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# Assessing Plant-Based Food Lifestyle to Reduce Obesity Risk

Erna Siregar
*Walden University*

# Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Erna Siregar

has been found to be complete and satisfactory in all respects,
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the review committee have been made.

Review Committee
Dr. Howell Sasser, Committee Chairperson, Public Health Faculty
Dr. Vasileios Margaritis, Committee Member, Public Health Faculty
Dr. Amy Thompson, University Reviewer, Public Health Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
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Abstract

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## Abstract

Despite an increasing number of healthy lifestyles throughout the country, Americans, including Native Hawaiians, keep gaining weight. Unlike several American lifestyles that have resulted in weight gain within the American population, the vegetarian lifestyle is a scientifically proven method for decreasing body weight and maintaining the weight loss for more than 1 year. This study aimed to compare the lifestyle patterns of 4 vegetarian lifestyles and 1 nonvegetarian lifestyle among Native Hawaiians aged 21 and older using their body mass index (BMI). This quantitative study utilized a correlational design, which is particularly suitable for examining the relationship of BMI to eating lifestyle and such variables as physical activity. A survey with 18 questions was administered to participants ($n$ = 300) who have chosen a specific lifestyle and have been following this lifestyle for 1 year or more. The main research question investigated the difference in the body weight of Native Hawaiians aged 21 and older who followed and maintained a vegan, lacto-ovo vegetarian, semivegetarian, or nonvegetarian diet. Participants' BMI was affected by the factors of age, self-efficacy, disease status (high blood pressure, no health risks), and eating habits (Vegetarian Lifestyle Scale). While the Vegetarian Lifestyle Scale was a significant predictor of BMI, there was no significant difference in the effect of the 2 lifestyle classifications of nonvegetarian and vegetarian on BMI, after controlling for other relevant factors. This study aimed to effect social change in the Native Hawaiian community by demonstrating the health benefits of a plant-based diet and better informing public health officials to guide their development of more effective nutrition and weight loss programs for Native Hawaiians.

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# Dedication

I dedicate my dissertation to my husband, John A. Siregar, PhD, MPH and to my children for their encouragement and for always helping me and believing that I could do it with God's help.

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# Chapter 1: Introduction to the Study

## Introduction to the Study

According to a report from the Hawaii Department of Health, approximately 18% of the people living in Hawaii are overweight, compared with nearly 42% of Native Hawaiians (McCubbin & Antonio, 2012). Additionally, the same report suggested that Native Hawaiians were at one time up to 70% overweight or obese (McCubbin & Antonio, 2012). Moreover, 44% of all Native Hawaiians are obese, compared with 21% of Whites in the mainland United States. One study indicated that Native Hawaiians are twice as likely to be obese when compared with the average American (Science News, 2010). Obesity is a serious health concern for any population given that it is associated with an increased risk of mortality and morbidity for people with high blood pressure, heart disease, diabetes, cancer, and digestive diseases.

## Background

The prevalence of adult overweight in the United States increased by 56% from 1988 to 1994 and 65% from 1999 to 2000. The Centers for Disease Control and Prevention (CDC) reported that, in 2014, more than 70% of American adults were overweight and over 37% of Americans were obese (CDC, 2015b). Compared with the general American population, the Native Hawaiian population has a much higher obesity rate, one that also exceeds the obesity rate of other ethnic groups in Hawaii (Maskarinec et al., 2006). In 2009, the Hawaii Department of Health pointed to the alarming statistic that Native Hawaiians had a prevalence rate of 70% for overweight and obesity.

Before Western contact in 1778, the population of Native Hawaiians was about 400,000, but this number decreased dramatically to between 7,000 and 8,000 in the late

1900s, according to Schmitt and Stannard (as cited in B. Hope & J. Hope, 2003, p. 1), reflecting a decline of nearly 98%. In contrast, the population of people who are part Hawaiian or mixed blood Hawaiian increased from zero to 401,162 (United States Department of Commerce, 2000). Research has indicated that, post-contact, the Hawaiian population has had high rates of physical morbidity and mortality, high rates of mental illness, low socioeconomic status, and low education levels. Additionally, Hawaiians have historically relied heavily on the U.S. welfare system and exhibited high rates of incarceration, drug abuse, high-risk behavior, and obesity (Blaisdell, 1989, 1990, 1996).

Western contact resulted in the virtual obliteration of the Hawaiian cosmology, beliefs, land, occupation, values, language, and lifestyle (Bushnell, 1993; Halfords, 1954; Mills, 1981), which likely also affected Native Hawaiians' eating habits and nutrition. Studies have shown that the Native Hawaiian population generally eats natural, healthy foods (78% complex carbohydrates, 12% protein, and 10% fat, with high levels of fiber intake) and is physically active (Shintani, 1993; Shook, 1985) but still exhibits high levels of obesity. The results of a 1993 study by Kumanyika showed that 50% of Native Hawaiians were severely overweight, compared with 45% of Samoans in Hawaii. Additionally, 16% of Native Hawaiians were overweight, compared with 30% of Samoans in Hawaii. The results also indicated that Native Hawaiians were the most obese of all minority groups in the United States in 1993, although Samoans in Hawaii had the largest percentage of overweight people.

Aluli, Reyes, and Tsark (2007) found that the combined overweight and obese Native Hawaiian population in 2007 constituted 75% of the total population of Hawaii. Obese Native Hawaiians, who were 39% of the population, were twice as obese as

Whites (19%) and three times as obese as Japanese (12%). A 2012 study by McEligot et al. suggested an increase in the obesity rate from 2007, with nearly 88% of Native Hawaiians living in Hawaii identified as either overweight or obese in 2012. The same study also found that 87% of the Native Hawaiians living in California were obese (McEligot et al., 2012). The following is an outline of the specific research problem addressed in this study.

## Problem Statement

The previously cited high rates of overweight and obesity among the Native Hawaiian population cause numerous adverse health effects. For example, the Native Hawaiian population experiences a 10% higher rate of cardiovascular disease when compared with the mainland U.S. population, and a 35% higher rate compared with nonnative Hawaiian residents (Aluli et al., 2007). Native Hawaiians also experience early mortality, with an average age at death of 65 years, compared with 75 years for Whites (Aluli et al., 2007). Finally, the high obesity rate and the unhealthy lifestyle associated with it are contributors to high rates of cancer in Native Hawaiians (McEligot et al., 2012), underscoring the need for more studies to address the obesity epidemic among Native Hawaiians.

## Purpose of the Study

The purpose of this quantitative, correlational study was to identify the associations between a vegetarian lifestyle and obesity for Native Hawaiians who live on the Big Island in Hawaii. The Native Hawaiian population lives on a diet rich in meat and high-fat dairy products, which seems to be a possible reason for its minimal success with weight management. The correlational design is beneficial when conducting a study

investigating the relationship between two variables (Bartram et al., 2012), such as diet and weight. The dependent variable was the body mass index (BMI), a calculation that is based on body weight and body height. The independent variables were explanatory and included five food lifestyles: a nonvegetarian lifestyle and four levels of a vegetarian lifestyle. Independent variables in this study also included demographic variables.

The goal of this study was to contribute to social change through the promotion of a healthy lifestyle. The study's results could potentially inform the work of public health practitioners in the creation of modern health policies in conjunction with other experts. The study was also intended to begin to close the gap in the literature regarding the comparative effects of meat-eating lifestyles and vegetarian lifestyles on the overweight and obesity rate of Native Hawaiians.

## Research Questions and Hypotheses

The research questions and hypotheses developed for this study were as follows:

RQ: Are there differences in BMI between Native Hawaiians aged 21 and older who classify their lifestyle/diet as nonvegetarian vs. vegetarian, after controlling for demographic variables and factor scores obtained from the Native Hawaiian Lifestyle Survey?

$H_{01}$: None of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{a1}$: At least one of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{02}$: After controlling for the descriptive variables, none of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{a2}$: After controlling for the descriptive variables, at least one of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{03}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian do not differ on the dependent variable of BMI.

$H_{a3}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian differ on the dependent variable of BMI.

## Theoretical Framework

Bandura's (1977) *self-efficacy theory*, which is part of social cognitive theory, suggests that people's beliefs in their own abilities and characteristics guide their behavior, determining how much effort they put into controlling their weight. Bandura's (1977) research described how control of eating behavior shifts from external sources to the individual. Several studies related to overweight adults have demonstrated that self-efficacy governs beliefs, lifestyle, and weight control, at least in part (Bernier & Avard, 1986; Slater, 1989). Because self-efficacy theory is a productive lens through which to understand the relationship between lifestyle choices and obesity prevention among Native Hawaiians (Baranowski et al., 2002), it provided an excellent framework for this study.

Additionally, the determinants of self-efficacy theory are designed to measure people's confidence or perceived ability to perform self-regulatory skills, such as maintaining a vegetarian lifestyle, reducing caloric intake, and exercising. The flexible nature of self-efficacy theory and its multiple associated constructs were thus an ideal fit for this study. Core determinants of self-efficacy related to the promotion of healthy behaviors included knowledge of health practices and risks for Native Hawaiians (Bandura, 2004).

In particular, Native Hawaiians must exercise high levels of self-efficacy daily when experiencing perceived social environmental inhibitors and impediments to making healthy behavioral choices (Bandura, 2004). As Dressler and Smith (2013) explained, there is a difference in the food choice efficacy, eating behavior, and food liking of participants with a healthy weight and those who are overweight or obese. It is thus important to consider self-efficacy and its related constructs when examining the lifestyle and BMI of Native Hawaiians.

## Nature of the Study

This study utilized a quantitative methodological approach with a correlational design. It was determined that quantitative methodology was more appropriate for the research topic than a qualitative or mixed methods approach primarily because quantitative analysis is better equipped for large sample sizes and more easily enables generalizing the findings to the broader population, compared with the two other methodologies. As Barr and Welch (2012) explained, qualitative research is most appropriate in order to gain a deeper understanding of aspects of social life for the purpose of generating themes and ideas for analysis.

Moreover, quantitative methodology was deemed the most appropriate for the study given the unique requirements associated with the study topic, which included the need to accommodate a large, widely dispersed sample. Yamashiro et al. (2010) demonstrated the advantage of quantitative methodology for working with a large sample size in their quantitative study on the effects of group-based lifestyle interventions on risk factors and insulin resistance for people at risk for metabolic syndrome ($N = 2986$). Yamashiro et al. (2010) also demonstrated the effectiveness of quantitative methodology for studies that utilize statistical models to test research hypotheses. In their study, the researchers used repeated analysis of variance (ANOVA) measures for continuous variables to test mean differences among groups over several periods, a design similar to that of the present study.

Furthermore, quantitative methodology enables researchers to draw inferences about a population based on participant responses to closed-ended questionnaires, as exemplified by Bhatti et al.'s (2013) study. By utilizing quantitative analysis of a closed-ended questionnaire, the researchers gained insight into the effects of leadership styles on job satisfaction in participants ($N = 205$). This methodology proved particularly beneficial for collecting primary data and for employing measures of central tendency to understand distribution within the sample. A quantitative methodology is also appropriate for studying a sample dispersed over a large geographical area, such as the Big Island of Hawaii. Bhatti et al.'s (2012) study demonstrated this advantage, as it involved a sample of public and private school teachers dispersed throughout the large geographical area of Lahore, Pakistan.

A correlational design was chosen for this study because there was no random assignment of participants to groups. The purpose of a correlation test is to understand changes in the independent variable associated with changes in the dependent variable (Ohsiek & Williams, 2011). In contrast, quasi-experimental and true experimental designs are beneficial when utilizing interventions, experimental groups, and random assignment groups to conduct a study (Griffioen-Roose et al., 2012)—none of which was the case in the present study. Rather, participants belonged to preexisting groups that were based on the lifestyle that they chose and had been following for 1 year or more. This correlational design offered the benefit of using a closed-ended survey instrument as the method of observation. The survey included 18 questions related to eating lifestyles, BMI, and other components of a healthy lifestyle. A correlational design is particularly useful for conducting *t* tests, ANOVA tests, and regression analyses to compare mean group differences in BMI (Ohsiek & Williams, 2011).

The design of the proposed study allowed the examination of the effect of food lifestyle choice on body weight for Native Hawaiians who had each chosen one of the food lifestyles and maintained that lifestyle for at least 1 year. Study participants were Native Hawaiians aged 21 and older. Participants were recruited through facilities on the Big Island of Hawaii that included the Native Hawaiians' health care system facilities, the YMCA facilities, churches located in Hilo, and several others. Observations included self-reported demographics, anthropometrics, comorbidities, and food lifestyles. These observations are useful in assessing the characteristics of successful weight management among five types of food lifestyles. The dependent variable was participants' BMI, and

the independent variables were the five food lifestyles, including four levels of vegetarians and one nonvegetarian level labeled a *meat-eater lifestyle*.

## Definition of Terms

*Body mass index (BMI)*: This was the dependent variable in the current study. BMI is a number calculated using the body weight and height of a person. The formula and calculation of BMI is $(WT/HT^2)X703$, where WT = weight in pounds and $HT^2$ = height in inches squared. According to the CDC (2015), BMI is used for screening and identifying possible weight problems for adults. It is also a reliable indicator of a person's body "fatness." The CDC chose BMI to measure overweight and obesity because it requires only the height and weight of participants, making it an inexpensive and easy way to calculate obesity in participants. BMI scores also allow people to compare their own weight status with that of the public (CDC, 2015a).

*Diet*: The food and drink regularly consumed by a person or group. For example, the diet of Native Hawaiians includes foods that they regularly consume, and a gluten-free diet includes foods regularly consumed by people who cannot tolerate gluten (Matavuli, 2013). A secondary definition is the restriction of oneself to small amounts or special kinds of food in order to lose weight.

*Native Hawaiians*: People born on the islands of Hawaii. Researchers have provided different definitions of Native Hawaiians that are based on various federal, state, and private agencies in the United States. These definitions are determined by blood quantum, and they influence where Hawaiians live, go to school, and work. The state of Hawaii uses a capital *N* in *Native Hawaiians* to describe Native Hawaiians with any Hawaiian blood, and a lower case *n* in *native Hawaiians* to describe Hawaiians with

50% or more Hawaiian blood. In this study, *Native Hawaiians* refers to all natives who have 50% or more Hawaiian blood in their bloodline and who reside on the islands that now comprise the state of Hawaii (gop.gov/bill/111/1/hr2314).

*Obesity*: An excess accumulation of fat tissue in the body that causes an increase in body weight that is greater than 20% of an individual's ideal weight (CDC, 2012). The condition is a chronic disease that causes devastating effects in Native Hawaiians. Given that there is no reliable scientific method for measuring fat directly in humans when assessing obesity, obesity assessments in this study are based on BMI, as suggested by Kearns et al. (2014).

*Vegetarian*: A person who practices or follows a lifestyle of eating a plant-based diet (fruits and vegetables). Vegetarians differ from omnivores in their eating pattern because of their exclusion of meat and fish (lacto-ovo vegetarians) or because of their exclusion of all animal-derived products (strict vegetarians or vegans). The dietary pattern of vegetarians is generally healthier due to a higher intake of fiber, folate, vitamin C, and vitamin A and a lower consumption of cholesterol and trans fat (Wong et al., 2013).

*Vegetarian diets*: The totality of food in a person's daily intake that is primarily devoid of animal protein. People typically think that a vegetarian diet is a diet that does not include meat, poultry, or fish, but vegetarian diets vary in what foods are included and excluded. For example, some people follow a *flexitarian diet*, which is also called a *semivegetarian diet*, and although this diet is primarily a plant-based diet, it also includes meat, dairy, eggs, poultry, and fish on occasion, or in small quantities, or at least once per month, but no more than once a week (Berkoff, 2013).

People who consume a *lacto-vegetarian diet* avoid meat, fish, poultry and eggs, as well as foods that contain them. Lacto-vegetarian diets include dairy products, such as milk, cheese, yogurt, and butter, but no eggs. People who are *lacto-ovo vegetarians* exclude meat, fish, and poultry but consume dairy products and eggs (Vinnari et al., 2009). Those who are *ovo-vegetarians* exclude meat, poultry, seafood, and dairy products from their diets but allow eggs (Vinnari et al., 2009). A flexitarian or semivegetarian diet includes dairy products, eggs, and meat at least once per month, but no more than once a week (Corliss et al., 2002). People who consume a *pesco-vegetarian diet* eat fish as well as the dairy products a lacto-ovo vegetarian consumes (Vinnari et al., 2009). A *vegan diet* excludes meat, poultry, fish, eggs, dairy products, and foods that contain these products (Berkow, Barnard, Eckart, & Katcher, 2010).

*Vegetarian lifestyle*: A type of lifestyle in which people eliminate meat from their diet (Bernard & Barlow 2010). These restricted diets are generally higher in vegetables, fruits, and whole grains. Nutritional analyses of vegetarian diets have indicated lower levels of protein and (saturated) fat and higher levels of carbohydrates and fiber. A recent dietary analysis of vegetarian diets indicated a more nutrient-dense pattern that is closer to current dietary recommendations than the diets of nonvegetarian or omnivores (Clarys et al., 2013).

## Assumptions and Limitations

### Assumptions

For the purpose of this study, it was assumed that participants would report the true nature of their ethnicity, eating lifestyle, weight, and height. It was also assumed that they would answer the survey questions honestly. Another assumption was that subjects

would have experience with excess weight and with the dietary norms of Native Hawaiians as assessed in this study. Finally, it was assumed that participants who disclosed that they had been living a vegetarian lifestyle had actually engaged in this lifestyle for at least the past 12 consecutive months.

**Limitations**

Participants may have been reluctant to disclose their body weight and height if they felt that they were overweight. Some participants who did not know their body weight may have resisted getting on a body weight scale to find out their true body weight. Other participants may have preferred to disclose their body weight but decided not to weigh themselves on a scale, making their true body weight different from their disclosed body weight. No systematic alteration to the reported weights was performed during the analysis phase of the study to account for possible underreporting. Observing the required sample size was dependent on access to Native Hawaiians through the Native Hawaiian Health Care System. To mitigate the limitations of this study, I utilized a sufficiently large sample size to account for any minor skewness in the data that would alter the validity of the results (Shieh, 2013).

## Scope and Delimitations

The participants included in this study were males and females who met the description and definition of Native Hawaiians. Participants were individuals aged 21 and older who lived on the Big Island of Hawaii and had maintained a vegetarian or nonvegetarian lifestyle for 1 year or more. The study specifically attempted to determine whether there were any correlations between different types of vegetarian and nonvegetarian lifestyles and the BMI of Native Hawaiians. The health status of

participants was not included as a variable in the study due to limitations in the timeline and budget of the research. The results of this study are generalizable to the Native Hawaiian population given the large, widely dispersed sample.

## Significance of the Study

In general, there remains a significant gap in the research on the effects of a meat-eater lifestyle and on the causes of the high obesity levels of Native Hawaiians. Particularly, studies examining indigenous populations and the impact of discrimination on health risk factors such as obesity or overweight are missing from the literature. This study of the sample addresses these factors. Finally, within indigenous research there is a paucity of research on discrimination and health risk factors among Native Hawaiians, making this study one of significant value to the research community (McCubbin & Antonio, 2012).

### Contribution to Social Change

The results of this study contribute to positive social change because practitioners can utilize the data generated to revise or develop new public policies that inform Native Hawaiians and help change the lifestyles of overweight and obese Native Hawaiians living in Hawaii. Positive social change will be evidenced in the eventual reduction in the prevalence of obesity and overweight in the Native Hawaiian population.

## Summary

This chapter considered the need to address the obesity epidemic of Native Hawaiians. The introduction provided an overview of the epidemic among the Native Hawaiian population, followed by the background, which briefly summarized the history of the population, delineated the various lifestyles associated with it, and outlined the rise

of the obesity epidemic. The problem statement focused on the current obesity epidemic among Native Hawaiians and the population's resulting health concerns.

The purpose statement followed, providing a justification for studying the current problem utilizing a quantitative methodology with a correlational design. The research questions and hypotheses were presented, which provided a clear direction for understanding the potential relationship between several eating lifestyles and obesity among Native Hawaiians. Bandura's (1977) self-efficacy theory was then introduced as the framework for the study. Key terms for this study were defined, followed by a consideration of the study's assumptions and limitations to ensure that the results of the study were not inhibited. Additionally, the scope and delimitations of the study were presented.

Following this discussion, a review of the existing knowledge gaps regarding Native Hawaiian obesity and overweight further illustrated the benefits of conducting this study and the contributions of the study to research and practice. Finally, the implications for social change were addressed. In the following chapter, current relevant literature is reviewed in order to identify the existing gaps in the research that this study aimed to address.

# Chapter 2: Literature Review

## Introduction

The purpose of this literature review is to examine previous studies on the relationship between BMI and the four types of vegetarian lifestyles, including vegan, lacto-ovo vegetarian, pesco-vegetarian, and semivegetarian. Research has shown that Native Hawaiians have an alarmingly high rate of obesity and overweight, which has many concerning health consequences. Many individuals unsuccessfully attempt to lower their BMI by reducing fat intake and caloric consumption. In light of these circumstances, the focus of this study was to determine whether adopting a vegetarian lifestyle is effective in lowering BMI among Native Hawaiians. Recent studies have suggested that a vegetarian lifestyle is associated with lower BMI in some cultures. This lifestyle, which the American Dietetic Association officially endorsed in 1993, is on the rise as an effective tool for battling obesity rates. This apparent correlation thus suggests vegetarianism as a promising intervention for the Native Hawaiian population, which this study aimed to investigate in further detail.

This chapter begins with a presentation of the literature search strategy employed in this literature review. Self-efficacy theory is then discussed in detail in terms of how it frames the variables and phenomena examined in the present study. The sections that follow include a discussion of research regarding the Native Hawaiian lifestyle and dietary choices. Also discussed are the results of previous obesity studies within recent literature on individuals' lifestyles, physical activities, social environment, and policy influences (Sallis et al., 2006). The chapter closes with a discussion of cognitive and social frameworks for this study and the gaps that this study addressed.

## Literature Search Strategies

To conduct this literature search about Native Hawaiian lifestyles, I used various electronic databases including CINAHL, MEDLINE, PubMed, Google Scholar, the National Institutes of Health (NIH), and other specialized databases provided by the University of Hawaii (UH) and Walden University libraries. Key terms used in the literature search included the following: *health-related quality of life*, *weight management*, *successful weight loss*, *weight regain*, *obesity*, *plant-based-food lifestyle*, *vegan*, *lacto-ovo vegetarian*, *pesco-vegetarian*, *non-vegetarian*, *self-reported overall health*, *physical activity*, *sedentary behavior*, and *inactivity*. Only peer-reviewed articles dated between 2009 and 2013 were included in the search, although a limited number of articles published before 2009 were also referenced to provide additional context in certain cases.

## Theoretical Foundation

Bandura's (1986, 1997) self-efficacy theory helped frame this study based on the idea that cognition, motivation, and processes affect one's belief in one's own behavioral capabilities. Researchers have suggested that when self-efficacy is high, people are more likely to persevere in times of difficulty. Additionally, people with high self-efficacy will demonstrate feelings of intrinsic motivation when working toward set goals, and any disappointment is unlikely to derail further attempts (Prat-Sala & Redford, 2010). This theory is useful across a wide spectrum of fields, including the fields of exercise and nutrition. For instance, Annesi and Tennant (2014) found that increased self-efficacy in physical exercise directly related to better eating habits. Given its relevance to the psychosocial components of health and lifestyle-related behaviors, this theory is

particularly useful when studying nutrition and BMI in individuals suffering from morbid obesity, which is the focus of this study.

Many people attempt to modify an aspect of their health behavior at some point in their lives with measures such as quitting smoking, drinking less alcohol, or exercising more often. For some, their intentions transform into successful behavioral change. For others, such intentions never result in actual behavioral change, or that change may be very fleeting. Eating behavior is usually difficult to change, particularly when this change involves dieting to lose weight. Although some studies have indicated that dieters may successfully reduce their energy intake (Kuijer & Boyce, 2012), other studies have demonstrated that dieters rarely reduce energy intake enough to be successful (NHS, 1997).

According to Herman and Mack's (1975) restraint theory, the impact of imposing cognitive restraint on eating reveals—paradoxically—that trying to eat less can result in overeating. Furthermore, reviews of the success of weight-loss intervention illustrated that although the proportion of people who initially lost weight had increased, a large majority regained weight in 5-year follow-up evaluations (Wadden, 1993). Other populations with different lifestyles have exhibited successful changes in eating behaviors, including vegetarians, those who choose to fast at specific times of the year for social or religious reasons, and those who avoid specific foods for religious reasons. Research in health/social psychology has highlighted the role of behavioral intention, attitude, and motivation in these behavioral changes.

Consistent research has shown that intentions can translate into actions when trying to change a behavior. For example, in terms of eating behavior, the intention to eat

healthily is a successful predictor of lifestyle change (Povey et al., 2007). Motivational factors also play an effective role in sustaining healthy eating behaviors, as demonstrated in Santos and Booth's (1996) study examining the motivations behind the choice to adopt a vegetarian diet; the researchers found that moral, health, gustatory, and ecological factors all influenced the decision-making process. Furthermore, the roles of behavioral attitudes are a function of a person's salient beliefs, which represent perceived consequences of the behavior (Conner & Norman, 2005). Eagly and Chaiken (1993) described the attitudes to target as particularly relevant in the area of eating behavior, given that different foods connote different meanings and generate both positive and negative responses. However, the links between types of motivation and food choices, as well as the relationships between different types of motivation and the success of meeting eating-related lifestyle goals, remain unexplored.

The aim of this study measuring success in body weight maintenance over the course of a year was to explore the link between types of motivation and food choices. There are three common methods of weight control: *cognitive interventions* (which are also called *behavioral interventions*), *environmental interventions*, and *medical interventions*. Cognitive methods include diet, exercise, and counseling programs. The primary goal of these types of programs is to teach individuals to make healthy food choices and to increase their activity levels so that they can maintain these habits throughout their lives. The Traditional Hawaiian Diet (THD) falls into the category of cognitive and behavioral intervention because it focuses on diet, exercise, and lifestyle habits.

THD programs that target individuals who are overweight are effective in helping individuals lose weight and improve their health within 21 days. Examples of other cognitive programs include Weight Watchers and Curves for Women. Although these cognitive programs can be successful in teaching people how to improve and change their lifestyles, many individuals go back to their old eating and exercise habits and regain weight when they stop participating in the program (Manson et al., 2004). The Agency for Healthcare Research and Quality identified several dietary intervention components that seem to be promising in modifying dietary change and in preventing the detrimental effects of repeated weight loss and gain. These factors include social support, goal setting, cooking, and the incorporation of taste testing (Agency for Healthcare Research and Quality [AHRQ], 2000).

Self-efficacy theory is particularly relevant to the study of BMI and weight management, as shown in Figure 1. McCleary-Jones (2011) found that improving self-efficacy in BMI management leads to improved self-management. Self-management is a cornerstone of overall BMI management and is defined as following a lifestyle over a long-term period (1 year or longer). The researchers argued that enhancing self-efficacy explains adherence to a lifestyle such as vegetarianism.

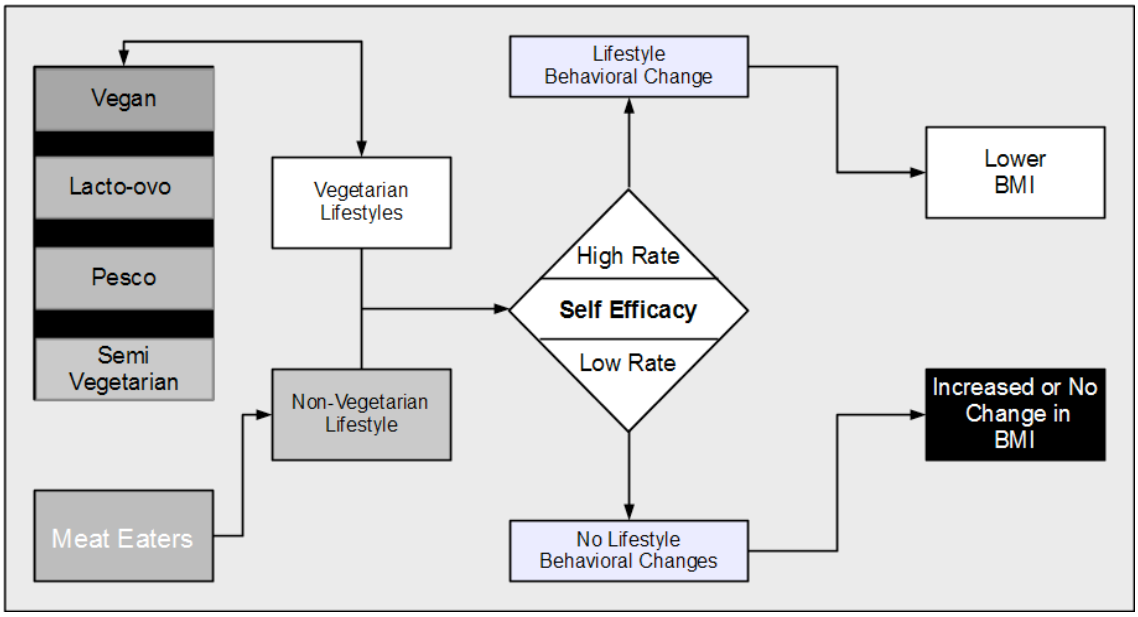


*Figure 1*. A theoretical model demonstrating the effects of self-efficacy on BMI. Adapted from "Self-Regulatory Skills Usage Strengthens the Relations of Self-Efficacy for Improved Eating, Exercise, and Weight in the Severely Obese: Toward an Explanatory Model," by J. J. Annesi, 2011, *Behavioral Medicine, 37*, pp. 71–76.

## Obesity and BMI

Voluminous research has documented the effects of being overweight and obese. A study by Kearns et al. (2014) observed the association between BMI and the prevalence of chronic diseases. Study results showed that a range of chronic diseases is associated with increased BMI, including increased back pain, high blood pressure, and high cholesterol. *Obesity* is defined as possessing a BMI level of 30 or higher. *Morbid obesity* is defined as possessing a BMI level of 40 or higher, and *overweight* is the term assigned to BMI levels from 25 to 30. A BMI level of 20 to 25 is considered *normal weight*, and a BMI level of less than 20 represents *underweight*. Recent reports from the Framingham Study indicated that even 5 to 10 pounds of extra weight is associated with

higher mortality rates. In other words, almost any degree of overweight has an adverse effect on health and longevity (Sharma et al., 2013).

Kearns et al. (2014) found that obese women suffered more from diabetes compared with obese men, that obese men suffered more from hypertension compared with obese women, that obese men were twice as likely to suffer from osteoarthritis compared with normal-weight men, and that the risk of diabetes was four times greater in obese women compared with the risk of diabetes in normal-weight women. The authors also found that lowering BMI by 1 unit accounted for a 4% to 7% reduction in chronic diseases for both genders. In addition, Kearns et al. (2014) indicated that reducing BMI levels by 1 unit accounts for a 6% reduction in obesity for men and a 5% reduction for women.

Researchers have argued that the loss of a pound of weight correlates to a 1-month increase in lifespan. For example, on average, a person who is 60 pounds overweight dies approximately 5 years earlier than someone of normal weight because of excess weight. Obesity causes psychological problems that further affect people who already have low self-image because of the obese condition (Sharma et al., 2013).

Despite the copious data on the adverse effects of obesity, studies have shown that treating it is not a primary concern of medical physicians. Muo et al. (2013) argued that people have to control their weight on their own because physicians do not treat obesity as a primary care condition. The researchers noted that physicians documented patients' BMI only 3% of the time, and documented a weight management strategy only about 9% of the time during patient consults. Together, these results demonstrate the importance of this study, which can help practitioners understand how altering eating behaviors from a

predominantly meat-eating lifestyle to a vegetarian lifestyle can benefit BMI reduction in overweight and obese Native Hawaiians.

## Lifestyle and Nutrition

Lifestyle patterns and individual nutrition are vital precursors of disease and good health, and as a result certain lifestyle patterns are effective predictors of cardiovascular disease (Long, Field, Armstrong, Chang, & Metlay, 2010) and of colon cancer (Ho et al., 2013). In addition, lifestyle patterns affect BMI and plasma/micronutrient levels (Danielsen et al., 2013). Freeland-Graves and Nitzke (2012) investigated the relationship between lifestyle and health and disease and found that lifestyle patterns are more useful frameworks than a focus on more specific data on nutrition is, because neither a single nutrient nor a single food adequately captures lifestyle behavior. Moreover, the researchers found that identifying good or bad nutrients is less helpful than describing healthy food lifestyle patterns that will both assist people in comprehending the totality of their food lifestyle and empower them to select foods that meet their tastes and lifestyles (Freeland-Graves & Nitzke, 2012).

## Food Culture

Food provides one of the best insights for understanding the culture of any group because food often links to the core of relationships among families and communities. Lindberg et al. (2013) argued that because of the strong ties between food and culture, certain cultural factors affect weight loss. One of the factors the researchers identified is the association between eating a lot of meat and high social status. Another factor is the limited intake of fruits and vegetables and high consumption levels of fast food.

Furthermore, Ristovski-Slijepcevic, Bell, Chapman, and Beagan (2010) argued that, in some cultures, being overweight is a sign of health and as such has led to increased overweight and obesity in the population. For instance, research has suggested that in some cultures men prefer large women, as a thin woman does not embody fertility or prosperity according to their traditions (Hanashiro & Ceria-Ulep, 2011). In some countries, including several Middle Eastern nations, food is a social symbol (Beşirli, 2010), whereas in Spain, cultural identity greatly influences human food preferences (Cantarero et al., 2013).

Hanashiro and Ceria-Ulep (2011) found that many weight-loss diets are eventually replaced with energy-dense foods, high protein and fat intake, and limited consumption of plant-based foods and fruits. More importantly, these researchers found that there is a fundamental link between sociocultural factors such as low education levels, low economic status, high rates of poverty, low health insurance rates, and low income and the social pathology of obesity. Although the relationship between food and culture need not be destructive, it is very strong because food is as important as air, water, and shelter (Ng, Young, & Corey, 2010). Conducting this study provides an understanding of the culture and food choices associated with Native Hawaiian lifestyles that lead to high obesity rates within the population (Wham et al., 2012).

## Self-Efficacy in Food Choice

Food choice is as important as food culture. Native Hawaiians typically maintain a lifestyle that consists of eating plenty of meat and high-fat dairy products, and they generally have minimal success in weight management. Not many Native Hawaiians have chosen to change their lifestyles. If it could be determined that members of the same

ethnic culture who had similar lifestyles and values achieved improved weight management after choosing to eliminate meat from their lifestyles, the information might convince others that this is an effective weight management approach. Thus, demonstrating successful weight management can compel Native Hawaiians to choose to adopt the vegetarian lifestyle needed to maintain their weight (McFerran et al., 2013).

## Health Issues

Researchers have found that the Native Hawaiian population has health issues that appear to be an individual aspect of a general quality of life; however, within a cultural context Native Hawaiians maintain a more crucial role. For this unique group of indigenous people, the persistence of traditional culture is an inseparable aspect of general well-being and an integral component when measuring quality of life (Detweiler, 2000). Given these circumstances, THD programs appeal to Native Hawaiians, especially regarding the health and cultural values of Native foods and the support of peers.

The majority of THD program participants realized short-term weight loss and improvement in health, but only a few individuals sustained significant weight loss. Most participants have difficulty adhering to the rules of the program due to barriers in accessing fresh, affordable produce, as well as the lack of a support system and environment that embraces healthy eating (Fujita et al., 2004).

### Causes of Obesity

Although there may be a genetic basis for obesity, the ultimate cause of obesity is the consumption of more calories than one expends (Serra-Majem & Bautista-Castaño, 2013). Inactive people are more likely to gain weight because they do not burn more calories than they consume. Other causes of obesity besides inactivity include the

environment, genes, family history, health conditions, medicines, emotional factors, smoking, age, pregnancy, and lack of sleep (Jimenez-Cruz et al., 2012).

## Weight Loss

Weight loss is a reduction of total body mass due to loss of fluid, body fat, adipose tissue, or lean mass such as mineral deposits, muscles, tendons, and other connective tissue. It can occur unintentionally due to an underlying disease or can arise from a conscious effort to improve an actual perceived overweight or obese state. Having a clear alarm in place for weight loss or weight gain is one way to approach weight management (Chambers & Swanson, 2012).

Successful weight maintainers adopt an approach to weight management that includes monitoring weight fluctuations and having a clear alarm signal for weight gain that triggers immediate action. People who maintain their weight have several behavioral strategies for weight control, such as engaging in exercise and making other small adjustments to their lifestyles on a regular basis. Additionally, weight maintainers have clear strategies for coping with any lifestyle interruptions that have the potential to trigger weight gain. In contrast, unsuccessful weight maintainers display negative cognitive factors, including inconsistent weight vigilance, failure to respond to warning signs of weight gain, and failure to restrict weight unless in a positive mindset. Their coping strategies for weight gain or failed weight loss efforts are poor, resulting in increased weight over time (Chambers & Swanson, 2012).

### Intentional Weight Loss Maintenance

Despite the growing understanding of the mechanisms relating to weight loss and maintenance, there are currently no confirmed public health interventions that are able to

achieve sustained long-term weight loss or to stop the increased occurrence of obesity in the population (Hafekost, Lawrence, Mitrou, O'Sullivan, & Zubrick, 2013). Including the word *intentional* in *intentional weight loss* is important as part of the definition, because unintentional weight loss occurs quite often and may have different causes and consequences than intentional weight loss does (Caterson et al., 2012). Losing 10% of one's total body weight is the criterion recommended to decrease risk factors for diabetes and heart disease. While a 10% weight loss may not return an obese person to a nonobese state, losing 10% of body weight provides meaningful health benefits for overweight and obese people (Salinardi et al., 2013).

## Weight Maintenance

### Energy Density

*Energy density* is the number of calories in a specific weight of food, and it is usually presented as the number of calories in a gram (kcal/g; U.S. Department of Agriculture 2005). Hogenkamp et al. (2012) argued that the intake of energy is associated with satiating capacity. The researchers found that obese people utilize visual food cues for energy intake regulation and argued that the level of energy intake was associated with feelings of hunger rather than with energy requirements. Due to their lack of awareness regarding the satiating capacity requirements for their physiological needs, people usually overconsumed energy in their diets, causing a rise in the obesity epidemic (Hogenkamp et al., 2012).

High-energy-density food is food that includes a high amount of calories in a small amount of food, while low-energy-density food is food that has a low amount of calories in a large quantity of food. Water is one constituent of food that has the most

impact on energy density, as it adds weight to food without increasing calories, thereby lessening energy density (Grunwald, Seagle, Peters, & Hill, 2001). Fiber also reduces energy density, but its influence is minimal compared with that of water because most foods have more water than fiber.

Rolls, Ello-Martin, and Tohill (2004) conducted a study on how fruit and vegetable consumption influences body weight and found that fruits and vegetables may differ greatly in their sensory and nutritional profiles but are usually low in fat content and energy density (kcal/g). This research also revealed that, because fruits and vegetables are high in water and fiber, the inclusion of both fruits and vegetables in a lifestyle can promote satiety and therefore decrease energy intake, which will result in a decrease in energy density.

**Impact of Fiber on Satiety**

Researchers have argued that a lack of required fiber intake is associated with increased consumption of low-fiber foods. Latulippe et al. (2013) argued that food high in dietary fiber has a positive effect on human intestinal health. Dietary fibers are not digestible and pass from the large intestines into the small intestines, providing positive physiological effects. The researchers posited that dietary fibers consist largely of carbohydrates, and that most people do not ingest enough dietary fibers to benefit from the physiologic effects of dietary fiber, which include pathogenic bacteria survival and nourished colonocytes. When fiber sources are plant based, the benefits of adequate fiber intake include laxation. Increased fiber is also associated with a lower glycemic response, lowering blood lipid levels and increasing calcium absorption.

Howarth, Saltzman, and Roberts (2001) conducted studies on the effect of fiber on satiety and energy intake. There have been inconsistent reports regarding the evaluation. Many have shown that increasing fiber consumption increases satiety, reduces hunger, and decreases energy intake. They also discovered that an additional 14 g/day of fiber for more than 2 days would lead to a 10% decrease in energy intake and a loss of 1.9 kg or 4.18 lbs. over a 3.8-month period. Hence, the increase in fiber intake through eating foods such as vegetables and fruits reduces energy intake and decreases body weight. According to Feinle, O'Donovan, and Horowitz (2002), the type and amount of carbohydrates in fruits and vegetables may also affect satiety and food intake. Given that most fruits and vegetables are low in energy density because of their high water and low fat content, adding fruits and vegetables to the lifestyle reduces overall energy density and increases the amount of food consumed for each calorie.

**Glycemic Response Effect**

When digested, carbohydrates in food convert to glucose, and the rate of this conversion process can be measured by assessing plasma glucose concentration over time (i.e., the glycemic response). Researchers have created a *glycemic index* (GI) that is based on the glycemic response of foods containing 50 grams of carbohydrates after 2 hours of consumption. Foods with a high GI cause a speedy but short-lived rise in blood glucose, and foods with a low GI cause a slower, more sustained rise. Furthermore, measurements of *satiation*, or the amount eaten when a food is freely available, indicate that foods with a low GI are more satiating than foods with a high GI (Tohill, 2005). Currently, there are no studies that show a strong association between GI and satiety, food intake, or body weight.

Researchers have found that when people consume foods with a high GI, blood insulin levels remain higher for longer compared with the blood insulin levels in people consuming foods that have a low GI. Zakrzewski et al. (2012) argued that there is a relationship between fat oxidation decline, insulin sensitivity, glucose tolerance, and obesity. Controlling these chemical responses in the body occurs only through glycemic response control when consuming energy. The researchers further showed that consumed carbohydrates directly affect the glycemic response, and that high-GI foods affect people differently than low-GI foods do. For example, lower oxidation and increased obesity tend to be associated with blood glucose peaking and remaining elevated after the consumption of high-GI foods (Zakrzewski et al., 2012).

Lifestyles that are high in protein and high-GI food consumption are associated with obesity. Kong et al. (2014) found that lifestyles that include low protein and high-GI foods are also associated with obesity, but a lifestyle that includes high protein and low-GI foods protects against obesity. The researchers argued that protein in isolation did not affect obesity until the introduction of high-GI foods. They also associated lifestyles that include high levels of low-GI foods with significantly lower total energy intake, which results in lower body weight over time.

Gustafsson, Asp, Hagander, and Nyman (1993) conducted a series of experiments to assess the influence of vegetables and fruits on satiation. The results showed that eating vegetables that have the rating of satiety was correlated positively with the fiber content, water content, and total weight of the meal. The few studies conducted on fruits demonstrated that they can enhance satiation, especially when consumed without cooking. Studies on satiation have shown that there is a reduction in energy density when

adding fruits and vegetables to a lifestyle because there is a spontaneous decrease in energy intake when palatability is controlled (Rolls, Ello-Martin, & Tohill, 2004).

There are several kinds of food that affect satiation during food consumption. For example, the higher fiber content of a whole fruit compared with that of fruit juice partially explains the whole fruit's greater effects on satiation. Additionally, beverages may affect the regulation of energy intake differently than solid food does (Forde et al., 2013). The body utilizes separate mechanisms to control hunger and thirst, but there is a lack of research on whether fruit juice alone affects hunger or thirst mechanisms. Additionally, conducting further research can determine whether the fiber content similarly influences hunger and thirst (Benelam, 2009).

As Zakrzewski et al. (2012) suggested, high-fasting glucose levels lead to diabetes and cardiovascular diseases. High fiber intake is associated with low-GI foods. The argument suggested that consuming low-glycemic foods usually means consuming high levels of fiber. The findings indicated further benefits to increasing fruits and vegetables in the lifestyle of Native Hawaiians to help reduce the onset of obesity.

## Long-Term Weight Loss

Controlling the obesity epidemic requires encouraging individuals to effectively lose weight and maintain weight loss. Venditti et al. (2014) argued that there are several barriers associated with losing weight. Some barriers include low activity, self-monitoring problems, social cues, internal cues (such as moods or thoughts), and motivation. The researchers proposed several beneficial ingredients for the maintenance of a weight loss program, including problem solving, self-monitoring, increased activity, and consumed energy control. Results indicated that problem-solving skills had the

strongest benefit in reducing weight loss barriers because most people use life problems as an excuse to stop goal-based behaviors. Thus, the study results indicated that dietetic responses alone are not enough to control long-term weight loss, and that Native Hawaiians need more autonomy in anticipating and controlling personal weight control barriers that lead to relapse and weight gain (Venditti et al., 2014).

In an earlier study, Klem et al. (1997) argued that there are three behavior strategies for individuals to maintain weight loss: (a) a lifestyle with a low-calorie, low-fat diet; (b) engaging in high levels of physical activity; and (c) measuring the individual's body weight frequently. These findings are similar to those of recent studies such as Venditti et al. (2014) that indicated that people who successfully maintain weight loss continue to address barriers to weight loss maintenance for many years after the reduction in weight. Another predictor of successful weight loss maintenance is a lower level of lifestyle disinhibitions. In measuring periodic loss of control of eating, Wadden, Berkowitz, Vogt, Steen, Stunkard, and Foster (1997) found that individuals with scores of less than 6 on the Eating Inventory subscale were 60% more likely to maintain their weight over 1 year. The results showed parallel results for depression, with lower levels of depression relating to greater odds for success (Wadden et al., 1997).

Another variable that has been documented as leading to successful weight loss is a triggering event. Medical triggering was the most common (23%), followed by an all-time high in weight (21%) and seeing a picture or reflection of oneself in the mirror (13%). A medical trigger involved events such as a doctor telling the participant to lose weight or a family member having a heart attack. People who had a medical reason for

weight loss also had better initial weight losses and maintenance rates (Gorin, Phelan, Hill, & Wing, 2004).

The findings of Gorin et al. (2004) suggest that the period following a medical trigger may be an appropriate time to start weight loss in order to enhance both initial and long-term loss outcomes. Gorin et al. (2004) indicated that participants who engaged in a healthy lifestyle consistently across the week were 1.5 times more likely to maintain their weight within 5 pounds over the subsequent year than were participants who engaged in a healthy lifestyle more strictly on weekdays. Participants who showed flexibility on holidays had a greater risk of weight regain, indicating that allowing for flexibility in a lifestyle may increase exposure to high-risk situations, creating more opportunity for loss of control.

There are many prevailing thoughts regarding the relationship between the rate of initial weight loss and the ability to maintain weight loss over the long term. For example, in a 2010 study, Nackers et al. argued that successful long-term weight loss is defined as a 10% or more reduction in body weight maintained for 1 year or longer. Some weight-loss professionals suggest that the goal is achievable using 15- to 24-week programs, but that the success of such weight loss is fleeting. Conversely, losing weight over a longer period is associated with a reduced risk of regaining the weight and long-term success in maintaining the weight loss. Nackers et al. (2010) found that there is no benefit to losing weight slowly. Participants who experienced rapid initial weight loss were able to maintain the weight loss in the long term at a rate similar to that of participants who used slow or moderately slow methods. Additionally, the study results revealed that participants who lost weight quickly experienced faster benefits, such as

improved body image appearance and higher levels of energy. These results suggest that Native Hawaiians can benefit from losing weight at fast, moderate, or slow rates.

## Lifestyle Patterns and Individual Nutrition

Lifestyle patterns are vital precursors of disease and good health, and as a result lifestyle patterns are predictors of cardiovascular disease, according to Long et al., 2010, and of colon cancer, according to Giovannucci (2004). In addition, lifestyle patterns relate to body mass index (BMI) and plasma/micronutrients levels (Polikandrioti et al., 2009). Researchers of the relationship between lifestyle and health and disease found that lifestyle patterns are more useful than individual nutrition is, because one nutrient or food cannot adequately describe lifestyle behavior (Rozin, 2005). Additionally, Rozin found that the identification of good or bad nutrients is less helpful than is the description of healthy lifestyle food patterns, which assist people in comprehending the totality of their lifestyle while selecting foods that meet their tastes and lifestyles.

### The Traditional Hawaiian Lifestyle

Shintani (1991) examined the effects of providing a traditional Native Hawaiian lifestyle rich in fruits and vegetables on food intake and body weight in overweight Hawaiians. A baseline measurement of the long-term effectiveness of THD began at the 3-week, 3-month, and 12-month markers. The literature suggested that THD programs are effective in helping individuals lose weight over 21 days. After 1 year, the individuals who maintained healthy eating and exercise patterns maintained their weight loss. However, because of obstacles in accessing fresh and affordable produce and a lack of a support system that embraced healthy eating, many participants reverted to old eating and exercise patterns that caused them to regain the weight lost.

## Quality of Vegetarian Lifestyle

According to Farmer (2014), vegetarians have a lower BMI than nonvegetarians do, suggesting that vegetarian lifestyle plans may be an effective approach for weight management. However, vegetarian lifestyles have a popular reputation of being deficient in certain nutrients. The objective of this study was to compare the lifestyle quality of vegetarians with a nonvegetarian lifestyle and to test the hypothesis that a vegetarian lifestyle would not compromise nutrient intake when used to manage body weight.

Lin, Gao, and Lee (2013) measured participants' average nutrient intake and BMI, adjusted for energy usage, gender, and ethnicity. Using analysis of variance, the researchers compared all vegetarian lifestyles with all nonvegetarian lifestyles, which revealed that although vegetarians' intake of vitamins E and A and magnesium exceeded that of nonvegetarians, the intake levels of both groups were less than ideal. The results of the Lin et al. study indicated that the Healthy Eating Index score did not differ significantly between vegetarians and nonvegetarians. This finding suggested that a vegetarian lifestyle is nutrient dense and consistent with the lifestyle guidelines that recommend weight management that does not compromise lifestyle quality (Lin et al., 2013).

## Vegetarian Lifestyle and Body Mass Index

Researchers have argued that people with a vegetarian lifestyle benefit because the lifestyle is associated with high levels of plant-based fiber and glycemic control. Barnard et al. (2009) argued specifically that low-fat vegetarian diets are effective for weight loss and reduced BMI levels in participants. In the study, participants not only experienced greater levels of glycemic control but also had higher levels of control over

insulin sensitivity. Additionally, Barnard et al. (2009) argued that a low-fat vegetarian lifestyle is associated with significant reductions in cardiovascular disease and that participants who performed mild exercise experienced greater benefits. The researchers also asserted that individuals with high blood pressure benefited from a low-fat vegetarian lifestyle, which is beneficial for reducing strokes, heart attacks, and premature deaths. In particular, a low-fat vegetarian lifestyle increased blood vessel elasticity by 50% compared with that of meat-eaters (Barnard et al., 2009).

**Vegetarian Lifestyle by Choice**

According to Pribis et al. (2010), there are major differences across generations regarding the reasons why people choose to live a vegetarian lifestyle. People aged 41–60 identified significantly more with the health-related reasons, whereas younger participants identified more with the moral and environmental reasons.

Phillips (2010) investigated whether changing to a self-selected vegetarian lifestyle resulted in changing to an anthropometric. The researchers argued that vegetarians are often leaner compared with nonvegetarians and suffer less from obesity and its associated complications compared with nonvegetarians. The results of the lifestyle calculations demonstrated that upon switching to a self-selected vegetarian lifestyle, there was a significant reduction ($p < 0.05$) in the proportion of energy intake from saturated fatty acids. There was also a significant increase ($p < 0.05$) in the proportion of energy from carbohydrates and in the intake of nonstarch foods.

Nieman (1999) explained that an increased intake of carbohydrates leads to greater stores of glycogen. In addition to the extra glycogen increase, water would be stored in the body (1g extra glycogen leads to 3g extra water); however, water levels

were not measured in the study. Additionally, Nieman found that body fat is stored differently in the body because of its extra glycogen, and as a result it moves from central stores to peripheral parts of the body. The study results suggested that switching to a vegetarian lifestyle was beneficial for decreasing weight in the hip and waist regions of the body. Nieman found that no change occurred in the waist-to-hip ratio, but that waist and height ratios decreased significantly. Central obesity is a particular risk factor for cardiovascular health (Mohammadifard et al., 2013); as such, choosing self-selected vegetarian lifestyles may bring about a reduction in cardiovascular disease.

The results of Key, Davey, and Appleby's (1999) study suggested that significant lifestyle changes help people who become vegetarians to conform more closely to health recommendations. Differences in weight between all types of vegetarians and meat-eaters has often been shown to be small, but significant reductions were observed in skin-fold thickness and waist-to-height ratios, which implies that the subjects became leaner upon changing to a self-selected vegetarian lifestyle.

**Nutritional Deficiencies in Vegetarian Lifestyle**

According to Hart (2009), *vegetarianism* refers to any number of diverse lifestyles that extend beyond the simple concept of not eating animal products. Hart argued that being a vegetarian does not necessarily translate into a healthy lifestyle and suggested that a nonconsumer of animal products may still eat foods that are high in fat. Individuals may choose to become vegetarians for moral, environmental, health-related, economic, and faith-based reasons (Pribis et al., 2010). There are several reasons why people stop being vegetarian and resume an omnivorous lifestyle, including concerns about their nutritional status. In addition, some people who abandon vegetarianism may experience a

change in living situation or miss the taste of meat (Barr & Chapman, 2002). Lifestyle behaviors have a significant impact on health and play a critical role in preventing and managing chronic disease.

The bottom line is that all lifestyles have potential risks and benefits and that understanding how to avoid or minimize such risks is beneficial for Native Hawaiians. Studies have shown that vegetarians who have poor meal planning are more likely to have nutritional deficiencies compared with people who plan well-balanced meals (Leitzmann, 2005). According to Di Genova and Guyda (2007), restrictive or unbalanced lifestyles such as a fruit-only diet or some macrobiotic lifestyles may lead to nutritional deficiencies, particularly in growing children, women in their reproductive years, and pregnant or lactating women, for whom energy necessities are higher. Thus, it is beneficial to have nutritional experts ensure adequate nutrition for these groups by providing guidance to parents of vegetarian infants and children, pregnant vegetarian women, and lactating vegetarian women.

**The Benefits of a Vegetarian Lifestyle**

While there are benefits to following a vegetarian lifestyle pattern, addressing the challenges of this lifestyle is important in order to make it practical and adequate and to meet nutritional needs in child and adult populations. Researchers conducting vegetarian studies were able to differentiate between vegetarians and nonvegetarians with higher scores for the vegetarian subjects (Clarys et al., 2013). Moreover, results of vegetarian studies demonstrated that people experience difficulties adhering to a strictly vegetarian lifestyle. Singh et al. (2003) found that it is possible that a lifestyle rich in specific fruits

and vegetables is as effective in the prevention and management of cardiac disease as taking one aspirin daily is.

## Summary

This chapter reviewed previous research related to obesity, various lifestyles, and vegetarianism. The introductory section provided an overview of the vegetarian lifestyle diet and its choices. The literature search strategy was then presented, followed by a discussion of self-efficacy theory as the theoretical foundation for the study. The review of the literature identified the extent to which and by what mechanism(s) a plant-based lifestyle may mediate body weight. The reviewed literature addressed lifestyles and nutrition, food choices, chronic diseases, weight maintenance, long-term weight loss, lifestyle patterns, individual nutrition, nutritional deficiencies in a vegetarian lifestyle, and body weight in vegetarians and nonvegetarians. With the limited recent studies available regarding the Native Hawaiian lifestyle and weight management, more research is clearly warranted to explore the effects of vegetarian diets on Native Hawaiians' BMI. Chapter 3 presents the research method utilized in this study.

# Chapter 3: Research Method

## Introduction

Chapter 3 presents an overview of the methodology that was used for this study. The study design, population, sampling methods, sample size, instrumentation, and data analysis procedures are discussed. The purpose of this study was to identify the associations between a vegetarian lifestyle and obesity for Native Hawaiians who live on the Big Island in Hawaii. The findings of this study may assist officials and inform researchers regarding the planning of health promotion services for Hawaiians (Friis & Sellers, 2004). The research question and associated statistical hypotheses utilized in the study were as follows:

RQ: Are there differences in BMI between Native Hawaiians aged 21 and older who classify their lifestyle/diet as nonvegetarian vs. vegetarian, after controlling for demographic variables and factor scores obtained from the Native Hawaiian Lifestyle Survey?

$H_{01}$: None of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{a1}$: At least one of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{02}$: After controlling for the descriptive variables, none of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{a2}$: After controlling for the descriptive variables, at least one of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{03}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian do not differ on the dependent variable of BMI.

$H_{a3}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian differ on the dependent variable of BMI.

## Research Design and Rationale

The independent and dependent variables of this study are presented here, followed by an explanation of the research design.

### Independent Variables

A hierarchical linear regression was used to test the hypotheses of this study. The regression model included 3 steps. The independent variables were coded and entered into each step as follows: (a) gender (coded as male = 0 and female = 1); (b) age (a continuous variable measured in years and mean centered); (c) level of education (an ordinal variable coded as high school or less = 0, some college = 1, 4 years of college = 2, and master's or doctorate degree = 3); (d) high blood pressure (a dichotomous variable coded as 0 = no and 1 = yes); (e) asthma (a dichotomous variable coded as 0 = no and 1 = yes); (f) diabetes (a dichotomous variable coded as 0 = no and 1 = yes); (g) heart disease (a dichotomous variable coded as 0 = no and 1 = yes); (h) cancer (a dichotomous variable coded as 0 = no and 1 = yes); (i) other health risk (a dichotomous variable coded as 0 =

no and 1 = yes); and (j) no health risk (a dichotomous variable coded as 0 = no and 1 = yes).

The second step included the addition of the four factors that were derived from the Native Hawaiian Lifestyle Survey: (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control. The four factors were measured on a continuous scale. The third step included the variables of the first two blocks as well as the variable of diet classification, which was coded as nonvegetarian = 0 and vegetarian = 1.

**Dependent Variables**

Body mass index (BMI) was the dependent variable. Each participant's BMI was derived from the participant's height and weight using the following formula: BMI = mass (lb.) × 703 / height in inches square (WHO, 2006).

**Research Design**

A quantitative, correlational, comparative design was utilized for this study. Examining the three parts of this design separately provides further insight into why this design was selected.

Quantitative research seeks to identify relationships between variables using numerical trends, means, and suggested characteristics (Bordens & Abbott, 2007; Leedy & Ormrod, 2005). The use of a quantitative research design for this study allowed for examination of the relationship between obesity and diet type (vegetarian vs. nonvegetarian). Moreover, the study's quantitative nature provided insight into the differences and similarities between the two groups of dieters by quantifying the differences and similarities numerically.

A correlational design is appropriate when the researcher wishes to examine the relationship between two or more nonmanipulated variables. In this study, it was not possible to control the participants' diet because the classification of individuals was based on the diet that the study participants followed leading up to the time of data collection. A correlational design does not allow for discerning the cause of relationships shown by the study; therefore, it is important for the researcher to avoid the implication of causality from the results of a correlational study (Triola, 1998).

A comparative study is designed to make comparisons between two or more groups. For this study, a comparison between Native Hawaiians aged 21 and older who followed a vegetarian lifestyle/diet and Native Hawaiians aged 21 and older who did not follow a vegetarian lifestyle/diet was performed.

## Methodology

In this section, an overview of the population, sampling procedures, data collection procedures, recruitment and informed consent, pilot study, and instrumentation is provided.

### Population

The population for this study included Hawaiians living in the state of Hawaii. The estimated size of the Hawaiian population in the state of Hawaii is approximately 1,345,500 people (U.S. Census Bureau, 2015).

### Sampling and Sampling Procedures

**Sampling strategy.** A cross-sectional sampling strategy was used. Cross-sectional data are collected by observation of subjects at a single point in time. According

to Skogmar et al. (2014), utilizing cross-sectional data collection is beneficial when observing participants with closed-ended survey questionnaires.

**Sampling procedures.** A convenience sampling approach was utilized in this study. According to Calkins (2005), although this manner of sampling is easier, it is also risky. Convenience sampling generally assumes a homogeneous population, where one respondent basically represents the perspective of others (Triola, 2008). Additionally, it is possible to introduce bias with a convenience sampling technique given that, by choosing the individuals who are most accessible rather than selecting them from a population randomly, convenience sampling does not represent every member of the population (Triola, 2008). A random sampling approach was not feasible for this study because the study was cross-sectional and nonexperimental. An experimental sampling framework would have required randomization of participants into a treatment or intervention; however, interventions were not performed in this correlational study.

**Sampling frame.** Although people of many ethnicities live on the Big Island of Hawaii, the sample frame for this study included only Native Hawaiians living there (Babbie, 2010). Native Hawaiians have a higher mortality rate compared with the general U.S. population and the other local populations in the state of Hawaii (Panapasa, Mau, Williams, & McNally, 2010). According to Panapasa et al. (2010), premature deaths are 15–50% higher among Native Hawaiians than among Whites. For every White person who dies prematurely, as many as four Native Hawaiians die, which further demonstrates the need for this study. Many other studies have indicated that early morbidity and mortality rates among Native Hawaiians correlate to the population's high obesity rates. Inclusion criteria for this study included the following: the participant was (a) a Native

Hawaiian, (b) 21 years of age or older, and (c) able to read and understand English fluently. Exclusions were not made for health status, comorbidities to high BMI, or other population or health factors.

**Sample size.** A three-step hierarchical linear regression was performed to test the hypotheses of this study. An a priori power analysis was performed to determine an adequate sample size using G*Power 3.1.9.2 software (Faul, Erdfelder, Lang, & Buchner, 2007). The power analysis was performed using an alpha level of .05, a power of .80, a medium effect size of $f^2 = .15$ with the number of predictors tested at the third level set as 1, and a total number of predictors set to 15. The medium effect size was chosen because an effect size was not readily reported in the literature, and therefore powering the study for a medium effect would allow me to see significance on associations that were moderate or larger. I did not power the study for a small effect size because a small effect was not important to my research. A total sample size of $n = 56$ was indicated as necessary to power the three-level hierarchical multiple regression at 80%. Given the sample size estimate of 56, the number of surveys actually collected ($N = 304$) appeared to satisfy all a priori assumptions.

## Procedures for Recruitment, Participation, and Data Collection

Selecting the sample for the proposed study required utilizing the convenience sampling method. This method was appropriate because the study was not an experimental design requiring randomization and participants were recruited conveniently from among a community of Native Hawaiians (Fergus, 2014). The participants were recruited at the local YMCA. Additionally, a house-to-house campaign was necessary to distribute the survey and collect information. Because only Native

Hawaiians lived in the villages I visited, the location was beneficial for finding suitable participants for the proposed study.

**Sampling Procedure**

Each participant provided his or her informed consent by signing the informed consent form attached to the first page of the Native Hawaiian Survey (see Appendix A). The form asked participants to check the "Yes" box after reading the terms of participation for the study. If participants chose not to check the "Yes" box and fill out the survey, they were not enrolled for participation in the study. Participation in the study was voluntary, and a participant could withdraw consent at any time during the study. If a participant withdrew consent, any survey or other information collected for the participant was voided and not utilized in the study sample.

**Recruitment and Informed Consent**

Data collection for this study was conducted in two ways. The first was via recruitment from a booth at the YMCA on the Big Island of Hawaii. A sign was placed on the booth asking people to participate in a health study about Native Hawaiians. Once a prospect expressed interest in volunteering for the study, an informed consent form was provided for the participant to sign indicating his or her consent to participate in the study.

Before administering the survey, participants were asked to acknowledge that they were 21 years of age or older and that they were Native Hawaiian. If they met both criteria, then the participant was asked to complete the informed consent form and the survey. If participants indicated that they were not Native Hawaiian or that they were not

21 years of age or older, they were thanked for their time and interest in the study and they did not proceed with completing the survey.

The second approach to data collection involved U.S. Postal Service mailings of the questionnaire of which I received 338 responses deemed acceptable for my study.

**Data Collection**

When participants agreed to participate in the study, they were given the informed consent form and asked to acknowledge consent by checking the "Yes" box on the form. In every case, a letter of invitation to participate accompanied each consent form and survey. The three forms were stapled together. Participating in the study was voluntary, and there was no compensation provided, other than gratitude, for completing the survey.

The expected duration for completing the survey was 10 minutes, and the first page of the survey provided instructions on how to fill it out. To ensure anonymity and confidentiality, participants were not asked for identifying information such as name, address, phone number, or email address. At the YMCA data collection site, participants personally placed completed surveys in a secure box onsite.

No follow-up procedures or debriefing sessions were required or provided to participants in this study.

**Native Hawaiian Lifestyle Survey Instrument**

Utilizing a survey for observations in social science is standard. The survey questions in this study consisted of 16 questions (see Appendix B). The first part of the survey collected information on the demographic characteristics of the respondents; the second part consisted of questions that included information on health, height, and body

weight; and the third part consisted of questions that were used to classify the respondents into lifestyle/diet groups (Newsted, Huff, & Munro, 1998).

**Validity**

The approved proposal for this study (dated February 17, 2014) included a statistical analysis plan for a comparative study. The plan included the use of an analysis of covariance (ANCOVA), with the independent variable of lifestyle group and the dependent variable of BMI. Thus, the Native Hawaiian Lifestyle Survey was designed as a tool to collect descriptive information and not as a factorable survey tool. All data were collected for the study before it was found that the proposed research could not be performed.

The ANCOVA model could not be used as proposed. The confounding variables of physical activity levels (none vs. once a week vs. three times a week vs. every day vs. once a month) and sedentary behavior levels (none vs. less than 2 hours per day vs. 2 hours per day vs. more than 2 hours per day) were not collected, and therefore the ANCOVA could not be performed. Further, a large majority of the participants (78.6%) stated they were nonvegetarian, and the remaining participants who followed one of the four vegetarian lifestyles were too few to achieve an adequate representation in the ANCOVA model. Due to these omissions and inconsistencies, the research question and hypotheses were adjusted to accommodate the inclusion of demographic variables, derived factors obtained after data collection from the survey, and diet with only two groups (vegetarian vs. nonvegetarian) in a hierarchical regression model with the dependent variable of BMI.

Because the factors were derived from the survey after data collection to accommodate an analysis that could be performed with the data collected, convergent and divergent validity of the Native Hawaiian Lifestyle Survey could not be established in this study. To do so would have necessitated the participants completing the study survey as well as two other surveys (one survey completed to test for convergent validity, and one survey to test for divergent validity) at the time of data collection. Thus, construct validity was not investigated in this study.

Prior to the pilot study, content validity was investigated by a panel of experts I chose to review the questions for readability and to determine how well each question measured the concepts of the study. This information was used to refine the instrument for the pilot study. Participants in the pilot study were asked for feedback on the ease of use of the survey. The participants were also asked for additional input on the survey questions and structure of the instrument. The information provided by the pilot study participants was used to further refine the survey for use in the final data collection. The results of the pilot study are presented in Chapter 4.

**Reliability**

A question requires careful phrasing in order to yield repeatable results. This means that a respondent's answer to a question will be the same if he or she takes the survey again. Respondents with a similar opinion or status often have similar answers. Questions on the survey that are too similar to each other also yield similar responses (Eckert & Stafford, 2012). For example, the response of a participant to survey question 2 will be the same on any day because the respondent remains a vegetarian (independent variable). Reliability was tested and verified through the pilot test of the survey; thus, the

critical measurement of the survey questionnaire aggregates into scales. Appropriate numerical formulas are applied to these numbers. In addition, the results of these formulas lead to conceptual representations of measurements. The factors derived in the pilot test were tested with the study sample, and Cronbach's alpha coefficients were measured to check internal consistency reliability of the instrument with the data collected. Table 7 in Chapter 4 presents the Cronbach alpha coefficients for the derived factors used for hypothesis testing. All four factors derived from the survey in the pilot test and confirmed in the confirmatory factor analysis had Cronbach's alpha coefficients above the .70 threshold of acceptance (Pallant, 2013). The factors were acceptable for use in the correlational analyses and hierarchical regression model.

**Operationalization of Variables**

The research question for this study was, "Are there differences in BMI between Native Hawaiians aged 21 and older who classify their lifestyle/diet as nonvegetarian vs. vegetarian, after controlling for demographic variables and factor scores obtained from the Native Hawaiian Lifestyle Survey?" Three hypotheses were tested via one hierarchical linear regression. The dependent variable was BMI. The regression had three steps or blocks.

The first step included demographic and health risk variables: (a) gender (coded as male = 0 and female = 1); (b) age (a continuous variable measured in years and mean centered); (c) level of education (an ordinal variable coded as high school or less = 0, some college = 1, 4 years of college = 2, and master's or doctorate degree = 3); (d) high blood pressure (a dichotomous variable coded as 0 = no and 1 = yes); (e) asthma (a dichotomous variable coded as 0 = no and 1 = yes); (f) diabetes (a dichotomous variable

coded as 0 = no and 1 = yes); (g) heart disease (a dichotomous variable coded as 0 = no and 1 = yes); (h) cancer (a dichotomous variable coded as 0 = no and 1 = yes); (i) other health risk (a dichotomous variable coded as 0 = no and 1 = yes); and (j) no health risk (a dichotomous variable coded as 0 = no and 1 = yes).

The second step included the addition of the four factors that were derived from the Native Hawaiian Lifestyle Survey: (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control. The four factors were measured on a continuous scale. The third step included the variables of the first two blocks as well as the variable of diet classification, which was coded as nonvegetarian = 0 and vegetarian = 1.

The regression model was specified with a reference of a participant who was male, 57.12 years of age, and a nonvegetarian. Table 8 presents the findings of the hierarchical regression analysis. The model findings are then used to address each of the three hypotheses separately.

**Data Analysis Plan**

All data were analyzed with IBM SPSS v.22 software. Inferential testing was performed using a 95% level of significance. Descriptive statistics were provided in the form of measures of central tendency (mean, standard deviation, and range) for all continuous variables (age, height, weight, BMI, and the four factors derived from the Native Hawaiian Lifestyle Survey), as well as frequencies and percentages for the categorical variables of the study. Cronbach's alpha coefficients were used to examine the internal consistency reliability of the four factors derived from the survey.

Prior to hypothesis testing, the assumptions associated with the use of a hierarchical linear regression were checked to ensure the appropriate use of the model. Assumptions for a hierarchical regression include the following: (a) absence of outliers, (b) normality, (c) linearity, and (d) homoscedasticity. Multicollinearity between independent variables was tested using Spearman's rank order correlations. Multicollinearity is detected when a bivariate correlation is .90 or greater (Tabachnick & Fidell, 2007).

Hypothesis testing was performed using a hierarchical linear regression model. The dependent variable, BMI, was regressed on the independent control variables of the study (gender, age, education level, high blood pressure, asthma, diabetes, heart disease, cancer, other health risk, no health risk) in the first step of the model. Step 2 included the variables from Step 1 in addition to the four factors of (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control. Step 3 included the variables from Step 2 as well as the independent variable of diet classification.

The three-step regression model was used to answer the three hypotheses relating to the research question of the study:

RQ: Are there differences in BMI between Native Hawaiians aged 21 and older who classify their lifestyle/diet as nonvegetarian vs. vegetarian, after controlling for demographic variables and factor scores obtained from the Native Hawaiian Lifestyle Survey?

$H_{01}$: None of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{a1}$: At least one of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{02}$: After controlling for the descriptive variables, none of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{a2}$: After controlling for the descriptive variables, at least one of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{03}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian do not differ on the dependent variable of BMI.

$H_{a3}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian differ on the dependent variable of BMI.

Model coefficients and associated *p* values were used to determine the magnitude and direction of the association between the predictors and the dependent variable of BMI. A predictor was determined to be statistically significant if the predictor's coefficient had a corresponding *p* value of $< .05$.

**Threats to Validity**

Internal validity was threatened by the instrumentation that was used for the study. Because this survey was not tested in previous research, one cannot know the true validity of the test. This threat, as well as the threat to content validity, was addressed by inclusion of a pilot study and by speaking with experts in an attempt to perfect the questions being asked. Internal validity may have also been threatened by a priori knowledge of the participants regarding the best practices of exercise and diet lifestyles, with the participants answering the questions with a bias favoring what they believe is the best answer for a particular question, and not answering truthfully. This type of bias is inherent in a self-assessment and is often one reason given for nongeneralizability of a study to a wider population (Leedy & Ormrod, 2005). Thus, utilizing a self-assessment via a survey is also a study limitation.

External validity may have been threatened by the volunteers who were recruited into the study. The type of participant who volunteers could be less than fully representative of the population. In a convenience sample, any biases or inherent differences in the participants cannot be controlled with randomization. Therefore, demographic and other variables relating to comorbidities were included as study controls.

**Protection of Human Subjects**

I followed the protocol outlined by the Walden University Institutional Review Board (approval # 06-24-14-0123135) in order to ensure protection of participants' rights and to follow a general code of ethics. Great care was taken to safeguard the data obtained from surveys. No identifying markers of the study participants were collected

other than the age, gender, and education level of each participant. Names of the participants were not obtained, and each survey was encoded with a reference number only. Once the data were compiled into the SPSS data file, the paper surveys were inserted into a large manila envelope and placed into a fireproof lock box at my home, for which I have the only access key and password. The surveys and data set will be kept for 5 years after the conclusion of the study.

During the data collection period of the study, I obtained consent for participation from each participant at the time of survey completion. The informed consent form contained a consent statement and information regarding the reason for the study, as well as any foreseen adverse consequences of participation. Consent was implied after the participants signed the informed consent stating their understanding of the conditions of participation.

**Limitations**

The greatest limitation of this study was the use of a self-assessment survey and the decision to utilize a convenience sample in lieu of an experimental design. The use of a survey for data collection eliminates the ability to confirm the type of diet followed and the presence of health conditions and/or comorbidities stated by the participants. However, using a survey for data collection was a necessity for this study due to limited resources. Thus, I needed to make the assumption that each participant was being truthful when both joining the study and answering questions.

## Summary

Chapter 3 presented the methodology to be used in this quantitative, correlational, comparative study. Native Hawaiians aged 21 years and older made up the population of

this study. A researcher-designed survey, the Native Hawaiian Lifestyle Survey, was used to collect the data for the study. Descriptive statistics were included to provide insight into the characteristics of the sample collected. Correlational analysis provided insight into the relationships between BMI and predictor variables within the hierarchical multiple regression. Further, results of the correlational analysis were used to check for multicollinearity between the independent variables of the study. A hierarchical multiple regression model was used for hypothesis testing within the study. The results of the study are presented in Chapter 4. A discussion of the results and the relationship of the current study's findings to extant literature, as well as implications for future research, is presented in Chapter 5.

# Chapter 4: Results

## Introduction

This chapter, which presents descriptive statistics of the data set as well as the results of the quantitative analysis, is divided into five sections: (a) pilot study, (b) population and descriptive findings, (c) confirmatory factor analysis of the survey instrument, (d) investigation of assumptions as related to inferential analysis, and (e) tests of hypotheses. The chapter concludes with a summary of the results. Mplus v.7 statistical software was used for the confirmatory factor analysis. SPSS v22.0 statistical software was used for the descriptive findings and hypothesis testing via a hierarchical regression. All hypotheses were tested at the 95% level of significance.

The purpose of this study was to identify the associations between a vegetarian lifestyle and obesity for Native Hawaiians who live on the Big Island in Hawaii. A hierarchical multiple regression model was tested to investigate the following research question and associated statistical hypotheses:

RQ: Are there differences in BMI between Native Hawaiians aged 21 and older who classify their lifestyle/diet as nonvegetarian vs. vegetarian, after controlling for demographic variables and factor scores obtained from the Native Hawaiian Lifestyle Survey?

$H_{01}$: None of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{a1}$: At least one of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{02}$: After controlling for the descriptive variables, none of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{a2}$: After controlling for the descriptive variables, at least one of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{03}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian do not differ on the dependent variable of BMI.

$H_{a3}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian differ on the dependent variable of BMI.

## Pilot Study

I received notification from the Walden Universty Institutional Review Board (IRB) on June 24, 2014 (#06-24-14-0123135), approving my application for my study entitled "Assessing Plant Based Food Lifestyle To Reduce Obesity Risk" which allowed me to conduct a pilot study prior to collecting data for the full study.

A series of three exploratory factor analyses using principal components analysis (PCA) was performed to obtain empirical factor loadings of the Native Hawaiian Lifestyle Survey using the data collected in a pilot sample ($N = 38$). The first factor

analysis included the six items of the Physical Activity Scale. The second factor analysis included the seven items of the Vegetarian Lifestyle Scale. The third factor analysis included the 10 items of the Lifestyle Control Self-Efficacy Scale. The survey used to collect the data for the pilot study is attached as Appendix C. Results for the factor analyses are presented according to each of the three factors. It should be noted that the number of records used in the factor analyses, $N = 38$, was much smaller than the number of records recommended. The findings from the PCA would have been more succinct with a larger sample. According to Tabachnick and Fidell (2013), it is "comforting" to have a sample of at least 300 records for a factor analysis (p. 613). Therefore, the data collected for the tests of hypotheses in this study were also investigated for factor loadings via a confirmatory factor analysis prior to inclusion of the factors in the full study.

**Principal Components Analysis for the Physical Activity Scale**

The Physical Activity Scale included six statements related to six recreational activities. Participants were asked to indicate their agreement with "doing the following activities each week." Participants were asked to rate their agreement on a scale from 1 = strongly disagree to 7 = strongly agree. Higher scores were associated with greater physical activity.

Prior to performing the principal components analysis (PCA), the suitability of the data for factor analysis was assessed. Inspection of the correlation matrix on the six items included in the model revealed the presence of many coefficients of .3 and greater. The Kaiser-Meyer-Oklin (KMO) value was .775. The recommended minimum of the KMO value is .6 (Kaiser, 1970, 1974); therefore, the KMO value was above the acceptable

minimum value. Bartlett's Test of Sphericity was performed on the six-item matrix and returned a significant value ($p < .0005$) supporting the factorability of the correlation matrix.

Principal components analysis revealed the presence of only one component with an eigenvalue exceeding 1, explaining a total of 58% of the variance. An inspection of the scree plot revealed a leveling after the first component (see Figure 2). Using Cattell's (1966) scree test, it was determined that one component would be retained for further investigation. The use of six items and one component was further supported by the results of parallel analysis, which showed only one component with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (7 variables × 38 respondents). The one-component solution revealed the presence of simple structure (Thurstone, 1947), with the component showing all seven items with strong loadings of .40 or above. It was decided that this factor solution was suitable.

Table 1 presents the six survey statements and their associated factor loadings for the one-component solution. The factor loadings, also called component loadings in PCA, are the correlation coefficients between the survey items (rows) and factors (columns). Analogous to Pearson's correlation coefficient, the squared factor loading is the percentage of variance in a particular survey item explained by the factor (component). Internal consistency reliability of the six-item, one-component solution was tested using Cronbach's coefficient alpha. A Cronbach's coefficient alpha value of .70 or greater indicates good reliability of an instrument with the data collected (Tabachnick & Fidell,

2007). The Cronbach's alpha coefficient of the six-item, one-component solution was .848, well above the .70 threshold for good internal consistency reliability.

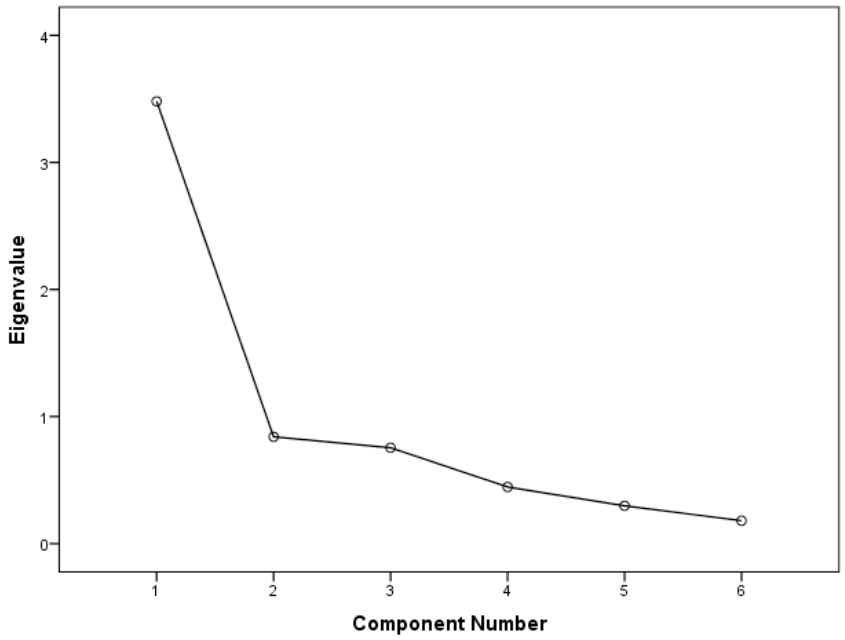


*Figure 2*. Scree plot of the six possible components of the Physical Activity Scale. The elbow at component 2, as well as components 2 through 6 indicating eigenvalues below 1, suggests a one-component solution.

Table 1

*Factor Loadings and Descriptive Measures of the Six Retained Survey Statements Onto the One-Factor Solution for the Physical Activity Scale (*N = *38)*

| Statement | *M* | *SD* | Factor Loading |
|---|---|---|---|
| Running/jogging for 30 minutes or more | 3.32 | 1.95 | .895 |
| Working out for 30 minutes or more | 4.18 | 1.96 | .825 |
| Swimming for 30 minutes or more | 3.42 | 1.67 | .804 |
| Dancing for 1 hour or more | 3.79 | 2.21 | .755 |
| Playing sports for 30 minutes or more | 2.92 | 1.85 | .732 |
| Walking more than a mile | 4.50 | 1.75 | .498 |

**Principal Components Analysis for the Vegetarian Lifestyle Scale**

The Vegetarian Lifestyle Scale included seven statements related to food group choices of the participants. Participants were asked to indicate their agreement with each of the seven statements on a scale from 1 = strongly disagree to 7 = strongly agree. Higher scores were associated with greater consumption of the foods in a given food group statement.

Prior to performing PCA, the suitability of data for factor analysis was assessed. Inspection of the correlation matrix on the seven items included in the model revealed the presence of many coefficients of .3 and greater. However, items 6 and 7 of the scale were negatively correlated with some of the other five items. The Kaiser-Meyer-Oklin (KMO)

value was .775. The recommended minimum of the KMO value is .6 (Kaiser, 1970, 1974); therefore, the KMO value was above the acceptable minimum value. Bartlett's Test of Sphericity was performed on the six-item matrix and returned a significant value ($p < .0005$) supporting the factorability of the correlation matrix.

Principal components analysis revealed the presence of two components with an eigenvalue exceeding 1, explaining a total of 65% of the variance. An inspection of the scree plot revealed an elbow at component 2 and then a gradual leveling (see Figure 3). Using Catell's (1966) scree test, it was determined that two components could be retained for further investigation. The use of seven items and two components was further supported by the results of parallel analysis, which showed only two components with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (7 variables × 38 respondents). However, item 6, "I consider myself a vegetarian," cross-loaded on both components and was negative on the first component. Other items on the Vegetarian Lifestyle Scale were associated with the eating of various food groups and types rather than a direct statement of a vegetarian lifestyle. The second component also included item 7, "In the past week I ate vegetables every day," which returned a poor interitem correlation ($r = .007$) with the other six variables in the full Vegetarian Lifestyle Scale of seven items. Further, the Cronbach's alpha score for internal consistency reliability for the second factor with three items was .248, much lower than the .70 threshold for good reliability with the data collected. Removal of items 6 and 7 left only item 4 on the second component. A factor should have at least three and preferably four items (Raubenheimer, 2004). Therefore, items 6 and 7 were removed, and

item 4 was retained for use as a factor with items 1, 2, 3, and 5 in a one-component solution with five items.

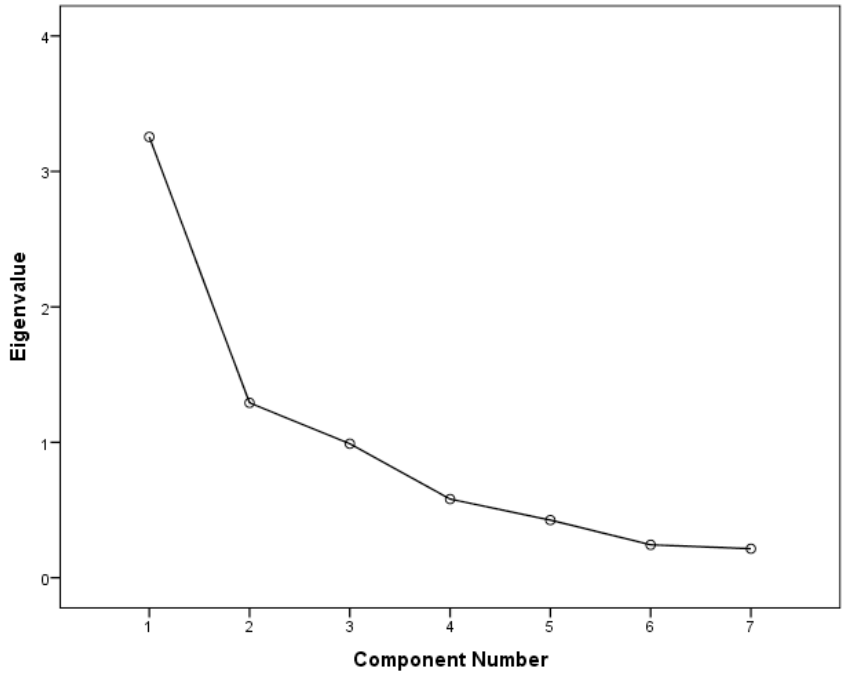


*Figure 3*. Scree plot of the seven possible components of the Vegetarian Lifestyle Scale. The elbow at component 2, as well as components 3 through 7 indicating eigenvalues below 1, suggests a two-component solution.

The PCA using a one-factor solution with varimax rotation indicated the presence of simple structure. Item 4, "I eat fish and fish products regularly," had a low factor loading of .330. The Cronbach's alpha coefficient for the five-factor solution was .811, indicative of good internal consistency reliability. However, the item–total statistics table indicated that if item 4 were removed from the factor, the Cronbach's alpha score would increase to .884. Thus, item 4 was removed and a one-factor solution with four items (items 1, 2, 3, and 5) was investigated.

The PCA with the one-factor, four-item solution explained a total of 75% of the variance. An inspection of the scree plot revealed a leveling after the first component (see

Figure 4). Using Catell's (1966) scree test, it was determined that the one-component solution would be a good fit. The use of four items and one component was further supported by the results of parallel analysis, which showed only one component with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (4 variables × 38 respondents). The factor solution revealed the presence of simple structure (Thurstone, 1947), with the component showing all four items with strong loadings of .40 or above. It was decided that this factor solution was suitable. Table 2 presents the four retained survey statements and their associated factor loadings for the one-component solution. The Cronbach's alpha coefficient of the four-item, one-component solution was .884, well above the .70 threshold for good internal consistency reliability. Two items in the solution, "I eat milk/dairy products/eggs regularly" and "In the past year I ate milk/dairy products/eggs regularly," were worded very similarly. Spearman's rank order correlation was used to check for possible multicollinearity between the two items. Multicollinearity is noted when a correlation between two variables is .90 or greater (Pallant, 2013). Although the correlation between the two items was strong and direct ($r$ = .616), multicollinearity was not noted, and both items were thus retained in the factor.

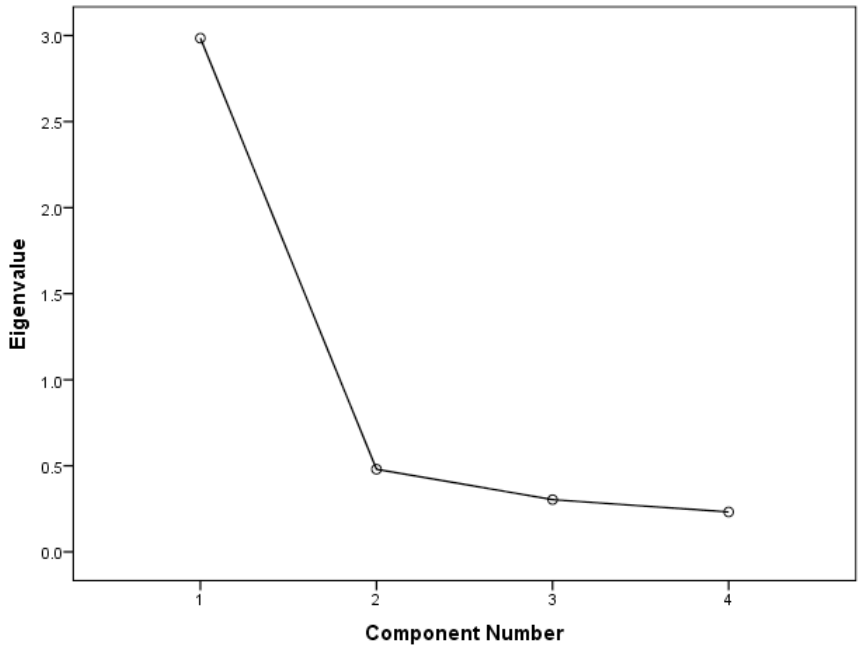


*Figure 4*. Scree plot of the four possible components of the Vegetarian Lifestyle Scale. The elbow at component 2, as well as components 2 through 4 indicating eigenvalues below 1, suggests a one-component solution.

Table 2

*Factor Loadings and Descriptive Measures of the Four Retained Survey Statements Onto the One-Factor Solution for the Vegetarian Lifestyle Scale (*N = *38)*

| Statement | *M* | *SD* | Factor Loading |
|---|---|---|---|
| Eating beef/pork/chicken has been part of my lifestyle for more than a year. | 5.55 | 1.65 | .890 |
| In the past year I ate milk/dairy products/eggs regularly | 4.68 | 1.68 | .886 |
| I eat meat and meat products regularly | 5.40 | 1.75 | .877 |
| I eat milk/dairy products/eggs regularly | 4.45 | 1.86 | .799 |

**Principal Components Analysis for the Lifestyle Control Self-Efficacy Scale**

The Lifestyle Control Self-Efficacy Scale included 10 statements related to participants' confidence and ability in making good food choices. Participants were asked to indicate their agreement with each of the seven statements on a scale from 1 = strongly disagree to 7 = strongly agree. Higher scores were associated with a participant feeling a greater self-efficacy in making good food choices.

Prior to performing PCA, the suitability of data for factor analysis was assessed. Inspection of the correlation matrix on the 10 items included in the model revealed the presence of many coefficients of .3 and greater. The Kaiser-Meyer-Oklin (KMO) value was .838. The recommended minimum of the KMO value is .6 (Kaiser, 1970, 1974); therefore, the KMO value was above the acceptable minimum value. Bartlett's Test of

Sphericity was performed on the six-item matrix and returned a significant value ($p <$ .0005) supporting the factorability of the correlation matrix.

Principal components analysis revealed the presence of two components with an eigenvalue exceeding 1, explaining a total of 70% of the variance. An inspection of the scree plot revealed an elbow at component 2 and then a leveling (see Figure 5). Using Catell's (1966) scree test, it was determined that two components could be retained for further investigation. However, the use of 10 items on one component was suggested by the results of parallel analysis, which showed only one component with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (10 variables × 38 respondents).

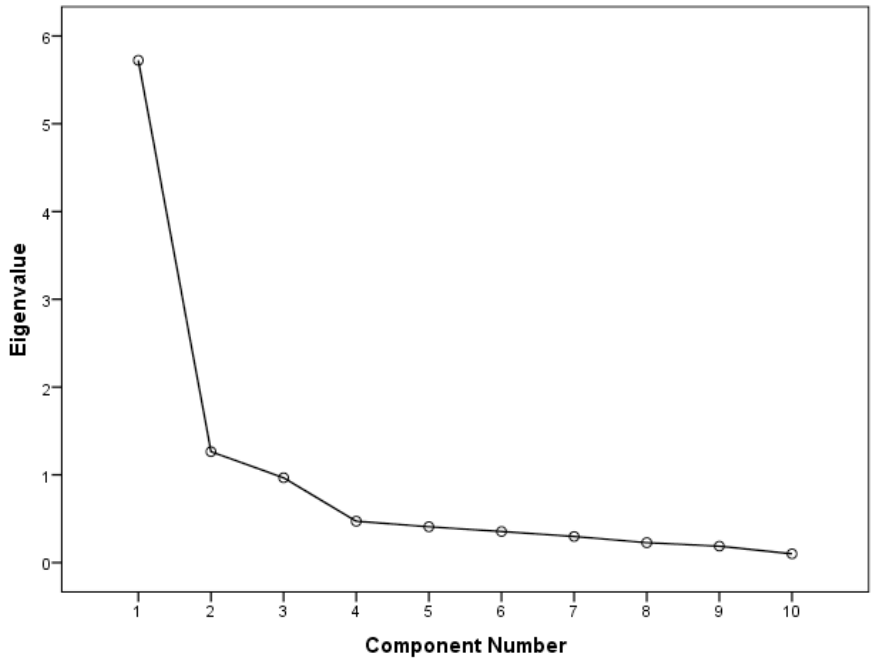


*Figure 5*. Scree plot of the 10 possible components of the Lifestyle Control Self-Efficacy Scale. The elbow at component 2, as well as components 3 through 10 indicating eigenvalues below 1, suggests a two-component solution.

The rotated factor solution showed three items cross-loaded onto both components. These items were removed, and another PCA with seven items on two components was tested. The KMO value was .787, and Bartlett's Test of Sphericity returned a significant value ($p < .0005$) supporting the factorability of the correlation matrix. Two components had an eigenvalue exceeding 1, explaining a total of 74% of the variance. An inspection of the scree plot revealed an elbow at component 2 and then a leveling (see Figure 6). Using Catell's (1966) scree test, it was again determined that two components could be retained for further investigation. However, the use of seven items on one component was supported by the results of parallel analysis, which showed only one component with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (7 variables × 38 respondents).

A one- or two-factor solution could feasibly have been derived for the seven-item Lifestyle Control Self-Efficacy Scale. Factor loadings and Cronbach's alpha coefficients were acceptable for both solutions. Further investigation into the items that loaded onto each of the two factors was done to check for similarities and differences in the wording of the items that loaded onto each factor. The four items of the first factor appeared to contain items related to maintaining good food choices during adverse or uncertain situations. The three items that loaded onto the second factor were related to regulation or control of eating habits. The correlation between the two factors was not direct and strong ($r = .536$), but not close to multicollinearity, which suggested that the two factors could indeed be assessing different phenomena. It was decided that the two-factor solution would be used. The first factor, which included the four items relating to maintaining good food choices during adverse or uncertain situations, was named Lifestyle-Coping.

The second factor, which included the three items that were related to regulation or control of eating habits, was named Lifestyle-Control. The Cronbach's alpha coefficients for Lifestyle-Coping and Lifestyle-Control were α = .861 and α = .831, respectively. Table 3 presents the factor loadings and descriptive measures for the two Lifestyle Control Self-Efficacy Scale factors.

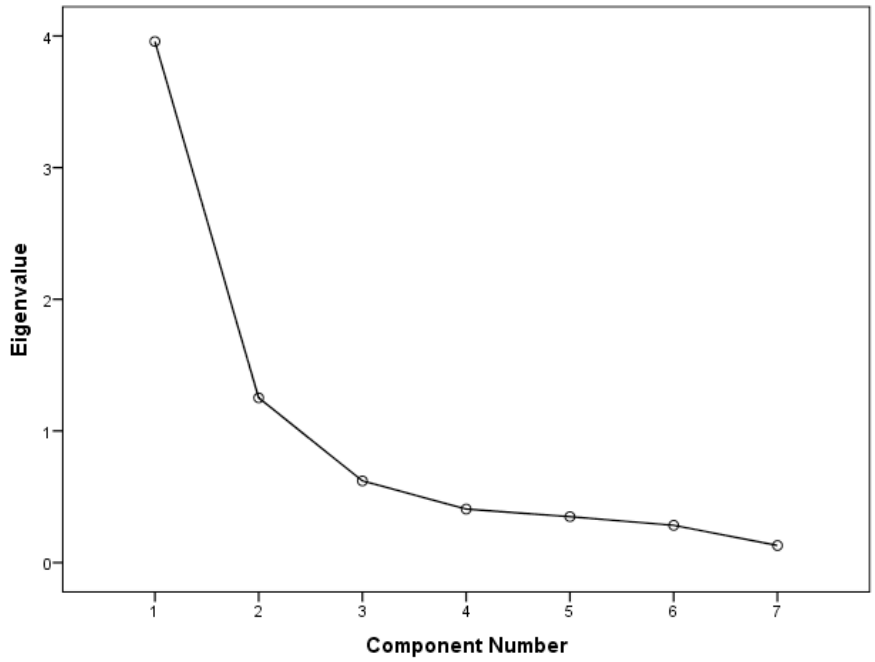


*Figure 6*. Scree plot of the seven possible components of the Lifestyle Control Self-Efficacy Scale. The elbow at component 2, as well as components 3 through 7 indicating eigenvalues below 1, suggests a two-component solution.

Table 3

*Factor Loadings and Descriptive Measures of the Seven Retained Survey Statements Onto the Two-Factor Solution for the Lifestyle Control Self-Efficacy Scale (*N = *38)*

| Factor/statement | *M* | *SD* | Factor Loading |
|---|---|---|---|
| Lifestyle-Coping | --- | --- | --- |
| I am confident that I could efficiently control my eating habits during unexpected events. | 5.11 | 1.06 | .908 |
| Thanks to my resourcefulness, I know how to control my eating habits during unforeseen situations | 5.03 | 1.20 | .861 |
| When it comes to making food choices, I usually make sensible choices. | 4.79 | 1.51 | .793 |
| I can remain calm when facing difficulties about food choices because I can rely on my coping abilities. | 5.29 | 1.06 | .764 |
| Lifestyle-Control | --- | --- | --- |
| If I do not get support, I can still find the means and ways to regulate my eating habits | 4.90 | 1.48 | .971 |
| When I am confronted with a problem regarding my food choices, I can usually find several solutions. | 5.05 | 1.33 | .940 |
| I can always manage to regulate my eating habits if I try hard enough. | 5.18 | 1.43 | .592 |

## Population and Study Demographics

The population for this study included Hawaiians living in the state of Hawaii. The estimated size of the Hawaiian population in the state of Hawaii is approximately 1,345,500 people (U.S. Census Bureau, 2015). The convenience sample collected from the population ($N$ = 304) included participants who were Native Hawaiians aged 21 and older, and who lived on the Big Island of Hawaii. To be included in the study, participants had to have followed one of the four vegetarian lifestyles or a nonvegetarian lifestyle for 1 year or more.

Table 4 presents the frequency counts and percentages of the categorical demographic and descriptive variables for the study participants. Table 5 presents the measures of central tendency and variability for the continuous descriptive variables relating to the participants' age and BMI. Participants ranged in age from 22 to 87 years ($M$ = 57.12 years, $SD$ = 14 years). More than half of the participants were female (175 participants, 57.6%). Forty-one percent of the participants had a high school education or less. The majority of participants followed a nonvegetarian diet (239 participants, 78.6%). Almost half of the participants had high blood pressure (49.3%). Approximately a quarter of the participants had diabetes (24.3%). The BMI for the participants ranged from 17.31 to 61.46, and on average the participants could be classified as obese ($M$ = 30.97, $SD$ = 7.78).

Table 4

*Frequencies and Percentages of Demographic and Categorical Descriptive Variables for the Study Participants (*N = *304)*

| Variable | Frequency | % |
|---|---|---|
| Gender | | |
| Female | 175 | 57.6 |
| Male | 124 | 40.8 |
| No response | 5 | 1.6 |
| Education level | | |
| High school or less | 126 | 41.4 |
| Some college | 94 | 30.9 |
| 4 years of college | 61 | 20.1 |
| Master's or doctorate degree | 22 | 7.2 |
| No response | 1 | 0.3 |
| Diet classification | | |
| Nonvegetarian | 239 | 78.6 |
| Vegan | 7 | 2.3 |
| Lacto-ovo vegetarian | 5 | 1.6 |
| Pesco-vegetarian | 12 | 3.9 |
| Semivegetarian | 31 | 10.2 |
| No response | 10 | 3.3 |
| Health risk(s) (can choose more than one) | | |
| High blood pressure | 150 | 49.3 |
| Asthma | 39 | 12.8 |
| Diabetes | 74 | 24.3 |
| Heart disease | 43 | 14.1 |
| Cancer | 14 | 4.6 |
| Other | 32 | 10.5 |
| None | 94 | 30.9 |

Table 5

*Measures of Central Tendency and Variability for Participants' Age and BMI Variables*

| Variable | *N* | *M* | *SD* | *Mdn* | Range |
|---|---|---|---|---|---|
| Age (in years) | 289 | 57.12 | 14.00 | 59.00 | 22–87 |
| Height (inches) | 296 | 66.18 | .71 | 66.00 | 41–77 |
| Weight (pounds) | 302 | 193.32 | 51.99 | 185.00 | 107–418 |
| BMI | 296 | 30.97 | 7.78 | 29.51 | 17.31–61.46 |

*Note.* BMI = Body Mass Index.

## Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was performed on the factors that were derived from the Hawaiian Lifestyle Survey in the pilot study. Confirmatory factor analysis assumes that the measured factors, also called latent variable constructs, are continuous in scale. Each of the four latent variable constructs of (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control were derived from Likert-scaled items that were ordinal in scale. However, computing the average of all items to obtain a score allowed the derived construct to be considered continuous in scale. Therefore, the assumption of a continuous scale of measurement for the four latent variable constructs of the survey was met. Mplus v.7 was used to run the full hypothesized CFA model. The full model converged. The relative $\chi 2$ value, also referred to as the normed $\chi 2$ value, was computed by dividing the $\chi^2$ index value of the fitted model by the model degrees of freedom (307.70/113 = 2.72). A value of 5 or less is

considered a good model fit (Schumacker & Lomax, 2004). However, the root mean square error of approximation (RMSEA) value of .075 was higher than the desired cutoff value of .05 (Hu & Bentler, 1999). The confirmatory fit index (CFI) of the model was .929. A CFI value of .90 or larger is desirable for indication of good model fit (Hugh & Bentler). Similarly, the Tucker Lewis Index (TLI) of the model was .914. The TLI is relatively independent of sample size according to Marsh, Balla, and McDonald (1988). Values of the TLI above .90 are considered acceptable for fit (Hu & Bentler, 1999).

Mplus provides a listing of model modification indices that can be used to modify the model in order to encourage a better fit. However, one must be careful not to over-fit the model to the data set of study. Modification indices suggested by the Mplus software would have complicated the model more than desired and did not improve the model fit. I investigated the factor loadings for the four variable constructs and found they were all above .40. It was decided that no further adjustments would be made to the factors. Cronbach's alpha coefficients were checked to determine the internal consistency reliability of the factors with the collected data. All four factors had Cronbach's alpha coefficients above the .70 threshold of acceptance. The factors were acceptable for use in the correlational analyses and hierarchical regression model. Table 6 presents the measures of central tendency and factor loadings of each of the items for the four factors. Table 7 presents the measures of central tendency and Cronbach's alpha coefficients for the four factors.

Table 6

*Factor Loadings and Descriptive Measures of the Survey Statements Retained on Four Factors Derived From the Hawaiian Lifestyle Survey*

| Factor/statement | *M* | *SD* | Factor loading |
|---|---|---|---|
| Physical Activity Scale | --- | --- | --- |
| Running/jogging for 30 minutes or more | 3.46 | 2.36 | .797 |
| Playing sports for 30 minutes or more | 3.74 | 2.35 | .776 |
| Working out for 30 minutes or more | 4.53 | 2.32 | .769 |
| Swimming for 30 minutes or more | 3.79 | 2.39 | .686 |
| Walking more than a mile | 5.17 | 2.05 | .644 |
| Dancing for 1 hour or more | 3.44 | 2.33 | .557 |
| Vegetarian Lifestyle Scale | --- | --- | --- |
| I eat milk/dairy products/eggs regularly. | 4.87 | 2.01 | .897 |
| In the past year I ate milk/dairy products/eggs regularly. | 5.00 | 2.03 | .865 |
| I eat meat and meat products regularly. | 5.05 | 2.16 | .722 |
| Eating beef/pork/chicken has been part of my lifestyle for more than a year. | 5.86 | 1.89 | .601 |
| Lifestyle-Coping | --- | --- | --- |
| I am confident that I could efficiently control my eating habits during unexpected events. | 5.20 | 1.80 | .871 |
| Thanks to my resourcefulness, I know how to control my eating habits during unforeseen situations. | 5.27 | 1.74 | .853 |
| When it comes to making food choices, I usually make sensible choices. | 5.00 | 1.75 | .836 |
| I can remain calm when facing difficulties about food choices because I can rely on my coping abilities. | 5.24 | 1.69 | .797 |
| Lifestyle-Control | --- | --- | --- |
| If I do not get support, I can still find the means and ways to regulate my eating habits. | 5.31 | 1.65 | .888 |
| When I am confronted with a problem regarding my food choices, I can usually find several solutions. | 5.63 | 1.78 | .687 |
| I can always manage to regulate my eating habits if I try hard enough. | 5.35 | 1.87 | .578 |

Table 7

*Measures of Central Tendency and Cronbach's Alpha Coefficients for the Four Factors Derived From the Hawaiian Lifestyle Survey*

| Factor/Item | *N* | *M* | *SD* | *Mdn* | α |
|---|---|---|---|---|---|
| Physical Activity Scale | 280 | 4.07 | 1.80 | 4.0 | .852 |
| Vegetarian Lifestyle Scale | 280 | 5.16 | 1.73 | 5.50 | .857 |
| Lifestyle-Coping | 280 | 5.17 | 1.54 | 5.50 | .910 |
| Lifestyle-Control | 289 | 5.42 | 1.51 | 5.67 | .798 |

*Note. M* = Mean; *SD* = Standard Deviation; *Mdn* = Median. The possible range for each variable was 1–7.

## Assumptions

The data set was investigated to ensure that it satisfied the assumptions of the hierarchical regression analyses of study: absence of missing data, absence of outliers, normality, linearity, and homoscedasticity as relating to the dependent variable of BMI.

Many records were missing data on the items that were used to construct the dependent and independent variables utilized for inferential analysis. However, a rule of thumb is to assume the missing-ness is missing completely at random (MCAR) if less than 5% of the data is missing for a variable (McKnight, 2007). None of the variables included in the hierarchical linear regression had more than 5% of the data missing. Thus, the missing-ness was assumed to be MCAR and thus not affecting the analysis outcomes. Pairwise deletion of cases is an option provided by SPSS for handling missing data. Pairwise deletion is a technique that excludes cases only when they are missing data for a particular analysis but includes the cases for all analyses for which they have the needed

information (Pallant, 2013). Therefore, to help retain as much power as possible for the study, the records with the missing information on the dependent variables and independent variables were excluded only for the hypothesis tests in which they were involved, but the records were retained for the hypothesis tests in which they had the available information.

Outliers in a data set have the potential to distort results of an inferential analysis. A check of box plots for the variables of BMI, age, and the four factors of (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control was performed to visually inspect for outliers. Fourteen outliers were found for BMI, and five outliers were found for Lifestyle-Control. The variables were standardized to check for the presence of extreme outliers ($z$ = +/-3.3), and three extreme outliers were in the upper range of the BMI variable. The tests used in this study are robust to the presence of outliers if other assumptions are met. Moreover, none of the outliers was found to be an illegitimate measurement or to be incorrectly coded. Because all outliers were in acceptable ranges of the BMI and Lifestyle-Control variables, all records were retained for analysis, and the outlier assumption was considered tenably met.

Normality for the scores of the BMI variable was investigated with SPSS Explore. The Kolmogorov-Smirnov test (K-S) for normality indicated that the values of the BMI variable were not normally distributed ($p < .01$). However, the K-S test is sensitive to larger sample sizes, with significant findings returned when sample sizes are larger ($n >$ 50; Pallant, 2007). A visual check of histograms and Normal Q-Q plots for the BMI variable indicated a right skew, which was a consequence of the outliers in the upper ranges. A comparison of the median and mean values for the BMI variable indicated that

the mean ($M$ = 30.97) and median ($Mdn$ = 29.51) were similar in value, further confirming that outliers and nonnormality were not affecting the data (see Table 5). Linear regression is robust to deviations from normality if the assumption of homoscedasticity is met (Tabachnick & Fidell, 2007 pp. 85-86). A histogram and scatterplot of the standardized residuals of the regression model were checked. The histogram indicated a normal distribution, and the plot showed scatter and no observable pattern in the residuals. Therefore, the data were not transformed and were used as observed in the regression models.

Assumptions of linearity between study variables and homoscedasticity were checked with scatterplots of the data. The assumptions of linearity and homoscedasticity were not violated. Multicollinearity diagnostics for hierarchical regression were performed by investigating bivariate correlations between the independent variables. Multicollinearity is defined as a positive correlation of .90 or greater between two variables (Tabachnick & Fidell, 2007). Multicollinearity was not found between any of the variable pairs, and the assumption of an absence of multicollinearity was met.

## Tests of Hypotheses

The research question for this study was, "Are there differences in BMI between Native Hawaiians aged 21 and older who classify their lifestyle/diet as nonvegetarian vs. vegetarian, after controlling for demographic variables and factor scores obtained from the Native Hawaiian Lifestyle Survey?" Three hypotheses were tested via one hierarchical linear regression. The dependent variable was BMI. The regression had three steps or blocks.

The first step included demographic and health risk independent variables: (a) gender (coded as male = 0 and female = 1); (b) age (a continuous variable measured in years and mean centered); (c) level of education (an ordinal variable coded as high school or less = 0, some college = 1, 4 years of college = 2, and master's or doctorate degree = 3); (d) high blood pressure (a dichotomous variable coded as 0 = no and 1 = yes); (e) asthma (a dichotomous variable coded as 0 = no and 1 = yes); (f) diabetes (a dichotomous variable coded as 0 = no and 1 = yes); (g) heart disease (a dichotomous variable coded as 0 = no and 1 = yes); (h) cancer (a dichotomous variable coded as 0 = no and 1 = yes); (i) other health risk (a dichotomous variable coded as 0 = no and 1 = yes); and (j) no health risk (a dichotomous variable coded as 0 = no and 1 = yes).

The second step included the addition of the four factors that were derived from the Native Hawaiian Lifestyle Survey: (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control. The four factors were measured on a continuous scale. The third step included the variables of the first two blocks as well as the variable of diet classification, which was coded as nonvegetarian = 0 and vegetarian = 1.

The model was specified with a reference of a participant who was male, 57.12 years of age, and a nonvegetarian. Table 8 presents the findings of the hierarchical regression analysis. The model findings are then used to address each of the three hypotheses separately.

Table 8

*Hierarchical Multiple Linear Regression Analysis of BMI Regressed on Variable Controls (Step 1), Derived Factors From the Native Hawaiian Lifestyle Survey (Step 2), and Diet Classification (Step 3) (*N = *278)*

| | | | | | | 95% CI for B | |
|---|---|---|---|---|---|---|---|
| Step/variable | *B* | *SE B* | B | *t* | *p* | Lower | Upper |
| Step 1 | | | | | | | |
| Gender | -0.434 | 0.901 | -0.028 | -0.481 | .631 | -2.208 | 1.341 |
| Age | -0.177 | 0.035 | -0.318 | -5.012 | <.0005 | -0.246 | -0.107 |
| Education level | -0.647 | 0.463 | -0.079 | -1.396 | .164 | -1.559 | 0.265 |
| High blood pressure | 2.297 | 1.161 | 0.148 | 1.705 | .049 | 0.012 | 4.583 |
| Asthma | 2.400 | 1.408 | 0.104 | 1.705 | .089 | -0.372 | 5.173 |
| Diabetes | 0.726 | 1.120 | 0.040 | 0.649 | .517 | -1.478 | 2.931 |
| Heart disease | 1.622 | 1.342 | 0.073 | 1.209 | .228 | -1.020 | 4.264 |
| Cancer | -0.805 | 2.158 | -0.022 | -0.373 | .710 | -5.053 | 3.444 |
| Other health risk | -0.994 | 1.48 | -0.039 | -0.668 | .505 | -3.921 | 1.934 |
| No health risk | -3.276 | 1.424 | -0.195 | -2.301 | .022 | -6.080 | -0.473 |
| (Constant) | 31.133 | 1.358 | --- | --- | --- | --- | --- |
| Model Summary | | | | | | | |
| $F = 5.534$ | | | | | | | |
| $R^2 = .172$ | | | | | | | |
| Adj. $R^2 = .141$ | | | | | | | |
| Sig. < .0005 | | | | | | | |
| Step 2 | | | | | | | |
| Gender | -0.623 | 0.868 | -0.040 | -0.719 | .473 | -2.332 | 1.085 |
| Age | -0.132 | 0.035 | -0.238 | -3.752 | <.0005 | -0.201 | -0.063 |
| Education level | -0.502 | 0.451 | -0.061 | -1.113 | .267 | -1.391 | 0.386 |
| High blood pressure | 1.735 | 1.125 | 0.112 | 1.542 | .124 | -0.480 | 3.949 |
| Asthma | 1.837 | 1.359 | 0.079 | 1.352 | .178 | -0.839 | 4.514 |
| Diabetes | 0.922 | 1.089 | 0.051 | 0.846 | .398 | -1.223 | 3.066 |
| Heart disease | 1.098 | 1.308 | 0.049 | 0.839 | .402 | -1.478 | 3.673 |
| Cancer | 0.004 | 2.083 | 0.000 | 0.002 | .998 | -4.097 | 4.106 |
| Other health risk | -1.123 | 1.434 | -0.044 | -0.783 | .434 | -3.945 | 1.700 |
| No health risk | -2.429 | 1.384 | -0.145 | -1.755 | .080 | -5.153 | 0.296 |
| Physical activity scale | -0.372 | 0.245 | -0.086 | -1.517 | .130 | -0.854 | 0.111 |
| Vegetarian lifestyle scale | 0.751 | 0.251 | 0.167 | 2.987 | .003 | 0.256 | 1.246 |
| Lifestyle-Coping | -1.213 | 0.424 | -0.240 | -2.863 | .005 | -2.048 | -0.379 |
| Lifestyle-Control | 0.239 | 0.423 | 0.046 | 0.563 | .574 | -0.595 | 1.072 |
| (Constant) | 33.813 | 2.559 | --- | --- | --- | --- | --- |
| Model Summary | | | | | | | |
| $F_{Change} = 6.417$ | | | | | | | |
| $R^2 = .245$ | | | | | | | |
| Adj. $R^2 = .205$ | | | | | | | |
| Sig. < .0005 | | | | | | | |

*(table continues)*

| Step/variable | *B* | *SE B* | B | *t* | *p* | 95% CI for B Lower | 95% CI for B Upper |
|---|---|---|---|---|---|---|---|
| Step 3 | | | | | | | |
| Gender | -0.611 | 0.870 | -0.039 | -0.703 | .483 | -2.324 | 1.102 |
| Age | -0.131 | 0.035 | -0.236 | -3.694 | <.0005 | -0.201 | -0.061 |
| Education level | -0.528 | 0.458 | -0.065 | -1.154 | .250 | -1.430 | 0.373 |
| High blood pressure | 1.772 | 1.131 | 0.114 | 1.566 | .119 | -0.456 | 4.000 |
| Asthma | 1.875 | 1.366 | 0.081 | 1.373 | .171 | -0.814 | 4.565 |
| Diabetes | 0.918 | 1.091 | 0.051 | 0.841 | .401 | -1.230 | 3.066 |
| Heart Disease | 1.110 | 1.311 | 0.050 | 0.847 | .398 | -1.471 | 3.690 |
| Cancer | -0.071 | 2.097 | -0.002 | -0.034 | .973 | -4.201 | 4.059 |
| Other health risk | -1.139 | 1.437 | -0.045 | -0.793 | .429 | -3.968 | 1.690 |
| No health risk | -2.371 | 1.396 | -0.141 | -1.699 | .091 | -5.119 | 0.377 |
| Physical activity scale | -0.373 | 0.245 | -0.086 | -1.520 | .130 | -0.856 | 0.110 |
| Vegetarian lifestyle scale | 0.789 | 0.274 | 0.176 | 2.879 | .004 | 0.250 | 1.329 |
| Lifestyle-Coping | -1.230 | 0.427 | -0.244 | 2.880 | .004 | -2.071 | -0.389 |
| Lifestyle-Control | 0.231 | 0.425 | 0.045 | 0.543 | .588 | -0.606 | 1.067 |
| Diet classification | -0.440 | 1.237 | -0.022 | -0.356 | .722 | -2.876 | 1.995 |
| (Constant) | 34.086 | 2.675 | --- | --- | --- | --- | --- |
| Model Summary | | | | | | | |
| $F_{Change} = 0.127$ | | | | | | | |
| $R^2 = .246$ | | | | | | | |
| Adj. $R^2 = .203$ | | | | | | | |
| Sig. .722 | | | | | | | |

*Note*. Reference group for gender = male. Reference group for diet classification = nonvegetarian.

**Hypothesis 1**

$H_{01}$: None of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

$H_{a1}$: At least one of the descriptive variables of (a) health condition, (b) gender, (c) age, or (d) level of education is a statistically significant predictor of the dependent variable of BMI.

Step 1 of the hierarchical regression included variables representing (a) health conditions, (b) gender, (c) age, and (d) level of education. The Step 1 model had an R value for regression that was significantly different from zero, $F(10, 267) = 5.53$, $p < .0005$, with $R^2$ of .172 (adjusted $R^2 = .141$). Three variables were significant predictors of BMI. Age was a significant predictor of BMI [$B = -0.177$; $t\ (267) = -5.012$, $p < .0005$]. The value of the magnitude and direction of the age coefficient indicated that each 1-year increase in age was associated with a 0.18-unit decrease in BMI. High blood pressure was also a significant predictor of BMI [$B = 2.297$; $t\ (267) = 1.705$, $p = .049$]. The magnitude and direction of the coefficient indicated that participants with high blood pressure had about a 2.3-point increase in BMI when compared with those who did not have high blood pressure. Participants who reported no health risks had significant decreases in BMI, about 3.3 points, compared with those who did have health risks [$B = -3.276$; $t\ (267) = -2.301$, $p = .022$]. A check of the squared semipartial correlations for the Step 1 model indicated that 8% of the variability in the dependent variable of BMI was uniquely predicted by age. Approximately 2% of the variability in BMI was uniquely predicted by the health risk = none variable, and about 1% of variability in BMI was uniquely predicted by the high blood pressure variable.

**Conclusion as relates to Null Hypothesis 1.** Reject Null Hypothesis 1. There is sufficient evidence to indicate that at least one of the descriptive variables—(a) health condition, (b) gender, (c) age, or (d) level of education—is a statistically significant predictor of the dependent variable of BMI. The descriptive variable of age remained a significant predictor in Step 3 of the regression model.

**Hypothesis 2**

$H_{02}$: After controlling for the descriptive variables, none of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

$H_{a2}$: After controlling for the descriptive variables, at least one of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI.

Step 2 of the hierarchical regression included the variables from Step 1 and the four factors derived from the Native Hawaiian Lifestyle Survey: (a) Physical Activity Scale, (b) Vegetarian Lifestyle Scale, (c) Lifestyle-Coping, and (d) Lifestyle-Control. The Step 2 model was a significant improvement from the Step 1 model [$F$ (14, 263) = 6.107, $p < .0005$; $F$-change (4, 263) = 6.417, $p < .0005$], with $R^2$ of .245 (adjusted $R^2$ = .205), for a total $R^2$ change of .074. Three variables were significant for the second step: Age remained a significant predictor of BMI [$B$ = -0.132; $t$ (263) = -3.752, $p < .0005$] and indicated that each 1-year increase in age resulted in a 0.13-point decrease in BMI. The squared semipartial correlation coefficient of the age variable indicated that 4% of the variance in the outcome of BMI was uniquely predicted by the age variable.

The Vegetarian Lifestyle Scale score was also a significant predictor of BMI [$B$ = 0.751; $t$ (263) = 2.987, $p$ = .003]. The Vegetarian Lifestyle Scale was scored such that higher values were associated with less adherence to a vegetarian lifestyle. Thus, each 1-point increase in the Vegetarian Lifestyle Scale score was associated with a .75-point increase in BMI. The squared semipartial correlation coefficient of the Vegetarian

Lifestyle Scale score indicated that 3% of the variance in the outcome of BMI was uniquely predicted by the factor.

Lifestyle-Coping was a significant predictor of BMI, [$B$ = -1.213; $t$ (263) = -2.863, $p$ = .005]. The Lifestyle-Coping Variable Scale was scored such that higher values were associated with greater coping skills for making healthy choices when presented with unexpected food situations. Thus, each 1-point increase in the Lifestyle-Coping score was associated with a 1.21-point decrease in BMI. The squared semipartial correlation coefficient of the Lifestyle-Coping Scale score indicated that 2% of the variance in the outcome of BMI was uniquely predicted by the factor.

**Conclusion as relates to Null Hypothesis 2.** Reject Null Hypothesis 2. There is sufficient evidence to indicate that after controlling for the descriptive variables, at least one of the factors derived from the Native Hawaiian Lifestyle Survey is a significant predictor of the dependent variable of BMI. The factors of Vegetarian Lifestyle and Lifestyle-Coping remained significant in Step 3 of the regression model.

**Hypothesis 3**

$H_{03}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian do not differ on the dependent variable of BMI.

$H_{a3}$: After controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian differ on the dependent variable of BMI.

Step 3 of the hierarchical regression included the variables from Steps 1 and 2 and the diet classification variable. The Step 3 model was not a significant improvement over

the Step 2 model [$F$ (15, 262) = 5.689, $p < .0005$; $F$-change (1, 262) = 0.127, $p = .722$], with $R^2$ of .246 (adjusted $R^2 = .203$), for a total $R^2$ change of zero. Because the $F$ change of the Step 3 model over the Step 2 model was not significant, the model coefficients were not investigated further. It can be concluded from the nonsignificant $F$ change that the diet classification variable did not significantly contribute to BMI after controlling for the variables in the prior steps of the model.

**Conclusion as relates to Null Hypothesis 3.** Do not reject Null Hypothesis 3. There is not sufficient evidence to indicate that after controlling for the descriptive variables and Native Hawaiian Lifestyle Survey factors, the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian differ on the dependent variable of BMI.

## Summary

Chapter 4 began with a description of the demographics of the participants in the study. Following the report of demographics, a CFA was performed to test the hypothesized factors derived from the Native Hawaiian Lifestyle Survey in the pilot study. Information pertaining to required assumptions for the hierarchical linear regression model was presented and discussed. Following the demographic, CFA, and assumption sections, hypothesis testing performed via hierarchical multiple regression was discussed. Significant results were found for the tests of null hypotheses 1 and 2, which supported the alternative hypotheses. Null Hypothesis 3 was not rejected, and the alternative hypothesis was therefore not supported. Chapter 5 presents a discussion of the results as well as the implications of the findings in relation to the literature review and suggestions for further research.

# Chapter 5: Summary, Conclusion, and Recommendations

## Introduction

The objective of this quantitative, correlational study was to identify the associations between a vegetarian lifestyle and obesity for Native Hawaiians who live on the Big Island in Hawaii. The Native Hawaiian population lives on a diet rich in meat and high-fat dairy products, which is a potential contributing factor to its minimal success with weight management (McEligot et al., 2012). Vegetarianism was therefore proposed as a potentially effective lifestyle for this population's successful weight management. The lifestyle patterns of four groups with different types of vegetarian lifestyles and one group with a nonvegetarian lifestyle (sustained for at least 1 year) were compared among a sample of 278 Native Hawaiians aged 21 and older based on their responses to the Native Hawaiian Lifestyle Survey (NHLS), a closed-ended survey instrument. The NHLS has 18 questions related to eating lifestyles, BMI, and other components of a healthy lifestyle. The dependent variable was participants' BMI, and the independent variables were the five food lifestyles.

As a result of certain omissions and inconsistencies in the research design and data collection processes, the study's research questions and hypotheses were adjusted prior to analyzing the data. The revised research questions and hypotheses were given in Chapter 4. Based on the data analysis of the three new hypotheses, the alternative hypothesis was confirmed for Hypothesis 1, indicating that at least one of the descriptive variables was a statistically significant predictor of the dependent variable of BMI. The alternative hypothesis for Hypothesis 2 was also confirmed, indicating that, after controlling for the descriptive variables, at least one of the factors from the Native

Hawaiian Lifestyle Survey was a statistically significant predictor of the dependent variable of BMI. However, the null hypothesis for Hypothesis 3 was not rejected, indicating that there was not a statistically significant difference between the two lifestyle/diet classifications of (a) nonvegetarian and (b) vegetarian on the dependent variable of BMI, after controlling for other relevant variables.

## Interpretation of the Findings

For Hypothesis 1, three descriptive variables were found to be significant predictors of BMI: age, high blood pressure, and no health risk reported. The results indicated that as participants' age increased, their BMI decreased slightly. The results are decisive and show that younger people have higher levels of BMI compared with older people among the group. This finding, while interesting, was not the central focus of the study; moreover, because most studies include age only as one of several descriptive variables, it is difficult to determine whether this finding is consistent across the extant literature.

Certain health conditions included in the descriptive variables were also found to correlate with BMI. In particular, participants with high blood pressure had a higher BMI level than did those without high blood pressure. Given that obesity (as indicated by high BMI levels) increases the risk of hypertension (Re, 2009) and considering the abundance of studies documenting the correlation between hypertension and overweight or obesity (Re, 2009; Hall, 2000; Hall, Crook, Jones, Wofford, & Dubbert, 2002), this finding is not surprising. Moreover, this result is in line with previous research documenting Native Hawaiians' higher rates of hypertension than other racial/ethnic groups, as well as their increased risk for heart disease (Aluli et al., 2010).

The final descriptive variable of statistical significance for the first hypothesis was no health risks: Those participants who reported having no health risks had significantly lower BMI levels. Again, this finding is in line with previous research indicating that higher BMI levels are associated with many health risks and with various types of chronic disease (Kearnes et al., 2014); thus, those individuals with fewer health risks have lower BMIs.

For Hypothesis 2, three variables were significant predictors of BMI after controlling for the descriptive variables: age, the Vegetarian Lifestyle Scale, and Lifestyle-Coping. With age, BMI again decreased slightly as age increased. The Vegetarian Lifestyle Scale was a significant predictor of BMI, as participants with more adherence to a vegetarian lifestyle exhibited decreases in BMI. This finding is of importance, as it indicates that adopting a vegetarian lifestyle has the potential to lead to decreased BMI in Native Hawaiians. This finding corroborates previous studies on the weight-loss and weight-management potential of vegetarianism, including Spencer et al.'s (2003) study demonstrating that fish-eaters, vegetarians, and vegans had lower BMI levels than meat-eaters did. Barnard et al.'s (2009) study, which indicated that living a low-fat vegetarian lifestyle is beneficial for maintaining long-term weight loss, is also confirmed by the findings of the present study.

The third variable in Step 2 that was found to be a significant predictor of BMI was Lifestyle-Coping. Those participants with greater coping skills for making healthy choices showed decreased BMI levels. This indicates that individuals' ability to control dietary behavior is a significant factor for controlling BMI. The items on the Lifestyle-Coping Scale are closely related to self-efficacy. This finding is therefore in line with

self-efficacy research identifying the promotion of healthy behaviors as one of the core determinants of self-efficacy (Bandura, 2004). Controlling one's dietary behavior is one such healthy behavior. McCleary-Jones's (2011) study also aligns with the findings of the current research, indicating that enhancing self-efficacy strengthens individuals' adherence to a lifestyle like vegetarianism. McCleary-Jones also found that increased self-efficacy in BMI management leads to improved self-management, which assists with long-term weight management. It is thus clear that self-efficacy is a critical variable when it comes to effective BMI management, particularly via lifestyle choices.

The results for Hypothesis 3 were nonsignificant, indicating that there was no significant difference in the effect of the two lifestyle classifications of nonvegetarian and vegetarian on BMI, after controlling for other relevant variables. The results therefore suggest that diet alone made no difference in the BMI levels among Native Hawaiians. While this finding was not anticipated, it is possible that the research design chosen for the study may not have been the most appropriate for measuring the effectiveness of lifestyle choices. Rather than relying on a self-assessment survey as the research instrument, more objective metrics such as actual BMI measurements or other data from individuals' medical records might have been more reliable. It is difficult to determine why the Vegetarian Lifestyle Scale was a significant predictor of BMI while at the same time there was found to be no significant difference between nonvegetarian and vegetarian lifestyles. One possibility is that the inclusion of four different levels of vegetarian lifestyle together may have "watered down" the results, especially if individuals with less stringent vegetarian lifestyles were included in the vegetarian group. Additional research is thus warranted to explore this discrepancy further.

## Grounding In Theory

Bandura's theory of self-efficacy is particularly relevant to the study of BMI and weight management, as shown in Figure 1. McCleary-Jones (2011) found that improving self-efficacy in BMI management leads to improved self-management. Self-management, defined as following a lifestyle over a long-term period lasting 1 year or longer, is the cornerstone of overall BMI management. Two of the factor constructs in this study, Lifestyle-Coping and Lifestyle-Control, were used to measure the lifestyle behavioral changes associated with self-management (McCleary-Jones, 2011). The Lifestyle-Coping construct relates to the maintenance of good food choices during adverse or uncertain eating situations. The Lifestyle-Control construct relates to an individual's ability to regulate their eating habits. With higher levels of self-efficacy, an individual is able to both control their eating habits (Lifestyle-Control variable) and maintain healthy food choices during eating situations that are challenging (Lifestyle-Coping; McCleary-Jones, 2011).

It was evident from the responses the researcher elicited through the pilot study that a Native Hawaiian's ability to make a decision and follow through on having a more healthy lifestyle by changing one's diet was predicated on whether that individual had the necessary knowledge and information to do so. This knowledge and information empowered the Native Hawaiian to consciously modify their diet from one that resulted in obesity, diabetes, and heart problems to one that allowed them to lose weight to counteract diabetes and other health problems. The study results specifically suggested this relationship between self-efficacy and self-management via the construct of

Lifestyle-Coping, which was found to be a significant predictor of BMI. With each 1-point increase in the Lifestyle-Coping score, there was a 1.21-point decrease in BMI.

## Limitations of the Study

There were several limitations associated with this study. The greatest limitations were the instrument and research design utilized in this study. Using a self-assessment survey for data collection eliminated my ability to confirm the type of diet that the participants followed and the presence of health conditions and/or comorbidities recorded by the participants. Moreover, some participants admitted not knowing their exact body weight and therefore recorded an estimated body weight instead, while others preferred to disclose their average body weight in lieu of their current body weight. The subjective nature of the survey may have affected the reliability of the results. However, using the survey for data collection was a necessity given the time and budget constraints of the study. As such, I made the assumption that each participant was honest both when he or she joined the study and when he or she answered the survey questions.

The use of the convenience sampling technique in lieu of an experimental design limited the generalizability of participants. This limitation affected the generalizability of the study. However, using this sampling technique was necessary due to the focused inclusion criteria of the population of the proposed study, as well as the limited resources available for data collection.

Another limitation was associated with the fact that observation of the required sample size was dependent on access to Native Hawaiians through Hawaiian public tax records. A larger sample size might have been possible if access to the sample population had not been so constrained.

## Recommendations

Given the dearth of research on the potential of vegetarianism to aid the Native Hawaiian population with weight management and the nonsignificance of some of the results of this study, further research is warranted. In order to generate more detailed, reliable data in this area, I recommend conducting studies that utilize metrics that are not self-reporting, such as clinician-administered tests or participants' medical records. Moreover, I strongly recommend that future research employ an experimental, or at least prospective, design in order to yield more variety in the study sample and ensure the generalizability of the results. Another study might also incorporate a qualitative component in order to gain further insight into individuals' lived experiences with overweight/obesity and vegetarianism.

I recommend that public health leaders consider several key issues when developing future programs targeting the Native Hawaiian population. First, the person(s) coordinating and leading the program(s) should be of Native Hawaiian heritage and should be familiar with the diet and custom of the Native Hawaiian lifestyle. It is an added benefit if the individual(s) speaks the native language. Second, the program(s) should be held in locations where Native Hawaiians live; that is, on the Native Hawaiian Homestead. Third, the persons coordinating and instructing the program(s) should have a background in food and nutrition, with an emphasis in diets and activities that promote a healthy lifestyle.

## Implications

Despite the lack of significance surrounding one hypothesis in this study, its findings still have the potential to contribute to social change through the promotion of a

healthy lifestyle among Native Hawaiians. The study's results—particularly regarding the Vegetarian Lifestyle Scale and Lifestyle-Coping—may inform the work of public health practitioners in the creation of modern health policies in conjunction with other experts. The additional insight that this study provides into the sample population is extremely important given that successful weight management can compel Native Hawaiians to choose to adopt the long-term vegetarian lifestyle that may be needed to maintain a healthy weight (McFerran et al., 2013). As Venditti et al. (2014) has found, Native Hawaiians need more autonomy in anticipating and controlling personal weight control barriers that lead to relapse and weight gain. Therefore, programs that focus on self-efficacy as a component of changing health-related behavior are recommended.

In addition, I recommend that the following practical steps be taken to improve the health of Native Hawaiians:

1. Install office(s) within local communities where health education classes are offered, and include a staff of medical and health professionals, such as physicians, public health professionals, nutritionists, and exercise instructors, available to answer questions and provide information.
2. Offer academic scholarships for Native Hawaiians interested in studying subjects such as nutrition and public health who are committed to working in health offices in local communities upon graduation.
3. Develop a quarterly health program that includes support groups to prevent the chronic diseases mentioned in this research study.

Finally, this study has contributed useful data to begin closing the gap in the literature regarding the comparative effects of meat-eating lifestyles and vegetarian lifestyles on the overweight and obesity rate of Native Hawaiians.

## Conclusion

The results of this study have revealed that the BMI of Native Hawaiians aged 21 and older is affected by factors such as age, self-efficacy, disease status (high blood pressure, no health risks), and eating habits (Vegetarian Lifestyle Scale). Younger Native Hawaiians are more overweight than older Native Hawaiians. When self-efficacy for dietary intake is reduced, BMI level decreases. Health conditions, such as high blood pressure, are more likely to correlate with high BMI levels. There was not a significant finding related to the difference in the effect of a nonvegetarian versus vegetarian lifestyle on BMI. Additional research is recommended to further explore the potential correlation between vegetarianism and BMI among Native Hawaiians, preferably utilizing an experimental or prospective design.

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# Appendix A: Research Participation Consent Form

## PARTICIPANT CONSENT FORM

This form is part of a process called "*informed consent*" to allow you to understand this study before deciding if to take part. Taking part in this study means you are a Native Hawaiian, 21 years or older.

Data Collection Procedure:
The study is about Native Hawaiian health lifestyle including only foods you eat and activity level. This questionnaire is used to collect data for this study that takes approximately 10 minutes to complete. You may fill out the survey in the privacy of your home and use the paid postage envelope to return the survey to me.

Purpose of the Research:
The purpose of this research study is to identify the effects of a vegetarian lifestyle for Native Hawaiians that live on the Big Island in Hawaii. Previous studies have shown that the Native Hawaiian population live lifestyles that include eating plenty of meat, high fat dairy products, and have minimum success in weight management. This study aims to determine the effects of meat eating lifestyles compared to vegetarian lifestyles for Native Hawaiians.

Voluntary Nature of the Study:
Your participation in this study is voluntary. No one anywhere will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. If you feel uncomfortable during the study, you may stop at any time. You may skip any questions you feel are too personal and you are encouraged to ask questions at any time during the research study.

Risks and Benefits of Being in the Study:
The risk of experiencing discomfort is low when answering personal questions about your eating habits and activities. If you feel uncomfortable, you may stop at any time. If you decide to participate in this research, professionals who work with Native Hawaiians will understand the effects of diet pertaining to Native Hawaiians lifestyles. By understanding these effects, public health professionals in Hawaii can create the necessary programs to help reduce harmful effects obesity and increase the health benefits for all Native Hawaiians.

Compensation:
Participating in this study can take about 10 minutes of your time. There is no monetary compensation for your participation and I will be eternally grateful for your decision to participate in this study.

Confidentiality:
All information provided is confidential. I will not use information outside of this research project and only for reporting study results. Data is gathered in large groups without identifying information.

Contacts and Questions:
If you have questions or concerns about participating in this study, contact me via email:

Implied Consent to Participate:
I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By checking yes, I acknowledge that I am Native Hawaiian and at least 21 years old and I am agreeing to participate in the study voluntarily. You may make a copy of this form for your records. Please check the yes box and return this form with your survey.

Yes, I agree to participate ☐. | No, I do not want to participate ☐.

If you check *YES*, please go to the next page to begin. If you check NO, thanks for your consideration.

Appendix B: Survey Instrument

# Native Hawaiian Lifestyle Survey

Thank you for participating in this important survey. Remember that your responses are confidential and remains anonymous. We appreciate your honest responses.

**Directions**
***Please indicate your agreement with the following statements by choosing <u>one number</u> that closely indicate your answer. Please answer all questions to the best of your ability.***

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Strongly Disagree** | | | | | | Strongly Agree |

## Survey Questions

**1. Please indicate your agreement for time spent doing the following activities <u>per week</u>**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| • **Walking** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| • **Swimming** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| • **Playing sports** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| • **Working out** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| • **Running/Jogging** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| • **Dancing** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**2. Choose the diet you have mostly followed for one year or more. (*Choose one*)**

| | |
|---|---|
| **(A) For one year or more, I have *not* eaten any animal products such as red meat, fish, poultry, eggs, milk, and dairy products (Vegan).** | ☐ |
| **(B) For one year or more, I have no restrictions on eating red meat, poultry, fish, eggs, milk, and dairy products (Non-vegetarian).** | |
| **(C) For one year or more, my diet included eating dairy products and** | |

| | |
|---|---|
| **/or eggs at least once per month but no fish or meat (Lacto–Ovo Vegetarian).** | ☐ |
| **(D) For one year or more, I limit eating fish, dairy products and or eggs, red meat, or poultry to once a month (Pesco-vegetarian).** | ☐ |
| **(E) For one year or more, I limit eating dairy products and /or eggs, fish, meat, and poultry to once per week (Semi-vegetarian).** | ☐ |
| | ☐ |
| | ☐ |
| **3. Please indicate the time in hours you spend doing the following activities.** | |
| ❖ **Time spent watching TV per day.** | _____ Hours per day |
| ❖ **On the Computer/Ipad/Talking on the Phone** | _____ Hours per day |
| ❖ **Sitting at Work** | _____ Hours per day |
| **4. Please indicate your level of agreement with the following statements** | |
| ➢ **I can solve most problems if I invest the necessary efforts to control my eating habits** | 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ |
| ➢ **Eating beef/pork/chicken has been part of my lifestyle for more than a year** | 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ |
| ➢ **If do not get support, I can still find the means and ways to regulate my eating habits** | 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ |
| ➢ **I can always manage to regulate my eating** | 1 2 3 4 5 6 7 |

| | |
|---|---|
| **habits if I try hard enough** | ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **I eat meat and meat products regularly** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **It is easy for me to control my eating habits to accomplish my goals** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **I eat milk/dairy products/eggs regularly** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **Thanks to my resourcefulness, I know how to control my eating habits during unforeseen situations** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **I eat fish and fish products regularly** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **I am confident that I could efficiently control my eating habits during unexpected events** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **I can remain calm when facing difficulties about food choices because I can rely on my coping abilities** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **In the past year I ate milk/dairy products/eggs regularly** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **When I am confronted with a problem regarding my food choices, I can usually find several solutions** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **I consider myself a vegetarian** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **When it comes to making food choices, I usually make sensible choices** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| ➢ **In the past week, I ate vegetables every day** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |

| | |
|---|---|
| ➢ **If I am in trouble regarding my food choices, I can usually think of a solution** | 1 2 3 4 5 6 7<br>☐ ☐ ☐ ☐ ☐ ☐ ☐ |

**5. A doctor or official health worker told me that I have one or more of the following conditions: Please choose all that apply.**

| High blood pressure | Asthma | Diabetes | Heart disease | Cancer | Other | Unknown |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | |
|---|---|
| **6. My current weight is** | _____ Lbs |

**7. The last time I weighed myself was**

| Never | Today | In the last Week | In the last Month | In the last Year | 2 years Ago | 2 years or more |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | |
|---|---|
| **8. My height is** | _____FT. _____IN. |
| **9. Please tell us your gender (Choose one)** | Male ☐ Female ☐ |
| **10. Please Say your age** | _____ Years old. |

**11. Please state the highest level of education you completed. (*Please choose one*)**

| Less than High school | HS | 2 yr. college | 4 yr. college | Master's Degree | Doctorate Degree |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**12. The last time I weighed myself was (*Please choose one*)**

| Never | Today | In the last Week | In the last Month | In the last Year | 2 years Ago | 2 years or more |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | |
|---|---|
| **13. My height is** | _____FT. _____IN. |
| **14. Please tell us your gender (Please Choose one)** | Male ☐ Female ☐ |

| | |
|---|---|
| **15. Please tell us your age** | _____ Years old. |

**16. Please state the highest level of education you completed. (*Please choose one*)**

| Less than High school | HS | 2 yr. college | 4 yr. college | Master's Degree | Doctorate Degree |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

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*Please check to make sure you have answered all questions*.

The End

Thank you for your participation.

Appendix C: Revised Survey Instrument

**Native Hawaiian Lifestyle Survey**

Thank you for participating in this important survey. Remember that your responses are confidential and remains anonymous. We appreciate your honest responses.

| **Directions** | | | | | | |
|---|---|---|---|---|---|---|
| **Please indicate your agreement with the following statements by choosing *one number* that closely indicate your answer. Please answer all questions to the best of your ability.** | | | | | | |
| **1** ☐ **Strongly Disagree** | 2 ☐ | 3 ☐ | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ Strongly Agree |

# Survey Questions

**1.**

| | |
|---|---|
| • **Walking more than one mile** | |
| • **Swimming for 30 minutes or more** | |
| • **Playing sports for 30 minutes or more** | |
| • **Working out for 30 minutes or more** | |
| • **Running/Jogging for 30 minutes or more** | |
| • **Dancing for 1 hour or more** | |

**2. Describe choose the diet you have followed for one year or more. (*Choose one*)**

| | |
|---|---|
| (A) For one year or more, I have not eaten any animal products such as red meat, fish, poultry, eggs, milk, and dairy products (Vegan). | ☐ |
| (B) For one year or more, I have no restrictions on eating red meat, poultry, fish, eggs, milk, and dairy products (Non-vegetarian). | ☐ |
| (C) For one year or more, my diet included eating dairy products and /or eggs at least once per month but no fish or meat (Lacto–Ovo Vegetarian). | ☐ |
| (D) For one year or more, I limit eating fish, dairy products and or eggs, red meat, or poultry to once a month (Pesco-vegetarian). | ☐ |
| (E) For one year or more, I limit eating dairy products and /or eggs, fish, meat, and poultry to once per week (Semi-vegetarian). | ☐ |

**3. Please indicate your level of agreement with the following statements**

| | |
|---|---|
| ➢ **I can solve most problems if I invest the necessary efforts to control my eating habits** | |
| ❖ **Eating beef/pork/chicken has been part of my** | |

| | |
|---|---|
| **lifestyle for more than a year** | |
| ➢ **If do not get support, I can still find the means and ways to regulate my eating habits** | |
| ➢ **I can always manage to regulate my eating habits if I try hard enough** | |

| | |
|---|---|
| | |
| ❖ **I eat meat and meat products regularly** | |
| ➢ **It is easy for me to control my eating habits to accomplish my goals** | |
| ❖ **I eat milk/dairy products/eggs regularly** | |
| ➢ **Thanks to my resourcefulness, I know how to control my eating habits during unforeseen situations** | |
| ❖ **I eat fish and fish products regularly** | |
| ➢ **I am confident that I could efficiently control my eating habits during unexpected events** | |
| ➢ **I can remain calm when facing difficulties about food choices because I can rely on my coping abilities** | |
| ❖ **In the past year I ate milk/dairy products/eggs regularly** | |
| ➢ **When I am confronted with a problem regarding my food choices, I can usually find several solutions** | |
| ➢ **When it comes to making food choices, I usually make sensible choices** | |
| ➢ **If I am in trouble regarding my food choices, I can usually think of a solution** | |

**4. A doctor or official health worker told me that I have one or more of the following conditions: Please choose all that apply.**

| High blood Pressure | Asthma | Diabetes | Heart disease | Cancer | Other | None |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | |
|---|---|
| **5. My current weight is** | _____ Lbs |

| | |
|---|---|
| **6. My height is** | _____FT. _____IN. |
| **7. Please tell us your gender (Choose one)** | Male ☐ Female ☐ |
| **8. Please tell us your age** | _____ Years old. |

**9. Please state the highest level of education you completed. (*Please choose one*)**

| Less than High school | HS | 2 yr. college | 4 yr. college | Master's Degree | Doctorate Degree |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

---

The End

Thank you for your participation.