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Nutrition Label Accuracy And The Theory Of Triadic Influence: The Impact Of Knowledge On Healthy Food Choices In A Predominantly Hispanic Sample

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NUTRITION LABEL ACCURACY AND THE THEORY OF TRIADIC INFLUENCE: THE IMPACT OF KNOWLEDGE ON HEALTHY FOOD CHOICES IN A PREDOMINANTLY HISPANIC SAMPLE

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NUTRITION LABEL ACCURACY AND THE THEORY OF TRIADIC INFLUENCE: THE IMPACT OF KNOWLEDGE ON HEALTHY FOOD CHOICES IN A PREDOMINANTLY HISPANIC SAMPLE

by

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DISSERTATION

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“Unless someone like you cares a whole awful lot, nothing is going to get better. It’s not.” – Theodor Seuss Geisel
Abstract

Unhealthy food choices and the outcomes of those choices are a significant concern in the United States. Multiple governmental agencies recommend using nutrition labels to promote healthier food choices. This study investigated this claim using the theory of triadic influence to examine the efficacious use of nutrition labels on food choices. The theory of triadic influence presents a model of variables that affect food choice, including knowledge pathways on which this study focuses. Within the model, we expected increased scores on two measures of health knowledge to predict nutrition label understanding, which predict healthy food attitudes. Next, we expected that healthier attitudes would predict healthy eating intention, which we anticipated would increase the likelihood of participants to select a healthier food option when participants were presented with two nutrition bars. The study tested the theory using a path model to predict a hypothetical food choice with 612 primarily Hispanic students at the University of Texas at El Paso in 2017. The hypotheses were partially supported. First, we found statistically significant results for both health literacy ($\beta = 0.47; SE = 0.04$) and nutrition knowledge ($\beta = 0.12; SE = 0.04$) predicting label understanding. Second, we found statistically significant results for healthy attitudes predicting healthy intention ($\beta = 0.31; SE = 0.03$). However, we did not find support for the relationship between healthy intention and hypothetical food choice. These findings provide partial support for the theory of triadic influence. We recommend future studies continue to examine the knowledge pathway of the theory of triadic influence, such as using culturally relevant variables related to health knowledge and asking about respondents’ frequency of using nutrition labels.
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Introduction

Many individuals make unhealthy food choices, and these choices are a considerable health challenge in the U.S. Since the 1970s, the number of people eating at fast food restaurants compared to eating at home has steadily increased (Clauson, 2000). Most restaurant food is calorie dense and nutritionally unsound (Food Research and Action Center, 2015). For many individuals, these unhealthy food choices comprise the vast majority of their daily dietary intake (Mazur, Marquis, & Jensen, 2003). These unhealthy food choices, in part, have led to higher rates of weight gain and various chronic diseases including obesity, type 2 diabetes, and cardiovascular disease (Mozaffarian, 2016). These increased rates of weight gain affect individuals from multiple ethno-cultural groups, but Hispanics are disproportionately affected, a phenomenon which has been called Hispanic health disparities (CDC, 2004). As one of the largest minority groups with the highest rates of weight-related diseases stemming from unsound food choices, it is even more pressing to decrease these disease rates. Determining the healthiness of food and acting on this information can help stem the increase in diseases. One way to determine the healthiness of food involves using nutrition labels (FDA, 2017). Nutrition labels help individuals determine the nutritional value of food and are particularly important in consuming convenience foods.

Nutrition labels on packaged foods contain information about the food, such as serving size, the nutrient amounts, and Daily Value percentage for each nutrient. This information gives individuals the tools to regulate the intake of nutrients and assist them to make informed decisions about their food. Altogether, nutrition labels display the amount of calories, fat, sugar, salt, and other nutrients in food along with the recommended serving size. However, a literature review found that participants may not likely understand food labels when read (Cowburn &
Stockley, 2005). Fortunately, ways to improve individuals’ understanding of food labels have been identified, using health-related cognitive abilities.

These health-related abilities include nutrition knowledge and health literacy. Nutrition knowledge is defined as an individual’s understanding of the relationship between diet and health (Kliemann, Wardle, Johnson, & Croker, 2016). Health literacy is defined as an individual’s numeric ability, literacy ability, and ability to locate information (CDC, 2016). Given the high rates of obesity and type 2 diabetes, as previously mentioned, Hispanic health disparities reflect unsound food choices, but these choices might also be influenced by educational disparities (CDC, 2004). Educational disparities among Hispanics are well documented (APA, 2012), but few studies have examined Hispanics’ nutrition knowledge and health literacy. If this educational disparity were addressed, by increasing health-related knowledge, it may also decrease health disparities related to food choice.

Improved health knowledge alone will not solve the problem of Hispanic health disparities. However, health education research can help to decrease weight-related diseases by providing individuals with the knowledge to make healthy choices. To this end, this study used a health theory to examine the effect of knowledge that enables people to make healthy food choices. We used the theory of triadic influence to investigate the individual use of nutrition labels and the associated impact of those decisions on food choice in a primarily Hispanic sample.

The theory of triadic influence examines multiple influences on health behavior (Flay & Petrakis, 1994). This theory posits three individual pathways for predicting behavior: biology, social situation, and environment. Figure 1 demonstrates the complexity of the model, which involves three major pathways with branching concepts leading to others, as discussed in the
following sentences. The personality pathway examines an individual’s intrapersonal traits and how that affects self-efficacy for specific behaviors. The social situation pathway examines individuals’ social norms about specific behavior and how that impacts their perceived expectations after the behavior. The environmental pathway examines an individual’s institutional and information structures that affects knowledge and thereby affects attitudes for specific behaviors. The environmental pathway, on which this research focuses, examines the education level of an individual. For the full theory, all three pathways are hypothesized to predict an individual’s intentions, which in turn, then predict behavior.

Due to the complexity of the model, most research examines only certain parts of the model to explain and predict health behaviors (DiClemente, Crosby, Kegler, 2009, p. 492). As it pertains to food choice in this study, the environmental pathway on the rightmost side will be examined, starting with the information section of the model (see Figure 1). The information section makes an effective choice to study due to information improving comprehension being a feature individuals can improve.

In terms of the theory of triadic influence, few studies have used the environmental pathway as well as the knowledge variables to examine food choice (de Bruijn et al., 2005). De Bruijn and colleagues found that greater educational attainment, positive attitudes toward restrictive eating, and greater intention toward restricted eating are associated with decreased snacking. While de Bruijn and colleagues attempted to examine the environmental pathway, they used a generic comprehension variable, educational attainment, rather than studied health-specific knowledge.

This study examined relevant information and knowledge variables in terms of food choice, which will be discussed in turn. The first information variable included nutrition
knowledge, defined as the relationship between diet and health (Kliemann et al., 2016). The second information variable is health literacy which can be divided into three variables—individual numeric ability, reading ability, and locating specific information (CDC, 2016). Altogether, nutrition knowledge and health literacy qualify as environmental variables according to the theory of triadic influence. However, no studies to our knowledge have examined dietary behaviors using both of those variables as predictors to knowledge.

Nutrition knowledge is defined as the ability of individuals to understand the relationship between nutrients and their effects on the body (Miller & Cassady, 2015). This knowledge comes from an individual bringing together their understanding of nutrition facts and dietary behavior (Axelson & Brinberg, 1992; Sims, 1981). This combined information represents consumers’ ability to understand and use nutrition information to improve their choices. With adequate nutrition knowledge, individuals can identify what nutrients they need and their associated health effects.

An individual’s nutrition knowledge can be manifested through the use of nutrition labels. Analogous to how the information pathway predicts knowledge in the triadic influence theory. Prior research demonstrates that a positive relationship exists between an individual’s nutrition knowledge and ability to accurately use nutrition labels (Burton, Garretson, & Velliquette, 1999; Grunert, Wills, & Fernández-Celemín, 2010; Miller & Cassidy, 2015). In general, increased nutrition knowledge helps consumers compare and select the healthiest food. Specifically, those studies found an individual’s increased nutrition knowledge was positively related to greater self-reported use of nutrition labels. Only one study examined a similar relationship that found nutrition knowledge positively related to food label use among Latinas (Fitzgerald, Damio, Segura-Pérez, & Pérez-Escamilla, 2008). Individuals need more than
nutrition knowledge to make healthy choices; people must also have adequate abilities in health literacy.

Health literacy, the second type of information, contains on three skills. The first skill is numeracy, which involves an individual’s capacity to comprehend numbers (CDC, 2016). The other two skills are reading ability and locating relevant information to health behavior (CDC, 2016). Altogether they comprise health literacy and relate to an individual’s accurate use of nutrition labels.

Despite these three parts of health literacy, researchers have only examined numerical and reading ability in regards to nutrition label understanding. Rothman et al. (2006) examined the influence of numerical and reading ability on nutrition label understanding in a sample of 200 patients. Rothman and colleagues examined reading ability by requiring participants to pronounce and define several medical terms and had participants complete math problems to test numerical ability. They did not include the third part of health literacy previously mentioned, locating information. Rothman and colleagues found that both reading and numerical ability strongly related to their participants’ accuracy when using nutrition labels (respectively, $r = .67$ and $r = .52$). Two studies have also examined the relationship between numeracy and nutrition label understanding (Dane’el, 2014; Weiss et al., 2005). Both studies found a similar and strong relationship between understanding and numeracy, although only Dane’el (2014) examined this relationship among a mostly Hispanic sample. While all three studies together demonstrate that numeric and reading ability influence nutrition label understanding, no studies to our knowledge have examined all three parts of health literacy as they affect nutrition label understanding.

Unfortunately, Americans have low health literacy rates (Kuter, Greenburg, Jin, & Paulsen, 2006). Studies examining literacy rates organize an individual’s competency into four
categories: proficient, intermediate, basic, and below basic. When examining percentages of ‘below basic’ skills, 12% of Americans have inadequate numeracy abilities, and when specifically focused on the Hispanic population, 56% qualify as ‘below basic’ for numeracy (Goodman, Finnegan, Mohadjer, Krenzke, & Hogan, 2013). Alternatively, when examining literacy, 14% of Americans compared to 56% of Hispanics score below basic literacy (Goodman et al., 2013). When examining health literacy as a whole, researchers found that only 9% of Americans have below basic health literacy whereas 41% of Hispanics have below basic health literacy (Kuter et al., 2006). These differences highlight the lack of understanding health-related knowledge for Hispanics. These educational disparities can also be a proxy for Hispanic health disparities, as both health literacy and nutrition knowledge influence the accuracy of nutrition label use.

The next part of the theory’s environmental pathway to be examined is attitudes (see Figure 1; path 23). Studies have examined how health knowledge can predict health attitudes, but no studies have examined if nutrition label understanding can predict health attitudes. For comparing and selecting healthy food, health knowledge manifests itself through an individual’s nutrition label understanding. Such knowledge can affect attitudes which can thereby assist individuals in making an evaluation about the food (Zepeda & Deal, 2008). Thus, knowledge about nutrition label use helps to predict healthy attitudes.

A wealth of literature exists on the impact of knowledge on attitudes. According to Davidson (1995), the concept of working knowledge involves relevant cognitive information influencing the formation of an attitude about a behavior. However, an individual’s working knowledge is influenced by subjective experiences and is subject to error (Scott, 1969).
Nevertheless, those attitudes can be more factually based by increasing the knowledge an individual has about the behavior (Steffen, Sternberg, Teegarden, & Shepherd, 1994).

In terms of working knowledge on healthy foods, there is a lack of research on the impact of label understanding on attitudes toward healthy food; however, studies have examined self-reported use of nutrition labels influencing attitudes toward healthy foods. Žeželj, Milošević, Stojanović, & Ognjanov (2012) found that an increase in nutrition label use was associated with an increase in healthy food attitudes. Furthermore, nutrition knowledge predicted food label use, once again demonstrating the relationship between the knowledge variables. Still, the findings from Žeželj and colleagues demonstrate that label use, as knowledge, can influence attitudes. Although attitudes do not necessarily lead to changes in behavior (Vermeir & Verbeke, 2006), attitudes more effectively predict intention (Sheeran et al., 2016).

Health attitudes can lead to changes in health intentions, a process also posited by the theory of triadic influence (Figure 1). In a meta-analysis, Sheeran et al. (2016) reviewed 204 studies which demonstrated that strong experimental manipulations on attitudes can lead to a modest change in intention ($d = .48$). In terms of that relationship for healthy food, a meta-regression indicated that larger effects occurred for studies that sought to increase, rather than decrease, health behaviors (Sheeran et al., 2016). They also found that while attitudes did lead to an increase in a behavior ($d = .38$), attitudes had a larger effect on intention. However, a limited amount of studies examined healthy food attitudes within the meta-analysis. Presumably, these effects would extend to increasing healthy eating, with positive attitudes towards healthy food leading to increased intention to eat healthy foods.

With regard to examining the attitude-intention relationship with healthy foods, two studies demonstrated this relationship (Michaelidou & Hassan, 2008; Øygard & Rise, 1996).
Both studies found a positive relationship between healthy food attitudes and intention to buy healthy foods, but these non-U.S. studies had no focus on Hispanics in the United States. One study with a predominantly Hispanic sample found that healthy food attitudes positively predicted an increased intention to purchase healthy food (Campbell, 2013). These three studies demonstrate a positive relationship between healthy food attitudes and intention to purchase, which is consistent with the environmental pathway for the theory of triadic influence (Figure 1). While the relationship between positive attitudes and increased intention toward a food choice has been demonstrated, the theory of triadic influence suggests one additional pathway before knowledge indirectly predicts behavior (Path 22 or 23, Figure 1). That pathway involves examining the relationship of an individual’s intention to select healthy foods and food choice.

The relationship between behavioral intention and acting on the behavior is complex. Much of the research focusing on this relationship uses cross-sectional data to examine a relationship between intentions and behavior, which limits causal inference (McEachan, Conner, Taylor, & Lawton, 2011). Additionally, considerable proportions of individuals do not conform to this relationship, which is referred to in the literature as the intention-behavior gap (Webb & Sheeran, 2006; Sniehotta, Scholz, & Schwarzer, 2005). That gap suggests intention does not effectively cause behavior. While there does remain a gap, a meta-analysis has demonstrated a causal relationship between both variables as well as demonstrating ways to decrease the gap.

In their meta-analysis, Webb and Sheeran (2006) examined forty-seven studies that manipulated intention to increase behavior change as well as examined the intention-behavior gap. Webb and Sheeran (2006) specifically examined experimental studies to investigate a causal relationship between health intentions and behavior. They found that a medium-to-large change in intention ($d = 0.66$) led to a modest change in behavior ($d = .36$). This meta-analysis
demonstrates that greater intention can promote behavior change. Webb and Sheeran (2006) also investigated ways to decrease the intention-behavior gap and found the gap decreased with variables that influence intention, such as habits and increased cognitive abilities. As for the previously mentioned relationship between knowledge and attitudes, there are relevant skills that influence attitudes towards specific behaviors. In terms of relevant cognitive abilities, the aforementioned knowledge variables affect the use of nutrition labels (Rothman et al., 2006). Although few healthy food studies were identified for Webb and Sheeran’s meta-analysis, this relationship can be expected with nutrition label use.

Based on the complex relationship between these previously discussed variables, we proposed several hypotheses, which are illustrated by the path diagram in Figure 2. Individuals may use nutrition labels to select healthy food, but they require the ability to do so which is influenced by nutrition knowledge and health literacy. These concepts of nutrition label use, nutrition knowledge, and health literacy are conceptualized as parts of the knowledge pathway. We can use the theory of triadic influence to explain how increased nutrition label understanding influences behavior, through positive attitudes and greater intention. Improved knowledge about nutrition and health literacy would predict positive attitudes towards healthy food, which would subsequently predict greater intention toward consumption. Finally, greater intention toward healthy food predicts participants would be more likely to select healthy food when presented with a choice.

The proposed study makes two contributions to the literature. Findings from this research will generate a more comprehensive and complete environmental pathway to how individuals choose food. The findings are also expected to confirm the relationships posed by the theory of triadic influence. As Hispanics are disproportionately affected by weight-related
diseases and low health literacy rates, the proposed study is the first not only to examine these relevant health issues, but also to examine the theory of triadic influence using health-specific knowledge.
Aims and Hypotheses

As summarized above, this study uses the theory of triadic influence and its environmental pathway to confirm the relationships between information, knowledge, attitudes, intentions, and food choice. Four hypotheses were tested: (1) participants’ health knowledge will positively predict nutrition label understanding; (2) participants’ nutrition label understanding will positively predict an individual’s attitudes towards healthy food; (3) participants’ positive attitudes towards healthy food will positively predict an individual’s intention towards selecting healthy food; and (4) greater healthy eating intentions will be associated with a greater likelihood of participants selecting the healthiest food option. Each of the hypotheses corresponds to the environmental section of the theory of triadic influence model (visually, the rightmost path of the model). Each hypothesis is denoted by various paths on Figure 1, specifically: hypothesis one is denoted by path 12 and two are denoted by path 18; hypothesis three is denoted by path 21; and hypothesis four is denoted by path 22. Health literacy and nutrition knowledge represent the information section. Then, nutrition label understanding is part of the knowledge section. An individual’s attitudes towards food represent the attitudes section of the theory. Health intention scores represent the intention section of the theory. Healthy food choice represents the behavior. To examine healthy food choice, the proposed study will give participants the choice between two nutrition bars, with one bar healthier than the other. For a model of the theory of triadic influence, refer to Figure 1. For an illustration of all the hypotheses, refer to the path analysis on Figure 2.
Methods

Participants

A test of exact fit, as suggested by Preacher and Coffman (2006), was used with an alpha set to .05, degrees of freedom set to 11, power set to 80%, and a Null RMSEA of .00 and an Alternative RMSEA of .05. The result of this power analysis indicated that a minimum of 613 participants were needed to test this model. These participants were recruited online from the UTEP Sona-Systems using Qualtrics for one hour of course credit.

We now elaborate on the size and characteristics of the sample. We collected a total of 713 participants for the study during the entire year of 2017. Due to this study being conducted online, some participants started multiple times before finishing which led to deleting 101 participants from the original sample size of 713 participants resulting in a total number of 612 participants. We deleted data if both a participant’s name appeared multiple times and the IP address was the same. In those cases, we kept the participant data that was complete. The majority of participants were female (71.4%) with an average age of 20.26 years (SD = 3.89). Hispanics were the ethnic majority (85.3%). Our missing data for variables ranged from 0 to 0.9%. More information about participants can be located on Table 1.

Materials

Demographic survey. This measure requested demographic information from participants (see Appendix 1). This survey contained similar demographic information collected in Dane’el (2014). Also, due to the study involving food choice, one item requested participants to rate their hunger on a 7-point Likert scale. The average self-reported hunger level was 4 (SD = 1.70) with higher scores indicating greater fullness. Self-reported native and strongest participant language were both English at 69.1% and 47.1%, respectively.
**Health Literacy Skills Instrument.** This 25-item measure (see Appendix 2) assessed participants’ health literacy (McCormack et al., 2010). The full measure examined health literacy in five different domains: prose literacy, document literacy, numeracy, oral, and internet. Only items relevant to the first three domains were used. A revised 15-item measure was used for this study, with items being scored as correct or incorrect. The composite score represents the total number of correct answers with missing data coded as incorrect. Scores range from 0 to 15, with increased scores indicating greater health literacy ability. Participants’ average score was 10.86 ($SD = 2.68$) with internal consistency that was inadequate (KR-20 = 0.68).

**Nutrition Knowledge.** This revised 71-item measure with four sections (see Appendix 3) originally created by Parmenter and Wardle (1999). The full survey measures participants’ knowledge about health claims from experts, with items being scored as correct or incorrect. However, only 20 items were used for the study. Specifically, we used items that pertain to the relationship between diet and health problems. The composite score represents the total number of correct answers with missing data coded as incorrect. Scores range from 0 to 20, with increased scores indicating greater nutrition knowledge. Participant scores ranged from 0 to 18 with an average score of 10.73 ($SD = 3.26$) with an internal consistency that was inadequate (KR-20 = 0.65)

**Nutritional Label Survey.** This modified 18-item measure (see Appendix 4) assessed participants’ ability to read and use nutritional labels (Rothman et al., 2006). The original measure was created with help from the FDA. When participants completed this survey, they were asked not to use a calculator, and items were scored as either correct or incorrect. The composite score represented the total number of correct answers. This study used a modified version from Dane’el (2014). The modifications occurred in questions seven through twelve.
with participants being asked to make calculations for their choice. The original version of the 12-item scale requested participants to compare the two fictitious foods and select the healthiest between the two. Participants had access to two fake food labels to answer the survey (Appendix 4a; labeled ‘Food A’ and ‘Food B’). The composite score represents the total number of correct answers with missing data coded as incorrect. Scores ranged from 0 to 18, with greater scores indicating increased accuracy when using nutrition labels. Participant scores ranged from 0 to 16 with an average score of 10.86 (SD = 3.29) with an adequate internal consistency (KR-20 = 0.76).

**Healthy Food Attitude Scale.** This modified 8-item measure (see Appendix 5) was created by Roininen, Lähteenmäki, and Tuorila (1999). The previous version of the scale asked general opinions towards healthy food; whereas the modified scale requested participants’ attitudes on nutrition bars. The Health Food Attitude Scale is a 7-point Likert scale (from Strongly Disagree to Strongly Agree) used to measure participants’ attitudes on how the healthiness of food impacts what they eat. The range of the scale is 8 to 56, with greater scores indicating a positive attitude towards healthy food. Participants scores ranged from 8 to 56 with an average score of 32.06 (SD = 8.02) with an adequate internal consistency (α = 0.73)

**Health Intention Scale.** This is a modified 5-item measure (see Appendix 6) was created by Conner, Norman, & Bell (2002). The modifications made involve the target intention being nutrition bars. Previously, the scale items asked participants about living a general healthy lifestyle. The Health Intention Scale is a 7-point Likert scale used to measure participants’ self-reported intentions towards eating healthy food. The range of the scale is 5 to 35, with increased scores indicating greater intention to eat healthy food. Participants scores ranged from 5 to 35 with an average score of 23.93 (SD = 7.36) with an adequate internal consistency (α = 0.92).
Nutrition bars. Pictures of Clif© and Fiber One© bars, along with their associated nutrition labels, were used as the dependent variables for the study (see Appendix 7). While most food choice studies use foods of opposing nutrition profiles (for example, cookies or potato chips to represent the unhealthy option and carrots to represent the healthy option; Oliver, Wardle, & Gibson, 2000; King, Weber, Meiselman, & Lv, 2004; Garg, Wansink, & Inman, 2007), this study used foods with similar nutrients and ingredients which have been previously used to examine food choices (Burger et al., 2010). These foods were used so that participants needed to use the nutrition labels to identify which food is the healthier option, if they chose to examine the nutrition labels. The Fiber One© bar had the following Nutrition Facts: 140 calories, 35 calories from fat, 4g of total fat, and 90mg sodium. The Clif© bar had the following Nutrition Facts: 240 calories, 45 calories from fat, 5g of total fat, and 140mg sodium. Participants made a hypothetical choice for a single bar. Due to the difference in nutrition, the Fiber One© bar was scored as the healthy option and the Clif© bar was scored as the unhealthy option. The outcome variable was scored as eating the Fiber One© bar (scored as “1”) or not eating the Fiber One© bar (scored as “0”). The majority of participants chose the Fiber One© bar (74.2%).

Attention checks. One binary choice question was presented after each scale, making four questions total. In order, the four questions were: “Were you asked your weight at the beginning of the experiment?”; “Were you allowed to use a calculator on the Health Literacy Scale Instrument?”; “Were you allowed to use a calculator on the Nutrition Label Survey?”; and “Did you have to answer questions about nutrition labels?” Participants were asked a final question at the end of the study, without threat of penalty, if they used a calculator. We used these questions to determine if participants paid attention to the various measures during the
study. All five answers for the attention checks were added together to make a composite variable where increased scores demonstrated participants paid more attention. The average score for participants was 4.30 ($SD = 0.83$). The percent correct for the individual attention check variables is located in Table 1.
Results

The correlation matrix (Table 2) denotes the relationships between the variables which ranged from -.05 to .52. The significant correlations involved the following pairs of variables: health literacy and nutrition knowledge \(r = .30\); label understanding and health literacy \(r = .52\); nutrition knowledge and label understanding \(r = .29\); health attitudes and nutrition knowledge \(r = .11\); and health attitudes with health intention \(r = .25\).

Overall Model

As nearly half of participants correctly answered all five the attention checks, we initially modified the theoretical model (Figure 2; Model 1) to include a composite check. We examined the effects of the composite attention check variable on each of the other variables label understanding; however, the composite score did not significantly predict any of the other variables. Thus, the final model did not include the composite attention check variable in the model. However, the final model used an attention check about calculator use to examine its influence on label understanding. This variable was coded such that zero denoted a participant used a calculator and one indicated an individual did not use a calculator. This calculator non-use attention check variable was significant \(\beta = -.09; SE = .04\), thus indicating that if participants used a calculator they had larger label understanding scores compared to individuals that did not use calculators.

The fit indices for Model 1 are as follows: \(\chi^2 (12, N = 612) = 36.06 (p < .00)\); RMSEA = .06 (95% CI = .04 – .08); CFI = .89; TLI = .83; WRMR = 1.22. According to the criteria in Hu & Bentler (1999), there are multiple indices to assess model fit. For adequate models, these fit indices should include CFI > .90, TLI > .90, RMSEA < .06, and SRMR < .08. Both the CFI and TLI indices do not meet the criteria recommended by Hu and Bentler.
Another index of model fit, the Squared Root Mean Residual (SRMR) was not used due to the use of a binary dependent variable. Instead, the Weighted Root Mean Square Residual (WRMR) was used. According to Yu (2002), adequate values of WRMR are less than one. So when including the WRMR, all four fit indices indicate a poorly fitting model. The $\chi^2$ value was also significant, indicating the data inadequately fits the model. Modification indices were examined for this model and we identified a revised model.

For the revised model, the modification indices recommended one parameter that would improve model fit. A new model with this one alternative parameter involves using nutrition knowledge to predict health attitudes (Figure 3; Model 2). While caution needs to be exercised in using local fit information to improve model fit due to capitalization on chance characteristics of the data set (MacCallum, Necowitz & Roznowski, 1992), estimating this parameter seems theoretically plausible and was subsequently estimated. The fit of the resulting model was $\chi^2 (11, N = 612) = 24.82, p = .01$; RMSEA = .05 (95% CI = .02 – .07); CFI = .94; TLI = .90 WRMR = .99. Also, we found the added pathway of nutrition knowledge predicting healthy attitudes significant ($\beta = .14; SE = .04$). The findings from the revised model do not substantively change the conclusions about the hypotheses from the first model. Thus, the hypotheses will be discussed based on the revised and improved model.

**Hypotheses Specific Findings**

As a reminder, this study examined the environment stream of the theory of triadic influence (Figure 1). We tested four hypotheses in this study: (1) participants’ health knowledge would positively predict nutrition label understanding; (2) participants’ nutrition label understanding would positively predict an individual’s attitudes towards healthy food; (3) participants’ positive attitudes towards healthy food would positively predict an individual’s
intention towards selecting healthy food; and (4) greater healthy eating intentions would lead to a greater likelihood of participants selecting the hypothetical healthier food option.

The model found that two hypotheses were supported. Of the two hypotheses—hypothesis one and three—were fully supported. For hypothesis one, both health literacy (β = .48; SE = .04) and nutrition knowledge (β = .12; SE = .04) positively predicted nutrition label understanding. For hypothesis three, health attitudes positively predicted health intention (β = .31; SE = .03).

Hypotheses two and four were not supported. Specifically, for the second hypothesis, label understanding did not predict health attitudes (β = -.04; SE = .04). For the fourth hypothesis, health intention did not predict the health behavior of selecting a hypothetical more nutritious bar (β = .07; SE = .05). We now move on to discuss the findings.
Discussion

In this study examining the theory of triadic influence and nutrition label use, we tested four hypotheses, of which two were supported. The research findings raise questions about the triadic influence model along with the challenges to measuring both nutrition knowledge and health literacy. Our research identified a modified model for the environment stream of the theory of triadic influence which revealed a relationship between nutrition knowledge and healthy attitudes. The first section discusses the major findings associated with both hypotheses one and two. This section also includes implications for how the results could influence future interventions. The second section discusses the rest of the hypotheses. The third section outlines the strengths and limitations of our study. The final section offers recommendations, both practical and policy, for future research in this area.

Major Findings of the Study

This study denotes two major contributions to health research based on the findings for both hypotheses one and two. First, this study examined the relationship between health literacy and label understanding (the first hypothesis). Previous studies that claimed to examine the relationship between health literacy and label understanding did not. Those studies examined how individual parts of health literacy, either numeracy or literacy, related to label understanding (Dane’el, 2014; Rothman et al., 2006, Weiss et al., 2005). Presumably, researchers failed to investigate this relationship due to the unavailability of a reliable health literacy scale. Until McCormack et al. (2010), researchers needed to use multiple scales to assess the individual parts of health literacy. Prior researchers assumed that health literacy would be related to label understanding due to the identified relationships with numeracy and literacy. With a newly available health literacy scale, this study was the first to examine the relationship between health
literacy and label understanding. The correlations between these two variables demonstrated a large effect size estimate ($r = 0.52$), demonstrating the importance of health literacy when studying label understanding.

The second major contribution for this study involved our findings with nutrition knowledge. Specifically, we identified the relationships nutrition knowledge has with both label understanding and healthy attitudes. First, previous researchers have indirectly examined the relationship, nutrition knowledge and label understanding in previous studies (Burton et al., 1999; Grunert et al., 2010; Miller & Cassidy, 2015); however, the correlations were examined with individual self-reported nutrition knowledge. This study more effectively qualified the correlation by using direct and objective examinations of the relationship. Second, we initially tested the predicted effect that label understanding would have on health food attitudes, but that parameter was not significant. When we examined local fit, we revised the model so that nutrition knowledge would predict healthy attitudes. We included this nutrition knowledge and healthy attitudes parameter; this was significant and improved model fit. While we did not initially predict this parameter, previous research had suggested a relationship between nutrition knowledge and healthy attitudes (Davar, 2012; Misra, 2007). Our research confirms this relationship. The findings from the major contributions could be used to improve label understanding and weight loss interventions.

Our findings from both nutrition knowledge and health literacy have practical importance for future interventions to improve label understanding. A literature review recommends researchers develop interventions with educational variables to improve label understanding (Campos, Doxey, & Hammond, 2011). Both of the findings with nutrition knowledge and health literacy demonstrate modest-to-large positive relationships with label understanding suggesting
their importance when designing an educational intervention. While the variables in this study were not associated with food choice, previous studies have suggested that label users weigh slightly less compared to individuals that do not use labels (Kreuter, Brennan, Scharff, & Lukwago, 1997; Variyam & Cawley, 2006). As our study was neither longitudinal nor an intervention, label use and understanding may need to be further studied to identify a positive change in long-term health behaviors.

The second major implication from this study involves the relationship between nutrition knowledge and healthy attitudes from hypothesis two, specifically, how that relationship could be used to develop a weight loss intervention. Although the nutrition knowledge-attitude relationship was not initially predicted, we did demonstrate that nutrition knowledge positively relates to healthy attitudes. This relationship has also been implied before in the literature (Davar, 2012; Misra, 2007). In terms of an intervention, improving healthy attitudes has been found in a previous study to lead to weight loss (Kilanowski & Gordon, 2015). The intervention had an experimental and control group in a seven-week intervention that used a variety of different measures to improve healthy attitudes. When examining the pre-posttest difference between the groups, Kilanowski and Gordon found that the participants in the intervention had improved healthy attitudes and greater weight loss compared to those in the control condition. While this study examined the relationship between nutrition knowledge and healthy attitudes at one time point, the intervention by Kilanowski and Gordon demonstrates a use for our findings in a longitudinal study. These remarks conclude the major findings of the study and we now move on to discuss the rest of the hypotheses.
Tests of Hypotheses

We did not find support for hypothesis two, which predicted label understanding would positively relate to health attitudes. There is a lack of prior research examining these two variables. While the triadic influence theory would recommend using a knowledge variable to predict health attitudes, the findings from this study along with the lack of research in this area may lead researchers to avoid using label understanding. While label understanding is one type of knowledge, nutrition knowledge may be an alternative variable that influences attitudes. The results from the revised model (Figure 3) demonstrate that nutrition knowledge may predict health attitudes. While this finding was not the intended pathway to examine, these results demonstrate that some knowledge influences attitudes and others may not. We discussed the revised model in the results section (with the nutrition knowledge-healthy attitudes pathway due to the modification indices and poor fit from Model 1), but we will address this research finding more in the recommendation section.

We found support for hypothesis three, which identified that health attitudes positively influence intention. Multiple studies have consistently found healthy attitudes predicting health intention. Sheeran et al. (2014) found that experimental manipulations of their respondents’ attitudes led to an increase in healthy intentions for healthy behaviors. However, this study adds to the literature, given that few studies examined this relationship while using attitudes toward a specific food, nutrition bars. In addition, a small-to-medium effect size has been identified for this part of our study ($r = .22$). While this study examined the hypothetical choice among nutrition bars, future studies may focus on different healthy foods to observe if healthy attitudes predict healthy intention consistently.
We did not find support for hypothesis four, which predicted that healthy intention would predict a healthier, hypothetical food choice. We have two reasons why this relationship was not significant and they include: (1) the effect size was small for intention and choice and (2) we chose to use a path analysis instead of a latent variable analysis. Each reason will be discussed in turn.

The first potential explanation for null results for hypothesis four could be due to a small effect size for the relationship between intention and choice. This effect size ($r = .25$) may have been too small to detect with the variables used in this study ($r = .31$ would be the minimum relationship for attitudes on intention, the previous hypothesis). According to Webb and Sheeran (2006), a medium-to-large effect needs to occur on intentions before a small behavior effect can be found. As this effect on intention to attitude was not large enough, no noticeable effect would be present for intention and choice.

The second potential explanation of null results for hypothesis four could be due to our use of a path analysis for the entire model. We created the health intention variable from a composite of five items. While the health intention scale had adequate reliability, another strategy would involve the use a latent path model approach to examine the influence of the individual items on health intention. Measurement error is removed from the predictor variable using this approach (Russell, Kahn, Spoth, & Altmaier, 1998). However, these models will have increased degrees of freedom and require additional participants to test (Russell, Kahn, Spoth, & Altmaier, 1998). From these explanations, one or more could explain the null results for hypothesis four.

In summary of the findings for our hypotheses, both models demonstrate that two pathways in the environment stream of the triadic influence model were statistically significant.
Both types of health information predict knowledge; and attitudes predict healthy intention. However, the other part of the environment stream was not supported: neither knowledge (via label understanding) to attitudes nor intentions to behavior. Thus overall, the environment stream of the theory of triadic influence had limited influence on an individual’s decision-making process when selecting food. While the results found mixed support for the theory of triadic influence, we now transition to discuss the strengths, limitations, and directions for future studies.

**Strengths and Limitations**

This study had multiple strengths that can inform future research. This study used a theoretical framework to examine nutrition label use and food choice. We used one part of a causal sequence from the theory of triadic influence, the knowledge section (Figure 1; rightmost stream). Few studies that examine nutrition label use involve theoretical frameworks.

A second strength of this study design involves using health literacy to study hypothetical food choice. Multiple studies have suggested the importance of examining health literacy due to the influence this understanding has on a variety of health behaviors (Nelson & Reyna, 2008; Reyna & Brainerd, 2007; Reyna, Nelson, Han, & Dieckmann, 2009). Most studies do not examine the effect of health literacy on health behaviors (Lipkus & Peters, 2009; Osborn, Cavanaugh, Wallston, & Rothman, 2010; Rothman et al., 2006), but rather one or two parts of health literacy. A more comprehensive measure of health literacy was necessary to study this variable; however, most researchers tended to use multiple objective scales to only partially study health literacy. With this study, we examined the relationship using a more complete health literacy scale on nutrition label use. Furthermore, as this study used the theory of triadic influence and contains a knowledge section, health literacy had been recommended as an
effective variable to use. Indeed, the findings from this study demonstrate the strong influence health literacy has on nutrition label use. Altogether, these findings suggest that practitioners seeking to improve nutrition label use should examine health literacy.

A third key strength for this study involves our use of objective measures for health-related cognition variables. We gathered data for health literacy, nutrition knowledge, and label understanding via objective measures. In contrast, many other health studies rely on using subjective measures to gather those types of health information (de Bruijn et al., 2005; Fitzgerald et al., 2008; Miller & Cassidy, 2015). Unfortunately, when researchers gather data primarily on subjective measures, these tend to be unreliable (Suber et al., 2015; van Merrienboer, 2015), which can limit their usefulness in analyses due to recall bias (Althubaiti, 2016). While some subjective measures can be useful, researchers should limit their use or enhance them by also including objective measures in their studies. For example, an individual’s beliefs about their skills and their actual abilities contrast with each other (Hargittai & Shafer, 2006). This finding is consistent with other studies suggesting that individuals have inadequate label understanding (Cowburn & Stockley, 2005; Dane’el, 2014; Rothman et al., 2006), yet they often self-report consistent use of nutrition labels (Guthrie, Fox, Cleveland, & Welsh, 1995; Ollberding, Wolf, & Contento, 2010). This study focused on using objective measures to enhance our understanding of those health-related cognitive variables. Based on the findings from these measures, we demonstrated that both health literacy and nutrition knowledge enhanced label understanding. As previous studies mostly used participants’ self-reported label-use instead of measuring their ability to use the label, the relationships between our three health-related cognitive variables have been more effectively understood.
A fourth strength involves this study using university students. The literature qualifies this type of sample as highly educated (Pollard, Kirk, Cade, 2002). This university sample allowed us to get the large sample size for the study. Also, this study was one of the first to examine the theory of triadic influence and food choice with a highly educated sample. This highly educated sample did not necessarily improve the level of understanding with health-related cognitive variables. This finding will be further discussed in the practical implication section of future directions.

The final strength is how this study adds to the growing number of studies that examine health behaviors with Hispanic Americans. While there is growing research that includes Hispanic health behaviors, there are still a limited number of overall studies that use a majority of this ethnic group in research studies (Office of Minority Health, 2012). Hispanics are also disproportionately affected by poor health behaviors, and that behavior is further compounded by this group having inadequate health literacy rates (Goodman et al., 2013).

While this study had multiple strengths, there are a variety of limitations to also discuss. First, test scores from two measures yielded inadequate reliability. McCormack et al. (2010) developed and pilot-tested the health literacy scale and our study suggests this measure may require refinement in future research. This refinement may be due to Hispanic Americans comprising less than ten percent of their sample in the pilot study participants, and perhaps this scale may not be as effective for studies with many non-native English speakers.

The difference between the findings in this study and the pilot studies from McCormack et al. (2010) could involve two possibilities. The first is that cultural or language barriers may lessen the effectiveness of the scale (Cha, Kim, & Erlen, 2007; Sousa & Rojjanasrirat, 2011). Similarly, Kliemann et al. (2016) assessed the reliability of this scale in a United Kingdom pilot
study sample and found an adequate estimate of reliability (G-C α = .77). Neither study asked or tested participants about their native language. This study did and found that 36.1% of our sample identified Spanish as their native language, which may explain why the item scores on the scales have lower reliability. In addition, we reduced the number of items in the scale. The original McCormack et al. (2010) scale used twenty-five items, and this study only used fifteen items to examine three aspects of health literacy. Both the Cronbach’s and Kuder-Richardson reliability coefficients are partly determined by the number of items in the scale. Therefore, measures with more items typically have larger estimates of coefficient alphas (Morera & Stokes, 2016). While this last reason may partially explain the low reliability, the explanation for the reliability estimate is likely complex and involves both alternatives presented.

A second limitation of this study is that we relied on some subjective data via attitudes and intentions. While some health constructs are difficult to objectively study, Althubaiti (2016) has investigated ways to improve subjective measures. For this study, Althubaiti (2016) would likely recommend asking participants multiple times about their attitudes and intentions. Researchers can then measure the difference between scores and take them into account when conducting analyses.

A third limitation for this study is that participants did not always give complete attention to the study. As a reminder, a composite from the attention check items was made with a perfect score of five indicating participants gave their full attention to the experiment. While the average score was 4.30, less than half sample earned a perfect score. We used those checks to assess participants’ attention due to our study being online. So while our use of an online study assisted in assessing many participants, an unfortunate side effect is that some participants may have paid less attention to the study compared to in-person data collection. While the composite
attention check variable did not significantly predict a theoretical variable, the single-item indicator of calculator use was associated with increased label understanding scores.

A fourth limitation for this study involves how we examined the label understanding and attitudes parameter. There are two issues. First, participants examined two different sets of nutrition labels for the study. Participants used an initial set for the label understanding measure. Later, participants used a second set of labels when they chose a nutrition bar. Using these two sets present a problem because the attitude and intention measures focused on nutrition bars, so there is no reason to suspect that label understanding should predict healthy food attitudes. Second, while the theory of triadic influence denotes how knowledge influences attitudes, there is also theoretical support for healthy food attitudes predicting knowledge (Shepard & Towler, 1992; Zarnowiecki, Sinn, Petkov, & Dollman, 2012). We examined an additional model, and we found a significant relationship when we used healthy attitudes to predict nutrition knowledge. Due to both of these findings, researchers could propose a variety of competing models to assess this relationship, as there is also a possibility of a feedback loop between healthy attitudes and knowledge. While such a model is neither currently identified nor testable (Rigdon, 1995), a future research direction would involve adding variables to test or revise this model to allow for alternative explanations that are theoretically driven.

As for the fifth limitation of our study, we did not counterbalance the order of our measures. We ordered our materials to stay consistent with the pathways we examined for the theory of triadic influence. By keeping that order, participants may have received fatigue effects towards the end of the study (Zeelenberg & Pecher, 2015). Thus, this fatigue could have influenced the participants’ answers starting with the label understanding measure. Also, another effect that could have occurred is the problem-size effect (Geary, 1996). This fatigue effect
occurs from individuals calculating numbers with more than one digit multiple times. For example, this effect would occur from calculating either the number .50 or 10 many times. For our study, participants had to make calculations using numbers between two and three digits. Both these effects could be more apparent as participants completed the health literacy and label understanding measures that were both cognitively demanding and included calculations. Thus, future research with a similar design would benefit from counterbalancing.

A sixth limitation for this study involves our use of university students. While this matter was previously discussed as a strength, our use of university students is also a limitation. In the literature, using students would classify as a highly educated sample (Pollard et al., 2002). While this sample does allow us to examine the abilities of highly educated individuals, these people are not a representative sample of the general US population as about thirty-three percent of working-age Americans earned college degrees (Ryan & Bauman, 2015). While this sample may not represent the general US population in terms of food choice, we can assume that an average American would score lower on the health-related cognition variables due to education being related to both health literacy and nutrition knowledge (Spronk, Kullen, Burdon, & O’Connor, 2014). This assumption will be discussed in the practical implications section of future directions.

A seventh limitation for this study involves how we dealt with missing data. We used list-wise deletion in regards to our attitudes and intention measures as the amount missing ranging from 0.1 to 0.14%. This deletion method is not recommended for researchers as it deletes the participant’s data during data analysis (Graham, 2009). The general concern for missing data is a loss of statistical power (Graham, 2009); however, as the dataset is missing less
than 1% and we almost have the recommended sample size we did not impute the data. We would recommend future researchers not to attempt this method for their datasets.

In our eighth and final limitation for this study, we did not collect self-report data on nutrition label use in our attempt to limit the number of subjective measures. Although subjective, self-reported nutrition label use—in addition to objective data—may clarify the relationship between label misunderstanding and health attitudes for the second hypothesis. However, self-reported label use may lack validity as most sample respondents overwhelmingly describe themselves as label users (Guthrie et al., 1995; Ollberding et al., 2010). To improve the validity of such self-report data, future research can follow the previously discussed recommendations of Althubaiti (2016). While this study had multiple strengths and limitations for examining nutrition label use and the theory of triadic influence, the following recommendations can inform future researchers.

**Future Directions**

The results from this study indicate multiple recommendations for researchers. We first recommend examining participants’ perception of healthy foods. If we examine the labels for both of the food choices, the Fiber One bar may not be necessarily healthier than the Clif bar. For example, the Clif bar contains more protein than the Fiber One bar. Also, the Clif bar has lower percent of calories from fat than the Fiber One bar. Depending on the amount of calories and protein needed for the day, individuals may consider the Clif bar to be healthier than the Fiber One bar. This explanation may also be evident in the Clif bar marketing slogan, “Born on a Bike (Clif Bar, 2018).” Cycling is a labor-intensive exercise which may require more calories, fat, and protein during or after their activity. Individuals that exercise that intensively may, presumably, select the Clif bar compared to the Fiber One bar. We did test out these possibilities
using moderations between hunger level and each of the three knowledge variables (using health literacy, nutrition knowledge, and label understanding) to predict food choice; however, none added significant parameters to the model. Our posthoc analysis covers one possible aspect involving perception, using hunger; however, we would suggest that future researchers examine an interaction or moderation between a more effective perception variable and knowledge. This example is one of many to involve a participant’s perception influencing their food choice.

The perception of participants requiring more calories or protein could be relevant to explain why participants made their choice, but false beliefs could also motivate individuals as well. According to Keane and Willetts (1994), these perceptions can influence our food choices. One example of a false perception involves an anecdotal story about very elderly individuals living for a long time from eating primarily fried foods and cake (Keane & Willetts, 1994). Both true and false perceptions can involve an optimistic bias to explain how individuals make their choices. Keane and Willetts (1994) argue that this variable is also a matter of culture. Perceptions about food can represent an area, traditions, and identity based on how it is made and who cooks it. This concept of culture influencing food choice is also consistent with the theory of triadic influence.

Our second recommendation for researchers involves the other significant variable in the environment stream of the triadic influence theory, culture. This study examined half of the pathways for the rightmost stream, environment, and did not include culture variables (Figure 1). However, by doing so, we may have compromised the full role of the environment stream in food choice. The association between culture and environment variables may have synergistic relationships that were not accounted for in the design of this study. According to the triadic influence theory (Figure 1), the culture variables that need to be examined include values,
evaluations, opportunities, and interactions with social institutions. A sample cultural variable to examine could be familism (Campos, Ullman, Aguilera, & Dunkel Schetter, 2014). Familism is a concept measuring individuals’ strength of family attachment (Sabogal, Marin, Otero-Sabogal, 1987). Individuals high in familism may not cook their own meals and depend on others to decide on food for the family. Altogether, all the variables within the rightmost stream may be useful for making changes in attitudes compared to only examining knowledge pathways.

Our third suggestion involves researchers’ use of other cognitive abilities to predict health attitudes. We identified theoretical and empirical support for using nutrition knowledge to predict attitudes. We identified two studies supporting this relationship. Both Misra (2007) and Davar (2012) found that nutrition knowledge positively predicted healthy attitudes in their model. The results from this study extend upon those findings, as our sample consisted of US university students with a predominantly Hispanic sample while objectively assessing nutrition knowledge.

The third suggestion, pilot-testing different kinds of food, can possibly inform and enhance the strength of the relationship between intention and behavior. Before a future study is conducted, researchers should examine how frequently participants eat the particular food for their study. While previous food studies used two foods with largely contrasting nutrition profiles (carrots and potato chips; King et al., 2004), we chose the nutrition bars for this study based on their similarity for both looks and nutrition profile. Participants needed to check the nutrition labels to determine which of the bars was the healthier. If participants rarely eat nutrition bars, then perhaps their routine does not include examining the nutrition label because that would not influence their choice. If researchers examined the relationships between these
variables in the future, then possible foods could be pilot tested for purchase frequency in the sample area while also including a similar nutrition profile.

Most nutrition label researchers use subjective measures as opposed to objective ones. We previously mentioned that although collecting subjective data is easier, it is more difficult to interpret study findings due to unreliability in the intention-behavior relationship. Researchers who gather objective measures on this behavior encounter difficult challenges because the options available are either eye-tracking or natural observational studies. Another possible type of study for examining this behavior is the use of mixed-methods design. For example, designs could use open-ended questions that ask participants why they chose a specific food. Other applications of mixed-methods designs would involve conducting in-depth interviews about the topics. These options would offer yet another way to build perception into research design. Very few studies examine nutrition label use using mixed-methods design; however, an exception is Seward, Block, and Chatterjee (2018). Seward and colleagues found that healthy attitudes led to a decreased desire for nutritional information via labels.

These recommendations conclude the section on future directions for researchers. We now move to theoretical, practical, and policy implications.

In summary, we found partial support for the theory of triadic influence when investigating the relationship between knowledge, attitudes, intention, and hypothetical food choice among nutrition bars. This study was the first attempt at using the theory of triadic influence with nutrition labels and food choice. We recommend that future researchers pilot test food preferences before conducting a study and use a mixed-methods design. Furthermore, researchers can still examine other pathways of the theory of triadic influence with food choice.
Researchers using this theory can also use social influence and personality characteristics variables to improve understanding of how individuals use nutrition labels.

As for practical implications from this study, we designed this study to investigate the influence of knowledge on health behaviors. As a reminder, Americans tend to have low rates of adequate health literacy. Hispanics demonstrate significantly lower rates of adequate health literacy compared to other ethnicities in the US as well as increased health risks due to poor health choices (CDC, 2004; Goodman et al., 2013). Although most participants denoted having some college experience, only eight individuals earned perfect scores for health literacy and none scored perfectly on the nutrition knowledge or label understanding scales. As the literature would classify this sample as highly educated, this implies an unfortunate conclusion for the less educated US population. Presumably, the general US population would score lower for all three health-related cognitive variables. However, we are unable to make direct comparisons between highly educated samples and the general US population for any of the other variables besides health literacy. Due to the federal and state government health agencies conducting surveys about health literacy and not routinely gathering information about nutrition knowledge and label understanding. Gathering these types of data may be useful to pursue practical public policy changes to foster greater health nutrition knowledge and thereby improve health attitudes.

This study suggests several key policy implications. First, the U.S. education system needs to do a more effective job of teaching practical knowledge to students relating to health and food. This claim is validated by our study’s findings on health literacy, nutrition knowledge, and label understanding. Out of those three measures, the US government only collects health literacy proficiency while data are not gathered for the other two. If we make conclusions based on the results from those all three measures, many highly educated students lack adequate
proficiency in each area. If these are the findings for highly educated citizens, then less educated Americans would presumably have lower scores and reduced understanding. With a lack of such knowledge, health crises in obesity and cardiovascular problems along with health-care costs for related diseases may continue. Second, the FDA and the national health departments need to persuade or require food corporations to use easier, simpler, and more transparent labels in packaging their products. This claim is validated by this study’s inadequate label understanding as well as previous findings described in a literature review (Cowburn & Stockley, 2005). Third, analyses of the public and participant samples need to stratify by ethnicity for health-related cognition variables to focus on man-made health problems. Studies of Hispanics in this region continue to offer insights and practical applications on the reduction of health disparities in an effort to promote health in a traditionally underserved population, but disparities among other groups likely exist.
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</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clif Bar</td>
<td>25.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber One Bar</td>
<td>74.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Correlation matrix for the variables under study ($N = 612$).

<table>
<thead>
<tr>
<th></th>
<th>Health Bar</th>
<th>Health Literacy</th>
<th>Nutrition Knowledge</th>
<th>Label Understanding</th>
<th>Health Attitudes</th>
<th>Health Intentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Bar</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Literacy</td>
<td>0.02</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrition Knowledge</td>
<td>-0.01</td>
<td>0.30*</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Label Understanding</td>
<td>0.04</td>
<td>0.52*</td>
<td>0.29*</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Attitudes</td>
<td>0.05</td>
<td>-0.05</td>
<td>0.11*</td>
<td>-0.00</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td>Health Intention</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.06</td>
<td>0.25*</td>
<td>—</td>
</tr>
</tbody>
</table>

*Significance denoted at the 0.01 level (2-tailed)
Figure 1. Theory of Triadic Influence
Figure 2. Hypothetical & Statistical Model
$\chi^2 (11, N = 612) = 24.82$ ($p = 0.01$)
RMSEA = 0.06 (95% CI = 0.02 – 0.07)
CFI = .94; TLI = .90; WRMR = 0.99

Figure 3. Revised Model
Appendix 1
Demographics

1. Age: ______

2. Gender: ______ Female (1) ______ Male (0)

3. Ethnic/ cultural background

   ____ (1) African-American
   ____ (2) Asian/ Asian-American/ Pacific Islander
   ____ (3) Caucasian/ White (not of Hispanic origin)
   ____ (4) Hispanic
   ____ (5) Native American
   ____ (6) Mixed (write in) ______________________
   ____ (7) Other (write in) ______________________

4. What is highest educational level?

   ____ (1) Less than high school    ____ (3) Some college
   ____ (2) High School              ____ (4) Undergraduate degree
   ____ (5) Masters or PhD           ____ (6) Not sure

5. What is your native language (the first language you learned)?

   ____ (1) English    ____ (2) Spanish    ____ (3) Mixed English and Spanish
   ____ (4) Other (please fill in) ______________________

6. What language do you consider your stronger language overall?

   ____ (1) English    ____ (2) Spanish    ____ (3) Mixed English and Spanish
   ____ (4) Other (please fill in) ______________________

7. How hungry are you right now?

   1       2       3       4       5       6       7

   Very Hungry       Very Full
Appendix 2
Health Literacy Scale

The following 14-items ask you to answer about various health topics. Do not use a calculator or search the internet while completing this scale. If you do not know the answer to a question, then it is okay to check the box that says “Don’t know.” Please select one answer.

### Cholesterol: What Your Level Means

**What is cholesterol?**
Cholesterol is a waxy substance the body uses to protect nerves, make cell tissues and produce certain hormones.

**Are there different types of cholesterol?**
Yes. Cholesterol travels through the blood in different types of packages, called lipoproteins.

Low-density lipoproteins (LDL) deliver cholesterol to the body. High-density lipoproteins (HDL) remove cholesterol from the bloodstream.

<table>
<thead>
<tr>
<th>Total cholesterol level</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Less than 200 is best.</td>
</tr>
<tr>
<td>• 200 to 239 is borderline high.</td>
</tr>
<tr>
<td>• 240 or more means a person is at increased risk for heart disease.</td>
</tr>
</tbody>
</table>

**LDL cholesterol levels**

<table>
<thead>
<tr>
<th>LDL cholesterol levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Below 100 is ideal for people who have a higher risk of heart disease.</td>
</tr>
<tr>
<td>• 100 to 129 is near optimal.</td>
</tr>
<tr>
<td>• 130 to 159 is borderline high.</td>
</tr>
<tr>
<td>• 160 or more means a person is at a higher risk for heart disease.</td>
</tr>
</tbody>
</table>

**HDL cholesterol levels**

<table>
<thead>
<tr>
<th>HDL cholesterol levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Less than 40 means a person is at higher risk for heart disease.</td>
</tr>
<tr>
<td>• 60 or higher greatly reduces a person’s risk of heart disease.</td>
</tr>
</tbody>
</table>

1. If a person is at high risk for heart disease, which of the following levels of low density lipoprotein (LDL) cholesterol is best?

102  86  129  129  155  Not sure

2. Which set of low density lipoprotein (LDL) and high density lipoprotein (HDL) levels is best?

   LDL of 134 & HDL of 61
   LDL of 98 & HDL of 82
   LDL of 140 & HDL of 50
   LDL of 165 & HDL of 80
   Not sure
3. Which of the following problems could be caused by this medicine?

Trouble breathing
Drowsiness
Loss of appetite
Trouble urinating
Not sure
1st Degree Burns
First-degree burns involve the top layer of skin. Sunburn is a first-degree burn

Signs:
- Red
- Painful to touch
- Skin will show mild swelling

Treatment:
- Apply cool, wet compresses, or immerse in cool, fresh water. Continue until pain subsides.
- Cover the burn with sterile, non-adhesive bandage or clean cloth.
- Do not apply ointments or butter to burn; these may cause infection.
- Over-the-counter pain medications may be used to help lessen pain & reduce inflammation.
- First-degree burns usually heal without further treatment. However, if a 1st-degree burn covers a large area of the body, or the victim is an infant or elderly, seek emergency medical attention.

2nd Degree Burns
2nd degree burns involve the first two layers of skin.

Signs:
- Deep reddening of the skin
- Pain
- Blisters
- Glossy appearance from leaking fluid
- Possible loss of some skin

Treatment:
- Immerse in fresh, cool water, or apply cool compresses. Continue for 10-15 minutes.
- Dry the clean cloth and cover the sterile gauze.
- Do not break blisters.
- Do not apply ointments or butter to burns; these may cause infection
- Elevate burned arms or legs.
- Take steps to prevent shock: lay the victim flat, elevate the feet about 12 inches, & cover the victim with a coat or blanket. Do not place the victim in the shock position if a head, neck, back, or leg injury is suspected, or if it makes the victim uncomfortable.
- Further medical treatment is required. Do not attempt to treat serious burns unless you are a trained health professional.

4. Which of the following is probably not a 2nd degree burn?

Blistering skin
Painful skin with a lot of swelling
Painful skin when touched with a little swelling
Skin that is leaking fluid
5. If John was visiting someone in room 130 and wanted to go to the cafeteria, which of these places would he pass if he took the shortest route?
Diagnostic imaging  Gift shop  Cardiac center  Emergency services  Don’t Know

6. Which of the following entrance is closest to the elevator?
There is no elevator
Surgery & Outpatient Center Entrance
Rehabilitation Institute Entrance
Main Entrance
Don’t Know
7. In the example listed in the first row of the table, when should the medicine be taken?

- 2 times a day anytime between 8am and 8pm
- At 8am or 8pm each day
- At 8am and 8pm each day
- Don’t Know
Lactose intolerance means that the body cannot digest foods with lactose in them. Lactose is the sugar found in milk and foods made with milk. Lactose intolerance is not serious. A person should feel better soon if they eat less food with lactose or if they use products that help them digest lactose. They cannot digest lactose because they do not have enough lactase enzyme. The small intestine needs lactase enzyme to break down lactose. If lactose is not digested, it can cause gas and stomach cramps.

After eating foods with lactose in them, some people may feel sick to their stomach. They may also have

- gas
- diarrhea
- swelling in your stomach

Some illnesses can cause these same problems. A doctor can tell a person if their problems are caused by lactose intolerance.

8. Which of the following is a symptom of lactose intolerance?
Constipation  Stomach ache  Sore Throat  Heartburn  Don’t Know
Signs of a Stroke

My mother is alive today because a police officer knew the signs of a stroke. You can save a life, too, if you learn these signs.

Mom was on her way to the dentist when a police officer noticed she was driving strangely and started to follow her. She pulled over on the highway. When the officer approached her, she told him she had a blinding headache. But she said that she had to get to her dentist appointment on time.

The officer also noticed that mom just wasn’t acting right. Some of her speech was confused. And she was a little dizzy.

Mom said she felt fine, but that didn’t stop the officer. He quickly called 911. That call saved my mother’s life.

Knowing the signs of a stroke could help you save a life, too. Remember, some people have all of these signs, but my mom only had a few.

If you or someone else has even a few of these signs, get help fast!

Five Signs of a Stroke

- Sudden numbness or weakness of the face, arm or leg, especially on one side of the body
- Sudden confusion, trouble speaking or understanding
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, or loss of balance
- Sudden, severe headache

American Stroke Prevention
9. Which of the following is NOT a sign of stroke?
Shaking chills
Blurred vision
Bad headache
Numbness on one side
Don’t Know
Expanding portions

Are you eating a variety of healthy foods, exercising and still struggling with your weight? Some people may need to pay closer attention to portion control — managing the amount of food that they eat — as their total calorie intake determines their weight.

A serving isn't what they happen to put on their plate. It's a specific amount of food defined by common measurements, such as cups, ounces or pieces. The serving sizes represented here are part of the Mayo Clinic Healthy Weight Pyramid — a food pyramid designed to promote weight loss and long-term health. Use these serving sizes in conjunction with a diet based on a variety of healthy foods. Add the right amount of regular physical activity, and a person will be well on their way to enjoying good nutrition and controlling their weight.

Vegetables

Until they’re comfortable judging serving sizes, you may need to use measuring cups and spoons. A half a cup of cooked carrots, for example, equals one serving. Here are the recommended serving sizes for other vegetables:

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw leafy vegetables</td>
<td>2 cups</td>
</tr>
<tr>
<td>Raw vegetables, chopped</td>
<td>1 cup</td>
</tr>
<tr>
<td>Chopped, cooked or canned</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>vegetables</td>
<td></td>
</tr>
</tbody>
</table>

Meat and beans

Familiar objects can help a person picture proper portions for meat, poultry, fish and beans. For example, a 3-ounce serving of fish is about the size of a deck of cards. Here are the serving sizes for meat and meat substitutes:

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooked skinless poultry or fish</td>
<td>3 ounces</td>
</tr>
<tr>
<td>Cooked lean meat</td>
<td>1 1/2 ounces</td>
</tr>
<tr>
<td>Cooked legumes or dried beans</td>
<td>1/2 cup or</td>
</tr>
<tr>
<td></td>
<td>about the size of an ice cream scoop</td>
</tr>
<tr>
<td>Egg</td>
<td>1 medium</td>
</tr>
</tbody>
</table>
10. A person is making a salad & wants to add one serving of chopped, uncooked carrots. How much should she use?
2 cups
1 cup
½ cup
¼ cup
Don't Know

11. A person is cooking dinner for himself and he wants to include one serving from the meat and beans group. What should he choose?
1.5 ounces of cooked lean beef
1.5 ounces of cooked fish
3 boiled eggs
1 cup of cooked kidney beans
Don’t Know

ABC Insurance Company
Plan Member: John Doe
Patient: Jane Doe

<table>
<thead>
<tr>
<th>Dates of service</th>
<th>Type of service</th>
<th>Submitted</th>
<th>Not covered</th>
<th>Covered</th>
<th>Co-pay</th>
<th>Plan liability</th>
<th>Patient responsibility</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/22/09</td>
<td>Physical therapy</td>
<td>140.00</td>
<td>0.00</td>
<td>140.00</td>
<td>140.00</td>
<td>0.00</td>
<td>140.00</td>
<td>A</td>
</tr>
<tr>
<td>7/15/09</td>
<td>Laboratory</td>
<td>170.00</td>
<td>66.00</td>
<td>104.00</td>
<td>30.00</td>
<td>74.00</td>
<td>30.00</td>
<td>B</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>310.00</td>
<td>66.00</td>
<td>244.00</td>
<td>170.00</td>
<td>74.00</td>
<td>170.00</td>
<td></td>
</tr>
</tbody>
</table>

12. How much will the insurance company pay for the physical therapy received on 7/22/09?
$140  $100  $40  $0  Not sure

13. How much does the patient have to pay for the laboratory services received on 7/15/09?
$140  $74  $66  $30  Not sure
14. More men die from prostate cancer than from other causes. Based on the chart above, would you say this is true, false, or are you not sure?
   True   False   Not sure

15. Based on the chart above, who is more likely to die of prostate cancer?
   White men   African American men   Both equally likely   Neither   Don’t Know
Appendix 3

Nutrition Knowledge

The following **20-items** ask you to answer about various health topics. **Do not** use the internet to answer these items. If you do not know the answer to a question, then it is okay to check the box that says "Don’t know.” Please select **one** answer.

These items are about health problems related to diet & weight management

1. Which of the diseases is related to a low intake of fiber? (select one)
   - Bowel disorders
   - Anemia
   - Tooth decay
   - Not sure

2. Which of these diseases is related to how much sugar people eat? (select one)
   - High blood pressure
   - Tooth decay
   - Anemia
   - Not sure

3. Which of these diseases is related to how much salt/sodium people eat? (select one)
   - Hypothyroidism
   - Diabetes
   - High blood pressure
   - Not sure

4. Which of these options do experts recommend to reduce the chances of getting cancer? (select one)
   - Drinking alcohol regularly
   - Eating less red meat
   - Avoiding additives in food
   - Not sure

5. Which of these options do experts recommend to prevent heart disease? (select one)
   - Taking nutritional supplements
   - Eating less oily fish
   - Eating less trans-fat
   - Not sure
6. Which of these options do experts recommend to prevent diabetes? (select one)

- Eating less refined foods
- Drinking more fruit juice
- Eating more processed meat
- Not sure

7. Which one of these foods is more likely to raise people’s blood cholesterol? (select one)

- Eggs
- Vegetable oils
- Animal fat
- Not sure

8. Which one of these foods is classified as having a high Glycemic Index (Glycemic Index is a measure of the impact of a food on blood sugar levels, thus a high Glycemic Index means a greater rise in blood sugar after eating)? (select one)

- Wholegrain cereals
- White bread
- Fruit & vegetables
- Not sure

9. To maintain a healthy weight, people should remove fat from their diet completely. (select one)

- Agree
- Disagree
- Not sure

10. To maintain a healthy weight people should eat a high protein diet. (select one)

- Agree
- Disagree
- Not sure

11. Eating bread always causes weight gain. (select one)

- Agree
- Disagree
- Not sure

12. Fiber can decrease the chances of gaining weight. (select one)

- Agree
- Disagree
- Not sure
13. What of these options can help people to maintain a health weight? (answer each one)

Not eating while watching TV  Yes  No  Not sure
Reading food labels  Yes  No  Not sure
Taking nutritional supplements  Yes  No  Not sure
Monitoring their eating  Yes  No  Not sure
Eating throughout the day  Yes  No  Not sure

14. If someone has a Body Mass Index (BMI) of 23, what would their weight status be? (select one)

Underweight  Normal weight  Overweight  Obese  Not sure

15. If someone has a Body Mass Index (BMI) of 31, what would their weight status be?

(select one)

Underweight  Normal weight  Overweight  Obese  Not sure

Look at the body shape below:

16. Which of these body shapes increases the risk of cardiovascular disease (Cardiovascular disease is a general term that describes a disease of the heart vessels, for example, angina, heart attack, heart failure, congenital heart disease, and stroke)? (select one)

Apple shape (left figure)  Pear shape (right figure)  Not sure
Appendix 4a
Nutrition Label Survey (look below for the labels)
Do not use a calculator to answer these questions

1) How many calories are in 1 serving of Food A’s package?

2) What is the percent daily value of total fat in 1 serving of Food A’s package?

3) You decide to eat one package of Food B. How many grams of total fat are you eating?

4) How many grams of saturated fat are in 2 packages of Food B?

5) You decide to eat one package of Food B twice and eat half a package of Food A. How many calories are you eating?

6) What is the percent daily value of total fat in one package of Food B?

7) Circle the product which contains fewer grams of saturated fat: eating all of Food A OR eating ½ of all the Food B? Also, state the grams of saturated fat for your choice.

8) Circle the product that contains more calories: eating ½ of Food A OR ½ of Food B. Also, state the number of calories for your choice.

9) Circle the combination of products which contains fewer grams of total fat: two package of Food A with ½ of Food B OR ½ of Food A with two package of Food B? Also, state the grams of total fat for your choice.

10) Circle the product with more calories: one package of Food A OR one package of Food B. Also, state the number of calories for your choice.

11) Circle the product that contains fewer grams of saturated fat: ½ of Food A or one package of Food B. Also, state the grams of saturated fat for your choice.

12) Circle the combination of products with less grams of total fat: one package of Food A with ½ of Food B or ½ of Food A and one package of Food B. Also, state the grams of total fat for your choice.
### Appendix 4a

<table>
<thead>
<tr>
<th><strong>Food A</strong></th>
<th><strong>Food B</strong></th>
</tr>
</thead>
</table>

#### Nutrition Facts

<table>
<thead>
<tr>
<th>Serving Size 55g</th>
<th>Serving size about 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount Per Serving</strong></td>
<td><strong>Calories 312</strong></td>
</tr>
<tr>
<td><strong>% Daily Value</strong></td>
<td><strong>Total Fat 24g</strong></td>
</tr>
<tr>
<td></td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Saturated Fat 4g</td>
</tr>
<tr>
<td></td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Trans Fat</td>
</tr>
<tr>
<td></td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Cholesterol 100mg</td>
</tr>
<tr>
<td></td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Sodium 600mg</td>
</tr>
<tr>
<td></td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Total Carbohydrate 62g</td>
</tr>
<tr>
<td></td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Dietary Fiber 6g</td>
</tr>
<tr>
<td></td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>Sugars 5g</td>
</tr>
<tr>
<td></td>
<td>Protein 5g</td>
</tr>
<tr>
<td>Vitamin D 10%</td>
<td>Potassium 15%</td>
</tr>
<tr>
<td>Calcium 10%</td>
<td>Iron 45%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.*

---

<table>
<thead>
<tr>
<th>Serving Size 55g</th>
<th>Serving size about 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount Per Serving</strong></td>
<td><strong>Calories 388</strong></td>
</tr>
<tr>
<td><strong>% Daily Value</strong></td>
<td><strong>Total Fat 16g</strong></td>
</tr>
<tr>
<td></td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>Saturated Fat 2g</td>
</tr>
<tr>
<td></td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Trans Fat</td>
</tr>
<tr>
<td></td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Cholesterol 150mg</td>
</tr>
<tr>
<td></td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Sodium 490mg</td>
</tr>
<tr>
<td></td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Total Carbohydrate 74g</td>
</tr>
<tr>
<td></td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>Dietary Fiber 3g</td>
</tr>
<tr>
<td></td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Sugars 20g</td>
</tr>
<tr>
<td></td>
<td>Protein 2g</td>
</tr>
<tr>
<td>Vitamin D 20%</td>
<td>Vitamin C 5%</td>
</tr>
<tr>
<td>Calcium 20%</td>
<td>Potassium 90%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.*

---

*Source: NutritionData.com*
Appendix 5
Health Attitudes Scale

Please indicate how much you agree with the following statements.

1. The healthiness of nutrition bars has little impact on my food choices
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree

2. I am very particular about the healthiness of the nutrition bars that I eat.
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree

3. I eat nutrition bars that I like and do not worry much about the healthiness of those bars.
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree

4. It is important for me that the nutrition bars I eat is low in fat.
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree

5. I always follow a healthy and balanced diet with the nutrition bars I eat.
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree

6. It is important for me that the nutrition bars I eat a lot of vitamins and minerals.
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree

7. The healthiness of nutrition bars I eat makes no difference to me.
   1 2 3 4 5 6 7
   Strongly agree  Strongly disagree
8. I do not avoid nutrition bars, even if they may raise my cholesterol.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Strongly disagree</td>
</tr>
</tbody>
</table>

72
**Appendix 6**

**Health Intentions Scale**

1. I intend to eat a healthy nutrition bars in the future.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Definitely do not

2. I will try to eat a healthy nutrition bars in the future.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<tbody>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Very unlikely

3. I want to eat a healthy nutrition bars in the future.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
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</thead>
<tbody>
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<td></td>
</tr>
</tbody>
</table>

Strongly disagree

4. I expect to eat a healthy nutrition bars in the future.

<table>
<thead>
<tr>
<th></th>
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<th>3</th>
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</tbody>
</table>

Very unlikely

5. How likely is it that you will eat a healthy nutrition bar in the future?

<table>
<thead>
<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</tbody>
</table>

Very unlikely
## Appendix 7

### Nutrition bars

<table>
<thead>
<tr>
<th>Fiber One bar</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Fiber One bar" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clif bar</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="Clif bar" /></td>
</tr>
</tbody>
</table>

**Choose one bar**

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Bars, Chocolate Chip - From CLIF</strong></td>
</tr>
<tr>
<td><strong>Serving Size</strong></td>
</tr>
<tr>
<td><strong>Servings Per Container</strong></td>
</tr>
<tr>
<td><strong>Amount Per Serving</strong></td>
</tr>
<tr>
<td>Calories</td>
</tr>
<tr>
<td>% Daily Value*</td>
</tr>
<tr>
<td>Total Fat</td>
</tr>
<tr>
<td>Saturated Fat</td>
</tr>
<tr>
<td>Trans Fat</td>
</tr>
<tr>
<td>Cholesterol</td>
</tr>
<tr>
<td>Sodium</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
</tr>
<tr>
<td>Dietary Fiber</td>
</tr>
<tr>
<td>Sugars</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Vitamin A</td>
</tr>
<tr>
<td>Vitamin C</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
<tr>
<td>Iron</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.
Vita

Mosi Dane’el received his Bachelor of Arts Degree in Psychology at the University of New Mexico at Albuquerque, New Mexico in 2006. Afterwards, he was accepted into the Experimental Psychology program at the University of Texas at El Paso in 2010 and also into the Masters of Public Health program at the University of Texas at Houston in 2014. He has also been a co-author on three peer-reviewed publications in the journals of Personality and Individual Differences, Local Environment, and Environmental Justice. Conscious of his privacy he maintains a public profile that includes only department contacts and publications.

This dissertation was typed by Mosi Staudt Dane’el.