 18, 19, 20). Items responses were then summed allowing for a range from 20, meaning the individual does not have empathy, to 100, meaning the individual has a high level of empathy (Carré et al., 2013).

Variables

The variables of interest included the AFFQ, BES-A, PRAL, and the percentage of protein in the diets coming from animal-based products. The AFFQ was used to assess an individual's daily frequency based off their response to each of the 22 listed animal-based products, which resulted in an overall AFFQ score. A score of 0 would indicate no intakes of animal-based products. The highest score would be 132, indicating that the individual answered "6 or more times per day" to each of the 22 questions. The BES-A was used to assess an individual's overall empathy level. PRAL and the percentage of protein in the diet coming from animal-based products were calculated utilizing data from the 3-day food logs that were analyzed using the program ESHA Research.

Procedures

Participant were sent a Qualtrics link where they were able to complete the first part of the study on any device that had access to the internet. In this Qualtrics survey, the subjects filled out a consent form (Appendix B) and answered qualifying questions such as verifying that they were over 18; stating that they would have access to a smartphone and internet throughout the study; describing their eating choices whether that be complete avoidance of all animal-based products, complete avoidance of animal flesh products, or regular consumption of animal-based products; and, affirming that they have sustained the diet for at least a year.

If they consented to the study and qualified to participate, they would move forward to answer demographic questions such as gender, ethnicity, and age. They

completed 2 questionnaires within this Qualtrics survey: the Animal-based food frequency questionnaire (AFFQ), and the Basic scale of empathy for adults (BES-A). Participants were then provided instructions for completing the 3-day food log (Appendix C).

Statistical Analyses

Scores were calculated for the AFFQ and BES-A. For the AFFQ, overall frequency of animal food consumption was calculated by deriving a calculated daily frequency for each response. For example, a response of 'Never' will equal a frequency of 0; a response of '1 time per month' will result in a frequency of .03 (1/30); a response of 2-3 times per month will result in a frequency of .08 (2.5/30); a response of 1-2 times per week will result in a frequency of .21 (1.5/7); a response of 3-4 times per week will result in a frequency of .5 (3.5/7); a response of 5-6 times per week will result in a frequency of .79 (5.5/7); a response of 1 time per day will result in a frequency of 1; a response of 2-3 times per day will result in a frequency of 2.5 (2.5/1); a response of 4-5 times per day will result in a frequency of 4.5 (4.5/1); and a response of 6 or more times per day will result in a frequency of 6 (6/1). All calculated frequencies for all items in the AFFQ were summed for a 'total daily frequency' of animal food consumption. Daily dietary records were recorded and analyzed using the ESHA Research program. The ESHA Research Inc. is a software company situated in Salem, Oregon that was founded in 1981. ESHA Research has a vast database that is used globally for nutritional analysis.

Finally, empathy scores were calculated using the techniques developed with the development of the initial survey tool.

The individuals were emailed instructions for filling out the 3-day food log. The email instructed the participants to first watch the instructional video that was created to walk the individuals through the document that included detailed instructions. This document guided the participants to record their dietary intakes for a total of 3 days. 2 days would consist of weekdays and or workdays, and 1 day would consist of a weekend or day off. They were instructed to not estimate and to resume on a different day if they missed a snack or meal when logging on a certain day. They were also instructed to be extremely specific when logging by stating serving sizes, the brand names of items, a link to unique items, preparation methods, and details about the food. Examples of when links to unique items were used are when a meal was made based off an online recipe, a meal was eaten from a restaurant, and plant-based substitution items such as plant-based meat alternatives, protein beverages, etc. were consumed. Examples of preparation methods consist of, “baked in butter or fried in canola oil”. An example of a detail to include about food items would be, that the bread eaten was whole wheat versus white bread.

In addition to this, an example of a day’s worth of food was provided. The participants were given a template. This template was a google excel that included different categories: date/day, food/beverage item, serving size/amount, notes, and link. The example of a day’s worth of food was also logged into this google excel sheet to be used as a guide.

The individuals filled out their 3-day food logs into a google excel. The researcher logged each individual and their 3-day food logs into ESHA Research. ESHA Research is a nutrition software that has a large food and beverage database and runs advanced nutritional analysis including macro and micronutrients. Each item listed in the food logs were added into the ESHA Research program. Some products such as soy milk, pepper jack cheese, scrambled eggs, olive oil, etc. were recorded into the program with similar items already in the database. Items such a meal from a specific restaurant, a meal that was made from an online recipe, and protein bars and shakes, etc. were manually added into the system's database based off the available online nutrition facts.

The ESHA Research program printed a detailed spreadsheet for each of the 12 participants. From this spread sheet, protein, phosphorus, potassium, magnesium, and calcium were used to calculate PRAL. To calculate PRAL, protein is multiplied by 0.49, phosphorus is multiplied by 0.037, potassium is multiplied by 0.02, magnesium is multiplied by 0.026, and calcium is multiplied by 0.013. From there, protein and phosphorus values are added, and potassium, magnesium, and calcium are subtracted to get the final value of PRAL.

To find the average amount of protein from animal-based products from the diet. Protein in grams was found for each day. Those 3 totals from the 3 days of food being logged were added and then divided by 3 to find the average amount of protein from each day. The same was done for the grams of protein from animal-based products consumed each day. From there the average grams of protein from animal-based products was

divided by the average grams of total protein and multiplied by 100 to find the percentage of protein coming from animal-based products.

SPSS version 27 was used to run the data analysis. The sample size was 12, so the Shapiro-Wilks test was run for normality on all variables and found that all the variables measured were normally distributed. All the variables met the assumptions for normality. To address the primary research aim, a Pearson correlation was used to determine relationships between AFFQ scores and PRAL and AFFQ scores and the average percentage of protein from animal-based products in the diet. A p value of <0.05 was used to assess significance. To address the secondary, exploratory aim of this study, a similar approach to correlation analyses was applied using the variables of AFFQ calculated daily frequency and empathy scores. As an exploratory analysis, correlations were conducted using both the 2-factor and 3-factor conception of the BES-A.

CHAPTER 4
RESULTS

Subject Demographics

Fifteen participants completed the first section of the study, and 3 dropped out during the second section due to the incompletion of the 3-day food log. The participants were given 2 weeks to complete the 3-day food log. Individuals were given a reminder and a 1-week extension. Once the 1-week extension came to an end, there was a lack of response. 12 participants completed the full study, including the survey and the 3-day food log. The 12 participants consisted of 5 individuals who ranged from ages 18-24 and 7 individuals who ranged from ages 25-34. Two participants identified themselves as vegan, 3 as vegetarian, 4 as flexitarian, and 3 as omnivore (please see Table 1).

Table 1. Participant Characteristics (N=12)

	# Participants	%
Gender		
Male	2	16.6
Female	10	83.3
Ethnicity		
White	3	25
Hispanic	6	50
Black	1	8.3
Asian	2	16.6
Age		
18-24	5	41.6
25-34	7	58.3
Dietary Choice		
Vegan	2	16.6
Vegetarian	3	25
Flexitarian	4	33.3
Omnivore	3	25

Table 2. Dietary Characteristics by Group

	Vegan/Veg (n=5)	Flex/Omni (n=7)
PRAL	0.9 ± 16.5	21.2 ± 14.9
Total avg. protein (g)	73.3 ± 52.1	85.8 ± 18
Avg. protein % animals	29.4% ± 38.1	79.4% ± 14.9

Note: values shown are mean ± standard deviation

Correlations

There was a significant relationship between AFFQ and PRAL (r=.831, p<.001), AFFQ and the percentage of protein from animal-based products in the diet (r=.676, p=.016), and the percentage of protein from animal-based products in the diet and PRAL (.676, p=.016). Individuals who self-identified as vegans consumed no animal-based products and had negative PRAL values while individuals who self-identified as omnivores did consume some animal-based products daily and had positive high PRAL values.

There was not a relationship between the AFFQ and the BES-A. The AFFQ was correlated with the 2-factor, Affective and Cognitive empathy (r= -.412, p=.183), as well as the 3-factor Cognitive empathy, Emotional disconnection, and Emotional contagion (r= -.307, p=.332).

CHAPTER 5

DISCUSSION

The primary purpose of this study was to explore the validity of a novel animal food frequency questionnaire (AFFQ) in relation to dietary animal food intake which used 3-day dietary food logs and measured PRAL. A secondary aim of this study was to explore the relation between AFFQ scores and empathy scores. This Chapter presents the discussion, an analysis of the results, limitations of the study, and future considerations.

Analysis of Results

There were strong relationships between PRAL, AFFQ, and the percentage of protein coming from animal-based products in the diet. These data show promise that AFFQ could be used as a simple, easy to use measurement to explore shifts in the daily frequency of animal-based product consumption. The AFFQ was based off of the NHANES' extensive food frequency questionnaire (Krebs-Smith et al., 2010). The AFFQ itself was not designed to measure PRAL or calculate the percentage of animal-based protein coming from the diet, but might be reflective of these variables given significant correlations found in this study. The AFFQ simply consists of 22 questions on the consumption of different animal-based products and gives an overall score based off the daily frequency of each item. This score shows to be significantly associated with both PRAL ($r=.831$, $p<.001$) and the percentage of protein coming from animal-based products in the diet ($r=.676$, $p=.016$).

Protein coming from animal products, specifically red meats, has been associated with poor health outcomes such as cancer, cardiovascular disease, a higher BMI, obesity, and diabetes (Najjar et al., 2018b; Sinha et al., 2009; Tuso, n.d.). Omnivores in comparison to vegans have a significantly higher mortality rate at 15% (Radnitz et al., 2015). In addition to red meat affecting individuals' health, animal agriculture can also be taxing on the environment. Meat consumption is expected to double by 2050, meanwhile the methane emitted from cattle largely contributes to greenhouse gas emissions and climate change (Dyett et al., 2014; Rosenfeld, 2019). By having the AFFQ, shifts can be viewed for the health of the individual, the environment, and to view trends in dietary patterns. This could have use in interventions aiming to reduce intake of animal-based products and exploratory studies to view different trends among different populations.

AFFQ, PRAL, and the percentage of protein coming from animal-based products were correlated. These measurements all give an estimate of the number of animal-based products coming from the diet. They also report on the overall quality of an individual's diet. PRAL reflects the pH of the body. A basic pH due to the alkalizing effect of fruits and vegetables resemble a plant-based diet. An acidic pH in the body resembles a diet high in animal-based products which is associated to poor health outcomes. By knowing an individual's AFFQ, knowing that it is well correlated to PRAL and the percentage of animal-based protein in the diet, it could be an easy measurement to get an estimate of the quality of a population's health as well as view shifts in a population's diet quality over time.

The AFFQ provides a new mechanism for measuring the level of adherence to a plant-based diet, a diet that limits the intakes of animal-based products. This would allow researchers to avoid categorization of participants such as vegan, vegetarian, flexitarian, and omnivore; terms that are error-prone and not accurate from study to study. For example, some individuals consider themselves vegetarian most the time, but will consume an animal-based meal when eating out with friends, and then will be unsure of how to categorize themselves within a study. The AFFQ scale would give the individual a score rather than a term which would assign them to a group. For example, an individual who limits most of the time, but consumed an animal-based meal when out with friends may be categorized in a study as an omnivore even though they try to limit animal-based products most of the time.

Studies looking at PRAL have used dietary recalls to calculate Remer's calculation (Remer, 2001). These studies have found that foods high in animal-based products that are reflective of the Western diet, such as meat and dairy, produce a higher net acidity level in the body which can cause harmful health outcomes, the most common being hip fractures and osteoporosis. (Deriemaeker et al., 2010; Frassetto et al., n.d.; Remer, 2001). Bone is able to buffer acidity to an extent, but not when high amount of meat and dairy are in the diet and continually increasing the net acid load in the body (Frassetto et al., n.d.). Fruits and vegetables can produce an alkalizing effect, reducing acidity and creating a basic pH in the body (Remer, 2001). This is reflective of the results, showing that the vegans and vegetarians had a lower PRAL than the flexitarians

and omnivores. The vegans and vegetarians consume little to no products coming from animals.

The results reflected this: the mean PRAL for the self-identified vegetarians and vegans was 0.9 whereas the mean PRAL for self-identified flexitarian and omnivores was 21.2. Table 2 shows that vegans and vegetarians consume 14% less protein than flexitarian and omnivores, but the flexitarian and omnivores have 62% more of their protein coming from animal-based products.

The current research on the secondary aim of the study, empathy in relation to diet choice explored individual's motivations in relation to their adherence to a plant-based diet. A common theme was that individuals adhered to the diet out of their empathy for the animals. The individuals who adhered to the diet long-term were animal-motivated and experienced aversion in the form of disgust towards animal-products (Janssen et al., 2016; Rosenfeld, 2019; Rosenfeld & Burrow, 2017). One study looked at empathy, disgust, and the degree of disassociation from the animal to the animal-based product (Kunst & Hohle, 2016). An example of this is having the word cow next to a picture of a cow on a menu versus having the word hamburger with a picture of a hamburger. It could be easier for the individual to experience the meat paradox and not associate the animal to the product when viewing the hamburger (Kunst & Hohle, 2016).

It was hypothesized that empathy may be a method for reducing an individual's daily frequency of animal intake. Research shows that those who adhere to plant-based diets for long period of times adhere due to their empathy and care for animal welfare (Rosenfeld & Burrow, 2017). This pilot study looked at an individual's overall empathy

to view if an individual's overall empathy influenced diet choice. The results were not reflective of this hypothesis. There was not a relationship between empathy level and the daily frequency of animal-products consumed in the diet. Increasing empathy specifically towards animals in individuals may be a method for reducing animal-based consumption but results herein did not draw this association.

Limitations

This was a pilot study done on a small sample through a snowball effect. The researcher was able to recruit self-identified vegans, vegetarians, flexitarians, and omnivores and the data did reflect the complete absence of animal-based products as well as varying levels of animal-based intake. To validate the AFFQ, the same study needs to be repeated in a larger sample.

The individuals were given multiple weeks to log two weekdays and one weekend day of food intake and instructed to restart on a different day and not estimate if they were to forget to log. Since the individuals did have the freedom to make their own food choices and log on their own, they may have forgotten to log an item, or may have not logged the exact portion of the item they ate. This could skew the data when calculating PRAL and the percentage of protein coming from animal-based products.

Individuals did submit their filled-out food logs in a Google Excel. From here, the researcher input the data into ESHA Research. Some items were input manually, while others were substituted for similar items already in the database. This could have slightly skewed the PRAL values as well as the percentage of grams of protein calculated from

the food log. In addition, the protein from animal-based products was based off instance. If an item was recorded in the 3-day food log such as a pepperoni pizza, the entire pizza would be logged as one item and the total grams of protein from that item would be logged as grams of protein from an animal-based product.

The AFFQ can access the frequency of animal-based intakes. Studies associate lower intakes of animal-based consumption with improved health outcomes, but the AFFQ cannot assess diet quality. This questionnaire would not be able to view if an individual increased fruit and vegetable consumption or used processed plant-based alternatives to the original animal-based products.

Future Considerations

First, to address the secondary aim of the study, although there was no relationship viewed between overall empathy level and AFFQ, it could be interesting to measure an individual's empathy specifically towards animals in relation to their AFFQ. If there were a relationship viewed, it could encourage research looking at increasing empathy towards animals and viewing possible shifts in diet choice. Researchers could have individuals take the AFFQ and then use the individuals who scored highly. They could view different methods of increasing animal empathy and the effect on the individuals' diet choice over time.

There was a significant relationship viewed between the AFFQ, PRAL, and the percentage of protein coming from animal-based products. The AFFQ could be used to give an individual a score ranging from 0 to 132 rather than a categorical title such as

vegan or omnivore. The AFFQ is a questionnaire that consists of 22 questions asking about the frequency of intake of different animal products. The AFFQ can be a quick, easy to use tool that can measure shifts in daily animal-based food consumption frequency. It can be a valuable measure in studies to view reductions or increases in animal-based consumption. This could be beneficial in interventions by having the participant fill out the AFFQ before and after the intervention has taken place. It can be used in exploratory studies, looking at the differences in animal-based consumption based on location, income, or accessibility to more plant-based options.

Although the AFFQ can be used to view shifts in animal-based intake frequency, an additional measurement should be included that looks at diet quality. An individual may reduce animal-based intake and supplement protein with the use of lentils in the diet, or they may supplement with the use of an animal-alternative processed patty. In order to view that the decrease in animal-based products is related to an increase in fruit and vegetable intakes, which would result in positive health outcomes, there needs to be an additional measurement included.

Conclusion

The present study concluded that the AFFQ may be able to be used in place of the current burdensome tools such as food frequency questionnaires and dietary recalls. Although some vegans adhere to their diet choice of the complete absence of animal-based products based on their empathy towards animals or environmental sustainability,

the results do not show a relationship between the plant-based adherence level based on the AFFQ score and overall empathy based on the BES-A score.

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APPENDIX A

IRB APPROVAL

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Christopher Wharton
CHS: Health Solutions, College of
602/496-1727
Christopher.Wharton@asu.edu

Dear Christopher Wharton:

On 7/20/2021 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Pilot animal-based food frequency questionnaire validation
Investigator:	Christopher Wharton
IRB ID:	STUDY00013864
Funding:	Name: ASU: Global KAITEKI Center, The
Grant Title:	
Grant ID:	
Documents Reviewed:	• AAFQ Pilot IRB Protocol.docx, Category: IRB Protocol; • AFFQ pilot survey with eligibility questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Exit email, Category: Participant materials (specific directions for them); • Informed consent form, Category: Consent Form; • Lose It app instructions, Category: Participant materials (specific directions for them);

APPENDIX B

INFORMED CONSENT

I am a professor of Nutrition at Arizona State University. I am conducting a research study to validate an animal-based food frequency questionnaire with a secondary exploration of the relationship between the adherence score and level of empathy.

I am inviting you to participate because you have stated to be older than 18 years of age, an English speaker, have had a relatively consistent diet over the past year (e.g., haven't just recently become vegan, haven't just recently quit being vegan) and have consistent access to a smart phone. Your participation will involve the completion of an intake online survey that asks about your demographic characteristics (e.g., age, gender, race/ethnicity), dietary pattern (e.g., omnivore, vegetarian, pescatarian, vegan). You will spend approximately 5-8 minutes completing this intake survey

The next survey will consist of the newly develop AFFQ which will include items asking about frequency of consumption of animal-based foods (e.g., dairy, meats/poultry, fish, etc.) using a Likert-type response ranging from 'Never' to '6 or more times per day'. The last survey will be a short assessment of empathy. You will take approximately 15-20 minutes completing this online survey.
Following the completion of the surveys, the participants will be asked to complete a three-day food record using a simple-to-use template. You'll spend approximately 10-15 minutes in total completing this dietary record. The time may shorten as you become familiarized with the app. Your total commitment for this study will be of approximately 30-43 minutes.

You have the right not to answer any question, and to stop your participation at any time. There are no foreseeable risks or discomforts to your participation. Your responses will be confidential. Only authorized research personnel will have access to the data. The results of this study may be used in reports, presentations, and/or publications, but your name will not be used. De-identified data collected as part of this study will not be shared with other investigators for future research purposes.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. If you complete all study-related activities as instructed, you will receive $10 in electronic gift cards. Electronic gift cards will be distributed via Tango card; you will have the option of choosing from a large variety of stores and restaurants (e.g., Starbucks, Applebee's, Target, etc). The $10 gift card will be sent electronically by email the day you complete the study in gratitude for your participation.

Your responses will be confidential. Only authorized research personnel will have access to the data. The results of this study may be used in reports, presentations, and/or publications but your name will not be used. An email address will be collected in order to provide you instructions for the study and access to surveys, as well as for digital delivery of gift cards at the completion of the study. However, only research personnel will have access to the address; it will be stored on a password-protected computer in a

locked office. It will not be shared and will be deleted upon completion of all study activities.

If you have any questions concerning the research study, feel free to contact me or the research specialist Maricarmen Vizcaino, PhD at mvizcain@asu.edu.

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By proceeding to the next page and completing the following survey you agree to take part of this study.

Thank you.

Christopher Wharton, PhD
Principal Investigator
Associate Professor
Nutrition Program, Arizona State University
cwharton@asu.edu

APPENDIX C

ANIMAL-BASED FOOD FREQUENCY QUESTIONNAIRE

Over the past 12 months how often did you:

1. Drink cow's milk as a beverage (NOT in coffee, NOT in cereal)? (Please include chocolate milk and hot chocolate)
2. Add cream, cow's milk, or half and half to your coffee or tea?
3. Drink meal replacement or high-protein beverages that included dairy, whey, or casein (for example protein drinks, instant breakfast, Ensure, etc.)
4. Eat yogurt (NOT including frozen yogurt)
5. Eat frozen yogurt, ice cream, ice cream bars, sherbet (do not include non-dairy based products)
6. Eat pudding or custard
7. Eat cottage cheese?
8. Eat cheese (for example on cheeseburgers, sandwiches, topping on pizza, etc.)
9. Eat eggs or egg whites (for example, egg salad, quiche, and souffles. Do not include egg substitutes)
10. Add spreads containing dairy (mayonnaise, cream cheese, sour cream, butter, margarine)
11. Eat a multi-ingredient dish that contained cow's milk, cheese, and or butter/margarine (for example cake, muffins, smoothie, milkshake, macaroni and cheese, lasagna, soup, etc.)
12. Eat a multi-ingredient dish that contained beef (for example beef stew, meatloaf, beef stroganoff, taco salad, meatballs, etc.)
13. Eat a multi-ingredient dish that contained chicken (for example chicken pot pie, chicken noodle soup, etc.)
14. Eat a multi-ingredient dish that contained pork (for example pork fried rice, dumplings, pulled pork etc.)
15. Eat a multi-ingredient dish that contained turkey (for example turkey primavera, casserole, etc.)
16. Eat deli-meat (for example turkey, ham, chicken breast, bologna, salami, roast beef, etc.)
17. Eat Chicken (for example chicken breast, fried chicken, chicken nuggets, please do not include multi-ingredient dishes or deli meats that contain chicken)
18. Eat Beef (for example ground beef, roast beef, please do not include multi-ingredient dishes or deli meats that contain beef)
19. Eat Turkey (turkey breast, grilled turkey, roasted turkey, please do not include multi-ingredient dishes or deli meats that contain turkey)
20. Eat Pork (for example broiled pork, sautéed pork, please do not include multi-ingredient dishes or deli meats that contain pork)
21. Eat canned tuna (including in salads, sandwiches, or casseroles)?
22. Eat fish or seafood (shellfish, oysters, clams, fish sticks, fillets, sushi, etc.)

Responses

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

APPENDIX D

BASIC EMPATHY SCALE FOR ADULTS

N°	**Item**
1	My friend's emotions don't affect me much
2	After being with a friend who is sad about something, I usually feel sad
4	I get frightened when I watch characters in a good scary movie
5	I get caught up in other people's feelings easily
7	I don't become sad when I see other people crying
8	Other people's feelings don't bother me at all
11	I often become sad when watching sad things on TV or in films
13	Seeing a person who has been angered has no effect on my feelings
15	I tend to feel scared when I am with friends who are afraid
17	I often get swept up in my friend's feelings
18	My friend's unhappiness doesn't make me feel anything
3	I can understand my friend's happiness when s/he does well at something
6	I find it hard to know when my friends are frightened
9	When someone is feeling 'down' I can usually understand how s/he feels
10	I can usually work out when my friends are scared
12	I can often understand how people are feeling even before they tell me
14	I can usually work out when people are cheerful
16	I can usually realize quickly when a friend is angry
19	I am not usually aware of my friend's feelings
20	I have trouble figuring out when my friends are happy

APPENDIX E

PARTICIPANT FOOD LOG GUIDE

Food Log Guide

The purpose of the food log is to track your food and beverage intake for 3 days. It is important to be specific and detailed as you record your diet. For example, if you made a hamburger at home, include the bun, cheese, ketchup, and seasonings. Describe how hamburger meat was cooked (for example, with 1 Tbsp of unsalted butter). Include your best estimate of the amount you ate, the brand names of products, and other important details (for example, if the hamburger bun was white bread, wheat bread, whole wheat bread, etc.).

Specifically, here's what you need to do:

1. Record all the food and beverages you consumed over 2 week days and 1 weekend day, OR over 2 work days and 1 day off.
2. Be extremely specific and detailed when filling out the Food Log.
    1. For example, estimate as closely as possible, the amount you ate of each item (in cups, tbsp, tsp, ounces, or whatever unit makes sense).
    2. Include brand names: for example, Kelloggs, Trader Joes, Heinz, etc.
    3. Include preparation where applicable: for example, baked in butter, fried in oil
    4. Include details about the food: for example, whole wheat versus white bread, etc.
3. Include website links for uncommon food and beverage items

1. For example, protein supplements and bars, less common cultural foods, and meal choices from restaurants and fast food locations.
    1. An example might be to share a link for a McDonalds meal you ate and specify your soda choice, if you got refills, and if you used dipping sauces with your meal, etc.

b. If you forget to log a day, do not try to estimate or recall what you ate! Instead, start logging on a different day. The days do not have to be consecutive, such as TH, FRI, SAT. The days can be non-consecutive, such as MON, TH, SUN for example.

Please email me if you have any questions or concerns. Contact: EvajeanAlpine@Gmail.com

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Here is a specific example of a day's diet, including foods and beverages. In the Google Sheets Food Log that has been shared with you, you can see how this day's food and beverage intake would be entered correctly.

Breakfast:

- 2 Slices Artesano bread
- 1 Tbsp peanut butter
- 1 banana
- McDonald's Mango Pineapple Smoothie

Lunch:

- 1 Can Amy's Organic Chili, Medium spice level
- 2 Slices Artesano bread
- 2 Tbsp butter

Snack:

- Homemade smoothie:
    - 1 cup plain Oatly yogurt
    - 2 Tbsp maple syrup
    - 1 cup frozen strawberries
    - 1 banana

Dinner:

- McDonalds
    - Big Mac
    - Large fries
    - 4 ketchup packets
    - Medium coke

APPENDIX F

SAMPLE FOOD LOG

Date/Day	Food/Beverage Item	Serving Size/Amount	Notes	Link (only for specific items)
07/18_Sunday	Artesano bread	2 slices	White bread	https://saraleebread.com/our-breads/artesano-b
07/18_Sunday	Peanut butter	1 Tbsp	Jiffy, unsalted	
07/18_Sunday	Banana	1 medium		
07/18_Sunday	Mcdonalds Mango Pineapple Smoothie	Small		https://www.mcdonalds.com/us/en-us/product/r
07/18_Sunday	1 Can Amy's Organic Chili, Medium spice	1 Can, 2 servings		https://www.amys.com/our-foods/organic-mediu
07/18_Sunday	Artesano bread	2 Slices	White bread, toasted	https://saraleebread.com/our-breads/artesano-b
07/18_Sunday	2 Tbsp butter	2 Tbsp	Great Value, unsalted	
07/18_Sunday	1 cup plain Oatly yogurt	1 serving, 1 cup	Smoothie, snack	https://us.oatly.com/products/oatgurt-plain
07/18_Sunday	Maple syrup	2 Tbsp	Smoothie, snack	
07/18_Sunday	Frozen strawberries	1 Cup	Smoothie, snack	
07/18_Sunday	Banana	1 medium	Smoothie, snack	
07/18_Sunday	Mcdonald's Big Mac			https://www.mcdonalds.com/us/en-us/product/b
07/18_Sunday	Mcdonald's Large fries			https://www.mcdonalds.com/us/en-us/product/l
07/18_Sunday	Mcdonald's ketchup	4 packets		https://www.mcdonalds.com/us/en-us/product/k
07/18_Sunday	Mcdonalds coke	Medium		https://www.mcdonalds.com/ca/en-ca/product/c
Monday…etc.				

APPENDIX G

PARTICIPANT FOOD LOG TEMPLATE

	Date/Day	Food/Beverage Item	Serving Size/Amount	Notes	Link (only for specific items)
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