THE ASSOCIATION BETWEEN MODERATE-VIGOROUS PHYSICAL ACTIVITY AND DIETARY BEHAVIOR AMONG CHURCHGOING LATINAS IN SAN DIEGO COUNTY

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DEDICATION

I dedicated this thesis to my parents who have always supported me financially throughout my academic career, without their support I would not be able to pursue my academic goal. To my sister and brother in law for their continued support.
ABSTRACT OF THE THESIS

The Association Between Moderate-Vigorous Physical Activity and Dietary Behavior Among Churchgoing Latinas in San Diego County

by

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Master of Public Health with a Concentration in Epidemiology
San Diego State University, 2015

The leading cause of deaths in United States is noncommunicable diseases (NCDs). The four known risk factors of NCDs are alcohol use, tobacco use, physical inactivity and unhealthy diets. This study focuses on physical activity and unhealthy diets. The Latino population is the largest and rapidly growing ethnic group in the U.S. leisure-time moderate-vigorous physical activity (MVPA) and fruit/vegetable intake in the Latino population remains low. This study aimed to examine the relationship between MVPA and dietary behaviors (fat intake and fruit and vegetable consumption) among churchgoing Latinas in San Diego County. A cross sectional study design using Fe en Acción (Faith in Action) baseline data was the basis for this project. A total of 437 participants were recruited from participating churches to partake in this study. Leisure-time MVPA, BMI and acculturation were found to be significantly associated with fat intake. Leisure-time MVPA and monthly household income were significantly related to fruit and vegetable consumption. This cross-sectional study suggests that there is a relationship between leisure-time MVPA, fat intake and fruit and vegetable consumption. To fully understand this relationship, a longitudinal study might be suitable for this research.
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CHAPTER 1

INTRODUCTION

According to World Health Organization (WHO), physical inactivity and nutrition along with tobacco and alcohol use are the main factors for noncommunicable diseases (NCDs; WHO, n.d.b). It has been a major challenge to global public health to prevent NCD. Noncommunicable disease accounted for sixty-three percent of all deaths in 2008 or 36 million people worldwide. WHO (n.d.a) states that approximately 38 million people die each year from NCDs. The total NCD deaths in the United States in 2012 was 2,656,000 with physical inactivity accounting for 43.2% of those deaths and 88% of the total deaths was caused by NCDs. Lack of physical activity has been recognized as the fourth leading risk factor for global mortality. Approximately 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of ischaemic heart disease burden are caused by physical inactivity (WHO, n.d.d).

Only 38.2% of Latino women in the US over the age of 18 years old met the 2008 Federal Physical Activity Guidelines of 150 minutes of moderate to vigorous physical activity a week and approximately 27.5% of Latinas in San Diego County engaged in regular physical activity. Mean total fat intake for adults 20 years of age and older for both males and females is 33.2% (data from 2007 – 2010). Even though US adults’ fat consumption falls within recommended guidelines, the average daily intake of saturated fat in the US is 11%. This is 4% over the American Heart Association (AHA) recommendation to limit saturated fats to less than 7% of total daily calories. The Nurses’ Health Study and Health Professional Follow-up Study states that those who consume an average of eight servings a day of fruits and vegetables are 30% less likely to have had a heart attack or stroke compared to those who consume less than 1.5 servings a day (Harvard School of Public Health [HSPH], n.d.). High total fat intake increases LDL cholesterol levels and causes heart disease. Additionally
high total fat intake leads to excessive energy intake and is positively linked to obesity in the United States (Lichtenstein et al., 1998).

Studies have proposed that engaging in physical activity encourages other healthy behaviors such as eating healthy food (Bebetsos, Chroni, & Theodorakis, 2002; Chai et al., 2010; Dutton, Napolitano, Whiteley, & Marcus, 2008). Therefore, as individuals realize the benefits of physical activity they may be motivated to improve their daily eating decisions. People engage in physical activity for many reasons, such as improved health, weight loss, and other related goals. Individuals who use physical activity to lose weight may adopt healthy eating to reach their goal weight. If a person just spent a lot of effort exercising, he or she may not want to negate it by eating unhealthily.

**STATEMENT OF THE PROBLEM**

There is little research focusing on Latina populations to examine the relationship between physical activity and health behavior. Studying this relationship in a Latina population could help inform future public health intervention programs tailored to the growing Latino community in San Diego or any community.

**PURPOSE OF THE STUDY**

The purpose of this study is to examine the relationship between moderate to vigorous physical activity and dietary behavior among churchgoing Latina in San Diego County. This project aims to learn whether people who are physically active are also eating healthy diets.

**HYPOTHESES**

I hypothesize that there is a significant association between moderate vigorous physical activity and dietary behavior among churchgoing Latina in San Diego County. A higher level of physical activity is associated with consuming a healthy diet, which is lower fat intake and higher fruit and vegetable consumption.

**BASIC ASSUMPTIONS**

The survey questions for the dietary behaviors used in this analysis and the GPAQ question were based on self-reported data therefore, recall, respondent and interviewer biases
may be present. The physical activity level was derived from the accelerometer data so the data is reliable assuming the participants actually wore the device and didn’t have their family member to wear it for them.
CHAPTER 2

REVIEW OF LITERATURE

Physical activity and diet are the two main risk factors for noncommunicable disease. WHO (n.d.b) states that diet and physical activity influence health both together and separately. Together, physical activity and proper diet play a vital role in preventing obesity and reducing the risk of chronic diseases such as heart disease, diabetes, and cancers, among many others. An imbalance of diet and physical activity can lead to obesity. Obesity is the second leading preventable cause of death and reflects an estimated cost of $147 billion to the US economy (Finkelstein, Trogdon, Cohen, & Dietz, 2009).

In 2008, 33.6% of adults in the United States were overweight, 34.3% were obese, and 6% were morbidly obese (Ogden & Carroll, 2010). The self-reported obesity rate in California, according to BRFSS in 2013, is 24.1% of which the Hispanic population accounts for 30.7%. This is the second highest proportion after non-Hispanic black adults (34.8%). According to the US Census Bureau American Community Survey in 2013, the Hispanic or Latino population in San Diego was 1,057,428 (male: 526,314 and female: 531,114), which accounts for 32.9% of the total population in San Diego County (United States Census Bureau, n.d.). The population of Hispanic/Latino females who are 18 years and older is 367,552, which is 11.41% of the total population in San Diego County. The Hispanic/Latino community is the second largest ethnic population in San Diego County. Only 38.2% of Hispanic adult women in the US over 18 years of age met the 2008 Federal Physical Activity Guidelines of 150 minutes of MVPA per week, 50.9% of non-Hispanic whites met the guidelines as did 35.5% of non-Hispanic blacks.

The University of California, Los Angeles (UCLA) Center for Health Policy Research (n.d.) reports that approximately 34.5% adults in San Diego County engaged in regular walking during one week in 2011-2012. The California Health Interview Survey 2009 reports that of all Latino women in California, 27.5% of them engage in PA, 61.4%
engage in some PA and 11.2% are sedentary / do no physical activity (UCLA Center for Health Policy Research, n.d.). WHO (n.d.d) states that approximately 3.2 million people die each year due to physical inactivity, and those who don’t meet the recommended PA have a 20% to 30% of higher risk of all-cause mortality.

WHO (n.d.d) reported that 1.7 million (2.8%) of deaths worldwide are attributable to lack of fruit and vegetable consumption. The Harvard-based Nurses’ Health Study and Health Professionals Follow-up Study state that those who consume an average of eight servings a day of fruits and vegetables are thirty percent less likely to have had a heart attack or stroke compared with those who only consume less than 1.5 servings a day. According to the UCLA Center for Health Policy Research (n.d.) approximately 30.6% of adults in San Diego County consume the daily recommendation of fruits and vegetables.

**DESCRIPTION OF DIETARY BEHAVIOR AND PHYSICAL ACTIVITY**

**Fat Intake**

According to The Dietary Guidelines for Americans it is recommended that adults age 19 years and older to consume about 20 – 35% of fat in their daily diet (United States Department of Agriculture [USDA] & United States Department of Health and Human Services [DHHS], 2010). The guideline for healthy fat intake is to limit saturated fats and consume most fat from polyunsaturated and monounsaturated fats within the guideline requirements. Consumption above the upper range is associated with higher saturated fat and energy intake. On the other hand, consuming less than the lower end increases plasma triacylglycerol concentrations and decreases high-density lipoprotein cholesterol concentration from high carbohydrates diets.

Mean total fat intake for adults 20 years of age and older for both males and females is 33.2% (data from 2007 – 2010). Even though American adults consume within the range of fat intake recommendations, the average daily intake of saturated fat in USA, which is 11%, is slightly over the 10% recommended by the US Dietary Guidelines.
**Fruit and Vegetable Consumption**

Consuming the recommendation of fruit and vegetables per day could prevent chronic diseases such as heart disease, cancer, diabetes and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies, especially in less developed countries (WHO, n.d.e). The recommendation for daily consumption of fruits and vegetables for women and men is 2.5 cups each for a total of 5 cups a day (American Cancer Society [ACS], 2012), although this number may vary according to our age, gender and the amount of physical activity we do each day. Only with both nutrition and physical activity will we expect a great result in preventing these chronic diseases.

Choose my plate defines one cup of vegetables as one cup of raw or cooked vegetables or vegetable juice, or 2 cups of raw leafy greens considered as 1 cup in the vegetable group (USDA, n.d.b). As for fruit, 1 cup of fruit or 100% fruit juice, or ½ cup of dried fruit is considered as 1 cup in the fruit group (USDA, n.d.a). The recommendation of greater than 5 cups a day for both fruit and vegetables intake is because fruits and vegetables may reduce CVD through the beneficial combinations of micronutrients, antioxidants, phytochemicals, and fiber in these foods (Liu et al., 2000).

The percentage of adults who report consuming fruits and vegetables less than one time daily in California is 35.7 and 19.1, respectively, and the median intake of fruits and vegetables is 1.3 and 1.8 times per day, respectively (Centers for Disease Control and Prevention [CDC], 2013). A prospective cohort of women was studied to assess whether fruit and vegetable intake can reduce the risk Cardiovascular Disease. Liu et al. (2000) concluded that higher fruit and vegetables intake maybe protective against CVD and support dietary guidelines to increase the consumption fruit and vegetables.

**Physical Activity**

According to the World Health Organization (WHO, 2011), the global recommendations on physical activity for health for adults (18-64 years old) is \( \geq 150 \) minutes of moderate-intensity aerobic physical activity (PA) throughout the week or \( \geq 75 \) minutes of vigorous intensity aerobic physical activity throughout the week or an equivalent combination of both. The activity should be conducted for \( \geq 10 \) minutes duration. And lastly it is recommended to do muscle-strengthening activities \( \geq 2 \) days a week (WHO, 2011).
Moderate-intensity aerobic activity means is defined as working out hard enough to raise the heart rate and to cause sweat. The easier way for us to differentiate light and moderate activity is to say that a person is still able to talk but not sing. Some examples of moderate PA are walking fast, doing water aerobics, riding a bike on level ground or with few hills, playing doubles tennis, pushing a lawn mower, etc. Vigorous-intensity aerobic activity means that a person breathes hard and fast and the heart rate rises somewhat (CDC, 2014). A person engaging in vigorous PA cannot talk without pausing for a breath. Examples of this activity are jogging or running, swimming laps, riding a bike fast or on hills, playing singles tennis, playing basketball, etc. Muscles-strengthening activities you are ones that work all the major muscle groups of the body such as legs, hips, back, chest, abdomen, shoulders, and arms (CDC, 2014).

Performing regular physical activity reduces the risk of cardiovascular disease including high blood pressure, diabetes, breast and colon cancer, and depression (WHO, 2011). 2.8 million people die each year as a result of being overweight or obese and Body Mass Index (BMI) correlates with the risk of heart disease, strokes, diabetes and certain cancers (WHO, n.d.c).

**STUDIES CONDUCTED ON FOOD INTAKE AND PHYSICAL ACTIVITY**

Dutton et al. (2008) investigated a cross-sectional and longitudinal relationship between health behavior and physical activity intervention. Dutton and colleagues (2008) assessed PA and dietary behaviors at baseline, month 3 and month 12 of 250 sedentary women. The participants completed the following survey: 7-Day Physical Activity Recall, Physical Activity Stage of Change and National Cancer Institute (NCI) Nutrition Screeners. Participants were randomly assigned to the following three conditions: Jumpstart, Choose to Move, and a wellness control conditions that were randomly assigned to the participants. They found no significant change in the daily consumption of fruits and vegetables from baseline to 3 month or baseline to month 12 for the three interventions. However, there was a significant association between weekly minutes of activity and fruit and vegetable intake at baseline. There was a significant decrease of fat intake from baseline to month 3 as well as from baseline to month 12.
Boutelle, Murray, Jeffrey, Hennrikus, and Lando (2000) found an association between leisure-time exercise and a number of health behaviors in working adults. More specifically, women who engaged in high levels of leisure time exercise consumed less fat. This finding is supported by others studies which suggest that engaging in physical activity may lead to reducing fat intake (Dutton et al., 2008; Wilcox, King, Castro, & Bortz, 2000). Higher fruit and vegetable consumption is associated with physical activity in college students (Adams & Colner, 2008). A similar study with university men and women reported a positive association between physical activity participation and healthy eating (Johnson, Nichols, Sallis, Calfas, & Hovell, 1998).

**Theoretical Basis**

Studies have proposed that physical activity may serve as a means for changing our health behavior, such as healthy eating (Bebetsos et al., 2002; Dutton et al., 2008). As people realize the benefits of physical activity they may be motivated to improve their daily eating decisions (Tucker & Reicks, 2002). People engage in physical activity for many reasons such as for health, weight loss, and so on. Individuals who use physical activity to lose weight will often adopt healthy eating to reach their weight goal.

**Factors Associated with Food Intake and Physical Activity**

Dehghan, Akhtar-Danesh and Merchant (2011) found that female participants with higher education and higher income consumed more fruit and vegetables. Approximately 77% of Canadian adults consumed fruits and vegetables less than five times a day. Single or never married participants, people who had never smoked, former drinkers, and older people reported a higher intake of fruits and vegetables compared with others. A similar result was found by Blakely, Dunnagan, Haynes, Moore, and Pelican (2004) that females and those with a higher education lead a healthier diet lifestyle. This could be because participants who have a higher education have more knowledge of nutrition compared to those with a lower education.

The study using 2007 Behavior Risk Factors Surveillance System (BRFSS) conducted by Heo et al. (2011) found that there is an association between Fruit and Vegetables intake with demographic factors, socioeconomic status (SES) and lifestyle...
behaviors. Age was significantly correlated with FV intake and the physical inactive group had the lowest prevalence of FV+5 for normal and obese weight status. The finding was that adults who are overweight and obese had low FV intake level. There was a relationship between low FV intake level and the demographic, SES and lifestyle variables.

Age, race, sex, education, and marital status have been found to be significantly correlated with dietary fat intake (Hart, Tinker, Bowen, Longton, & Beresford, 2006). Studies have found that those who completed a higher education are more likely to make a healthier food choice. Higher acculturation has also been associated with increased fat intake among Hispanics (Winkleby, Albright, Howard-Pitney, Lin, & Fortmann, 1994). Another study has reported an association between high income and low fat intake (Diez-Roux et al., 1999).

**CONCLUSION**

Regular physical activity and proper nutrition play a critical role as they can both reduce our risk for getting cardiovascular disease, type 2 diabetes, metabolic syndrome, and many cancers as well as bring us other benefits that come from meeting the recommended physical activity and diet guidelines. One’s physical activity level may influence and predict their eating healthy decisions. Many people have their own reasons for being physically active, whether it’s for health or for maintaining or reducing weight. Those who are physically active may rethink what they consume daily in order not to reduce the benefits of their exercise routine and some may become motivated to improve their diet as they realize how important PA is.

This research question intends to examine whether physical activity correlates with healthy eating decisions. Many studies have produced mixed results: some found a significant relationship between physical activity and health behaviors (Boutelle et al., 2000; Johnson et al., 1998) and some have not (Wilcox et al., 2000); however none of those studies were conducted in the specific city and population examined in this evaluation. Nonetheless, of the existing literature, a limited number of studies focused on completely Latina samples. Studying this relationship in a Latina population could help inform future public health intervention programs tailored to the growing Latino community in San Diego or any community.
CHAPTER 3

METHODS

STUDY DESIGN

The present study was based on cross-sectional baseline data from *Fa en Acción* (Faith in Action). Faith in Action is a five-year group randomized controlled trial to evaluate a faith-based multi-intervention to improve physical activity among churchgoing Latina women. Sixteen churches were enrolled in this study and were randomly assigned intervention (physical activity) or attention-control (cancer prevention) conditions. Churches were required to have at least 200 Hispanic/Latino families and at least one Spanish-language service. *Promotoras* (community health workers) were hired because it was believed that trusted members of the community would be the best people to lead programs in their community (United States Department of Health and Human Services Office of Minority Health [OMH], 2012). Forty *promotoras* were recruited and trained to lead the physical activity classes and to teach the cancer prevention workshops in their parishes. The *promotoras* lead six free exercise classes per week in their churches for the physical activity portion of the program. As for the cancer prevention program, six-week workshops about the prevention of colorectal cancer, skin cancer, breast cancer and cervical cancer series were offered at the parishes. All of the classes offered at the churches were opened to all of the churches members and not only limited to study participants.

STUDY POPULATION

A total of 437 participants were recruited from participating churches to partake in this study. In person church announcements, postings in the weekly bulletins, printed fliers, and word of mouth among church members were the means with which study participants were recruited. Participants were asked by trained bilingual research assistants (RAs) to fill out a participant recruitment screener to determine their eligibility. The criteria to be eligible
for this project are as follows: participants must (a) self-identify as Hispanic / Latina women between the ages of 18-65 years old, (b) be members of the church for at least six months, (c) live within 15 minutes of walking or driving distance from the church, (d) have the ability to travel to churches using a reliable form of transportation, and (e) plan to live at the same residence for the next two years. Additional eligibility criteria included attending church activities, such as worship or ministry, at least four times a month. Participants were excluded if they reported having medical conditions preventing them from participating in physical activity and reported attending services at other churches.

Informed consent was given at the participant’s first appointment and anthropometric measures were taken by RAs during this appointment. Then an accelerometer was given to each participant to wear for a week. Upon returning for their second appointment, which was scheduled a week after their first appointment, the accelerometer was collected and checked for valid data. A self-administered 313-item survey was given either in English or Spanish depending on the language preference of the participant.

**Data Collection**

Anthropometric and other health measures were taken at the participant’s first appointment by RAs; the measurements included height, weight, waist circumference, one-minute step test, blood pressure, one-week accelerometer wear, and a 313-item questionnaire. The 313-question survey consisted of the following components: questions from the Global Physical Activity Question 1 (GPAQ 1) that covered their activities in occupational, active transportation, leisure time, and sedentary behavior. Additional questions related to food and beverage consumption, advocacy for the community, church and neighborhood cohesion, place attachment, park use, emotional health, group exercise participation, socio-demographics, acculturation, health conditions, religion (perceived religiosity on health outcomes), God and health, faith organization and health, behavioral strategies for physical activity, cancer screenings, and perceived barriers to cancer screenings. Seven-day accelerometer wear, demographics, fruit and vegetable consumption, and food and beverage consumption were analyzed for this study. Participants completed measurement at baseline, 12 months and 24 months but for the purpose of this study, only baseline data was used.
DEMOGRAPHICS

The demographics questions were selected from the Behavioral Risk Factor Surveillance System (BRFSS) and the Institute for Behavioral and Community Health (IBACH) consensus demographic questions (CDC, 2005). The following questions asked were included in this study: participant age, education, monthly household income from all sources, marital status, and employment status. Participant age was used as a continuous variable. Highest education completed was dichotomized as (0) less than high school and (1) high school or high school completed. Marital status and employment status were also dichotomized as (1) married or living as married vs (2) single or non-partnered; (1) employed (full-time, part-time, self-employed, seasonal) or (2) not employed (all other), respectively. Monthly household income was categorized as (1) less than $2,000 (2) $2,000 or more and (888) I don’t know. The calculated body mass index (BMI) was based on the anthropometric measurement.

ACCULTURATION

Bi-Dimensional Acculturation Scale for Hispanics (BAS) was used in the measurement of acculturation (Marin & Gamba, 1996). BAS measured three language-related areas: language use, linguistic proficiency, and electronic media. For example: “How often do you think in English?” “How well do you understand programs in English?” “How well do you write in Spanish?” Average score was calculated in both Hispanic and non-Hispanic culture domains based on the 12 items questions in each domain. A cutoff of $\geq 2.5$ was used to indicate the low and high level of adherence for each cultural domain. When both domain score are greater than 2.5, it means that a participant shows biculturalism. For the purpose of this study the non-Hispanic domain was used.

MODERATE-VIGOROUS PHYSICAL ACTIVITY

Accelerometer Data

Each participant wore an accelerometer (Actigraph GT3X) for a week and when the device was collected, the RAs checked the validity of the wear. The criteria for the validity were that the participant had to wear the accelerometer for at least 5 days that would include at least one weekend.
Average minutes per week of moderate, vigorous, moderate and vigorous, light and sedentary times were obtained from the accelerometer. The Troiano (2008) adult cut-points and the 100 counts per minute (cpm) were used as the cut-points to calculate the minutes. These cut-points were: (a) Sedentary: 0-99 CPM, (b) Light: 100-2019 CPM, (c) Moderate: 2020-5998 CPM, and (d) Vigorous: 5999 - ∞ CPM. The percentage of sedentary time was computed by dividing the sedentary time by total wear time, and whether the participants met the Physical Activity Guidelines or not, was determined using the 2008 PA Guidelines for Americans (Troiano, Berrigan, Dodd, Masse, Tilert, & McDowell, 2008). For the purpose of the current study, only the moderate-vigorous physical activity was examined.

**Global Physical Activity Questionnaire (GPAQ)**

Global Physical Activity Questionnaire (GPAQ) was a questionnaire developed by WHO which comprised of 16 questions to assess an individual’s level of physical activity in three domains: work, transportation, and leisure time (WHO, 2004). Spanish version of GPAQ was used for the Faith in Action project. Current study only used the total minutes of moderate-vigorous physical activity in leisure time.

**Fruit and Vegetable Consumption**

Questions for this section were adapted from National Cancer Institute (NCI) Food and Attitudes Survey (FAB) (Yaroch et al., 2012). Participants were asked two questions about how many cups of fruits and vegetables were consumed each day in the last month and were categorized as (0) None, (1) ½ cup or less, (2) ½-1 cup, (3) 1-2 cups, (4) 2-3 cups, (5) 3-4 cups, (6) 4 or more cups (Yaroch et al., 2012). These two questions were added based on the response from 0 – 6 to get a sum of score of F/V consumption, which ranges from 0 – 12. This variable was used as continuous (0-12) and higher numbers indicate higher consumption of F/V.

**Fat Intake**

Seventeen items were asked in the food intake component, which were developed by National Cancer Institute (NCI) to estimate an individual’s usual intake of percentage energy from fat. Participants were asked about their eating habits for the past 12 months from breakfast, lunch, dinner, snacks, eating out, and at a restaurant or a friend’s house. Types of
foods measured were (a) cold cereal, (b) skim milk, on cereal or to drink, (c) eggs, fried or scrambled in margarine, butter, or oil, (d) sausage or bacon, regular fat (e) margarine or butter on bread, rolls, pancakes, and more. The responses to these questions were: never, less than once per month, 1-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 1 time per day, and 2 or more times per day. Use of reduced-fat margarine when preparing food with margarine or ate margarine was also asked and the responses for this question were: didn’t use; almost never, about ¼ of the time, about ½ of the time; about ¾ of the time; and almost always or always. The last question for this component was to ask the participant to rate their diet from high, medium and low in fat, which wasn’t used in the analysis.

The scoring procedures provided by NCI were used to compute the individual’s percentage energy from fat. The frequency response on the food intake was converted to number of times per day and the age and gender specific portion sizes were multiplied by the frequency calculated in the previous step. All of these calculation steps were provided by NCI in a SAS program to calculate the percentage energy of fat using this 17 items questionnaire (excluded the last question).

**Statistical Analysis**

SAS (version 9.3; SAS Institute Inc, Cary, NC) was used to analyze the data. Descriptive statistics (e.g. means, standard deviation, frequencies, and medians) were used to summarize the outcome, independent variables, and covariates. Unadjusted bivariate relationships were examined to study the relationship between the outcome, independent variables, and covariates. All analyses were considered significant at the p < 0.05 level.

Additional analyses were used for model building to test the relationship between MVPA recommendations and dietary behavior. Multivariate linear regression was used to test the relationship between MVPA, fat intake and fruit/vegetable consumption. Collinearity for the covariates variables: age, BMI, marital status, education level, income, and acculturation was assessed before creating the final adjusted models.
CHAPTER 4

RESULT

DESCRIPTIVE STATISTICS

The baseline data for Faith in Action project included 437 participants who were churchgoing Latina from San Diego County. Table 1 represents descriptive statistics of participants’ demographics and characteristics of interest. The study participants’ mean age was 44.4 years old (SD=9.58). The majority of the women had an education of less than high school (54.94%). Approximately, 65.6% of them reported having a full-time, part-time, self-employed, or seasonal job and 54.3% reported having monthly income less than $2,000. In the study, most of the women were married or living as married (77%). Mean BMI of participants was 30.31 (SD=6.25), suggesting that the majority of the sample was overweight.

The mean of leisure time MVPA was 67 minutes/week (Range: 0 – 720 minutes), which meant that most of the participants were not getting the recommended amount of physical activity. The mean of MVPA for all domains measured by accelerometer was 103 minutes per week (Range: 3 – 249 minutes). The average of participants consumed 29.54% (4.14) of calories from fat. The mean score of fruit and vegetable intake was 7.14 (SD=2.69; Range 0-12).

BIVARIATE ASSOCIATIONS

Table 2 represents the bivariate associations among participants with fat intake by the categorical variables of covariates of interest. Analysis showed that monthly income, and adherence to non-Hispanic culture domain were significantly associated with fat intake (p < 0.05). The mean of fat intake of participants who do not know their monthly income was higher than those who have a monthly income $2,000 or more and less than $2,000 (p=0.0404). The mean of women who had a monthly income of 2000 or more consumed an
Table 1. Descriptive Statistic Among Hispanic Woman Participants in Faith in Action Project in San Diego, 2013

<table>
<thead>
<tr>
<th>Continuous Variable</th>
<th>N</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>437</td>
<td>44.40 (9.58)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>435</td>
<td>30.31 (6.25)</td>
</tr>
<tr>
<td>Fruit and Vegetables intake*</td>
<td>434</td>
<td>7.14 (2.69)</td>
</tr>
<tr>
<td>Fat Intake (%)</td>
<td>437</td>
<td>29.54 (4.14)</td>
</tr>
<tr>
<td>Leisure time MVPA (minutes/week)a</td>
<td>437</td>
<td>67.44 (112.69)</td>
</tr>
<tr>
<td>MVPA by accelerometer for all domains (minutes/week)</td>
<td>437</td>
<td>103.06 (63.79)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Categorical Variable b</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>239</td>
</tr>
<tr>
<td>High school or high school completed</td>
<td>196</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
</tr>
<tr>
<td>Employed (full time, part time, self-employed, seasonal)</td>
<td>285</td>
</tr>
<tr>
<td>Not employed (all other)</td>
<td>141</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Married or living as married</td>
<td>335</td>
</tr>
<tr>
<td>Single or non-partnered</td>
<td>98</td>
</tr>
<tr>
<td>Monthly Income c</td>
<td></td>
</tr>
<tr>
<td>Less than $2000</td>
<td>237</td>
</tr>
<tr>
<td>$2000 or more</td>
<td>169</td>
</tr>
<tr>
<td>Adherence to nonhispanic</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>285</td>
</tr>
<tr>
<td>Yes</td>
<td>135</td>
</tr>
</tbody>
</table>

Med (Range) for Leisure Time MVPA(min/week) is 0(0,720)
Numbers do not add up to 437 due to missing data
N(%) Monthly Income reported as ‘I don’t know’ is 30 (6.88)
Range 0 - 12

estimate of 29.80% calories from fat. Result showed that there was a significant difference in the mean of fat intake by acculturation. Those who showed an adherence to non-Hispanic culture had a significantly higher mean fat intake than those who don’t adhere to non-Hispanic culture. Participants who were adhered to nonhispanic culture domain had a mean of fat intake of 30.15%.

Table 3 represents the bivariate associations among participants with fruit and vegetable consumption by categorical variables of covariates of interest. Education and monthly income were significantly associated with fruit and vegetables consumption (p < 0.05). Women who had a higher education and higher monthly income consumed more fruit
Table 2. Bivariate Association of Fat Intake by Categorical Covariates of Interest Among Faith in Action Participants, San Diego 2013

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>239</td>
<td>29.43 (3.71)</td>
<td>0.5573</td>
</tr>
<tr>
<td>High school or high school completed</td>
<td>196</td>
<td>29.67 (4.63)</td>
<td></td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed (full time, part time, self-employed, seasonal)</td>
<td>285</td>
<td>29.66 (4.12)</td>
<td>0.4107</td>
</tr>
<tr>
<td>Not employed (all other)</td>
<td>141</td>
<td>29.31 (4.00)</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or living as married</td>
<td>335</td>
<td>29.44 (4.00)</td>
<td>0.32</td>
</tr>
<tr>
<td>Single or non-partnered</td>
<td>98</td>
<td>29.91 (4.59)</td>
<td></td>
</tr>
<tr>
<td>Monthly income*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $2000</td>
<td>237</td>
<td>29.17 (4.26)</td>
<td>0.0404</td>
</tr>
<tr>
<td>$2000 or more</td>
<td>169</td>
<td>29.80 (3.83)</td>
<td></td>
</tr>
<tr>
<td>Don't know</td>
<td>31.02 (4.58)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adherence nonhispanic culture domain*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>285</td>
<td>29.27 (3.98)</td>
<td>0.0374</td>
</tr>
<tr>
<td>Yes</td>
<td>135</td>
<td>30.15 (4.20)</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05

and vegetables. Participants who completed high school had a mean F/V intake score of 7.46 (2.66). The mean overall F/V score for those who had a monthly income of $2000 or more was 7.36 (2.56).

Table 4 showing the unadjusted regression model assessing the relationship between the outcome and controlling variables. Unadjusted analysis showed that leisure time MVPA, BMI, and adherence to nonhispanic culture domain were significantly associated with fat intake. For every 30 minutes increased in the leisure time MVPA, fat intake decreased by 0.09 unit. A unit increased in participant’s BMI, fat intake increased by 0.098%. Fat intake increased by 0.88% for woman who adhered to nonhispanic culture domain.

Leisure time MVPA, MVPA measured by accelerometer, and education were significantly associated with F/V intake. A 30 minutes increased in the leisure time MVPA, F/V overall score increased by 0.09 unit. For every 30 minutes increased in MVPA measured by accelerometer, F/V overall score decreased by 0.12 unit. F/V score increased by 0.6 unit for those who completed high school.
Table 3. Bivariate Association of Fruit and Vegetable Consumption by Categorical Covariates of Interest Among Faith in Action Participants, San Diego 2013

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>219</td>
<td>6.86 (2.69)</td>
<td>0.0201</td>
</tr>
<tr>
<td>High school or high school completed</td>
<td>186</td>
<td>7.46 (2.66)</td>
<td></td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed (full time, part time, self-employed, seasonal)</td>
<td>264</td>
<td>7.12 (2.76)</td>
<td>0.882</td>
</tr>
<tr>
<td>Not employed (all other)</td>
<td>141</td>
<td>7.16 (2.57)</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or living as married</td>
<td>314</td>
<td>7.13519 (2.66)</td>
<td>0.9707</td>
</tr>
<tr>
<td>Single or non-partnered</td>
<td>91</td>
<td>7.1237 (2.81)</td>
<td></td>
</tr>
<tr>
<td>Monthly income*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $2000</td>
<td>225</td>
<td>7.22 (2.72)</td>
<td>0.0002</td>
</tr>
<tr>
<td>$2000 or more</td>
<td>154</td>
<td>7.36 (2.56)</td>
<td></td>
</tr>
<tr>
<td>Don't know</td>
<td>26</td>
<td>5.23 (2.53)</td>
<td></td>
</tr>
<tr>
<td>Adherence to nonhispanic culture domain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>274</td>
<td>7.03 (2.57)</td>
<td>0.1385</td>
</tr>
<tr>
<td>Yes</td>
<td>131</td>
<td>7.45 (2.88)</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

Table 4. Unadjusted Regression Model Assessing the Relationship Between the Outcome (Fat Intake and Fruit/Vegetables Consumption) and Controlling Variables Among Faith in Action Participants, San Diego 2013

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fat Intake</th>
<th>F/V Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>p-value</td>
</tr>
<tr>
<td>Leisure time MVPA (minutes/week)</td>
<td>-0.00384*</td>
<td>0.0288</td>
</tr>
<tr>
<td>MVPA by accelerometer for all domains (minutes/week)</td>
<td>-0.00185</td>
<td>0.5524</td>
</tr>
<tr>
<td>Age (years)</td>
<td>-0.00953</td>
<td>0.6457</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.098**</td>
<td>0.0018</td>
</tr>
<tr>
<td>Education</td>
<td>0.23996</td>
<td>0.5486</td>
</tr>
<tr>
<td>Employment status</td>
<td>-0.34272</td>
<td>0.4107</td>
</tr>
<tr>
<td>Marital status</td>
<td>0.47272</td>
<td>0.32</td>
</tr>
<tr>
<td>Monthly Income (2000 or more vs. &lt; 2000)</td>
<td>0.63359*</td>
<td>0.1274</td>
</tr>
<tr>
<td>Adherence to nonhispanic culture domain</td>
<td>0.883*</td>
<td>0.0374</td>
</tr>
</tbody>
</table>

Note: *p<0.05, **p<0.01

Dependent variable is fat intake measured in % and f/v consumption measured in score 0-12

*aβ(p-value) for monthly income (‘I don't know’ vs. < $2000) is 1.84789 (0.0211)

*bβ(p-value) for monthly income (‘I don't know’ vs. < $2000) is -1.99124 (0.0001)
MULTIVARIATE ASSOCIATIONS

Before each significant variable was added in the model building, a multi-collinearity test was conducted to determine whether the variables were highly correlated with one to another. The Variance Inflation Factor (VIF) test showed that there was no correlation among the variables and there inflation between variables was not present (Department of Statistics, Pennsylvania State University, 2014). Multiple linear regressions were analyzed to test the final models between the dependent variables and the independent variables. Significant covariate variables were also tested in the final models.

A summary of regression coefficients of fat intake with covariates of interest is presented in Table 5 and indicated that leisure time MVPA, BMI and adherence to non-Hispanic is significantly related to fat intake. Holding all other variables constant, fat intake decreased by 0.123 per 30 minutes increase in leisure time MVPA per week, fat intake increased by .103 per one unit increase in BMI, and fat intake increased by 0.898 for participants who adhered to non-Hispanic culture.

<table>
<thead>
<tr>
<th>Covariate</th>
<th>β</th>
<th>SE</th>
<th>t value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leisure time MVPA (minutes/week)</td>
<td>-0.00409</td>
<td>0.00171</td>
<td>-2.4</td>
<td>0.0168</td>
</tr>
<tr>
<td>MVPA by accelerometer for all domains (minutes/week)</td>
<td>0.00005817</td>
<td>0.00309</td>
<td>0.02</td>
<td>0.9850</td>
</tr>
<tr>
<td>Age (years)</td>
<td>-0.02266</td>
<td>0.02044</td>
<td>-1.11</td>
<td>0.2684</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.10345</td>
<td>0.03061</td>
<td>3.38</td>
<td>0.0008</td>
</tr>
<tr>
<td>Adherence to nonhispanic culture domain</td>
<td>0.89785</td>
<td>0.42350</td>
<td>2.12</td>
<td>0.0346</td>
</tr>
</tbody>
</table>

A summary of regression coefficients of fruit and vegetables consumption with covariates of interest is presented in Table 6 and indicated that leisure time MVPA contributed significantly in this model. Previous bivariate association showed a significant difference in the mean of F/V with education, however after controlling for other variables in the model, education became insignificant. The sum of F/V score increased by 0.09 per 30 minutes increased in leisure time MVPA per week. Women who have a household income of $2,000 or more had a .08 higher F/V score compare to women who had a monthly income of
less than $2000 after holding all other variables constant. Monthly income reported as ‘I
don’t know’ compare to those had a monthly income of less than $2000 is significantly
associated with fruit and vegetable consumption. The F/V overall score decreased by 2.02 for
women who reported having income of ‘I don’t know’ compare to those who had an income
of less than $2000.

Table 6. Fitted Regression Model Assessing the Relationship Between Fruit and
Vegetables Consumption with Covariates of Interest Among Faith in Action Participants,
San Diego 2013

<table>
<thead>
<tr>
<th>Covariate</th>
<th>β</th>
<th>SE</th>
<th>t value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leisure time MVPA (minutes/week)</td>
<td>0.00313</td>
<td>0.00114</td>
<td>2.76</td>
<td>0.0061</td>
</tr>
<tr>
<td>MVPA by accelerometer for all domains (minutes/week)</td>
<td>-0.00363</td>
<td>0.00203</td>
<td>-1.78</td>
<td>0.0754</td>
</tr>
<tr>
<td>Age (years)</td>
<td>0.01445</td>
<td>0.01382</td>
<td>1.05</td>
<td>0.2964</td>
</tr>
<tr>
<td>Education</td>
<td>0.41702</td>
<td>0.29173</td>
<td>1.43</td>
<td>0.1536</td>
</tr>
<tr>
<td>Monthly Income ($2000 or more vs. &lt; $2000)a</td>
<td>0.08954</td>
<td>0.27465</td>
<td>0.33</td>
<td>0.7446</td>
</tr>
<tr>
<td>Adherence to nonhispanic culture domain</td>
<td>0.18849</td>
<td>0.30821</td>
<td>0.61</td>
<td>0.5412</td>
</tr>
</tbody>
</table>

a β(p-value) for monthly income reported as I don't know vs. < $2000 is -2.02437( 0.0001)
CHAPTER 5

DISCUSSION

The purpose of this study was to determine the association between leisure-time MVPA and MVPA in all domains and dietary behavior (fat intake and F/V consumption). The findings showed a significant association between MVPA and dietary behavior, a higher level of physical activity is associated with lower fat intake and F/V consumption, which is consistent with results from others studies showing an association between physical activity and healthy eating (Boutelle et al., 2000; Johnson et al., 1998).

Leisure time MVPA was found to be significant consistently with fat and F/V intake. On the contrary MVPA measured by accelerometer was not significant. Leisure time activity measures participants’ conscious effort to participate in physical activity, possibly with the intentions to maintain or improve their health. Accelerometer data is measuring all activities from the day including routine and occupational activity. Thus, accelerometer data could vary greatly from person to person (e.g. a sedentary desk job vs. a physically strenuous job in construction). As such, accelerometer data is likely not suitable to analyze participants' efforts to exercise as it is not possible to tease out leisure time physical activity vs. routine activity recorded by accelerometer data unless there is an accurate activity log to supplement the data. Leisure time activity, though possibly biased by self-report, is a theoretically more accurate way to gauge conscious efforts to exercise and it’s a better fit for this hypothesis.

The outcome of fruit and vegetable consumption in this study was used as an overall score (ranges 0 – 12), which is a very unusual way to describe F/V consumption. F/V intake barely measured in a continuous scale, common ways of estimating the portions of F/V intake is usually used in cup or serving. Therefore by using a continuous scale we can’t really report the amount and ratio of fruit and vegetable consumption of a participant. For example: a participant with an overall score of 6. How many cups of fruit or vegetable does the participant consume? Is the consumption of fruit higher than vegetable or vice versa. For that
reason, assessing F/V consumption in cups or serving may be a suitable way than in a continuous scale.

Dehghan et al. (2011) found that female participants with higher education and higher income consumed more fruit and vegetables. The outcomes of bivariate association are consistent with this result. However after adjusting for other variables in the model, education became non-significant and monthly income stayed significant. Women who have lower monthly income consume less fruits and vegetables. This could be because lower income families have restricted budgets for food and the cost of fruits and vegetables is usually higher than their budget allows. Another reason they might not want to purchase perishable items is because they usually don’t last long and that could cause these items to go to waste.

Monthly income was associated with fat intake in the bivariate association. However, monthly income became statistically insignificant in the final model. Another study has shown an association between high income and low fat intake (Diez-Roux et al., 1999). This study did not find education or age to be significantly associated with fat intake. Whereas, Hart, Tinker, Bowen, Longton, and Beresford (2006) found fat intake was associated with education, age, employment status, marital status, and monthly income.

Marital status was found to be insignificant compared to fruit and vegetable consumption; however, previous studies have found mixed findings. Tamers, Agurs-Collins, Dodd, and Nebeling (2009) found no association, Devine, Wolfe, Frongillo, and Bisogni (1999) and Pollard, Greenwood, Kirk, and Cade (2001) concluded that married people consumed more fruit and vegetables, and Dehghan et al. (2011) found that single/never married people consumed more fruit and vegetables.

**STRENGTHS AND LIMITATIONS**

The results of this study cannot be generalized very well to other populations and communities because it focused only on churchgoing Latina women. Therefore, to gain a better understanding of the relationship between physical activity and dietary behavior, research on other ethnicities and social/religious groups should be investigated in the future. However, the findings of this study can be generalized to the to sedentary women in the Latino population because the majority of the participants have a low physical activity.
A cross-sectional design was used in this study which means causation cannot be determined from the findings. The survey was long and could take up to two hours, potentially resulting in response fatigue bias. Additionally, this survey was based on self-reported data therefore recall and reporting bias could arise. The accelerometer device used in determining the MVPA was not waterproof therefore some water activities may be missed in participants’ physical activity.

There is little research done on community samples to assess the relationship between dietary behavior and physical activity, therefore, this study contributes to the sparse literature on the association between physical activity and healthy eating in a community sample. However, additional research should look at other related factors like grocery store availability or transportation that are known to affect F/V consumption.

**CONCLUSION**

This research finding suggests that there is a relationship between leisure-time MVPA, fat intake, and fruit and vegetable consumption, a higher level of leisure time is associated with lower fat intake and higher F/V consumption. Cross sectional study design was used therefore, we couldn’t determine causal relationships. A longitudinal study to determine the cause and effect of dietary behavior in the Hispanic population should be started. Future directions for this research will include investigating the changes of MVPA and dietary behavior from baseline to one year and two years for the *Fe en Acción* project. Findings suggest that the fat intake of churchgoing Hispanic women falls within the recommendations therefore, future programs may not need to spend as much time on this topic. Planning health promotion programs that combine physical activity and fruit and vegetable consumption in this population will optimize health behavior changes and health outcomes such that those who participate in physical activity will also make healthy eating decisions.
REFERENCES


