TRENDY HEALTH FOOD CONSUMPTION AND BODY MASS INDEX IN UNIVERSITY STUDENTS

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by

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San Francisco, California

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CERTIFICATION OF APPROVAL

I certify that I have read *Trendy Health Food Consumption and Body Mass Index in University Students* by Krista Nichol Winchester, and that in my opinion this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirement for the degree Master of Arts in Family and Consumer Sciences at San Francisco State University.

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San Francisco, California
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Research on "trendy", marked by ephemeral, superficial, or faddish appeal (Merriam-Webster, n.d.), food and nutrition supplements and their relationship to body mass index (BMI) is sparse. A response to this under studied subject area was the development of a survey to test the relationship between BMI and health perception as well as intake of trendy foods in San Francisco State University (SFSU) students. A total of 195 surveys were collected during the spring 2018 semester. Kendall's *tau* was used to examine correlations between the foods, attitudes toward intake of these foods, and BMI and chi-square was used to examine other variables of interest. A positive correlation was identified between increased weekly intake of jackfruit and increased BMI, r_τ (193) = .138, p = .020. Though few results were significant, these findings are important for Registered Dietitian Nutritionists to understand that there may be food trends that influence health outcomes.

I certify that the Abstract is a correct representation of the content of this thesis.

Chair, Thesis Committee

12.7.18
Date

PREFACE AND ACKNOWLEDGEMENTS

My journey to become a Registered Dietitian Nutritionist and complete my Master of Arts in Family and Consumer Sciences led me down a long and winding path. Along the way, I've had the pleasure of taking dietetics classes from a passionate bunch of professors who are still excited about nutrition and the profession. Thank you to Dr. George and Wanda for your time, thoughtful editing suggestions, and encouragement in completing my thesis. This would not have been possible though without the support and encouragement of my husband and two children. Thank you all for hanging in there with me and for enduring the never-ending stacks of flashcards!

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Introduction

Healthy Foods and the Registered Dietitian Nutritionist

According to the Academy of Nutrition and Dietetics (AND), a Registered Dietitian Nutritionist (RDN) must possess an understanding of the human body in terms of basic physiology, anatomy, and biochemistry (AND, 2018). The profession requires knowledge regarding interaction of prescription drugs, supplements, food, and their impact on nutrition and health (AND, 2016). Many foods and supplements are perceived by laypersons in a binary way as either "healthy" or "unhealthy" instead of on a continuum. According to the *Dietary Guidelines For Americans 2015-2020* from the United States Department of Health and Human Services (HHS) and the United States Department of Agriculture (USDA), a healthy eating pattern does not depend on single foods but consists of lower intake of foods which are high in saturated fat, sodium, and sugar, and higher intake of vegetables, fruit, and fiber-rich foods such as legumes and whole grains (HHS, 2015). Despite this moderate and practical approach recommended by RDNs and government agencies, there is still confusion about what foods people should be eating to be healthy. This pervasive and widespread misunderstanding of how to eat “healthy” was the impetus for this research.

“Trendy” foods marked by ephemeral, superficial, or faddish appeal (Merriam-Webster, n.d.) and food fads can be seen everywhere from grocery stores to coffee shops to social media posts. In a review of Facebook pages offering nutrition information in Australia, a study found that most of the pages promoted “real food”, and that the

majority of advice did not align with Australian Guidelines to Healthy Eating, and were often hosted by celebrities (Ramachandran et al., 2018). According the Pew Research Center, 44% of adults in the U.S. reported searching the internet for information on diet, nutrition, vitamin, or nutrition supplements, and approximately half of the individuals in the study reported they rarely check the source of the information (Fox & Fallows, 2003). Of particular interest in the current study are nutraceuticals, commonly referred to as dietary supplements, and functional foods. Nutraceuticals are typically packaged and sold in pill or liquid form and contain bioactive substances that offer health benefits (AND, 2013). Functional foods are different in that they are still whole foods which may be enriched, fortified, or enhanced and may offer health benefits beyond basic nutrition (AND, 2013). Several years ago, açaí berry was touted as a disease-preventing "superfood" and can still be found added to juices, smoothies, and salads at businesses such as Bowl'd Acai, a fleet of food trucks in the San Francisco Bay Area of California (https://www.bowldacai.com). A systematic review of açaí foods and products found that when ingested as food, açaí was likely safe up to 140 grams at a time but when consumed daily as a juice, there may be adverse effects when taken with lipid-lowering or blood-glucose lowering drugs (Ulbricht et al., 2012). The study revealed açaí had antioxidant activity but needs to be tested further to determine its use in improved blood glucose control and improved total or LDL cholesterol (Ulbricht et al., 2012). The popularity of açaí as a functional food may be waning as turmeric seems to be on the upswing and is found in supplement form, salad dressing, and at Peet's Coffee which currently sells three

"Golden Beverages" including a turmeric latte. Although trendy foods may have some benefit, the claims are often unsubstantiated by nutrition science, or depend on exaggerated health claims which go beyond evidence available in current scientific studies as addressed below in the literature review.

There are some clear rules established by the U.S. Food and Drug Administration (FDA) in food and supplement labeling where foods can be labeled "high" or a "good source" if a nutrient meets a certain percentage of the Reference Daily Intake (RDI) or Daily Reference Value (DRV) (FDA, 2005). However, ambiguous claims that do not address RDI or DRV specifically, such as "supports the immune system", are acceptable labeling by the FDA and can be used to market foods and supplements (FDA, 2005). For individuals trying to eat healthy, these claims can be confusing and can lead consumers to feel pressured to spend extra money on these foods. The *Nielsen Global Health and Wellness Report* found 21% of respondents in North America willing to pay more for foods with some health attributes, such as those which are GMO-free or are fortified in some manner (Nielsen, 2015).

Overall eating patterns and lifestyle choices such as exercise and moderate alcohol intake are important factors in maintenance of healthy weight. RDNs use body mass index (BMI), a ratio of weight to height used to estimate body composition, as one factor when evaluating appropriate nutrition interventions in healthcare settings. Obesity prevention has been a focus of epidemiological study because of its association with increased rates of disease and mortality (Centers for Disease Control [CDC], 2015).

Longitudinal studies like the National Health and Nutrition Examination Survey (NHANES) focus on differences between food patterns and BMI, age, sex, socioeconomic status, and race or ethnicity and help to identify increased risk and targets of future nutrition interventions (CDC, 2016). While large cohort studies have been useful in outlining and recommending healthy eating patterns related to reduced disease risk there are many unexplored areas of research, specifically in understanding functional foods and supplements, given the dissemination of misinformation in the media. Currently, there is very little research into food trends, i.e. "superfoods", from mainstream popular culture and whether purchasing and consumption habits are impacted by the perceived notion these foods are healthy. Furthermore, little research has been conducted to explore any relationship between intake of functional foods, other healthy behaviors, and BMI.

The United States functional food and nutraceutical market revenue was $64.8 billion dollars in 2015 and is expected to grow to $102.6 billion dollars by 2024 (U.S. Nutraceuticals, 2017). To put this in perspective, the pharmaceutical industry made $690 billion dollars in the U.S. in 2016 (Munos, 2017). The pharmaceutical industry has significant expenses for research and development, clinical trials, and to prove safety which is in contrast with nutraceuticals which do not have to be proven safe before being marketed and sold in the U.S. (American Cancer Society, 2015). For those interested in preventing disease, functional foods and supplements may hold great appeal.

Theoretical Framework

The Health Belief Model (HBM) is a behavioral psychology theory which is typically used to explore the reasons individuals choose to utilize or avoid prevention measures such as cancer screening and vaccination (Glanz & Bishop, 2010). The constructs of the theory are "perceived susceptibility and perceived severity, perceived benefits and perceived barriers, cues to action, and self-efficacy" (Glanz & Bishop, 2010). The theory can be applied to dietary intake of foods or supplements when an individual thinks they are at risk of developing a disease and they take prevention measures. For example, if a person visits their doctor and has been informed they are at risk of developing cardiovascular disease because of family history, they may decide to limit saturated fat by reducing intake of red meat and increase intake of soluble fiber from oatmeal. Another example is if an individual believes they have increased inflammation and decides, based upon advice found on websites from a simple internet search, they should purchase and begin taking herbal supplements daily. The former is based on epidemiological and science-based nutrition interventions (Mayo Clinic, 2018), the latter is questionable given the imbedded links to purchase several supplements on a website (Krebs, n.d.).

Basis for Research Hypothesis

Anders and Schroeter (2017) found individuals who reported taking diet supplements (multivitamin/minerals, individual vitamins or minerals, and/or other dietary supplements) had lower BMI measurements compared to those who did not take

supplements. Although the supplements themselves in the study did not lead to better health overall, there were other traits and behaviors including higher socioeconomic status, higher levels of education, and higher intake of fruits and vegetables for those with lower BMI when compared to those with higher BMI (Anders & Schroeter, 2017). This suggests there may be other healthy behaviors which were associated with the intake of supplements.

The purpose of the survey was to determine whether students perceived trendy functional foods as being healthy and to quantify the number of times each week students consume these foods, then to explore whether there was any correlation with BMI. Given the results of the study by Anders and Schroeter (2017), and the concepts of the theoretical underpinnings of the HBM, the hypothesis for this study was that students' positive perception of the five trendy health foods and higher weekly intake of these foods may be associated with lower BMI. This hypothesis does not support the notion that higher intake of these foods would lead to a lower BMI, only that there may be an association.

Review of Literature

Health and BMI

According to the CDC in 2016, 2.6% of Californian adults (18 years and older) were underweight, 36.4% were within a healthy BMI range, while 36.0% were overweight and 25.0% were obese; an increase from obesity prevalence of 19.9% in 2000 (Behavioral Risk Factor Surveillance System [BRFSS] Prevalence & Trends Data, 2018). When comparing California rates of obesity to the United States, the prevalence was lower as 29.9% of the U.S. population was categorized as obese during 2016 (BRFSS Prevalence & Trends Data, 2018). As obesity rates have risen over the past decades, the percentage of individuals in a healthy weight range has declined (CDC, 2015). Health is not only determined by BMI but maintaining weight in a healthy range, as reflected by BMI, is an important component in reduced disease risk (CDC, 2015).

The association of obesity and higher stores of visceral fat with an increased risk of a myriad of diseases makes it a focus of healthcare and nutrition professionals. According to the CDC (2015), obesity increases the risk of all-cause mortality, type 2 diabetes, heart disease, hypertension, joint pain and osteoarthritis, depression, dyslipidemia, and other diseases and issues. Obese individuals spend an estimated 42% more in personal healthcare costs, receive a greater number of prescribed prescription drugs, and have a greater number of emergency room visits when compared to those in a healthy weight range (The State of Obesity, 2015). There are many factors outside of weight alone that influence a state of health or disease such as cigarette smoking, alcohol

and drug use, and exercise or lack thereof. Nutrition plays an enormous role in maintenance of weight and general health and well-being.

Eating Patterns of College Aged Young Adults

Understanding the eating patterns of college students may provide insight into how decision-making in early adulthood may influence weight and health over time. In a study of Canadian college students' typical dietary habits, Brunt, Rhee, and Zhong (2008), found that overweight and obese individuals consumed more meat in general when compared to their counterparts in a healthy weight range, and that the lower weight individuals had higher intake of cheese, leafy greens, and vegetables. They also found nearly all students consumed snacks high in fat, sugar, and sodium regardless of weight status (Brunt et al., 2008). When examining coronary heart disease (CHD) risk factors at the University of Rhode Island, a study found students with a healthy BMI had increased fiber intake, lower dietary intake of sugar, and higher HDL cholesterol levels, which are associated with lower CHD risk. Those with higher BMI had greater sugar intake, higher triglyceride levels, and higher alcohol intake, behaviors associated with higher risk of CHD (Fernandes, Dimond, Hirshberg, & Lofgren, 2013). Though research focused on college aged young adults is sparse, these studies provide similar conclusions related to advocating for better nutrition education and environmental change, such as placement of healthy foods on campus to establish good eating habits in hopes of healthy weight maintenance into adulthood. Understanding overall eating patterns of selected groups of college students through research is important, but focusing on food intake, instead of the

decision-making process can overlook necessary components essential in behavioral change.

When exploring motivating factors for eating well and being physically active, Walsh, White, and Greaney (2009), found college aged young men were not as motivated to eat well as they were to participate in physical activity. The findings revealed young men wanted to improve fitness to maintain good long-term health, increase self-esteem, have an ability to participate in sports, and to be attractive. The men in the focus group ate dairy foods, fruits, and vegetables if they used relevant guidelines for dietary patterns, used will-power to eat well, or if they liked how healthy foods tasted (Walsh, et al., 2009). Taste of food also seems to be a motivating factor in general for food choice as demonstrated by Kourouniotis et al. (2016). Australian university students who reported taste of food as very important had higher intake of sweets, meat, pizza, and chips, and lower intake of fruit and vegetables compared to students who reported the taste of food as not important or moderately important. While there was no association between these preferences and BMI, eating patterns high in calorie dense foods can lead to weight gain over time (Kourouniotis et al., 2016).

Healthy Eating Patterns in Adulthood

The importance of healthy eating habits and maintenance of a healthy weight during young adulthood cannot be overstated as many of these patterns carry on into later life. Using self-reported weight at age 25 to calculate BMI, and comparing it to measured BMI in the same individuals when they were between the ages of 45-64 years old, a study

found that mortality increased when BMI was elevated at age 25 compared to those who had a normal weight at the age of 25 (Stevens, Truesdale, Wang, Cai, & Erber, 2013). These observations held true for African American women, and white women and men. Increased mortality with high BMI at age 25 was not observed in African American men, which was believed to be due to differences in causes of death of this group when compared to the other groups. Eating patterns were not taken into consideration in this study as it was more focused on the relationship between BMI over time and mortality (Stevens et al., 2013).

In several studies exploring eating patterns associated with healthy BMI, certain trends emerged. In an analysis using data from the NHANES study 2003-2006, greater intake of a variety of foods that were found to be healthy, such as fruits, vegetables, and whole grains, according to the US Healthy Food Diversity index (HFD), were associated with lower adiposity levels (Vadiveloo, Dixon, Mijanovich, Elbel, & Parekh, 2014). It seems the types of food consumed are more important than variety alone as Asghari, Mirmiran, Yuzbashian, and Azizi (2017) found dietary diversity was associated with an increase in obesity while consumption of a variety of foods which scored high on the Healthy Eating Index (HEI) were found to be associated with lower BMI and healthier lifestyle habits. It was believed that when access to a variety of food increased, there may have been an increase in the intake of calorie dense and nutrient dense foods, thereby increasing overall intake of all types of foods, and increasing BMI.

When exploring the specific relationship between the types of foods consumed and location of adipose deposits, Shah et al. (2016), found a better-quality diet was associated with lower pericardial and visceral fat, and lower hepatic fat in addition to a better lipid profile, lower inflammatory markers, and improved insulin sensitivity. Inversely, a higher intake of less healthy foods like red and processed meat, and sugar-sweetened drinks were associated with greater pericardial fat deposits (Shah et al., 2016). From studies like these, certain patterns begin to emerge of dietary choices that seem to have a relationship with maintenance of healthy weight and reduced cardiovascular disease risk.

While a greater BMI can raise disease risk, eating patterns can influence the development of disease as well in individuals who are in a normal BMI range. Metabolic Syndrome occurs when an individual has at least three of five of the following: obesity, elevated triglycerides, hypertension, hyperglycemia, low HDL. Metabolic syndrome is associated with a greater risk of cardiovascular disease (American Heart Association, 2016). There are individuals who are in a normal BMI range, but who have at least three of four of the remaining disorders, and have been referred to as "metabolically obese normal weight". Basically, they have the same metabolic disorders, but maintain what is typically considered a healthy weight range. In exploring healthy eating patterns in normal weight individuals, Suliga, Koziel, Cieśla and Gluszek (2015), found that an eating pattern higher in whole grains, and fish, and lower in highly refined foods, sugar, and cured meats was associated with higher HDL cholesterol and lower blood sugar.

There are other factors, however, which have yet to be explored, such as how food trends and purchasing decisions impact individuals' overall health and BMI.

Functional Foods and Nutraceuticals

Functional foods and nutraceuticals are two categories of food which are marketed as providing benefits beyond nourishment and are often sold in serving sizes which exceed those typically consumed in a regular eating pattern. According to the AND (2013), functional foods are defined as "whole foods along with fortified, enriched, or enhanced foods that have a potentially beneficial effect on health when consumed as part of a varied diet on a regular basis at effective levels based on significant standards of evidence". According to the AND, many individuals identify fruits and vegetables as "functional foods" and are aware of health benefits of consuming them. This definition is changed a bit when manufacturers market functional foods and "say they promote optimal health and help reduce the risk of disease" (Zeratsky, 2018). Having health benefits is different than reducing disease risk, yet many manufacturers and internet sites make claims regarding foods which are greater than the evidence available. Functional foods are still consumed in food form, such as fruits, vegetables, oils or juices, unlike nutraceuticals which are typically sold and consumed in supplement form.

In the U.S., the FDA does not regulate functional foods, and the labeling of these foods is currently the same as conventional foods (Lupton, 2009). Health claims related to functional foods are a gray area as many of the claims do not have objective measurements, such as the Recommended Dietary Allowance (RDA) for vitamin C,

vitamin D, or calcium. The concern with some functional foods, as with supplements, is that sometimes the foods are enhanced with additives which are more concentrated than they would be in conventional foods (Lupton, 2009). For example, if a food contains an added ingredient to make it a functional food, this addition may prevent the other nutrients in the food from being absorbed properly, or very high levels may even cause harm.

Nutraceuticals can be "nearly any bioactive component that delivers a health benefit, commonly in supplement form" (AND, 2013). Nutraceuticals are often supplements in pill or liquid form, often made from plant compounds, are available over the counter and are not regulated as drugs by the FDA. Some nutraceuticals, such as multivitamins, may be useful in those with malnutrition or poor intake. According to Sauer and Plauth (2017), the literature surrounding the efficacy of nutraceuticals is lacking in solid evidence as many of the products have poor documented bioavailability or depend on animal models to make claims. The problem with animal models is that they are a starting point for many studies, not proof a substance will function in the human body in the same way it does in an animal. Bioavailability is an issue as well because many substances are metabolized and excreted in the urine or feces and have very little effect on the tissue or organ of interest. This does not stop supplement manufacturers from making health claims as long as they have clearly labeled "This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease" (FDA, 2005).

Attitudes of the target demographic are important for marketing of functional foods and for understanding the messaging reaching consumers. When comparing college students' perceptions of functional foods, there were differences observed based upon gender and nationality where women in Canada and America had the highest belief in the health benefits of and positive general attitude towards these foods (Kolodinsky et al., 2008). While women from both countries thought there were benefits from these foods, they were unsure whether the information surrounding them was credible. French college students had the lowest interest in functional foods of the three countries surveyed. It seems the types of food and the health claims may impact acceptance of functional foods as well. In a survey conducted in Switzerland, Siegrist, Stampfli, and Kastenholz (2008) found yogurt enhanced with additional health benefits would be accepted more willingly than soup or chocolate with the same added benefits by individuals. In addition, they found an age difference where older consumers were more apt to purchase functional foods. In a similar study in Uruguay, adults were asked about their willingness to consume, and about the perceived health benefits of five foods with four different enrichment options: fiber, calcium, antioxidants, or iron (Ares & Gámbaro, 2007). Again, yogurt was perceived as the healthiest among all groups, but sugary foods like dulce de leche and marmalade with functional additives were more appealing to younger adults (Ares & Gámbaro, 2007). These findings suggest there are some differences between the acceptance of functional foods based upon gender, age, and culture, where foods such as yogurt may already be perceived as having some health benefits. For younger adults who

may not be as concerned as older adults with overall health and chronic disease prevention, there may be some willingness to consume novel functional foods. While only one study above included participants from the U.S., there were no similar studies of functional foods available for review.

Food Trends and the Internet

Many ideas surrounding nutrition and the concept of which foods are deemed healthy come from the internet and television, and not necessarily evidence-based nutrition science. According to Chi et al. (2016), top trending functional food searches on Google.com from August 2015 through February 2016 were for turmeric, apple cider vinegar, jackfruit, Manuka honey, kefir, and coconut milk. When a lay person does an internet search on any of these foods, their qualities and purported benefits can seem almost magical. Many internet searches lead to websites with official sounding names, selling products backed by "evidence". Considering obesity trends, and the popularity of Google searches for health foods, it would be worthwhile to explore whether any relationship exists between unsubstantiated popular culture health food trends and healthy weight.

Government sites, such as ChooseMyPlate.gov in the U.S., offer practical, evidence-based, free guidance regarding nutrition, but the sites are not always as appealing as industry sponsored sites selling supplements and quick fixes. When comparing the nutrition information offered on health websites most commonly used by Canadians, only about 31% of the advice given was in line with the Canada Food Guide,

while the remaining advice was either in conflict, mixed, or did not contain pertinent nutrition information (Ostry, Young, & Hughes, 2008). Most website visits, about 80%, were to commercial websites with questionable nutrition advice. The biggest issue with many of these websites was that they had a mix of scientifically valid and unsubstantiated advice, so laypeople would be unable to distinguish between the two, leading to confusion. This confusion was evident in the International Food Information Council (IFIC) Foundation survey which found that 38% of consumers could not name a food that could help with their most pressing health concern, and 80% reported feeling there was conflicting information about which foods are healthy and which foods they should avoid (IFIC, 2018). Given the widespread uncertainty regarding foods, and the claims surrounding them, five of the top trending foods from the Google Food Trends-2016 report will be analyzed to explore the evidence available for their use as functional foods or nutraceuticals.

Turmeric

The first of the foods, turmeric (*Curcuma longa*), is a bright orange colored rhizome, related to ginger, which has been used in traditional foods throughout India and Asia, and is responsible for the deep yellow color of curry dishes. A Google search for turmeric brings up a link to Healthline.com which has "evidence based" articles with links to scientific literature and a team of nutritionists and RDNs fact checking articles. According to an article on Healthline.com, turmeric has powerful medicinal properties, is an anti-inflammatory, increases antioxidant function in the body, may reduce brain

disease development, could reduce heart disease, may prevent cancer, could be used in Alzheimer's prevention, is useful in arthritis treatment, may be used to treat depression, and may combat aging and chronic disease (Gunnars, 2018). Since the website is a commercial site, the article concludes with a link to purchase a turmeric supplement enhanced with piperine, a black pepper extract which is said to "increase the bioavailability of turmeric by 2000%". The referenced article which demonstrated improved bioavailability was a study conducted in rats and 8 human male volunteers. The study found the blood serum concentration of curcumin enhanced with piperine in humans did improve and spike between 30-45 minutes after oral ingestion (Shoba, Joy, Joseph, Majeed, Rajendran, & Srinivas, 1998). There were no indications in the article that excretion of curcumin in urine or feces was measured, so it is unknown whether the improved bioavailability resulted in delivery of curcumin to intended targets in the tissue. In addition, this was a small study with significant, but preliminary results. The issue with the article by Gunnars and its claims is that many of the links to scientific articles reference animal experiments, or articles which do not mention turmeric at all, and instead discuss antioxidants or cardiovascular disease. Many of the articles are preliminary studies which may or may not have statistically significant results, yet they were interpreted as definitive in nature. For laypersons reading an article like this, it may seem that turmeric is extremely healthy, and they should be purchasing and consuming it daily.

The evidence to support widespread use of turmeric as a nutraceutical is not clear. The issue of concern with turmeric as a remedy is that it is not very well absorbed in the human body because of its chemical structure and it does not always reach the targeted tissue or organ. Nelson et al. (2017), discussed barriers to the development of curcumin, a well-studied component of turmeric, as a pharmaceutical and reviewed the evidence of its efficacy in clinical trials. They found several issues including differences in curcumin preparations making experiments difficult to reproduce, poor solubility of the compound in water, low detection of the original compound in blood serum, and most of the compound was found to be excreted in feces. In their review of clinical trials, the study found modest or no statistically significant effects when experiments used curcumin for treatment of radiation dermatitis, colon cancer, Alzheimer's disease, or pancreatic cancer (Nelson et al., 2017). The authors make a valid point that if turmeric were effective, it would likely be developed into a more potent drug instead of its continued use as a supplement. In a wide-ranging review of curcumin use in many different chronic diseases from cancer to diabetes to Alzheimer's, Kunnumakkara et al. (2017), concluded with optimism regarding the potential uses of the compound, but also discussed its low bioavailability as a barrier to its therapeutic use. The authors suggest curcumin may be effective as a therapy for many diseases because of its antioxidant properties and ability to target inflammatory mediators but encourage further study to develop and improve the bioavailability.

Although turmeric may not be a panacea, there may be some promising and limited uses. In a meta-analysis of randomized clinical trials, Daily, Yang, and Park (2016), found curcumin in doses of about 1 gram per day had effects on reduction of pain from osteoarthritis equivalent to that of analgesics and Nonsteroidal Anti-inflammatory Drugs (NSAIDs) with no adverse effects. Given the sometimes uncomfortable gastrointestinal and other side effects of NSAIDs and analgesics, turmeric or curcumin may be an attractive alternative or conjunctive therapy for reducing joint pain. Even with the meta-analysis, however, the sample sizes were fairly small, and were more of a starting point for further research (Daily et al., 2016). Another area of interest in turmeric research is in prevention of type 2 diabetes. In a small study of healthy subjects, ingestion of 6 grams of turmeric resulted in a significant increase in insulin levels, but no change in blood glucose levels after an oral glucose tolerance test (Wickenberg, Ingemansson, & Hlebowicz, 2010). So far, turmeric is of extreme interest in prevention and treatment of chronic disease. From the evidence available, it is likely not going to cure disease, but the worst side effect when taken in moderate doses, tends to be gastrointestinal discomfort. For those who enjoy the flavor of turmeric, when eaten as part of a meal, it may not have the medicinal effects of a supplement, but it is fine as part of a healthy eating pattern.

Apple Cider Vinegar

Although apple cider vinegar is an important acidic ingredient in many foods, it has also been used as a home remedy for a number of ailments. The health claims found on the internet for the effects of apple cider vinegar are not quite as broad as those of

turmeric, but include such benefits as helping with upset stomach, curing hiccups, possibly lowering cholesterol, preventing indigestion, aiding in weight loss, clearing acne, boosting energy, reducing leg cramps at night, and controlling blood sugar according to "15 Ways Apple Cider Vinegar Benefits Your Health" (*Reader's Digest*, n.d.). Unfortunately, most of the references refer to other articles from *Reader's Digest*, and not from other verifiable sources.

Studies of apple cider vinegar use in humans tend to be focused on glycemic control and weight loss. In a meta-analysis of studies conducted in humans, pooled data revealed significant reductions in postprandial mean glucose and insulin levels in groups receiving vinegar with meals (Shishehbor, Mansoori, & Shirani, 2017). The meta-analysis included 8 studies with fewer than 16 participants in each, and there were differences in the individual studies in terms of the type of vinegar used, the dose, and the glycemic load of meals. In another study exploring the possible mechanism responsible for the anti-glycemic action observed in other studies, 5 healthy human volunteers without diabetes were given placebo twice and given apple cider vinegar twice with meals while insulin was suppressed (Salbe, Johnston, Buyukbese, Tsitouras, & Harman, 2009). There was no evidence that apple cider vinegar reduced carbohydrate absorption as it did not result in reduced blood glucose levels in the participants. When exploring the influence of vinegar on appetite suppression and weight loss, it was suggested that the feelings of nausea following ingestion of apple cider vinegar were responsible for reduced intake (Darzi, Montaser, Yap & Robertson, 2014). The authors did not encourage

induced nausea as a means for weight loss or appetite control. According to Kohn (2015) there remains a lack of evidence for apple cider vinegar to be recommended for people with diabetes or to aid in weight loss, as there have been some serious side effects, such as esophageal injury, when it is consumed daily or in tablet form.

Jackfruit

Jackfruit (*Artocarpus heterophyllus*), is a large, mildly sweet tropical fruit popular in South and Southeast Asia. It is gaining popularity in the U.S. as a substitute for meat in stir-fry dishes and is being sold canned at a number of retail grocery stores. Jackfruit is being promoted as an immunity booster and possibly as potent against cancer. It may boost magnesium levels, reduce heart disease, reduce constipation, and may reduce osteoporosis according to Dr. Axe, a certified doctor of natural medicine, doctor of chiropractic, and clinical nutritionist ("Jackfruit: 5 Remarkable Benefits", n.d.). These claims are innocuous and could be true for many other fruits and vegetables. Again, the references either lead to other articles written by Dr. Axe, or to references unrelated to jackfruit. The site does not sell jackfruit directly, but does have many supplements and oils for sale.

The roots and leaves of jackfruit have been used in herbal supplements, but the fruit has typically been consumed fresh, dried or canned instead of used as a nutraceutical. There is very little evidence regarding the use of jackfruit beyond consuming it as a fruit. In an experiment to explore the anti-inflammatory properties of the fruit, an in vitro trial using three compounds extracted from the *A. heterophyllus* fruit,

one compound was found which inhibited nitric oxide production and the expression of inflammatory proteins (Fang, Hsu, & Yen, 2008). When using a different compound from the fruit, it appeared to reduce colon inflammation and tumor growth in mice with colon cancer and showed some promise as a cytotoxic agent using human colon cancer cells (Sun et al., 2017). As these studies were not done in the human body, and they are preliminary studies, it is too early to tell whether jackfruit has medicinal use beyond that of a fruit as part of a well-balanced diet.

Kefir

Kefir is a milk-based drink fermented with grains which originated in Eastern Europe and Western Asia and has risen in popularity in recent years given interest in probiotics, the live "good" bacteria or yeast. Dr. Axe reports benefits of kefir include boosting the immune system, improving bone strength, possibly fighting cancer, supporting digestion and improving irritable bowel syndrome, reducing allergies, healing skin, and improving lactose intolerance ("7 Kefir Benefits", n.d.). Again, many of the references either return to other articles written by Dr. Axe, or to animal or in vitro studies to support claims. Unlike other commercial websites, there is not a link to purchase kefir grains, but there are many links to purchase other supplements and products promoted by the site.

There is great interest in the use of kefir as a functional food, mostly as a remedy for gastrointestinal (GI) problems. In a study comparing adults who are lactose intolerant, those who lack the enzyme to digest milk, participants were each given five different

treatments: milk, plain yogurt, plain kefir, flavored yogurt, or flavored kefir, then tolerance of each of the foods was measured using hydrogen breath tests (Hertzler & Clancy, 2003). Participants also ranked symptoms including abdominal pain, gas, loose stool, and headache. The kefirs and yogurts all resulted in lower hydrogen breath tests and less severe GI symptoms when compared with milk. Weight loss tends to be a focus of functional foods, and kefir is no exception. In a study of overweight or obese premenopausal women, four servings of kefir daily led to similar outcomes as four servings of low-fat dairy daily where both groups had significant reductions in weight, BMI, and waist circumference when compared to the control group who received two servings of dairy daily (Fathi, Faghih, Zibaeenezhad, & Tabatabaei, 2016). This was a small trial and would need to be confirmed with a larger study to prove kefir and low-fat dairy are helpful in weight loss and maintenance. In a review of studies on the effects of kefir on GI symptoms, hypercholosterolemia, inflammation reduction, and as an anti-carcinogen, among others, the authors cautioned that better clinical trials were needed since most studies were conducted in animals or in vitro (Rosa et al., 2017). As with the other foods, kefir may have some benefits as part of a healthy diet and may be a good alternative for lactose intolerant individuals who would like to incorporate some dairy into their diets.

Coconut Milk

The final of the five foods of interest is coconut milk. While coconut oil had been extremely popular for several years, Google searches for coconut milk have now taken

over. According to Healthline.com, coconut milk may aid in weight loss, may lower LDL cholesterol, and raise HDL cholesterol, reduce inflammation, improve ulcers, and reduce viruses and bacteria in the body (Spritzler, 2016). Most of the references to imply benefits are for coconut oil, or for flaked coconut, not for coconut milk specifically.

In a study of rats, coconut milk led to the reduction of stomach ulcers when compared to a control group, and was similar to sucralfate, a common drug used for ulcer treatment (Nneli & Woyike, 2008). This study was very limited in scope, and like many of the other studies, cannot be generalized to humans. In one cross-over study of coconut milk in adult humans, porridge supplemented with coconut milk resulted in significant reduction in LDL cholesterol and increase in HDL cholesterol when compared with porridge supplemented with soya milk which only reduced LDL cholesterol in individuals who were high at baseline (Ekanayaka, Ekanayaka, Perera, & DeSilva, 2013). This study has important implications in the understanding of traditional fats and their impact on cardiovascular disease factors such as cholesterol. Neither study of coconut milk can infer its use as a functional food, but as with the other foods explored, may be a part of a healthy diet.

There is an enormous amount of confusion regarding which foods are healthy, which are not, and where the focus should be. As the exploration of these five foods have revealed, there are differences in the ways foods are portrayed based upon the source and motivation. All the foods addressed in this research can be incorporated into a healthy eating pattern. When a balanced eating pattern is not the priority any longer and is

usurped by the promises attached to high intake of individual foods or supplements based on overstated health claims, it is unclear how these choices impact overall health and BMI.

Methods

Participants

The population of interest was college aged students, 18 years or older, attending SFSU during the spring semester of 2018. To capture a representative group of university students, the plan was to collect a cross-sectional convenience sample of core classes in each of the six colleges at SFSU (Business, Education, Ethnic Studies, Health & Social Sciences, Liberal & Creative Arts, and Science & Engineering). Core classes were defined as those classes designated as core classes for majors within the six colleges at SFSU. Initially, emails were sent to colleges, then to individual professors to gain permission to conduct the survey in person at the beginning of core class periods. The professors were contacted beginning in the fall of 2017. Neither the college of Education, nor the college of Ethnic Studies were represented in the survey due to lack of response or schedule conflicts with professors.

Foods of Interest

A systematic review was conducted during the fall of 2017 to identify current health food trend topics. From this search, the "Food With a Function: Top Trending" section of the Google *Food Trends-2016* report revealed functional foods with the highest searches on Google.com (Chi et al., 2016). The top six searched for functional foods were turmeric, apple cider vinegar, jackfruit, Manuka honey, kefir, and coconut milk. Foods that were readily available in the California Bay Area at several retailers were used as the five foods in the survey. Manuka honey was excluded from the survey because of its

limited availability and high price tag. As the price online ranges from about $20-50 for a 12 oz jar, price may be a barrier to college students purchasing it as a functional food. The five foods included in the survey were turmeric, apple cider vinegar, jackfruit, kefir, and coconut milk. Although the survey does not specifically address the forms of the foods, both turmeric and apple cider vinegar can be considered either functional foods or nutraceuticals based upon the frequency and amount consumed.

Survey Approval and Data Collection

The Institutional Review Board for the Protection of Human Participants at SFSU approved the protocol as exempt under code 45 CFR 46.101 (b)(2) because it is research involving the use of survey procedures, and participants were 18 years or older. Surveys were conducted between February and April 2018 at the beginning of classroom instruction in a total of four classrooms; three of the four professors had two sections of the core classes, so the survey was given in a total of seven classes. In an attempt to avoid biasing students, the researcher wore similar clothing to each class, and read from a prepared script to introduce the study (Appendix 1). Following distribution and collection of the survey in one of the core classes with two sections, the professor requested time for questions and discussion regarding the process of thesis development. As all survey materials were gathered prior to the discussion, students were not privy to any information beyond the standard script before completing the survey. A total of N = 217 surveys were collected from students; incomplete surveys were not included in the results.

Survey Design

As there were five specific foods of interest which are not included in already validated food questionnaires, a survey was developed using existing models as guidelines. The language used was modeled after that in the Diet History Questionnaire II (DHQ II), developed by the National Cancer Institute (NCI, 2018), and the National Health and Nutrition Examination Survey (NHANES) Food-frequency Questionnaire, developed and extensively used by the National Institutes of Health (NIH) and the National Cancer Institute (NCI, 2018). Both tools have been validated and updated over time as tools for accurately measuring dietary intake (NCI, 2016). The language used, and time periods of intake were also discussed with graduate advisor, Gretchen George, PhD, RDN, an Assistant Professor of Nutrition and Dietetics at SFSU, with experience in nutrition research and survey design. Due to time limitations, the survey was casually tested on and discussed with acquaintances who were close in age to the participants of interest prior to distribution in classrooms.

For each of the five foods, questions were included regarding student perception of health of the selected foods using a Likert scale as follows: "Very healthy", "Somewhat healthy", "Not healthy or unhealthy", "Unhealthy", or "Not sure/Don't know". To measure frequency of consumption during a typical week, answers were also collected on a Likert scale as follows: "Never", "1-2 times per week", "3-4 times per week", "5-6 times per week", or "Every day". For demographic information, the survey ended with questions regarding past enrollment in a human nutrition class, visits to a

Registered Dietitian, age, weight, height, grade level, gender, race/ethnicity, and income (Appendix 2).

Spaces were provided for self-reported height and weight, which could be reported in imperial or metric measurements. BMI calculated from self-reported height and weight is a common measurement used in surveys because of its ease of use. BMI was calculated using a tool available through the NIH that depends on the following formula: 703 x weight (in pounds) / height (in inches) ^{2}, or weight (in kilograms) / height (in meters) ^{2} (NIH, n.d.). BMI was categorized as follows according to the NIH: underweight < 18.5 kg/m^2, normal 18.5-24.9 kg/m^2, overweight 25.0-29.9 kg/m^2, obese > 30.0 kg/m^2.

Data Analysis

Data was analyzed using R Studio (version 1.1.414; R Studio Inc., Boston, MA) with the significance level $p < .05$. As all results had multiple outliers, Kendall's *tau* was used to examine correlation between the perceived health of each food and BMI as well as the reported weekly consumption of each food and BMI. Chi-square was used to compare reported BMI to expected BMI rates for adults in California and to compare the study population with the population of SFSU. To examine the population of the study more closely, Chi-square was used to compare the BMI of students aged 18-34 in the study to adults aged 18-34 in California. Chi-square was also used to establish whether there was a relationship between perceived health of the foods and increased weekly

intake. Reported income was not included in the data analysis due to the large number of individuals who answered with “Not sure/Choose not to answer”.

Results

Quantitative Results

A total of 217 surveys were collected, 22 of which were incomplete and were excluded from data analysis. A total of 195 complete surveys were included in data analysis (selected details in Table 1). Of the complete surveys, 75.9% were female (n = 148), 22.6% were male (n = 44), and 1.5% were other gender (n = 3). By comparison the enrollment during the spring 2018 semester was 56.8% female and 43.2% male (SFSU "Interactive Enrollment Report", 2018). Using a chi-square difference test, there was a significant difference between reported gender of the sample population when compared to SFSU students, χ^2 (1, n = 192) = 32.19, $p < .001$, $w = 0.41$. Mean age was 22.83 $\pm$ 3.26 years, ranging from 18 to 51 years. Income was not included in the data analysis because 34.9% (n = 68) individuals answered monthly income as "Not sure/Choose not to answer". As this is such a large proportion of the answers, it will not be addressed.

Race and Ethnicity

The majority of respondents were Asian (44.1%), followed by Hispanic or Latino (20.0%), White (16.9%), Two or more races (15.9%), Black or African American (2.6%), and Native Hawaiian or other Pacific Islander (0.5%). By comparison, the total enrollment at SFSU by ethnicity in 2016 was Asian (30.0%), Hispanic or Latino (32.9%), White (24.2%), Two or more races (6.8%), Black or African American (5.4%), Native Hawaiian or other Pacific Islander (0.5%), and Native American/Alaskan Native (0.2%) (SFSU "Enrollment by Ethnicity", 2016). Using a chi-square difference test with Yates'

correction, there was a significant difference between the reported races/ethnicities of survey participants when compared to the SFSU population, χ^2 (6, n = 195) = 54.09, p <.001, w = 0.53.

Weight and BMI

Mean weight was 145.12 ± 37.70 pounds, ranging from 89 to 306 pounds. Mean height was 64.97 ± 3.74 inches, ranging from 52 to 80 inches. Mean BMI was 23.94 ± 4.92 kg/m², ranging from 15.9 kg/m² to 43.9 kg/m². The percentage of individuals from the sample were categorized according to BMI as follows: underweight (5.6%), healthy (62.1%), overweight (22.1%), and obese (10.3%). The population of adults over the age of 18 in California in 2016 were categorized according to BMI as follows: underweight (2.6%), healthy (36.4%), overweight (36.0%), and obese (25%), (BRFSS Prevalence & Trends Data, 2018). Using a chi-square difference test, there was a significant difference observed between the sample BMI when compared to California BMI, χ^2 (3, n = 195) = 69.68, p < .001, w = 0.61. As BMI prevalence is lower in younger individuals, excluding the four students aged 35 and over allowed for a comparison of percent BMI ranges from the sample compared to California BMI ranges in adults aged 18-34. The percentage of individuals aged 18-34 from the sample were categorized according to BMI as follows: underweight (4.7%), healthy (62.3%), overweight (22.5%), obese (10.5%). The population of adults between the ages of 18-34 in California in 2016 were categorized according to BMI as follows: underweight (5.1%), healthy (46.2%), overweight (29.9%), and obese (18.9%), (BRFSS Prevalence & Trends Data, 2018). Using a chi-square

difference test, there was a significant difference observed between the sample BMI when compared to California in adults aged 18-34, χ^2 (3, n = 191) = 21.36, $p < .001$, w = 0.33.

The largest number of individuals of participating in the survey identified ethnically as Asian (44.1%) and were not representative of either the population of SFSU or of BMI in the state of California. The percentage of Asian individuals from the survey sample were categorized according to BMI as follows: underweight (8.1%), healthy (72.1%), overweight (9.3%), and obese (10.5%). The population of Asian adults over the age of 18 in California in 2016 were categorized according to BMI as follows: underweight (5.8%), healthy (54.6%), overweight (30.1%), and obese (9.5%), (BRFSS Prevalence & Trends Data, 2018). Using a chi-square difference test, there was a significant difference observed between the sample BMI of Asian participants when compared to California BMI for Asians, χ^2 (3, n = 86) = 18.07, $p < .001$, w = 0.46.

Nutrition Knowledge and BMI

When examining the relationship between a previous visit to a RDN and BMI, 8.2% (n = 16) of respondents answered "yes", they had seen an RDN, 3.1% (n = 6) answered "not sure", 88.7% (n = 173) answered "no". Using Kendall's *tau*, there was no significant correlation between visiting an RDN and BMI, $r\tau$ (193) = .095, p = .106. For students who had previously taken a nutrition class, 22.6% (n = 44) reported "yes" they had taken a human nutrition class, and 77.4% (n = 151) reported "no". Using Kendall's

tau, there was no significant correlation between taking a human nutrition class and BMI, $r\tau$ (193) = -.025, p = .677.

Table 1. Details of SFSU student participants in the Healthy Food Survey

Characteristic		Mean ± SD
Age		22.83 ± 3.26
Weight (in pounds)		145.12 ± 37.70
Height (in inches)		64.97 ± 3.74
BMI		23.94 ± 4.92
	n	%
Gender		
Male	44	22.6
Female	148	75.9
Other	3	1.5
Race		
Asian	86	44.1
Black or African American	5	2.6
Hispanic or Latino	39	20.0
Native Hawaiian or other Pacific Islander	1	0.5
Two or more races	31	15.9
White	33	16.9
BMI Categories		
Underweight (< 18.5 kg/m²)	11	5.6
Healthy (18.5-24.9 kg/m²)	121	62.1
Overweight (25.0-29.9 kg/m²)	43	22.1
Obese (> 30.0 kg/m²)	20	10.3
Taken a Human Nutrition Class		
Yes	44	22.6
No	151	77.4
Visit to Registered Dietitian		
Yes	16	8.2
No	173	88.7
Not Sure/Don't Know	6	3.1

Turmeric

When examining the perceived health benefits of turmeric, 28.7% (n = 56) of respondents answered, "very healthy", 39.0% (n = 76) answered "somewhat healthy", 5.6% (n = 11) answered "not healthy or unhealthy", 0% (n = 0) answered "unhealthy", and 26.7% (n = 52) answered "not sure/don't know". Using Kendall's *tau*, there was no significant correlation between perceived health of turmeric and BMI, $r\tau$ (193) = -.0006, p = .992. A scatterplot showing the relationship of BMI to perceived health of turmeric is displayed in Figure 1.

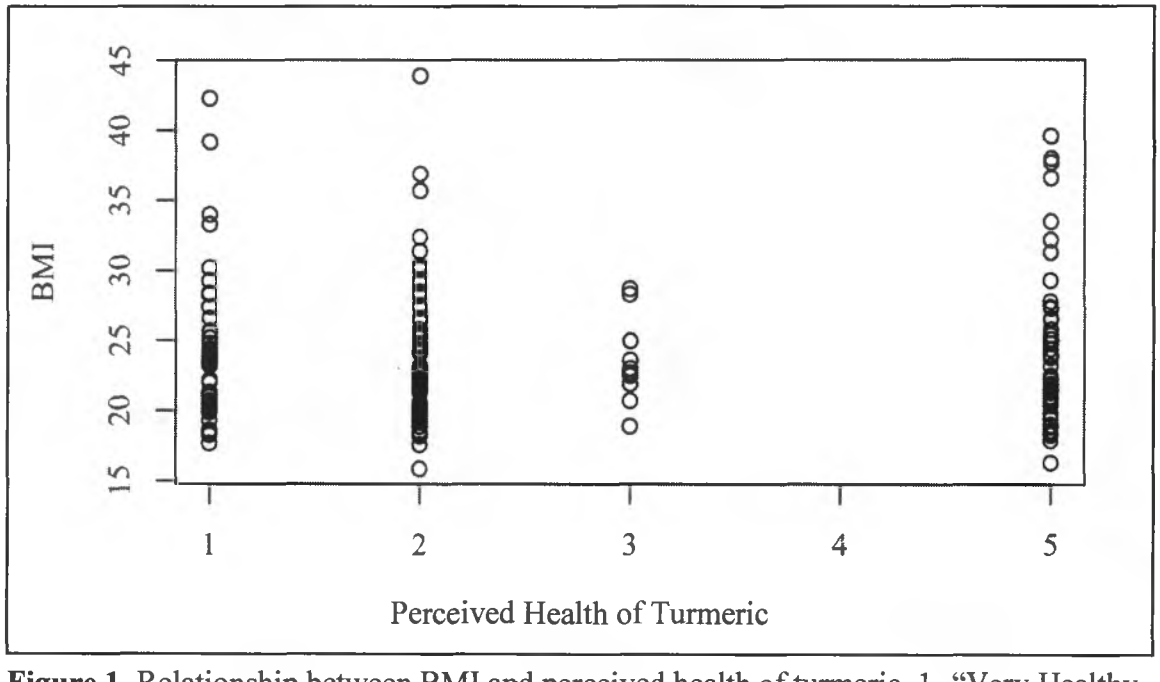

Figure 1. Relationship between BMI and perceived health of turmeric. 1- "Very Healthy, 2- "Somewhat Healthy, 3- "Not Healthy or Unhealthy", 4- "Unhealthy", 5- "Not Sure/ Don't Know.

Reported weekly consumption of turmeric showed 67.2% (n = 131) of participants answered they "never" eat turmeric, 27.2% (n = 53) eat turmeric "1-2 times"

per week, 3.1% (n = 6) eat turmeric "3-4 times" per week, 2.1% (n = 4) eat turmeric "5-6 times per week, and 0.5% (n = 1) reported eating turmeric "every day". Using Kendall's *tau*, there was no significant correlation between weekly intake of turmeric and BMI, r_τ (193) = -.054, p = .355. A scatterplot showing the relationship of BMI to weekly intake of turmeric is displayed in Figure 2.

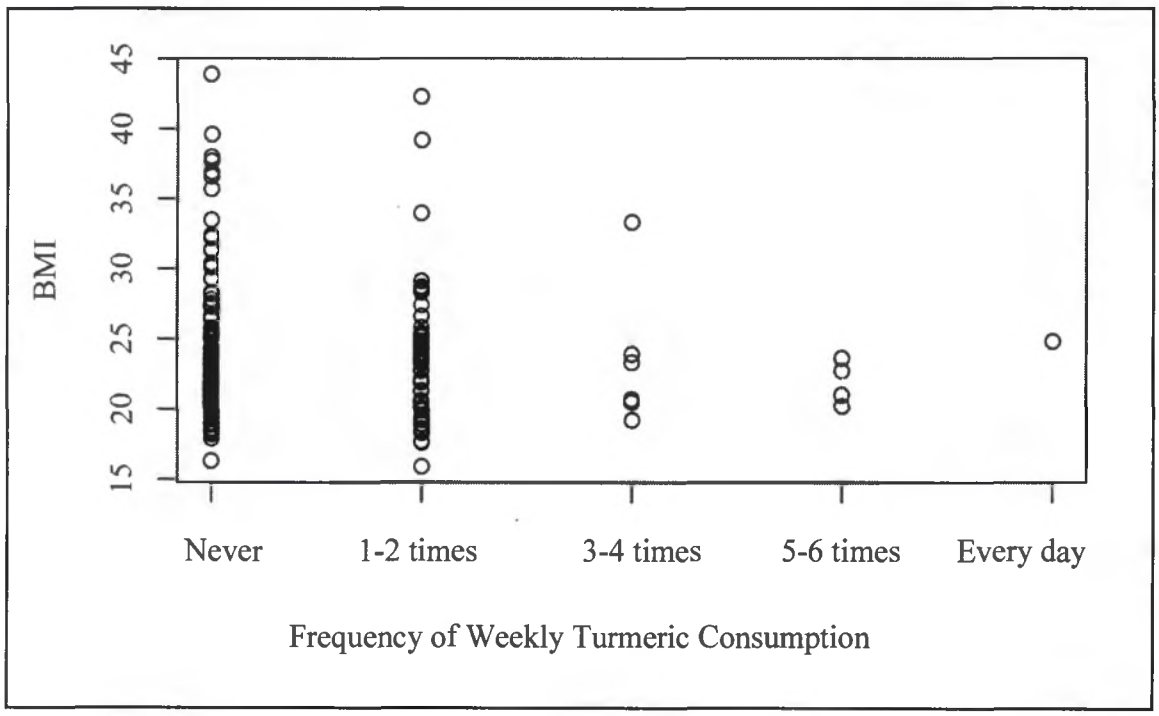

Figure 2. Relationship between BMI and weekly turmeric consumption.

To establish whether there was a relationship between turmeric being perceived as very healthy and a corresponding increase in intake, categories of perceived health were used as follows: 28.7% (n = 56) perceived turmeric as "very healthy" where all other answers encompassed the remaining 71.3% (n = 139) of respondents. Individuals who reported high weekly intake of turmeric 5.6% (n = 11) answered "3-4 times", "5-6 times"

or "every day" were compared to others who had low intake of which 94.4% (n = 184) answered "1-2 times" or "never" per week. Using a chi-square difference test, there was a significant difference observed between turmeric being perceived as very healthy when compared to high weekly intake of turmeric, χ^2 (1, n = 195) = 50.67, $p < .001$, $w = 0.51$.

Apple Cider Vinegar

When examining the perceived health of apple cider vinegar, 28.7% (n = 56) of respondents answered "very healthy", 48.7% (n = 95) answered "somewhat healthy", 6.7% (n = 13) answered "not healthy or unhealthy", 2.1% (n = 4) answered "unhealthy", and 13.8% (n = 27) answered "not sure/don't know". Using Kendall's *tau*, there was no significant correlation between perceived health of apple cider vinegar and BMI, r_τ (193) = -.022, p = .685. A scatterplot showing the relationship of BMI to perceived health of vinegar is displayed in Figure 3.

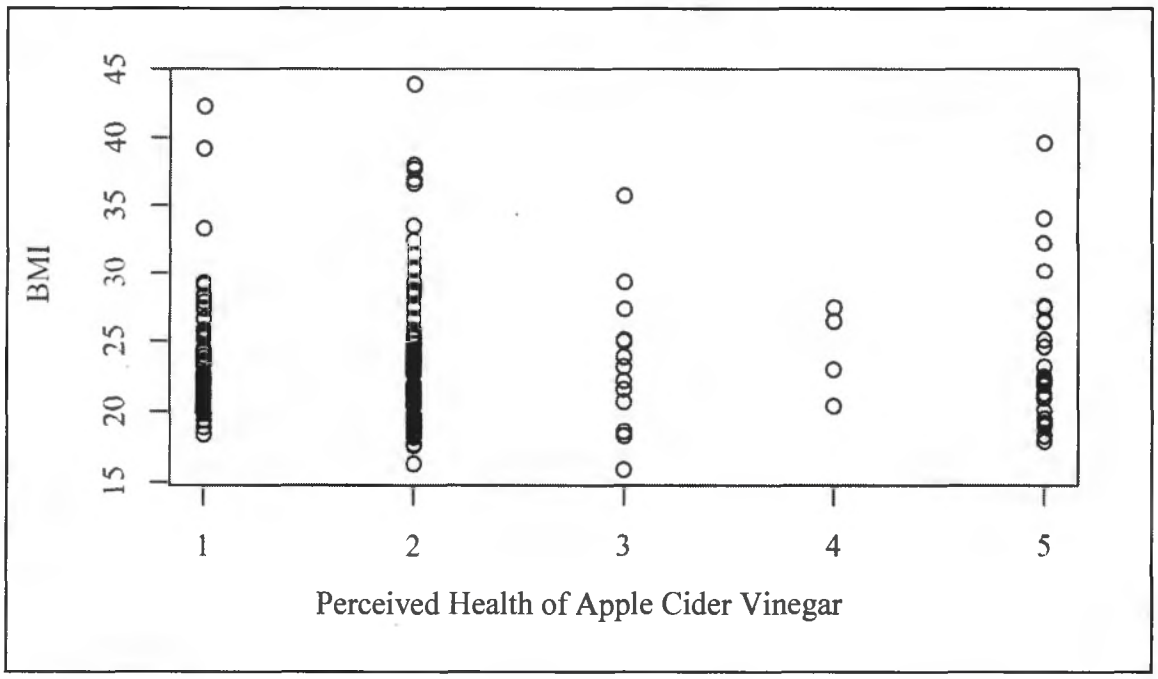

Figure 3. Relationship between BMI and perceived health of apple cider vinegar. 1- "Very Healthy, 2- "Somewhat Healthy, 3- "Not Healthy or Unhealthy", 4- "Unhealthy", 5- "Not Sure/ Don't Know.

Reported weekly consumption of apple cider vinegar showed 70.3% (n = 137) of participants answered they "never" eat or drink vinegar, 24.1% (n = 47) eat or drink vinegar "1-2 times" per week, 2.6% (n = 5) eat or drink vinegar "3-4 times" per week, 1.5% (n = 3) eat or drink vinegar "5-6 times" per week, and 1.5 % (n = 3) reported eating or drinking vinegar "every day". Using Kendall's *tau*, there was no significant correlation between weekly intake of apple cider vinegar and BMI, $r\tau$ (193) = -.040, p = .487. A scatterplot showing the relationship of BMI to weekly intake of apple cider vinegar is displayed in Figure 4.

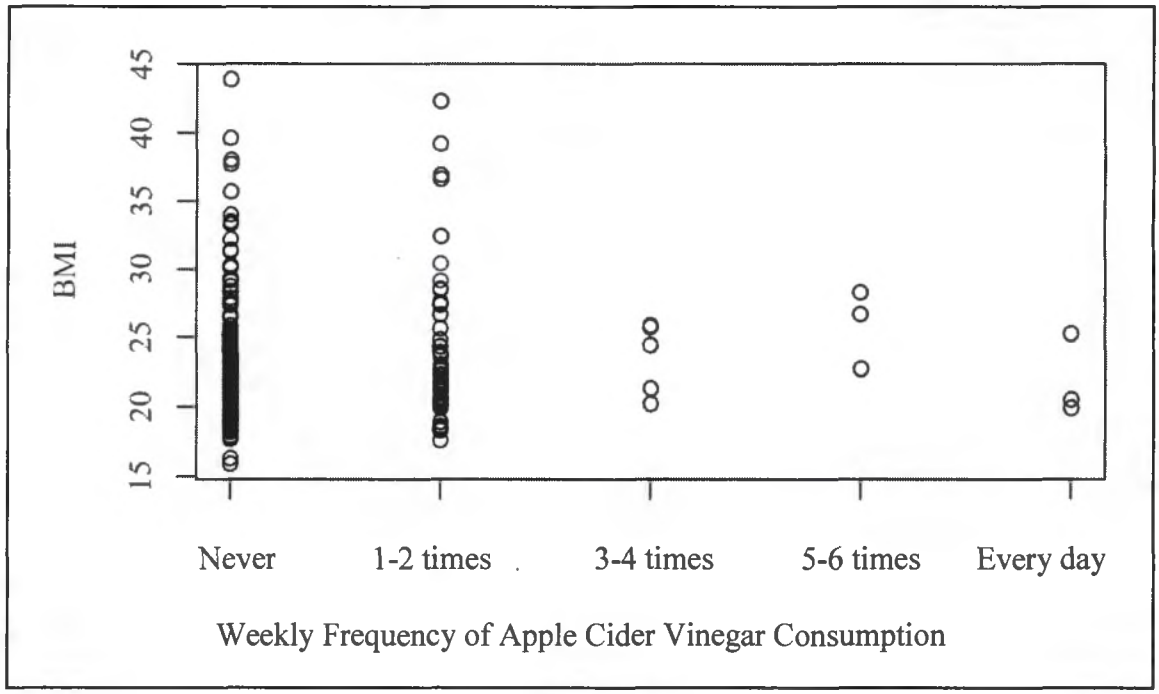

Figure 4. Relationship between BMI and frequency of apple cider vinegar consumption.

To establish whether there was a relationship between apple cider vinegar being perceived as very healthy and a corresponding increase in intake, categories of perceived health were used as follows: 28.7% (n = 56) perceived apple cider vinegar as "very healthy" where all other answers encompassed the remaining 71.3% (n = 139) of respondents. Individuals who reported high weekly intake of apple cider vinegar 5.6% (n = 11) answered "3-4 times", "5-6 times" or "every day" where all others who had low intake, 94.4% (n = 184) answered "1-2 times" or "never". Using a chi-square difference test, there was a significant difference observed between apple cider vinegar being perceived as very healthy when compared to high weekly intake of apple cider vinegar, χ^2 $(1, n = 195) = 50.67, p < .001, w = 0.51$.

Jackfruit

When examining the perceived health of jackfruit, 21.0% (n = 41) of respondents answered "very healthy", 40.0% (n = 78) answered "somewhat healthy", 6.7% (n = 13) answered "not healthy or unhealthy", 0.5% (n = 1) answered "unhealthy", and 31.8% (n = 62) answered "not sure/don't know". Using Kendall's *tau*, there was no significant correlation between perceived health of jackfruit and BMI, $r\tau$ (193) = -.042, p = .442. A scatterplot showing the relationship of BMI to perceived health of jackfruit is displayed in Figure 5.

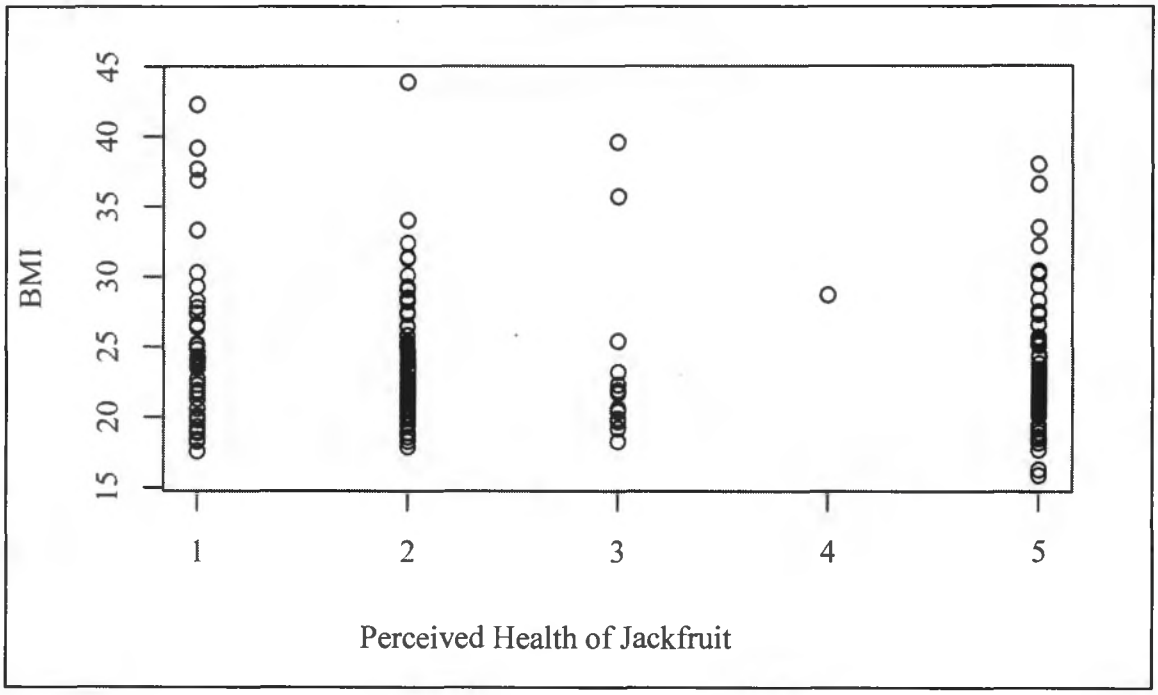

Figure 5. Relationship between BMI and perceived health of jackfruit. 1- "Very Healthy, 2- "Somewhat Healthy, 3- "Not Healthy or Unhealthy", 4- "Unhealthy", 5- "Not Sure/ Don't Know.

Reported weekly consumption of jackfruit showed 89.7% (n = 175) of participants answered they "never" eat jackfruit, 9.7% (n = 19) eat jackfruit "1-2 times"

per week, 0% (n = 0) eat jackfruit "3-4 times" per week, 0.5% (n = 1) eat jackfruit "5-6 times per week, and 0% (n = 0) reported eating jackfruit "every day". Using Kendall's *tau*, there was a significant positive correlation between increased weekly intake of jackfruit and increased BMI, r_{τ} (193) = .138, p = .020. A scatterplot showing the relationship of BMI to weekly intake of jackfruit is displayed in Figure 6.

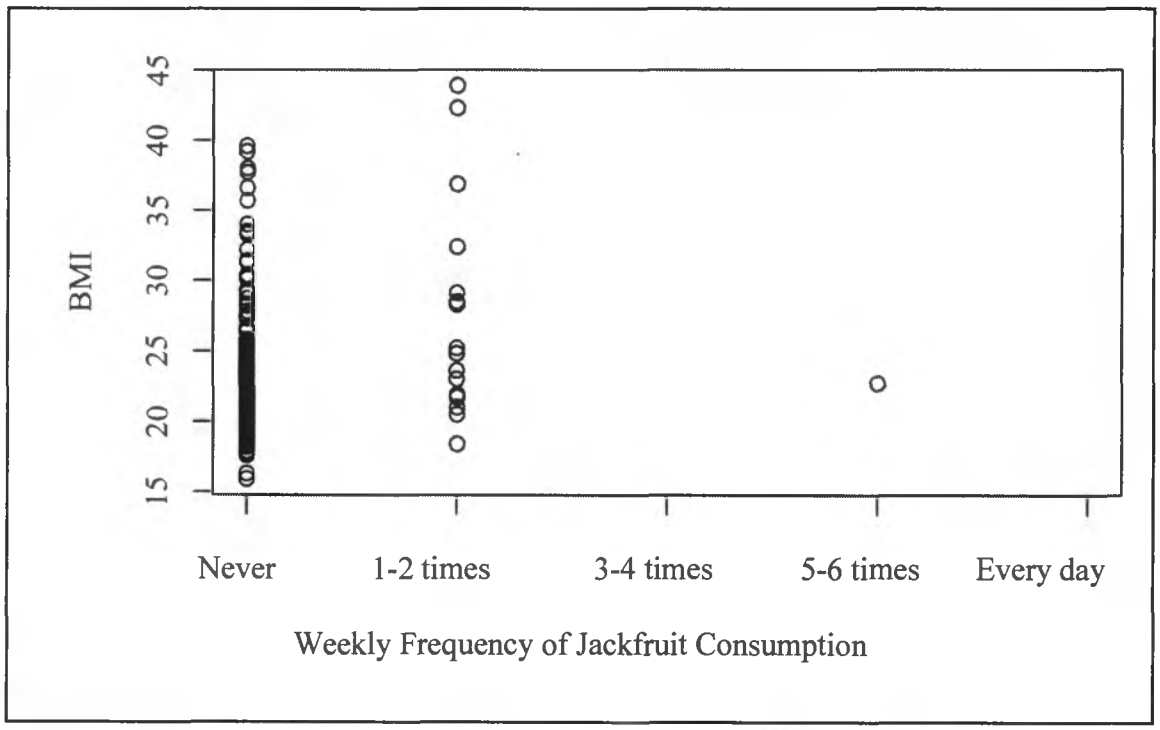

Figure 6. Relationship between BMI and frequency of jackfruit consumption.

To establish whether there was a relationship between jackfruit being perceived as very healthy and a corresponding increase in intake, categories of perceived health were used as follows: 21.0% (n = 41) perceived jackfruit as "very healthy" where all other answers encompassed the remaining 79.0% (n = 154) of respondents. Individuals who reported high weekly intake of jackfruit 0.5% (n = 1) answered "3-4 times", "5-6 times"

or "every day" where all others who had low intake, 99.5% answered "1-2 times" or "never". Using a chi-square difference test with Yates' correction, there was a significant difference observed between jackfruit being perceived as very healthy when compared to high weekly intake of jackfruit, χ^2 (1, n = 195) = 49.34, $p < .001$, $w = 0.50$.

Kefir

When examining the perceived health of kefir, 15.4% (n = 30) of respondents answered "very healthy", 14.4% (n = 28) answered "somewhat healthy", 3.1% (n = 6) answered "not healthy or unhealthy", 1.0% (n = 2) answered "unhealthy", and 66.2% (n = 129) answered "not sure/don't know". Using Kendall's *tau*, there was no significant correlation between perceived health of kefir and BMI, $r\tau$ (193) = .069, p = .224. A scatterplot showing the relationship of BMI to perceived health of kefir is displayed in Figure 7.

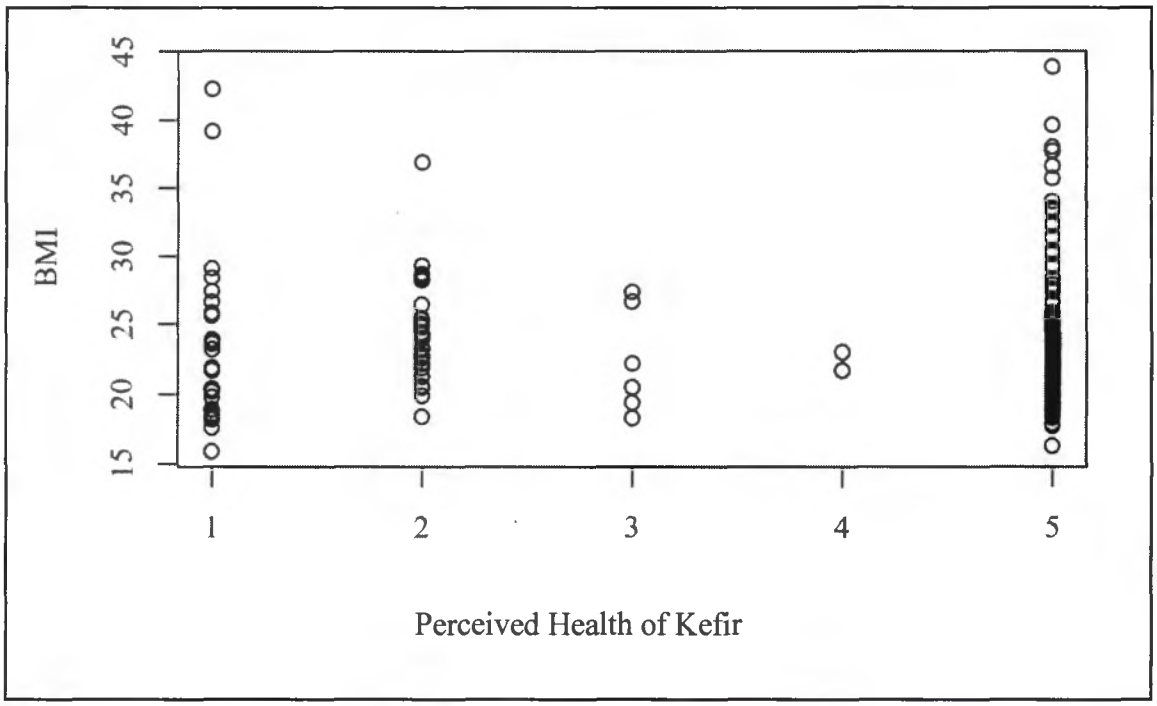

Figure 7. Relationship between BMI and perceived health of kefir. 1- "Very Healthy, 2- "Somewhat Healthy, 3- "Not Healthy or Unhealthy", 4- "Unhealthy", 5- "Not Sure/ Don't Know.

Reported weekly consumption of kefir showed 87.7% (n = 171) of participants answered they "never" eat or drink kefir, 9.7% (n = 19) eat or drink kefir "1-2 times" per week, 2.1% (n = 4) eat or drink kefir "3-4 times" per week, 0% (n = 0) eat or drink kefir "5-6 times per week, and 0.5% (n = 1) reported eating or drinking kefir "every day". Using Kendall's *tau*, there was not a significant correlation between weekly intake of kefir and BMI, $r\tau$ (193) = -.003, p = .960. A scatterplot showing the relationship of BMI to weekly intake of kefir is displayed in Figure 8.

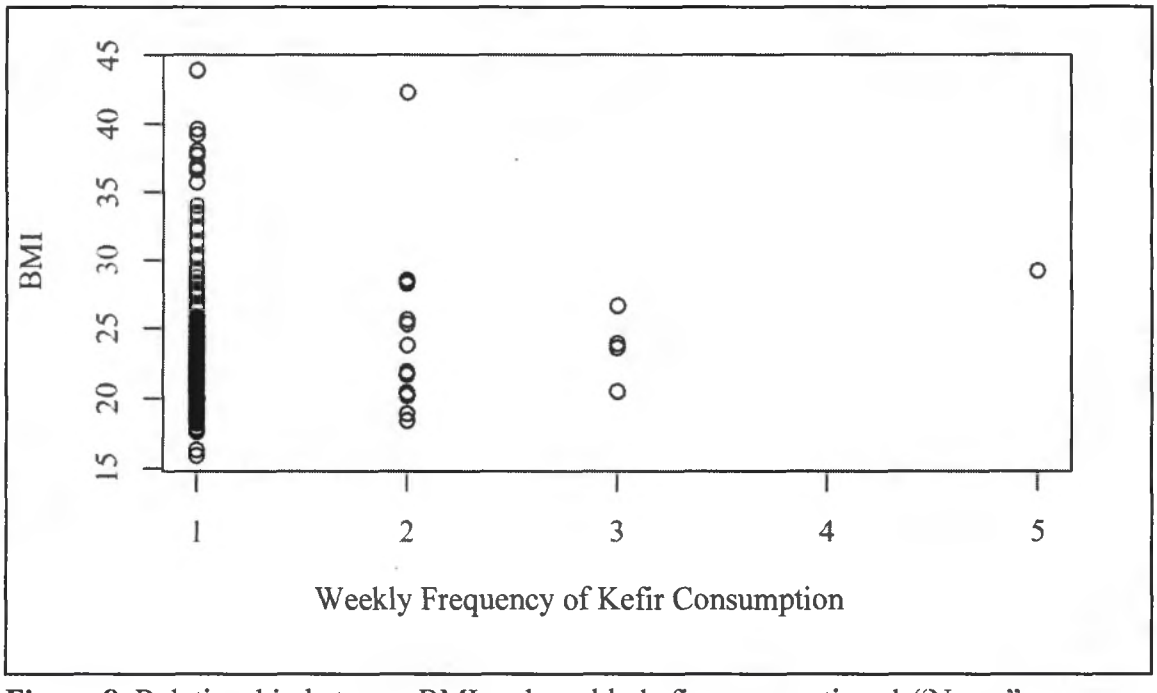

Figure 8. Relationship between BMI and weekly kefir consumption. 1-"Never", 2-"1-2 times", 3-"3-4 times", 4-"5-6 times", 5-"Every day".

To establish whether there was a relationship between kefir being perceived as very healthy and a corresponding increase in intake, categories of perceived health were used as follows: 14.4% (n = 28) perceived kefir as "very healthy" where all other answers encompassed the remaining 85.6% (n = 167) of respondents. Individuals who reported high weekly intake of kefir 2.6% (n = 5) answered "3-4 times", "5-6 times" or "every day" where all others who had low intake, 97.4% (n = 190) answered "1-2 times" or "never". Using a chi-square difference test, there was a significant difference observed between kefir being perceived as very healthy when compared to high weekly intake of kefir, χ^2 (1, n = 195) = 22.16, $p < .001$, $w = 0.34$.

Coconut Milk

When examining the perceived health of coconut milk, 24.6% (n = 48) of respondents answered "very healthy", 57.4% (n = 112) answered "somewhat healthy", 10.3% (n = 20) answered "not healthy or unhealthy", 2.1% (n = 4) answered "unhealthy", and 5.6% (n = 11) answered "not sure/don't know". Using Kendall's *tau*, there was no significant correlation between perceived health of coconut milk and BMI, $r\tau$ (193) = -.029, p = .600. A scatterplot showing the relationship of BMI to perceived health of coconut milk is displayed in Figure 9.

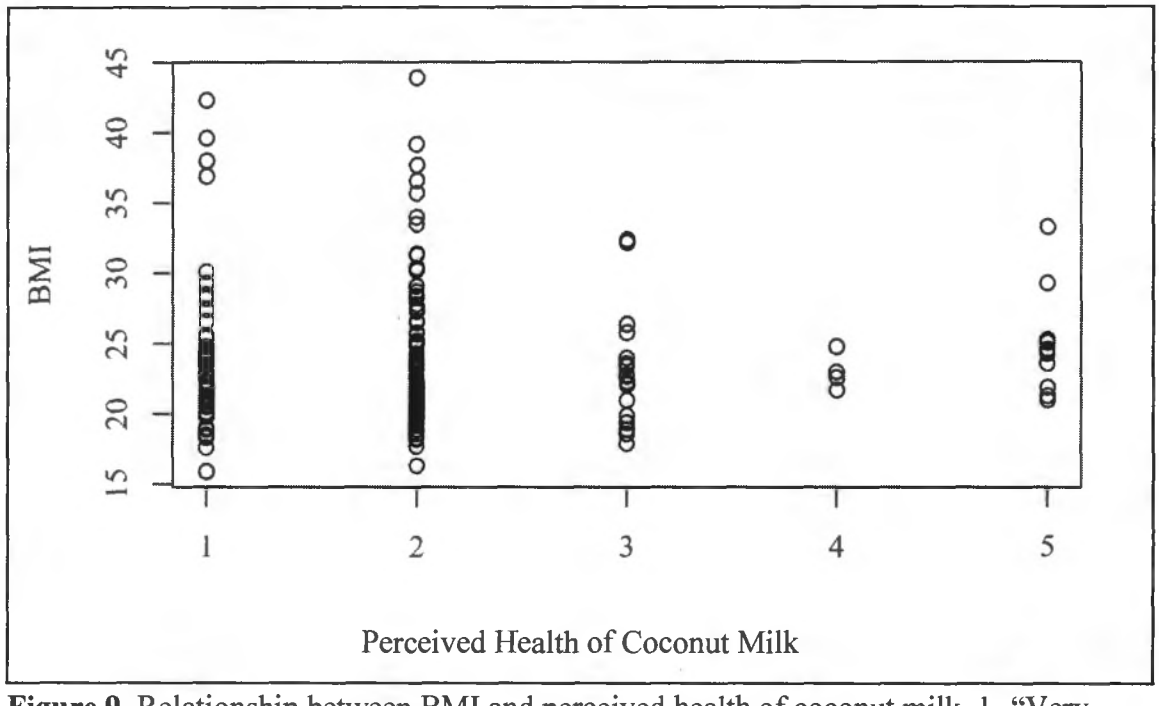

Figure 9. Relationship between BMI and perceived health of coconut milk. 1- "Very Healthy, 2- "Somewhat Healthy, 3- "Not Healthy or Unhealthy", 4- "Unhealthy", 5- "Not Sure/ Don't Know.

Reported weekly consumption of coconut milk showed 57.9% (n = 113) of participants answered they "never" eat or drink coconut milk, 32.8% (n = 64) eat or drink

coconut milk "1-2 times" per week, 6.7% (n = 13) eat or drink coconut milk "3-4 times" per week, 1.0% (n = 2) eat or drink coconut milk "5-6 times per week, and 1.5% (n = 3) reported eating or drinking coconut milk "every day". Using Kendall's *tau*, there was not a significant correlation between weekly intake of coconut milk and BMI, $r\tau$ (193) = .007, p = .903. A scatterplot showing the relationship of BMI to weekly intake of coconut milk is displayed in Figure 10.

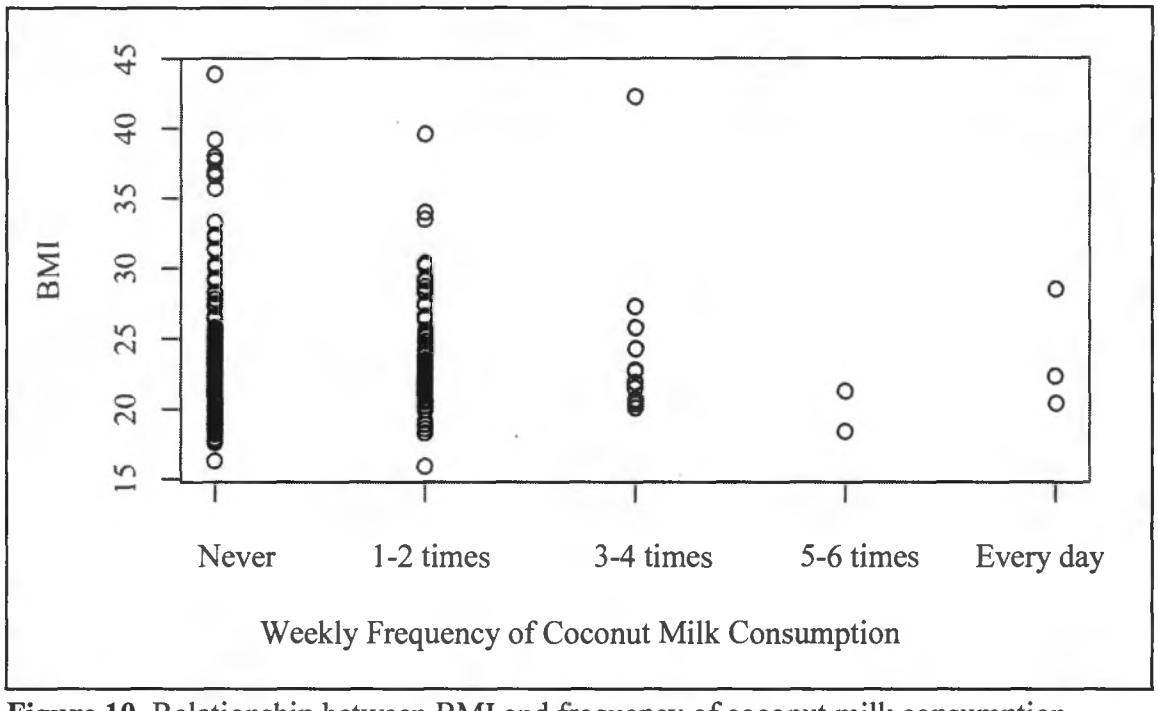

Figure 10. Relationship between BMI and frequency of coconut milk consumption.

To establish whether there was a relationship between coconut milk being perceived as very healthy and a corresponding increase in intake, categories of perceived health were used as follows: 24.6% (n = 48) perceived coconut milk as "very healthy" where all other answers encompassed the remaining 75.4% (n = 147) of respondents. Individuals who reported high weekly intake of coconut milk 9.2% (n = 18) answered "3-

4 times", "5-6 times" or "every day" where all others who had low intake, 90.8% (n = 177) answered "1-2 times" or "never". Using a chi-square difference test, there was a significant difference observed between coconut milk being perceived as very healthy when compared to high weekly intake of coconut milk, χ^2 (1, n = 195) = 24.83, $p < .001$, $w = 0.36$.

Discussion

Survey Results and Trendy Foods

None of the foods of interest revealed significant correlations between BMI and perceived health of the foods or between BMI and differing levels of weekly intake of the foods except for jackfruit intake (Figure 6). There was a positive correlation, using Kendall's *tau*, between increased weekly intake of jackfruit and increased BMI, r_τ (193) = .138, p = .020. This does not mean that an increase in jackfruit intake caused increased BMI, only that there was a weak positive relationship between the two variables. When the analysis was limited to Asian participants, who made up the largest percentage of race/ethnicity in the survey, results were similar where there were no significant correlations between perceived health of the foods and BMI or weekly intake of the foods and BMI except for jackfruit. There was a significant relationship between increased weekly intake of jackfruit and increased BMI in the Asian population as well, r_τ (84) = .308, p = .0006. Although the positive relationship between the two variables improves slightly when limited to the Asian population, there is still only a medium effect size between the increase in intake of jackfruit and increased BMI. Since the relationship between the variables became stronger when the Asian population was examined alone, this suggests the overall significant result for the increased intake of jackfruit having a significant relationship with increased BMI was likely the influence of this group. Using chi-square, no significant relationships existed between foods being perceived as "very healthy" and high weekly intake of the foods, defined as "3-4 times" per week or more. It

could be the students perceive the foods as healthy but eat them occasionally as part of what they consider to be a healthy diet.

While students were familiar with a few of the selected foods and had some concept of their "healthiness", the responses seem to indicate these foods are not high priorities in the students' eating patterns. Turmeric and apple cider vinegar were both perceived as "very healthy" by 28.7% (n = 56) of respondents and 5.6% (n = 11) reported high intake (3-4 times per week, 5-6 times per week, or every day) of both foods. Of those reporting high intake, one student reported consuming turmeric every day and three students reported consuming apple cider vinegar every day. The survey did not distinguish between functional foods and nutraceuticals, so there is no way to determine how these two foods were being consumed, as food, or in supplement form. Of the five foods, turmeric and apple cider vinegar could be either considered functional foods or dietary supplements depending on their modes of consumption. It is important to distinguish the difference between functional foods and supplements because the regularity of intake and the dose may vary greatly, thereby possibly impacting nutrition. An example of apple cider vinegar used as a functional food is as a regular addition to salads as part of a dressing. When used as a nutraceutical, there may be complications as there are no guidelines for safe dosage according to the Natural Medicines Comprehensive Database (Apple Cider Vinegar, 2017). Although rare, there have been problems associated with high intake such as esophageal injury related to the suspected high acid content of an apple cider vinegar pill and low potassium and osteoporosis in an

individual who consumed apple cider daily for 6 years (Apple Cider Vinegar, 2017). The limited scope of the current study does not allow for insight into the preparation methods of the foods consumed either which is an important consideration for nutritional value of the foods. Jackfruit is readily available in many stores in the San Francisco Bay Area in processed forms such as chips and candy. A study found processed fruit, such as canned or dried fruit, and fruit juices may have pro-obesity effects because they can increase calorie intake and reduce satiety when compared to whole, fresh fruit (Sharma, Chung, Kim, & Hong, 2016). Since the results showing a significant positive relationship between increased intake of jackfruit and increased BMI was stronger when the Asian population was isolated, there are likely some specific differences in food intake and preferences between populations within the survey, but further analysis is not possible due to constraints of the survey tool.

Coconut milk and kefir could both be considered functional foods. Coconut milk was considered "very healthy" by 24.6% (n = 48) of the students and 9.2% (n = 18) reported high intake (3-4 times per week, 5-6 times per week, or every day). Coconut milk had the highest weekly consumption of the five foods in the survey. On the other hand, kefir was the least popular where 14.4% (n = 28) students considered it "very healthy" and had the highest number of students 66.2% (n = 129) reporting they were "not sure/don't know" how healthy it was. Since the foods perceived as "very healthy" did correspond to high weekly intake, students may not be motivated to consume these foods often as "superfoods", but as occasional healthy foods in their diets. Functional

foods, specifically, and the motivation to purchase them falls into somewhat of a gray area since they may be targeted to different audiences based upon their specific health claims. A study found young adults aged 25-34 were interested in increased energy and added vitamins and minerals in functional foods when compared to "early-middle-aged" adults in the 35-44 age range who were more focused on foods which reduced cardiovascular disease risk or contained lower cholesterol (Krystallis, Maglaras & Mamalis, 2008).

There could be other explanations as to the significant differences between foods being reported as very healthy and increased intake. For instance, students may be young enough and healthy enough that the concepts of the HBM, which are "perceived susceptibility and perceived severity, perceived benefits and perceived barriers, cues to action, and self-efficacy" do not pertain to their cohort (Glanz & Bishop, 2010). The cues to action of the HBM stem from individuals acting based upon perceived susceptibility and perceived severity of a condition. If students are young and free of chronic illness, they may perceive certain foods as healthy, but they may not be motivated to act if the perceived benefits are lower than perceived barriers. A survey of college men found participants were aware fruits and vegetables were healthy, but identified issues such as dislike of the taste, lack of accessibility, and limited shelf life as barriers to regular fruit and vegetable consumption (Walsh et al., 2009).

In a study examining between-groups differences in nutrition- and health-related psychosocial factors, adults aged 20-34 scored significantly lower than adults aged 35-65

in the following measures: nutrition knowledge and beliefs, nutrition importance, considerations of key factors affecting food choices, awareness of nutrition-related health risks, and intention to improve diet (Wang & Chen, 2012). These disparities in nutrition beliefs and behaviors were also observed in a study of functional foods. Differences in willingness to purchase functional foods were revealed in the results of a study from Siegrist et al. (2008) which found older adults more willing to purchase functional foods than younger adults. The results of the current study may also reflect a mismatch of functional foods with specific characteristics which could have greater appeal with a younger cohort. In a study of functional foods, Ares & Gámbaro (2007) found sugary foods with functional additives like fiber or calcium appealed to younger adults more than to older adults.

The five foods included in the survey originated from top trending functional food searches on Google.com (Chi et al., 2016). Since the report has no pertinent information regarding the ages of individuals who conducted the internet searches, there may have been a marked difference in the popularity of search subjects when compared to the interests of the students at SFSU. According to the report, of the 3.9 million views of turmeric videos on YouTube.com, the subjects of interest included "acne, arthritis, blood sugar, blood thinner, cardiovascular, chronic joint pain, depression, detoxification, gall bladder, cancer, high blood pressure, high cholesterol, inflammation, liver detoxification, and weight loss" (Chi et al., 2016). Many of these health concerns, such as chronic joint pain, cancer, high blood pressure, and high cholesterol are associated more with the aging

process and chronic conditions and may not be within the purview of college students. A study of motivating factors for the purchase of functional foods found that young adults were more interested in foods claimed to provide "more energy" and improve overall physical performance where older adults were more interested in reducing cardiovascular disease risk and in general disease prevention (Krystallis et al., 2008). Aside from motivating factors associated with food choice, younger adults may also process information from the internet differently than their older counterparts.

Young adults currently between the ages of 18 and 35 have grown up in the internet age where nutrition and health advice are available via a brief online search. In a study of the online habits of university students, 66.1% searched for health information including specific illness, treatment options, and alternative treatments (Horgan & Sweeney, 2012). Only 3.5% of the health information searches were for alternative treatments, which may or may not have included dietary supplements or functional foods. The subjects of highest interest in the health information category revolved around sexual health, "such as contraception, sexually transmitted diseases, erectile dysfunction, and pregnancy" (Horgan & Sweeney, 2012). Overall though, students spent far more time searching for information regarding college, sending e-mails, social networking, and on news and entertainment, which may reflect a hierarchy of priorities during this busy time of life.

The hypothesis for the current study, students' positive perception of the five trendy health foods and higher weekly intake of these foods may be associated with lower

BMI, was based upon a study which found an association between increased supplement intake and lower BMI (Anders & Schroeter, 2017). Although only two of the foods included in the survey, turmeric and apple cider vinegar, can be consumed as either functional foods or as dietary supplements, there was no other research at the time which examined the relationship between BMI and functional foods. Since functional foods and nutraceuticals are often discussed together due to some of the similarities, it was thought the relationship between lower BMI and supplement intake found by Anders and Schroeter (2017) may extend to functional foods. This was not the case for students in the current study at SFSU and may be related to the age of the population, and a possible mismatch with the foods in the survey. A study examining the motivating factors for supplement use in the U.S. found that younger adults were more interested in short-term benefits such as increased energy or enhanced immune function where older adults were motivated to use supplements for heart health or memory (Bailey, Gahche, Miller, Thomas & Dwyer, 2013).

More important though than motivation for the consumption of nutraceuticals or functional foods, is safety. Dietary supplements are often perceived and promoted as "natural" products, and therefore, safe to purchase over-the-counter. There are concerns, however, as use of supplements may cause drug interactions, and may not contain the exact ingredients listed on the bottle (Carroll, 2018). Furthermore, it is estimated "about 23,000 visits to emergency departments each year can be attributed to adverse events from dietary supplements" (Carroll, 2018). As for functional foods, there are concerns

that those with added ingredients may impact the absorption of nutrients given the lack of their safety given the lack of science-based evidence (Marone, Birkenbach & Hayes, 2016). Given the questionable evidence to support the use of functional foods and supplements, and the possibility of adverse effects, nutrients from a diet high in fruits, vegetables, and whole grains continues to be a prudent way to support good health. According to the *Nielsen Global Health and Wellness Report*, however, 21% of survey respondents in North America are willing to pay more for GMO-free or fortified foods (Nielsen, 2015). Prudence, and practical, affordable advice may not be the only solutions consumers and patients are looking for when making food and supplement choices.

BMI and Demographics

The BMI results from the survey are only pertinent for the survey sample at SFSU. BMI results cannot be generalized to the SFSU population because they were calculated based upon self-reported height and weight in the survey sample and were significantly different from the population of California. The significant difference between populations held when the BMI ranges of the survey sample of 18 to 34-year-old individuals was compared to 18 to 34-year-old people in California. This may be in part due to the large number of Asian participants (n = 86) 44.1% in the study. In 2016 in California, those who identified as Asian were categorized according to BMI as follows: underweight (5.8%), healthy weight (54.6%), overweight (30.1%), and obese (9.5%), (BRFSS Prevalence & Trends Data, 2018). This means there may have been more individuals in a healthy weight range in the study compared to the population of adults

over the age of 18 in California in 2016 who were categorized according to BMI as follows: underweight (2.6%), healthy (36.4%), overweight (36.0%), and obese (25%), (BRFSS Prevalence & Trends Data, 2018). Had BMI been more representative of the state, results may have been closer to reflecting the population of SFSU. Even when the BMI ranges of Asian participants were compared to BMI ranges of Asians in California, significant differences were still observed. The survey sample was not representative of BMI ranges of Asian individuals in California and cannot be generalized outside the survey. Although BMI categories for some Asian groups is lower, where > 23.0 kg/m² is considered overweight according to the World Health Organization, the current study used standard categories given they were utilized by the CDC in estimating prevalence of obesity in California (WHO, 2004). The sample was also not representative of the reported race/ethnicity of the population of SFSU, so results cannot be generalized to SFSU at large, and are only applicable to this specific population of students.

Nutrition Knowledge

Since some exposure to nutrition knowledge may have informed students' answers in the survey, two questions were included regarding RDN visits and nutrition classes. In terms of both prior visits to a RDN and taking a Human Nutrition class, there was no significant relationship between either of these factors and BMI. Education beyond high school, higher socioeconomic status, and ethnicity were all associated with better knowledge surrounding nutrition and food choice in a study conducted by Wang

and Chen (2012). Given the students in the SFSU survey sample are all enrolled in college, there may already be some basic nutrition knowledge across all BMI categories.

Limitations

There were several limitations that may have affected the conclusions of the current study. The Healthy Food Survey used in the study at SFSU was modeled after existing validated tools like the DHQ II, developed by the NCI (2018), and the NHANES Food-frequency Questionnaire, developed by the NCI (2018). There may have been some issues with the wording of the questions that compromised internal validity. The students may have given biased answers to questions such as "How healthy do you think turmeric is?" Although the wording was discussed with individuals close in age to the population of interest, and was discussed with graduate advisors, the questions may not have captured the variable well. Since the questions were about perception of health of the foods, students may have felt pressured to answer that the foods were healthy. On the other hand, it very well could be that the students perceived the foods as healthy but were not consuming them as functional foods or as nutraceuticals, and instead were eating them as part of a healthy and well-balanced diet.

The BMI measurements in the current study may have some error as the values were calculated based upon self-reported height and weight by SFSU students in the survey. BMI is not a precise instrument for estimating body fat and is not always accurate, but because it is such a practical and inexpensive measure, it is often a good place to begin assessments of adequate nutrition. In a study comparing BMI based upon

self-reported height and weight and BMI based upon measured height and weight, Stomel and Schoenborn (2009) found "more than 43% of respondents classified as 'underweight' and 16% of respondents classified as 'overweight' based on measured BMI were classified as 'normal weight'…19% of respondents classified as 'obese' using measured BMI were misclassified as 'overweight' using self-reported BMI". Overall, however, the differences were found to be "within the margins of sampling errors" (Stomel & Schoenborn, 2009).

The study participants were mostly female 75.9% (n = 148), and due to gender norms, there may have been a tendency to underreport weight according to the findings of Stomel and Schoenborn (2009). Without accurately measuring height and weight, this will remain an unknown influence upon the results of the study. In addition, the reported gender of individuals in the study was significantly different than the population at SFSU. The limitations were significant, but there are still a few conclusions which may help to guide future study.

Implications for RDNs

Although the findings of the current study only resulted in one significant association between increased intake of jackfruit and increased BMI, the lack of results is promising. For RDNs trying to understand how pop culture, advertising, and food marketing are impacting what individuals consume, these results allow for some insight into this specific population. In this very limited study of students at SFSU, participants indicated there were foods they thought were "very healthy", however, corresponding

intake did not increase dramatically. This may indicate the five foods are incorporated into a healthy diet or are outside the scope of knowledge and not prioritized as functional foods or supplements by this population.

Conclusion

The demand for functional foods and nutraceuticals continues to grow as the market in the U.S. in 2015 was $64.8 billion dollars and expected to grow to $102.6 billion dollars by 2024 (U.S. Nutraceuticals, 2017). When individuals search the internet for solutions to health problems, they will encounter misinformation. The current study set out to explore if five trendy functional foods (turmeric, apple cider vinegar, kefir, coconut milk, and jackfruit) were perceived as healthy by SFSU students, whether students consumed these foods throughout a typical week, and whether there was any relationship between these factors and healthy BMI. Other than one weak positive correlation between increased intake of jackfruit and increased BMI, none of the results were significant, and cannot be generalized outside this specific sample of SFSU students. This study contributed, ever so slightly, to the knowledge available to RDNs in that this small group did not seem to be prioritizing trending foods from Google.com searches (Chi et al., 2016). Future studies could help to determine how and what nutrition information and advice is reaching college students via the internet. If students are consuming functional foods and supplements regularly, it would be worthwhile to understand what their priorities and motivations are when making purchases. Science-based and government websites could find ways to incorporate some of the tactics used

by nutraceutical and food manufacturers to promote good nutrition in college-aged individuals to encourage maintenance of healthy weight into later adulthood.

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Appendix 1

Introduction to Survey

First, I want to thank Professor _____ for letting me take a few minutes of class time today. My name is Krista Winchester, I graduated with my BS in Dietetics from SF State, completed my Dietetic Internship here, and am now working as a Registered Dietitian Nutritionist while I pursue my master's in Family & Consumer Sciences. For my thesis, I am conducting a survey in a core class in each of the six colleges at SF State. I am interested in foods that are trending on Google searches to find out whether there is any relationship between trendy health food consumption and Body Mass Index in University students.

Participation is voluntary, and you must be 18 years or older and agree to the informed consent at the beginning of the survey. If you choose to participate, please keep in mind there are no right or wrong answers, and the information will be going into a database without any identifying information. If you complete the survey, you'll be helping me with my thesis and you will be helping to further evidence-based nutrition science.

Appendix 2

Healthy Food Survey

(format of original survey was 12-point font)

Implied Consent to Participate in Research

Data collected from this confidential survey will be used for completion of a master's degree in Family & Consumer Sciences at San Francisco State University. The information gathered will be used for research on the relationship between trendy health food consumption and Body Mass Index (BMI) in students at San Francisco State University.

The survey questions will be about five foods, whether you think they are healthy, and how often you eat these foods. There will also be questions about weight, height, demographic information, and income. You have been invited to participate because you are a student at San Francisco State University.

You must be 18 years of age or older to participate. There are no risks or benefits to you in participating in this survey. You may choose to participate or not. You may answer only the questions you feel comfortable answering, and you may stop at any time. If you do not wish to participate, you may simply return the blank survey, with no penalty to yourself. If you do participate, **completion and return of the survey indicates your consent to the above conditions. Your decision whether or not to participate in this research will have no influence on your present or future status at San Francisco State University.**

Please do not put your name on this form. The survey should take approximately 10 minutes to complete.

Any questions or concerns should be directed to the principal investigator, Krista Winchester, R.D.N., at knawin@mail.sfsu.edu,or the research advisor, Professor Gretchen George, Ph.D., R.D.N, at glgeorge@sfsu.edu.

Instructions

- For the five foods listed below, think about whether they seem healthy to you.
- Think about how often you usually eat or drink these foods.
- For height, spaces are available for feet/inches **or** centimeters.
- For weight, spaces are available for pounds **or** kilograms.
  -use whole numbers to fill in one value for height (feet/inches **or** centimeters) and one value for weight (pounds **or** kilograms)
- Choose the best answer for each question. Mark only one answer for each question.

1. How healthy do you think turmeric is?

☐ Very healthy ☐ Somewhat healthy ☐ Not healthy or unhealthy

☐ Unhealthy ☐ Not sure/Don't know

1a. During a usual week, how often do you eat turmeric?

☐ Never ☐ 1-2 times per week ☐ 3-4 times per week

☐ 5-6 times per week ☐ Every day

2. How healthy do you think apple cider vinegar is?

☐ Very healthy ☐ Somewhat healthy ☐ Not healthy or unhealthy

☐ Unhealthy ☐ Not sure/Don't know

2a. During a usual week, how often do you eat or drink apple cider vinegar?

☐ Never ☐ 1-2 times per week ☐ 3-4 times per week

☐ 5-6 times per week ☐ Every day

3. How healthy do you think Jackfruit is?

☐ Very healthy ☐ Somewhat healthy ☐ Not healthy or unhealthy

☐ Unhealthy ☐ Not sure/Don't know

3a. During a usual week, how often do you eat Jackfruit?

☐ Never ☐ 1-2 times per week ☐ 3-4 times per week

☐ 5-6 times per week ☐ Every day

4. How healthy do you think kefir is?

☐ Very healthy ☐ Somewhat healthy ☐ Not healthy or unhealthy

☐ Unhealthy ☐ Not sure/Don't know

4a. During a usual week, how often do you drink kefir?

☐ Never ☐ 1-2 times per week ☐ 3-4 times per week

☐ 5-6 times per week ☐ Every day

5. How healthy do you think coconut milk is?

☐ Very healthy ☐ Somewhat healthy ☐ Not healthy or unhealthy

☐ Unhealthy ☐ Not sure/Don't know

5a. During a usual week, how often do you eat or drink coconut milk?

☐ Never ☐ 1-2 times per week ☐ 3-4 times per week

☐ 5-6 times per week ☐ Every day

6. Have you ever taken a Human Nutrition class?

☐ Yes ☐ No

7. Have you ever seen a Registered Dietitian for nutrition advice?

☐ Yes ☐ No ☐ Not sure/Don't know

8. What is your current weight?

_____pounds **or** _____kilograms

9. What is your current height?

_____feet/inches **or** _____centimeters

10. What is your age?

_____ years

11. What is your grade level in college?

☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior ☐ Graduate

12. What is your gender?

☐ Male ☐ Female ☐ Other

13. What is your race and/or ethnicity?

race(s) and/or ethnicity(s)_____

_____

14. What is your monthly household income?

☐ Less than $1,000

☐ $1,000 to $1,999

☐ $2,000 to $2,999

☐ $3,000 to $3,999

☐ $4,000 to $4,999

☐ $5,000 to $5,999

☐ $6,000 to $6,999

☐ Greater than $7,000

☐ Not sure/Choose not to answer

Thank you for participating in this survey.