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School of Public Health

THE RATIO OF POSITIVE TO NEGATIVE AFFECT, FLOURISHING, AND HEALTH BEHAVIOR

By

Michael Stuart Leibow, MA, MS

A Dissertation in Partial Fulfillment of the Requirements for the

Degree of Doctor of Public Health in Preventive Care &

Degree of Doctor of Psychology

August 2012

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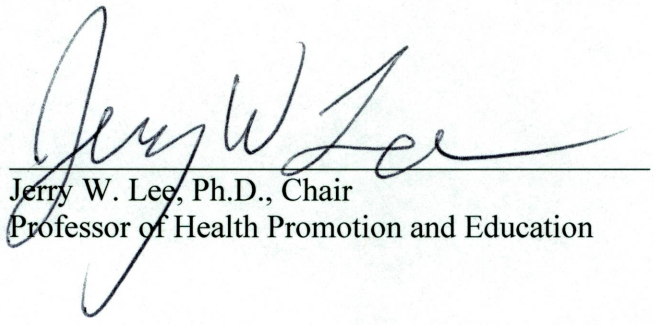
Each person whose signature appears below certifies that this dissertation, in his/her opinion, is adequate in the scope and quality as a dissertation for the degree of Doctor of Public Health in Preventive Care and Doctor of Psychology.



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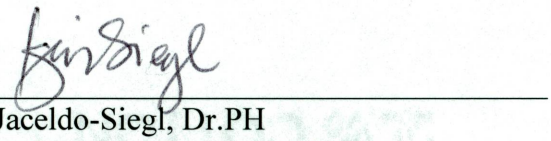

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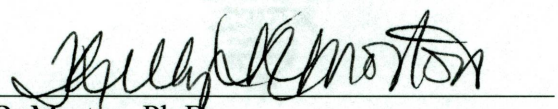

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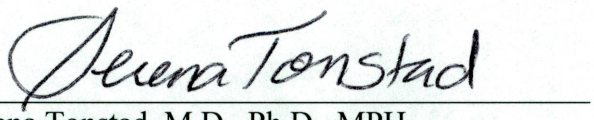

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ABSTRACT OF DISSERTATION

THE RATIO OF POSITIVE TO NEGATIVE AFFECT, FLOURISHING, AND HEALTH BEHAVIOR

By

Michael Stuart Leibow

Doctor of Public Health Candidate in Preventive Care & Doctor of Psychology

Loma Linda University, Loma Linda University, 2010

Jerry Lee, Ph.D., Chair

The ratio between positive and negative affect, known as the positivity ratio (PR) is thought to be associated with flourishing (psychological and social well-being). However, little research has been done on how PR and flourishing relate to specific health behaviors. The relationships between PR and flourishing with health behavior—i.e., physical activity, and diet (fruit, leafy green vegetables [LGV] and meat intake)—were investigated in this study. We examined whether PR mediated the relationship between flourishing and health behaviors, and whether flourishing mediated the relationship between PR and these behaviors. Gender and ethnic differences for the above associations were examined were also examined.

Cross-sectional data from a subset (n=8,507) of the Biopsychosocial Religion and Health Study (BRHS) was used. All participants completed a 20 page questionnaire regarding religion, psychosocial and lifestyle mediators, and health. Data analyses were performed using partial correlation and general linear model analysis to test associations of PR and flourishing with control variables.

PR was moderately correlated with flourishing (r=.502, p=<.001). PR was positively associated with physical activity after controlling for age, education, difficulty meeting expenses (β=.125, p<.001). This relationship remained statistically significant after additional adjustments for flourishing and BMI. Similarly, flourishing was positively associated with physical activity (β=.077, p<.001). After adjustment for PR, the association remained statistically significant (β=.026, p=.042), but lost significance after controlling for BMI. PR was positively associated with fruit (p<.001) and LGV (p<.001) intake and negatively associated with meat intake (p<.001) after controlling for age, education, expenses and BMI. Further adjustments for flourishing and BMI did not change these relationships. Flourishing was positively associated with fruit and LGV intake and negatively associated with meat intake after adjusting for age, education, expenses and BMI (p<.001 for all). When we controlled for PR and BMI, only associations with fruit and LGV remained significant. There were no statistically significant gender and ethnic differences in these relationships.

In conclusion, PR and flourishing may be novel factors related to physical activity and dietary intake. Whether interventions designed to increase PR and flourishing will promote healthy behaviors requires future study.

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CHAPTER 1

INTRODUCTION

A. Statement of Problem

1. Lifestyle and Health

Influential factors that affect morbidity and mortality of individuals worldwide include health behaviors such as smoking, lack of physical activity, dietary intake patterns, and alcohol use (Berrigan, Dodd, Troiano, Krebs-Smith, & Barbash, 2003). These modifiable health behaviors have been associated with many chronic diseases, which are therefore preventable (Reeves & Rafferty, 2005). In this study I will focus on two of the most widely studied lifestyle practices that have been associated with poor health—physical inactivity and dietary intake— and how they might relate to positive and negative emotional states.

2. Epidemiology of Health Behaviors

a. Physical Inactivity Physical inactivity is a problem in the U.S. that has resulted in a major public health issue (Haskell, 2007). Less than half of U.S. adults meet the Centers for Disease Control and Prevention/American College of Sports Medicine physical activity recommendations (Wendel-Vos, Droomers, Kremers, Brug, & van Lenthe, 2007). Even though Americans are aware of the evidence that physical inactivity is a public health problem, a large percentage of the population is sedentary. There are many studies that show that U.S. adults are not as physically active as they should be (Haskell, 2007). King et al. (2009) reported that over the past 18 years, the number of

adults participating in physical activity 12 or more times a month has dropped from 53% to 43% across all races.

Physical inactivity is considered a major modifiable risk factor for chronic disease and is a major contributing factor to the overweight and obesity problem (Ball, Owen, Salmon, Bauman, & Gore, 2001). King, et al. (2009) report that physical inactivity contributes significantly to morbidity and mortality and is the underlying cause of premature death in cardiovascular and other diseases. Health behaviors that include physical activity have been shown to decrease cardiovascular disease. Moreover, higher rates of physical activity have been associated with lower levels of stroke, hypertension, type 2 diabetes mellitus, certain types of cancer, osteoporosis, and obesity (William L. Haskell et al., 2007). Though physical activity has many benefits, only a small proportion of the population adheres to this health behavior (King, et al., 2009).

b. Unhealthy Dietary Patterns Dietary intake patterns can have detrimental effects on health and chronic disease. Researchers have found significant associations of dietary intake patterns to obesity, cardiovascular disease, type 2 diabetes mellitus, and certain types of cancers (Basiotis, Carlson, Gerrior, Juan, & Lino, 2004; Cusatis, et al., 2000). Unhealthy dietary intake patterns result in medical problems that cost Americans $250 billion annually in decreased productivity and increased health care costs (Nayga & Capps, 1999). A change in diet may help avoid preventable maladies, which in turn would result in enhanced wellbeing and reduced health care costs. There are significant problems with dietary intake patterns which pose a threat to both morbidity and mortality. For example, consumption of red meat is associated with risk of cardiovascular disease (Kelemen, Kushi, Jacobs, & Cerhan, 2005) and certain types of

cancer. Furthermore, studies that explore the effects of animal protein on health show positive associations between the consumption of dietary animal protein and risk of diabetes (Vang, Singh, Lee, Haddad, & Brinegar, 2008). However, there is some controversy about whether it is the meat protein itself that is unhealthy or the saturated fat and other unhealthy dietary components that are associated with disease (Astrup, 2010).

Aldana, et al. (2005) reported that 77 percent of individuals in the United States do not maintain healthy nutrition. Milner (2002) explained that one-third of all cancers and more than 50 percent of annual deaths are related to dietary intake patterns. Recommendations for a healthy diet include eating two or more fruits and three or more vegetables per day (Chung & Hoerr, 2005). The proportion of Americans that consume five or more fruits and vegetables daily has decreased from 42% to 26% in adults aged 40-74 years-old over an 18 year span from 1988 to 2006 (King, et al., 2009). Small improvements in diet, such as eating fruits and vegetables, can produce reduced risks of chronic disease including cardiovascular disease, type II diabetes, and certain types of cancer (Aldana, et al., 2005). Furthermore, maintaining a healthy dietary intake pattern has been shown to improve glucose tolerance, increase insulin sensitivity, reduce body fat and weight, and decrease blood pressure (Aldana, et al., 2005). Specifically, the consumption of leafy green vegetables (LGV) has an inverse relationship with major chronic disease and cardiovascular disease (Hung et al., 2004). Nutrition and health are closely associated (Milner, 2002) as dietary intake patterns contribute significantly to longevity in all cultures (Wahlqvist et al., 2005). Better dietary intake patterns may improve longevity by 20 percent per year by reducing chronic disease rates (Newby et al., 2003).

3. Psychological Factors Contributing to Health Behaviors

a. *Physical Inactivity* Chesney, et al. (2005) noted that negative emotions have been positively associated with detrimental health behaviors such as smoking, physical inactivity, and the consumption of alcohol which subsequently lead to various chronic diseases. On the other hand, they report that positive emotions have been associated with positive health behaviors, such as greater amounts of physical activity and sleep; lower levels of depression also have been shown to be positively associated with higher levels of physical activity. However, positive affect has been associated with higher levels physical activity (Kelsey et al., 2006). There is strong evidence that self-efficacy and social support are positively associated with physical activity levels and both self-efficacy and social support have been associated with positive emotions (Shibata, Oka, Harada, Nakamura, & Muraoka, 2009).

b. *Unhealthy Dietary Patterns* Anton and Miller (2007) found that patients with coronary heart disease who experienced negative emotions were more prone to smoking, overeating, sleeping less, and increased sedentary behavior. Individuals were found to eat more when experiencing negative emotions (Ouwens, van Strien, & van Leeuwe, 2009). Negative emotions have been shown to predict overeating behavior in obese individuals, many of whom have learned that overeating alleviates their negative emotions, possibly by diverting their attention (Spoor, Bekker, Strien, & Heck, 2007). In sum, emotional eating may occur because of an individual's inability to cope adequately with negative emotion (Spoor, et al., 2007). Oliver and Wardle (1999) have shown that individuals decrease the consumption of fruit and vegetables during stressful times, possibly preferring rich, carbohydrate-laden foods of the increased energy demands of

stressful emotions, which would in turn increase the serotonin in the brain leading to a more positive mood. This is unfortunate since fruit and vegetable intake is associated with a lower risk of depression via folate, which is found in leafy green vegetables (LGV). In addition, decreased intake of folate has been associated with increased risk of depression (Akbaraly et al., 2009). As such, diets with high LGV intake such as vegetarian diets have fewer negative emotions than omnivorous diets (Beezhold, Johnston, & Daigle, 2010).

4. Positivity Ratio and Flourishing

Experiencing positive emotion is quite beneficial and has been shown to increase one's attention, creativity, intuition, and "broaden behavioral repertoires" (Fredrickson & Losada, 2005, p. 678) . Positive affect also strengthens the immune system, decreases the inflammatory response of stress, reduces the risk of stroke and can increase longevity (Fredrickson & Losada, 2005). On the other hand, negative affect can take a toll on health and negatively impact cognition and social processes (Hemenover, Augustine, Shulman, Tran, & Barlett, 2008). Fredrickson and Losada (2005) reported that there is a ratio of positive to negative emotions called the positivity ratio (PR) which is associated with flourishing or the presence of mental health, and languishing or the absence of mental health (Keyes, 2002) (C. L. M. Keyes, 2002) (C. L. M. Keyes, 2002). They explain that individuals who flourish are more resilient, better able to access personal and social resources, more likely to be happy and satisfied, and to demonstrate behavioral flexibility. More specifically, flourishing denotes a higher level of positivity than negativity, and the defining factor is that flourishing signifies an optimal functioning which includes four main factors: goodness, generativity, growth and resilience. On the

other hand, individuals with low a PRare thought to be languishing, which signifies feelings of being empty or hollow (Fredrickson & Losada, 2005).

5. Modification of Health Behaviors and Psychological Factors by Gender

Men and women may display different behaviors in the presence of distressing events. In general, the literature supports that women have a higher level of negative affect than men because women tend to feel emotions more intensely (Brebner, 2003). In the presence of negative affect, women tend to eat sweet, high calorie comfort foods (Dubé, LeBel, & Lu, 2005). On the other hand, men eat more protein-dense foods (i.e. meat and meat products) as a comfort food compared to women (Dubé, et al., 2005). Interestingly, low calorie, non-sweet foods are consumed when an individual experiences positive affect (Dubé, et al., 2005).

6. Conclusion

Physical inactivity and deleterious dietary intake patterns are major contributors to the increasingly problematic epidemic of lifestyle related chronic diseases and mortality rates in today's society. Both positive and negative emotions influence health behaviors such as physical activity and intake of fruit, LGV, and meat. Fredrickson and Losada (2005) report that a higher PR is associated with flourishing. Higher amounts of positive than negative affect are associated with better mental and physical health. Languishing, which is distinguished by a lower PR, is associated with more days missed from work and poorer physical health (Fredrickson & Losada, 2005). To date, no studies have examined the independent associations of PR and that of flourishing with health behavior. In addition, there appears to be no research on whether PR is mediated by flourishing, and if PR is associated with health behavior outcomes.

B. Theoretical Framework and Underpinnings

Both positive and negative emotions have been associated with physical activity and dietary intake patterns (Christensen & Pettijohn, 2001; Rosqvist et al., 2009). A large proportion of health behavior research has been focused on consequences of negative emotions on health behavior, and research on the relationships of positive emotion and health behavior has been increasing. With respect to the research on positive emotion, Fredrickson and Losada (2005) outlined the theory of broaden-and-build, which is based on support that that emotions are psychological adaptations that have increased our ancestor's ability to survive and reproduce. Negative emotions narrow behavioral urges to behaviors necessary to preserve physical safety in life threatening situations, while positive emotions broaden an individual's behavioral repertoire in non-life-threatening situations strengthening "thought-action repertoires" which evolve over time; this is turn contributes to individual adaptation. Some of the benefits of this broadening include developing long standing personal resources that such as improved coping ability, social connectedness, and knowledge of the environment. Positivity helps these personal resources to grow, and over time they act as a buffer against future threats and provide a greater ability to adapt. Fredrickson and Losada (2005) report that while emotions are fleeting, over time positivity increases and helps an individual become more resilient. They argue that a high ratio of positive to negative emotion (PR) is associated with flourishing and a lower ratio is associated with languishing.

Flourishing is defined as "living within an optimal range of human functioning, one that connotes goodness, generativity, growth, and resilience" (Fredrickson & Losada,

2005, p. 678). Goodness includes "happiness, satisfaction, and superior functioning"; Generativity includes "broadened thought-action repertoires and behavioral flexibility." Growth includes "gains in enduring personal and social resources," and lastly, resilience includes "survival and growth in the aftermath of adversity" (Fredrickson & Losada, 2005, p. 685). Languishing is defined as feelings of being empty or hollow, characterized by emotional distress, psychosocial impairment, limited daily activities and absenteeism at work (Fredrickson & Losada, 2005).

Fredrickson and Losada (2005) empirically derived a positivity ratio in which for every one negative emotion, an individual experiences 2.9 or more positive emotions in order to flourish. They examined the frequency and level of 20 various positive and negative emotions experienced by first and second year university students within a 28 day period, (Losada, 1999) performed Boolean algebra based mathematical calculations on positive and negative emotions in business teams and found that this 2.9 ratio was the dividing line -- or the Losada line -- between flourishing and languishing.

Fredrickson and Losada (2005) defined flourishing with a 33-item measure producing 11 variables of psychological and social functioning. Because PR is so closely related to flourishing, the variables that measured emotional well-being were omitted to "avoid conceptual circularity" (Fredrickson & Losada, 2005, p. 683). The 11 variables for defining flourishing were self-acceptance, purpose in life, environmental mastery, positive relations with others, personal growth, autonomy, social coherence, social integration, social acceptance, social contribution, and social actualization. Fredrickson and Losada (2005) reported that an individual deemed as flourishing must have high scores on 6 out of these 11 areas, which was associated with a PR equal to or greater than

2.9. Languishing was found to have resulted in a PR lower than 2.9 in association with lower scores on 6 of the 11 scales of positive functioning (Keyes, 2002).

In the present study, 7 of the 11 variables that comprise flourishing will be assessed: environmental mastery (manage everyday activities, sense of control), self-acceptance (positive self-attitude) (Ryff, 1989), purpose in life (purposeful and meaningful life) (Ryff & Keyes, 1995), autonomy, social integration (feeling part of society, belonging to society), social contribution (social responsibility) and social acceptance (accept and trust others, find comfort with others) (Keyes, 1998).

Positive and negative emotions are associated with physical activity, thus it seems plausible that there may be a relationship between the ratio of positive to negative emotion (PR) with physical activity and dietary intake. Higher PRs have predicted "better subjective well-being, marriages, and business team performance" (Barber, et al, 2010, p. 664). The significance of measuring positive and negative emotions together is that a PR outlines the "affective texture of a person's life" (Fredickson & Losada, 2005, p. 678). On the other hand, the Kiviniemi, Orom, and Giovino (2011) negative-affect mood repair hypothesis suggests that when an individual experiences negative emotion, a behavior that is most associated with positive feelings would be performed, and the behavior that is most associated with negative affect avoided. This is a social cognitive mechanism of decision making such that affective associations are related to the activation of a behavior. For example, when experiencing negative emotions one is motivated to engage in behaviors that are associated with more positive feelings. Thus, negative emotions may also be associated with greater levels of physical inactivity (VandenAuweele, 1997) and decreased consumption of fruits and vegetables (Kiviniemi,

et al, 2011). Positive emotions lead to improved self-regulation (Tice et al, 2007) and increased energy; thus individuals are better able to engage in healthier behaviors, such as increased physical activity and enhanced dietary behavior (Anderson, et al, 2007; Gibson, 2006; Reichert, et al, 2007).

To date it appears that no studies have examined the relationship of PR and flourishing with the health behaviors of physical activity, fruit and LGV intake, and meat intake.

Figure 1.1 shows the proposed relationships between these research variables. According to the model, flourishing would mediate the relationship between PR and health behavior. In addition, PR as a mediator of the relationship of flourishing and health behavior will be examined. Keyes (2002) explains that individuals who flourish miss fewer work days and have fewer limitations of daily living, the opposite is true for individuals who are languishing.

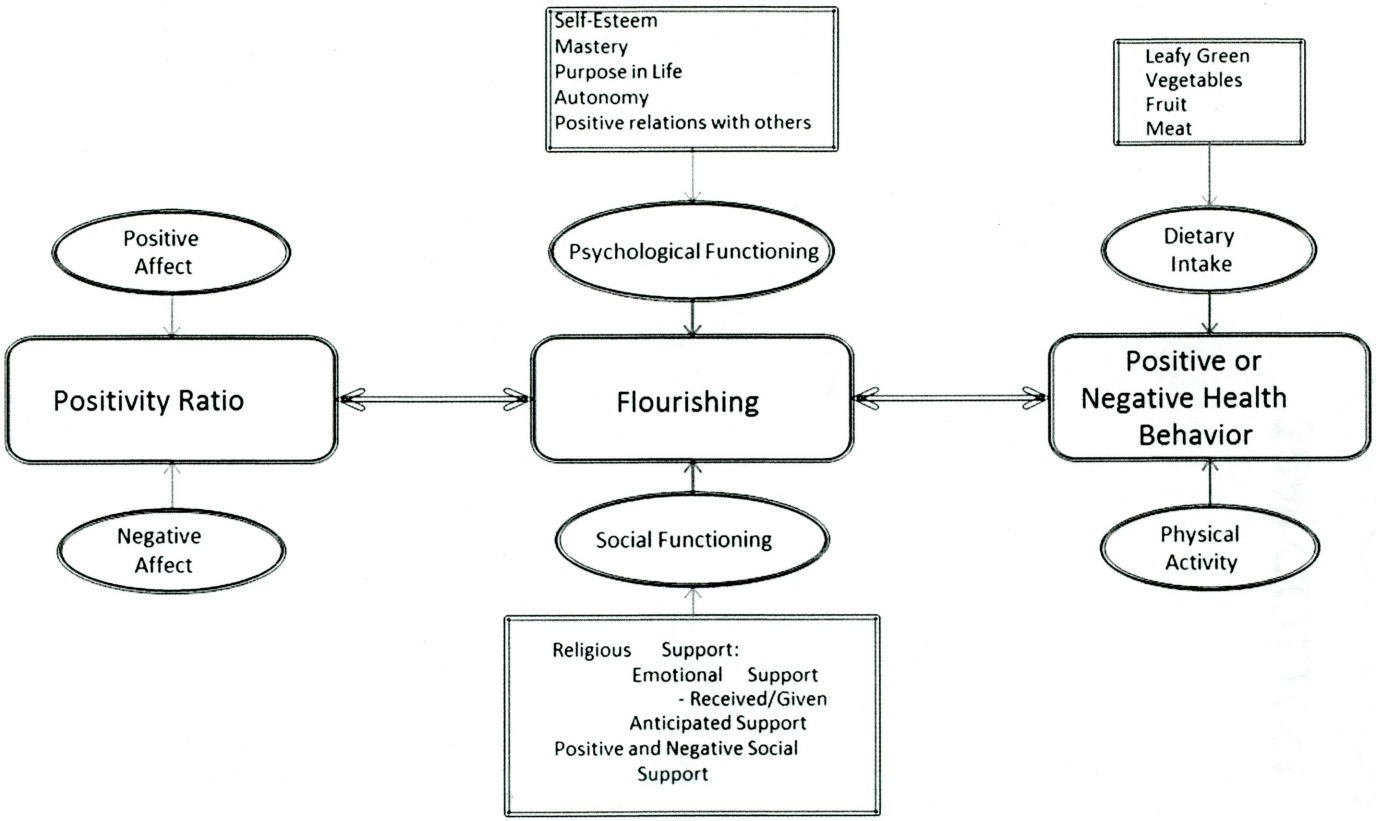

Figure 1.1 Schematic Model of Positivity Ratio on the Mediating Variables of Flourishing / Languishing on Exercise and Dietary Intake

C. Purpose of Study

The purpose of this study is to determine how affect and mental health is associated with physical activity and dietary intake patterns. More specifically, I will examine the relationships of PR and flourishing with physical activity, and fruit, LGV, or meat intake. In addition, I will examine gender and ethnic differences in the study variables. To date, it appears that there have been no research studies that have explored the above relationships. Therefore, this study may contribute to the understanding of mental health and health behavior.

D. Research Questions

In the previous section, flourishing was defined by a combination of variables similar to those used by Fredrickson and Losada and is explicated further in the methods section. After controlling for age, education, ethnicity, and difficulty with expenses in the last year:

- How is PR associated with:
    - Physical activity?
    - Dietary intakes of:
        - Fruit?
        - LGV?
        - Meat?
- How is flourishing related to physical activity, and fruit, LGV, and meat intake?
- Are PR and flourishing significantly associated with one another?
- Are associations of PR with health behaviors mediated by flourishing?
- Are associations of flourishing with health behaviors mediated by PR?
- How do gender and ethnicity influence the above associations?

CHAPTER 2

LITERATURE REVIEW

A. Introduction

This chapter will review the literature pertaining to the above stated research questions and will serve as a basis for further needed research in the area of positive and negative affect and health behavior. Discussion regarding physical activity and dietary intake patterns, and the effects of positive and negative affect are explored. In addition, PR with regard to flourishing and languishing is reviewed.

B. Physical Activity: Overview/Prevalence

Physical inactivity is a problem in the U.S. that represents a major public health concern (Haskell, et al, 2007). Less than half of U.S. adults meet the CDC/ACSM recommendations for physical activity (Wendel-Vos, et al., 2007). Physical activity incorporates all types of physically active movement (Resnick, Ory, Coday, & Riebe, 2008, p. 21) and is defined as "bodily movement that is produced by contraction of skeletal muscle and that substantially increases energy expenditure" (Miles, 2007, p. 318). Haskell, et al. (2007) reported physical inactivity is a risk factor for coronary artery disease. Fletcher and colleagues (2005) reported that only 50% of individuals who begin an exercise program will continue for more than six months. According to the CDC/ACSM, individuals should get 150 minutes of moderate intensity, 75 minutes of vigorous intensity or a mix of moderate and vigorous aerobic exercise per week, as well as muscle strengthening exercises on at least two days of the week that incorporate all of the major muscle groups (William L. Haskell, et al., 2007).

Physical inactivity is a modifiable risk factor for many diseases including cardiovascular disease, type II diabetes mellitus, obesity, hypertension, bone and joint diseases, and depression (William L. Haskell, et al., 2007; Warburton, Nicol, & Bredin, 2006). Regular physical activity is a primary and secondary prevention strategy for cardiovascular disease and diabetes mellitus (Warburton, et al., 2006). Fletcher, et al. (2005) also report that there is an inverse relationship between physical activity and mortality from cardiovascular disease. Physical activity also is shown to help lessen the incidence of osteoporosis, colon cancers, and increase insulin sensitivity (Fletcher, et al., 2005). There is a significant decrease in risk, 33-50%, of acquiring type II diabetes mellitus when an individual is physically active (Miles, 2007). Research has also found that individuals with physically demanding jobs have a lower likelihood of developing coronary artery disease (Fletcher, et al., 2005). Physical activity changes body composition and lowers blood pressure (Miles, 2007). As such, physical activity can prevent and alleviate various chronic diseases and conditions.

Men's physical activity levels have decreased more than those of women; physical activity levels of 12 or more times per month has decreased from 57 to 43 percent in men and 49 to 43 percent in women (King, et al., 2009). Women have lower rates of leisure time physical activity (LTPA) and Black women are less physically active than White women (Eyler et al., 2002). Ball, et al. (2001) found in a cross-sectional study of 1,302 men and women a significant association between increased levels of LTPA. While men and women participate in moderate exercise at the same rates, men participate in vigorous exercise more often. There is a significant increase in all-cause

mortality from cancer in middle-aged women who were physically inactive (Warburton, et al., 2006).

C. Dietary Intake Patterns: Overview and Associated Effects

Good dietary intake patterns are crucial in securing appropriate amounts of nutrients and energy for growth (Sabaté, 2001). Dietary intake patterns are defined as the distribution of foods in the habitual diet (Togo, Osler, Srensen, & Heitmann, 2001). In the 2005 Dietary Guidelines for Americans, it is recommended that individuals eat a variety of foods, control calorie intake, eat less than 10 percent of saturated fat; use little salt when preparing food, and drink alcohol in moderation. In addition, a diet should include plenty of fruits, vegetables, and grains, and less sugar (Nayga & Capps, 1999).

There have been major changes in the food industry within the past century. Bente and Gerrior (2002) explain that from 1909 until 1999, the consumption of certain major food groups increased significantly. For example, in the U.S. consumption of meat products (i.e. red meat, poultry, and fish) has risen from 176 to 245 pounds per year, per person, constituting a 40% increase. Fat and oil intake increased by 78%, and consumption of sugar products and sweeteners increased dramatically as well. However, consumption of vegetables decreased (Bente & Gerrior, 2002). One of the major problems is the rising cost of whole grains, fruits and vegetables, lean meats, and low fat dairy products. The price of fruits and vegetables has increased significantly since 1985 as compared to fats, sweets, and soft drinks (Monsivais & Drewnowski, 2007).

Fast food restaurants have increased their sales significantly in the latter part of the twentieth century. High calorie foods are much more available than lower calorie foods ("Keeping portions in proportion. (Cover story)," 2007). Low energy dense foods

are recommended be\cause they provide fewer calories per gram for a particular food. Diets with lower levels of energy dense food are linked with higher diet quality (Bente & Gerrior, 2002). Higher energy density is associated with higher consumption of fat and lower levels of fruits and vegetables (Mendoza, Drewnowski, & Christakis, 2007).

1. Dietary intake and chronic disease

Dietary intake patterns appear to be associated with chronic disease states. Sabate (2001) reported that the best quality diet is comprised of plant based foods, and low or no consumption of meat which contributes to lower rates of chronic disease, thus promoting health and longevity. Individuals who follow a vegetarian diet have reduced their risk of type 2 diabetes mellitus, obesity, and coronary heart disease. This type of diet includes abundant consumption of fruits, vegetables, nuts, and legumes. Diets based on the consumption of animal products are higher in energy, total and saturated fat, and are associated with increased risk of cardiovascular disease. The prudent dietary intake pattern, similar to a Vegetarian, Mediterranean or Asian diet, includes fruits, vegetables, fish, poultry, low-fat dairy products, whole grains and moderate alcohol consumption. The Western diet includes red meat, processed meats, refined carbohydrates, high fat foods, and high-fat dairy products (Hu et al., 2000).

Liese, et al. (2009) found that consumption of red meats, bread, cereal, dried beans, fried potatoes, eggs, cheese, high calorie soft drinks, and low levels of fiber, wine and fruit are positively associated with the development of diabetes. This was confirmed by Nettleton, et al. (2008) who found that individuals who ate diets rich in red meats, processed meat, sugary beverages, and white potatoes were at 18 percent greater risk of

developing diabetes, while individuals with a dietary intake pattern rich in whole grains, fruits, nuts, LGVs, and low-fat dairy had a 15 percent lower risk for diabetes.

Hodge, et al. (2007) found that the Western diet was significantly associated with diabetes mellitus while the prudent diet decreased the risk. Hu and colleagues' (2000) found that there was a positive association between the Western diet and coronary heart disease and an inverse association with the prudent diet (fruits, vegetables, whole grains, and fish). They further explained that folate, vitamin E, and fiber in some of these foods protect against coronary heart disease. Coronary heart disease causes thirty percent of all the deaths in Western nations (Osler et al., 2002). McNaughton, et al. (2009) found that a dietary intake pattern high in consumption of white bread, fried potatoes, sugar in tea and coffee, burgers, sausages, and soft drinks while low in consumption of vegetables, was positively associated with: greater levels of total cholesterol, lower levels high density lipid protein, increased levels of triglycerides and coronary heart disease. Hung, et al. (2004) found that total fruit and vegetable intake was inversely associated with cardiovascular disease. Moreover, the consumption of LGV had the strongest inverse relationship with major chronic disease and cardiovascular disease (Hung, et al., 2004). This study supports the findings from Joshipura (2001) that LGV have a protective effect against coronary heart disease. Tarwadi and Agte (2003) indicate that LGV have a protective effect via iron and antioxidants. Carter, et al. (2010) studied the effects of fruits and vegetables on the incidence of diabetes with a systematic review and meta-analysis of four studies that examined LGV and diabetes. They reported that an increase of 1.15 servings of LGV was associated with a 14% risk reduction in type II diabetes and

concluded that these findings could indicate that LGV could significantly reduce type II diabetes.

Dietary intake patterns have also been associated with cancer risk. After conducting a factor analysis of dietary data from a population based study of 1,903 cases of colon cancer and 2,410 controls, Slattery, et al. (1998) reported that the Western diet was positively associated with the risk of colon cancer in both men and women. In another study of 4,779 subjects in Canada, Nkondjock, et al. (2005) found that increased consumption of legumes, fruits and vegetables reduced the risk of pancreatic cancer by a 49%.

2. Gender differences in dietary intake

With regard to gender, women have been reported to consume more fruits and vegetables than men (Baker & Wardle, 2003; Pennington & Hernandez, 2002). Men tend to eat higher amounts of meat, potatoes and bread, and lower amounts of fruits, vegetables, fish, chicken, and sweets than women. In addition, men consume higher amounts of animal products while women tend to consume more vegetable products with regard to total energy intake (Prättälä et al., 2007). The highest level of animal protein intake comes from processed meats, red meats, poultry and game followed by fish and then dairy products (Halkjær et al., 2009). Women have been reported to consume more leafy vegetables, fruit and fish than men (Pennington & Hernandez, 2002).

D. Positive Affect and Physical Activity

Positive affect has been related with health, physical activity and sleep (Chesney, et al., 2005; Hulens et al., 2002). Richman, et al. (2005) found that positive emotion could help thwart the development of chronic disease. Individuals experience many

positive and negative emotions during their lifetime and Kelsey, et al. (2006) explain that positive affect has been positively associated with various health behaviors, particularly physical activity. In a study of 1,093 blue collar females, Kelsey et al. (2006) found that positive affect was associated with higher levels of recreational exercise; however, since the study was cross-sectional the authors were unable to state whether positive affect increased exercise. An interesting finding of the study was that women who exercised on a regular basis did not use eating or snacking as a coping mechanism for stress. One of the limitations of the study was that it consisted only of women (Kelsey, et al., 2006). Griffin, et al. (1993) in a study of college students also found that undergraduates' positive affect was positively associated with exercise. Positive affect increased the likelihood of exercise in government employees in England who filled out daily diaries for four weeks on positive and negative affect and health behaviors (Jones, O'Connor, Conner, McMillan, & Ferguson, 2007). They concluded that positive mood states may motivate individuals to participate in activities that are healthy, possibly by increasing their energy level and motivation to engage in these activities (Griffin, et al., 1993).

E. Positive Affect and Dietary Intake

While there has been a substantial amount of research on the effects of negative emotions influencing dietary intake patterns, few have focused on the effects of positive emotions on diet (Macht, 2008). A cross-sectional study by Dube, et al. (2005) examined the effects of positive emotion on dietary intake and found that emotions have various reported associations with food choice by gender. In particular, men report that prior to eating comfort foods they had positive emotions, while women report negative emotions. In another cross-sectional study, Lyman, et al. (1982) had university students

imagine each of 22 emotions, either positive or negative, as vividly as possible and then indicate which specific food they would eat. They found that positive emotions were positively associated with an individual imagining eating healthy foods. Griffin, et al. (1993) found that positive affect increases fruit and vegetable intake. In contrast, Kelsey, et al. (2006) reported no significant associations between dietary intake and positive affect (Kelsey, et al., 2006). The participants in Griffin, et al's study were university students, both men and women, while Kelsey, et al. recruited only blue collar women. Neither study is fully generalizable to both genders and across educational strata.

F. Negative Affect and Physical Activity

Chesney, et al. (2005) noted that depression and anger were positively associated with detrimental health behaviors such as physical inactivity. This is further corroborated in a cross-sectional study by Strine, et al. (2008) which found a dose response relationship between physical inactivity and depression. Women who had a lifetime diagnosis of depression or an anxiety disorder were significantly more likely to be physically inactive and obese; however, the association was not significant in men (Strine, et al., 2008). Furthermore, Allgower, et al. (2001) examined the potential associations between depressive symptoms and health behavior in college students from 16 different countries, and found that depressive symptoms had a positive association with physical inactivity (Allgower, et al., 2001).

Negative affective states have been associated with risky behaviors in coronary heart disease patients. For example, individuals who are depressed and anxious tend to smoke, overeat, sleep less and be sedentary. In a prospective study by Stetson and colleagues (1997) on the effects of stress on exercise, researchers had women complete

eight weeks of exercise diaries (planned and completed exercise; perceived exertion, duration and type of exercise) and weekly stress inventories (weekly minor stressors). They found that minor stressors significantly impaired exercise adherence and that in times of stress, planned exercise could be perceived as another stressor (Stetson, et al., 1997). One of the strengths of the study is that it was prospective and the causality could be inferred, however, only women were examined.

G. Negative Affect and Dietary Intake

Emotional eating can be defined as an increase in eating due to a maladaptive coping response to negative emotions (Spoor, et al., 2007). Eating behavior is affected by changes in emotional states such as joy, anger, anxiety, depression, and sadness (Liu, et al., 2007). Macht, et al. (2002) explored the effects of two different emotions, sadness and joy, on eating behavior in men by showing the participants various movie clips to induce these feelings. They found that the men who experienced sadness had decreased appetites while those who experienced joy had increased appetites for chocolate.

There has been support that diets rich in fruits, vegetables and fish reduce the vulnerability for depression, and diets rich in meat, sweets, refined foods and high fat dairy increased the risk of depression (Dog, 2010). Akbaraly, et al. (2009) explained that the potential benefit from eating fruits and vegetables could be due to their antioxidant properties,, which reduce the risk of depression. In addition, LGV contain a substantial amount of folate, which is also associated with a lower risk of depression (Akbaraly, et al., 2009). A cross-sectional study by Oliver and Wardle (1999) examined the association of perceived stress on eating behavior (e.g. amount of snacking, types of foods eaten). When the participants perceived more stress they consumed less fruit, vegetables, fish

and meat, especially women. Furthermore, Liu, et al. (2007) reported that fruit intake was inversely associated with perceived stress and depression. Unasan (2006) concurs that stress is associated with less fruit and vegetable intake.

Anxiety has been linked with lower vegetable intake and higher meat intake in women, and lower legume intake in men (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). In addition, daily hassles defined as "events, thoughts or situations which, when they occur produce negative feelings such as annoyance, irritation, worry or frustration, and/or make you aware that your goals and plans will be more difficult or impossible to achieve," have been related to lower consumption of vegetables for both men and women (O'Connor, et al., 2008).

In an intervention study, Zellner, et al. (2006) examined the eating habits of 34 female undergraduate students by placing four different bowls on a table where the participants were seated and told the students that the food was a thank you for their participation in the experiment. Half of the participants were given solvable anagrams (unstressed group) and the other half were give unsolvable anagrams (stress group).After 10 minutes the participants were asked to rate their stress level and also asked other questions about dietary habits. Women in the stressed group ate more unhealthy food (i.e. M&M's) than the unstressed group. Zellner, et al. (2007) conducted the same experiment with male undergraduates and found that the stressed men ate less unhealthy foods than unstressed men, highlighting a gender difference regarding stress and food intake patterns.

Akarbaly, et al. (2009) reported that whole food dietary patterns comprised of fruits, vegetables, and fish, were associated with lower five year depression risk at

midlife compared to processed food patterns (processed meats, chocolates, sweet desserts, high fat dairy products, fried food and refined cereals). Nanri, et al. (2010) also found that fruits and vegetable intake is associated with fewer depressive symptoms.

There have been very few studies on the association of positive and negative affect with the consumption of protein-rich foods. One such study by Christensen and Pettijohn (2001) labeled individuals who have a tendency to consume protein rich foods as "protein cravers". Christensen and Pettijohn (2001) found that men rather than women experienced a craving for protein in certain emotional states. In particular, they found significant association between anger and protein cravings in men. On the other hand, they found that there were very few women who indicated that they were protein cravers. In addition, men and women have both been found to have carbohydrate cravings (Christensen, 2007). The researchers noted that the satisfaction from alleviating the craving is similar to self-medicating by consuming certain types of foods, with the increased serotonin levels serving to decrease dysphoria.

H. Flourishing and the Connection to the Positivity Ratio

Keyes (2003) defined flourishing as feeling a "positive emotion towards life and functioning well psychologically and socially." In addition, individuals who flourish have "excellent emotional health, have reduced levels of missed work, cut back on fewer days, have fewer physical limitations in their daily lives." (p. 294). Keyes (2007) explains that "measures of disability, chronic physical illness, psychosocial functioning, and health care utilization reveal that anything less than flourishing is associated with increased impairment and burden to self and society" (p. 95). Less than 25 percent of adults ages 25 to 75 years old are considered to be in a state of flourishing (Corey L. M.

Keyes, 2003). More specifically, Keyes (2002) estimated that 17.2 percent of adults are flourishing, 12.1 percent are languishing, and 56.6 have moderate mental health. Those individuals who are neither flourishing nor languishing are considered to be moderately mentally healthy. The opposite condition from flourishing, languishing, is a "state in which an individual is devoid of positive emotion toward life, is not functioning well psychologically or socially" (p. 294). Keyes (2003) describes languishing as being in "quiet despair" and those who languish may report feeling "hollow or empty" (p. 294).

There have been various studies that examine flourishing. For example, Keyes (2007) noted that people who flourish have the least amount of chronic physical diseases and conditions, and utilize health-care the least. Keyes reports that individuals who flourish have the highest amount of psychosocial functioning, which includes having the "lowest levels of perceived helplessness, and the highest levels of functional goals (knowing what they want from life), self-report resilience, and intimacy" (C. L. M. Keyes, 2007, p. 100).

Barber, et al. (2010) found that a positivity ratio can help to distinguish between those who flourish or languish. Fredrickson and Losada (2005) reported that in order to flourish an individual may have to experience more positive emotions than negative emotions because the research supports that "bad is stronger than good" (p. 681). Higher PR's have been shown to support better subjective well-being, marriages, and the performance of business teams (Barber, et al., 2010). The defining factor is that flourishing signifies an optimal functioning which includes four main factors: goodness, generativity, growth and resilience. To date there appear to be no studies relating flourishing to health behavior.

I. Ethnicity

Since the Adventist Health Study Biopsychosocial Religion and Health Study cohort includes primarily White or Black participants, the present study will compare these two groups. In general, researchers have found that Blacks have higher levels of psychological distress and lower well-being than Whites (Vega & Rumbaut, 1991). Overall, ethnic minorities have lower levels of physical activity, with Whites having the highest levels (Haskell, et al., 2007). In 2005, the Centers for Disease Control and Prevention reported that White men had the highest levels of exercise, followed by men of mixed race, then by non-Hispanic Black, and lastly, Hispanic men. Non-Hispanic White women had the highest rate of physical activity, followed by Hispanics and other races, with the lowest level of exercise observed in non-Hispanic Black women.

With respect to diet, Blacks have less social support with aging, coupled with higher levels of stress; therefore they are more likely to cope with stressors with unhealthy behaviors such as overeating (Jackson, Knight, & Rafferty, 2010). Overeating may be effective in the short-term in alleviating emotional states such as anxiety, depression, and frustration but in the long term results in increased chronic illness (Jackson, et al., 2010).

J. Conclusion

Affective differences relate to health outcomes and possibly to health behaviors. Since individuals experience positive and negative affect at the same time, PR may provide a dimension of affect that might better explain its relationship with health behavior. Keyes (2007) explains that the mental health profession has primarily focused on mental illness, and research on flourishing will highlight the importance of mental

health promotion. A study that examines the association of PR and flourishing to health promoting behaviors of physical activity and dietary intake patterns will contribute to the literature.

CHAPTER 3

METHODS

A. Participants

The Adventist Health Study-2 (AHS-2) is a prospective study of approximately 96,000 members of Seventh-day Adventist churches from Canada and the United States (Butler, et al., 2008). A cross-sectional research design was used to examine archival data from the Biopsychosocial Religion and Health Study (BRHS) collected from September 2006 to August 2007. A random sample of 20,000 AHS -2 participants were randomly selected to receive the BRHS questionnaire, of which 10,988 responded. Of these, we excluded individuals if they were: under the age of 35 years, not Seventh-day Adventists; smoked cigarettes within the last 12 months; consumed one alcoholic drink per week or more; were neither Black nor White (because a majority of the participants were either Black or White, 31% and 60%, respectively), and missing more than two relevant variables. Thus, 8,507 participants were included in this study.

B. Measures

1. Positive and Negative Emotions

Positive and negative emotions were measured by the Positive and Negative Affect Schedule (PANAS). This 10-item scale includes five items on positive emotion: inspired, alert, excited, enthusiastic, and determined, and five items on negative emotion: afraid, upset, nervous, scared and distressed. The items were assessed on a 5-point rating scale ranging from *very slightly/not at all (0), a little (1), moderately (2), quite a bit (3), or extremely (4),* based on the statement "This set of questions consists of

a number of words and phrases that describe different feelings and emotions. Mark a bubble to show to what extent you have felt this way during the past year" (Mackinnon, et al., 1999). Cronbach's alphas were .85 for positive and .87 for negative affect for the full cohort sample.

2. Flourishing Subscales

The scales which were selected to assess flourishing may be divided into two subsets: social and psychological functioning. The scales are described in the following sections. The process by which these scales were selected for inclusion in this paper is described in the data analysis section which follows.

a. Social Functioning

i. Religious Support Scale The Religious Support Scale (Krause, 1999) includes emotional support received, emotional support given, anticipated support and negative interactions subscales with 12 items, 3 items each (Cronbach's alphas = .78, .82, .91 and .74, respectively). Participants were asked about the people with whom they worship in church, Bible study class and Sabbath school class, and were instructed to answer *never, once in a while, fairly often, very often*, or *always.* A sample item for emotional support received was "How often do people you worship with listen to you talk about your private problems and concerns?" A sample item for emotional support given is "How often do people you worship with express interest and concern in your well-being?" A sample item of anticipated support is "If you had a problem or were faced with a difficult situation, how much comfort would the people in your congregation be willing to give you?" The scale was used as a surrogate measure for social functioning scales that

Fredrickson and Losada (2005) used because it closely matched the domain of social coherence.

ii. Positive and Negative Social Exchanges (PANSE) The Positive and Negative Social Exchanges (PANSE) scale assesses four positive domains: informational support, instrumental support, emotional support and companionship (Cronbach's Alpha's=.89, .81, .51, and .72, respectively); and four negative domains: unwanted advice or intrusion, failure to provide help, unsympathetic or insensitive behavior, and rejection or neglect (Cronbach's alphas=.72, .65, .77, and .77, respectively). The overall Cronbach's alpha for Positive and Negative Social Support are .87 and .86, respectively. This assessment examines the social exchanges over a 4-week period (Newsom, et al., 2005). For example, "In the past month, how often did the people you know (spouse, family, friends, relatives etc.) suggest ways that you could deal with problems you were having?" Participants rated each of the items from *never* to *very often* on a 5-point rating scale (Newsom, et al., 2005). This scale measures social integration and social contribution.

b. Psychological Functioning

i. Mastery Mastery is the level of control which one believes one has over one's own life. Individuals who believe they can influence their environment and cause a desired outcome to occur are said to have high mastery (Pudrovska, Schieman, Pearlin, & Nguyen, 2005). Individuals with low mastery have the perception that external events control their outcomes. In this study there are four out of the five original scale items on the mastery scale. Respondents answered *not true, somewhat true*

or *true* resulting in a Cronbach's alpha is .73. A sample statement is "I often feel helpless in dealing with the problems of life" (Pearlin & Schooler, 1978).

ii. Rosenberg Self-Esteem Scale The Rosenberg Self-Esteem Scale.. (RSE) is a widely used instrument and is a reliable and valid measure of self-worth (Robins, Hendin, & Trzesniewski, 2001)which appears to have good face validity (GrayLittle, Williams, & Hancock, 1997). This measure assesses the level of self-acceptance which helps define flourishing. The original version of the RSE consisted of 10 items intended to measure global self-esteem (Vispoel, Boo, & Bleiler, 2001). To control for response bias, five items were worded in a positive manner, and five were worded in a negative manner. A shortened 4-item scale was used in this study, with participants rating their responses from *not true, somewhat true,* to *very true,* resulting in a Cronbach's alpha of.77. A sample statement is "On the whole I am satisfied with myself" (Dobson, Goudy, Keith, & Powers, 1979).

iii. Spiritual Meaning Scale Mascaro, et al. (2004) developed the Spiritual Meaning Scale (SMS) comprised of 14 items. The SMS, which measures purpose of life is reported to have moderate to high correlations with other assessments of meaning. Convergent and divergent validity appear to be strong (Mascaro, et al., 2004). The SMS is correlated with personal and implicit meaning (Mascaro, et al., 2004). Spiritual meaning is defined as "the extent to which an individual believes that life or some force of which life is a function has a purpose, will or way in which individuals participate" (Mascaro, et al., 2004, p. 845). In the present study, the scale will be used to assess purpose of life with 5 items rated on a 3-point scale from *not true,* to *very true,*

resulting in a Cronbach's alpha of .71. A sample statement is "My life is meaningful" (Mascaro, et al., 2004).

iv. Perceived Stress Scale Cohen, et al. (1983) developed the Perceived Stress Scale (PSS) comprised of 4 items to assess the degree that situations in one's life are perceived as stressful on a 5-point scale (*never* to *very often;* Cronbach's alpha of .77) (Cohen, et al., 1983). This measure was a used to measure autonomy.

3. Health Behavior Outcomes

For this study, two health behavior outcomes are thought to be a function of flourishing and the positivity/negativity ratio. These are physical activity and diet.

a. Physical Activity The physical activity questionnaire used in this study was previously validated in non-Black and Black subjects (Singh, Tonstad, Abbey, & Fraser, 1996). Physical activity was assessed by days per week and amount of time spent exercising vigorously each day. These items on physical activity were transformed into a single factor by multiplying physical activity frequency per week by the midpoint value of the minutes per exercise session. Minutes of exercise per session were weighted as follows:: None was assigned a weight of 0; 10 minutes or less was assigned a weight of 5; 11-20 minutes was assigned a weight of 15; 21-30 minutes was assigned a weight of 25; 31-40 minutes was assigned a weight of 35; 41-50 minutes was assigned a weight of 45; 51-60 minutes was assigned a weight of 55; more than 1 hour was assigned a weight of 65. This number was then multiplied by frequency (the number of times exercised) per week to obtain minutes of exercise per week. Frequency weights used were: *never engage in activities this vigorous* = 0; *less than once per week* = .5; *1 time per week* = 1; *2 times per week* = 2; *3 times per week* = 3; *4 times per week* = 4; *5 times per week* = 5; *6*

or more times per week = 6.5. The resulting values of mean minutes per week multiplied by the mean frequency per week equaled the physical activity score.

b. Dietary Intake Patterns Dietary intake was assessed using an abbreviated 14-item food frequency questionnaire. Respondents were asked to estimate their frequency of intake over the past 12 months. Frequency categories were converted to weekly intake, thus never or rarely was assigned a weight of 0; 1-3 per month was assigned a weight of 0.5; 1 times per week was assigned a weight of 1; 2 to 4 times per week was assigned a weight of 3; 5 to 6 time per week was assigned a weight of 5.5; 1 time per day was assigned a weight of 7; 2 to 3 times per day was assigned a weight of 17.5; 4 or more times per day was assigned a weight of 32.5. Weighted frequencies under each of the food groups were summed to produce a total score of weekly intake of fruits, vegetables and meats. Based on factor analysis, 3 food groups emerged as main factors from the food list. These included fruit, LGV, and meat. Fruit included any kind of frozen, canned or dried fruit, as well as raw or cooked fruits. Leafy vegetables consisted of broccoli, cabbage, brussel sprouts, kale, collards, mustard greens, poke salad, ruccola, and other LGV. Meat included red meats, turkey and chicken. Fish, vegetarian protein, soy milk, and dairy-based cheese intake did not load high with these foods and therefore were not included as part of the dietary intake to be examined.

C. Control Variables

Control variables included gender, age (>35 years), education, economic status, and ethnicity (Black or White). Economic status was assessed by the question, "how difficult was it for your family to meet expenses for basic needs like food, clothing, and

housing, in the past year," to which individuals responded to a 5-point rating scale ranging from "not at all" to "very often" (Pudrovska, et al., 2005).

D. Calculation of Positivity Ratio and Flourishing

1. Positivity ratio

Positive and negative affect were calculated as the sum of the individual responses to all of the five items on each affect scale from 0, 1, 2, 3 or 4, indicated by *very slightly/not at all* (0), *a little* (1), *moderately* (2), *quite a bit* (3), or *extremely* (4), respectively. Thus, a maximum score of 20 and a minimum score of 0 was possible for each type of affect. The PR was calculated as the ratio between the positive score and the negative score. There was no need to correct for a negative affect score of zero because there were no such cases. We calculated the range of PR scores.

With regard to examining PR, Fredrickson and Losada (2005) measured PR by using the Positive and Negative Affect Schedule (PANAS) (20 items) which was administered to the participants. They had participants rate how they felt every 24 hours to the extent of both positive and negative emotions, from *not at all* to *extremely* on a5 point rating scale for 28 days. Similar to our study, the researchers divided the total number of positive emotions by the negative emotions for the month, indicating the positivity ratio. Barber, et al. (2010) had individuals rate how they generally felt on 11 positive and 8 negative emotions, again using the PANAS, which was similar to Fredrickson and Losada's method (2005); however, Barber, et al.'s methodology differed from the earlier study by separately taking the means for positive and negative and then dividing them by each other. Trute, et al. (2010) also used the PANAS and asked participants to rate their emotions over the last week. The method used to calculate

was the same as that of Fredrickson and Losada (2005). Shrira, et al. (2011) measured positive and negative affect by using the Affect Balance Scale, which included five positive affect and five negative affect items. The positivity ratio was calculated by dividing the mean positive affect by mean negative affect score.

2. Flourishing

Fredrickson and Losada (2005) defined flourishing to include two constructs: psychological and social functioning. In the present study we conceptually matched Fredrickson and Losada's two constructs with the available subscales in the BRHS dataset. In our study, flourishing was composed of four psychological functioning domains (mastery, self-esteem, purpose in life, and perceived stress), and six domains of social functioning (positive social exchanges, negative social exchanges, and the four religious support scales described earlier), which matched 7 out of the 11 areas of Fredrickson and Losada's model (2005) with 10 scales. Each negative scale was rescaled into a positive scale by multiplying the scale by minus one. We standardized each of the 10 subscales and summed the standardized scores. We calculated the range of flourishing scores. Our method differed from Fredrickson and Losada's (2005) in that they used 11 psychological and social functioning scales, and categorized an individual as flourishing if he/she scored in the upper tertile of 6 out of the 11 scales. Our methodology was similar to that of Diener et al. (2010) where the flourishing scale was summative though in their case they only summed eight items rather than standard scores (z-scores) over 10 subscales/scales.

Flourishing has been measured in a number of ways. Keyes (2002), who has spent the most time developing the concept, measured flourishing by using 13 scales to

gauge emotional well-being, psychological well-being and social well-being. Two scales measured emotional well-being, including the presence of positive affect and absence of negative affect. Psychological functioning scales consisted of self-acceptance, environmental mastery, purpose in life, personal growth, positive relations with others, and autonomy (Ryff, 1989). The social well-being scales included social coherence, social integration, social contribution and social actualization. Those who scored in the highest tertile (after standardizing) of one of the two scales for emotional well-being, and 6 out of the 11 psychological and social well-being scales were labeled as flourishing. Fredrickson and Losada (2005) examined flourishing in a similar manner as Keyes, but omitted the two emotional well-being scales. Flourishing was defined as participants scoring in the upper tertile of 6 out of the 11 scales. Catalino and Fredrickson (2011) used the Mental Health Continuum Short-Form which is divided into three subscales comprised of 14 items measuring emotional, psychological, and social well-being. They calculated the mean of all 14 items and participants who scored high were categorized as flourishing. : Other studies have categorized participants with a PR of 2.9 or higher as flourishing without using other formal flourishing scales (Barber, Bagsby, & Munz, 2010; Otto, Howerter, Bell, & Jackson, 2010). Diener, et al. (2010) developed their own short scale to measure flourishing consisting of eight items including positive relationships, having positive meaning and purpose, feelings of competence, being engaged and interested in daily activities, and other concepts similar to those used by Keyes. This scale is treated as a simple Likert style summative rating scale and no attempt was made to divide people into flourishing or languishing categories.

A. Data Analysis

Cases that were missing more than two relevant variables were dropped from the analysis. Missing data on the remaining cases was imputed using the expectation maximization algorithm available in SPSS 20. A significance level of .01 was used in this study due to the large sample size. The distribution of participants was categorized by ethnicity and gender. Chi square was calculated to examine group differences between categorical variable (i.e., ethnicity and gender). We generated means and confidence intervals for the dependent variables using multivariate general linear model analysis.

To test the association of PR with flourishing we used partial correlation analysis. The effects of PR and flourishing on physical activity and dietary intake were analyzed by using multiple linear regression while controlling for gender, ethnicity age, education, difficulty meeting expenses. We then examined the mediating effect of flourishing on PR and vice versa, in influencing physical activity and dietary intake by comparing differences between β coefficients when PR and flourishing were regressed separately and together. We analyzed these relationships with and without control for BMI. Finally, interactions with gender and ethnicity on PR and flourishing in predicting physical activity and dietary intake were tested.

Question 1. How is PR associated with: flourishing; physical activity; dietary intake: fruit, LGV, and meat intake? Regression of each health behavior on PR plus the control variables was performed.

Question 2: How is flourishing related to the health behaviors of physical activity, fruit intake, LGV intake, and meat intake? Regression of each health behavior on flourishing plus the control variables was performed.

Question 3: Are PR and flourishing significantly associated? Partial correlation analysis was performed to examine the relationship between PR and flourishing.

Question 4: Are any associations of PR with health behaviors mediated by flourishing? PR was regressed with the health behaviors adding flourishing as a covariate along with the control variables. The beta weights for PR in each equation were examined to see whether PR is still statistically significant when flourishing is in the equation.

Question 5: Are any associations of flourishing with health behaviors mediated by PR? Flourishing was regressed with the health behaviors adding PR as a covariate along with the control variables. The beta weights for flourishing in each equation were examined to see whether it is still statistically significant when PR is in the equation.

Question 6: How does gender and ethnicity influence the above associations? Confidence intervals for each regression coefficient were examined. Interactions of gender and ethnicity with PR and flourishing in predicting physical activity and dietary intake were tested. This was done by redoing the appropriate regression from each research question with the addition of the interacting variable and a product term to represent the interaction.

F. Power Analysis

The power analysis was based on the lowest amount of power needed to detect a difference. The association between PR and the various health behaviors was assessed by multiple linear regression analysis. G*Power 3.1 software was used to calculate the minimum number of subjects needed for this study. The results based on a small effect size of f=0.01, power of 80% and an alpha of 0.05 yielded a result of 779 subjects needed for the study. This is based on being able to detect a 1% increase in R^2 when a substantive variable (e.g., physical activity) is added to a regression equation containing up to 6 other variables. The other variables would include control variables (e.g., age, education) and possible interaction terms. Given that there are 8,507 participants in the study there was adequate power.

G. Research Ethics

Using the Belmont Report (1978) guidelines for treatment of human subjects, issues of justice, beneficence, and respect were accounted for in this study. A random sample of 20,000 participants from the AHS-2 study was given the opportunity to participate in the BRHS. AHS-2 study participants who chose to take part were told that they were free to withdraw from the study at any time and that their participation in the overall AHS-2 study would not be affected. All of the participants received a cover letter with the questionnaire, which explained that mailing back a completed questionnaire indicated implied informed consent. They were also informed that their data would be kept confidential. The student investigator had no access to identifying information. The participants were informed that they would be protected from harm. Lastly, the BRHS has already been approved by the Institutional Review Board of Loma Linda University.

CHAPTER 4

FIRST PUBLISHABLE PAPER

The Ratio of Positive to Negative Affect, Flourishing, And Physical Activity

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Abstract

While positive emotions may promote and negative emotions hinder protective health behaviors, it is unclear how the positivity ratio (PR, ratio of positive to negative emotion) and flourishing relate to physical activity. The Biopsychosocial Religion and Health Study (BRHS), a study of psychological factors, religious practice and health habits in Seventh-day Adventists (n=8,507) was the source of data for this cross-sectional study. PR was derived from the short-form of the Positive and Negative Affect Scale (PANAS); flourishing from Positive and Negative Social Exchanges, Religious Support, Mastery, Rosenberg Self-Esteem, Spiritual Meaning and Perceived Stress scales; and physical activity from a questionnaire regarding exercise habits. PR and flourishing were regressed on physical activity controlling for gender, ethnicity, age, education, and economic status both with and without control for BMI.

PR was related to physical activity regardless of BMI (β=.131, p<.001), as was flourishing (β=-.085, p=<.001). PR was significantly associated with flourishing (r=.502, p<.001). While flourishing did not mediate the relationship of PR with physical activity, PR partially mediated the relationship of flourishing with physical activity after controlling for BMI.

These findings suggest that high positive and low negative emotions, as well as flourishing, are associated with physical activity independent of BMI. However, the direction of these relations cannot be determined with cross sectional data.

Keywords: affect, positivity ratio, flourishing, health behavior, physical activity

Ratio of Positive to Negative Affect, Flourishing, and Physical Activity

Physical activity affects morbidity and mortality rates worldwide (Berrigan, et al., 2003). Less than half of U.S. adults meet the CDC/ACSM physical activity recommendations (Wendel-Vos, et al., 2007). According to the CDC/ACSM, individuals should get 150 minutes of moderate intensity, 75 minutes of vigorous intensity or a mix of moderate and vigorous aerobic exercise per week (Haskell, et al, 2007).

Significant health behavior research focuses on the consequences of emotions on health behaviors. Both positive and negative emotions are associated with physical activity patterns (Christensen & Pettijohn, 2001; Rosqvist, et al., 2009). Positive emotions have been found to be associated with health promoting behaviors, such as increased physical activity and sleep. Kelsey, et al. (2006) suggest that positive emotion relates to improved recreational physical activity. Positive mood states may motivate individuals to participate in activities that are healthy, possibly by increasing their energy level and motivation (Griffin, et al., 1993).

Conversely, negative emotions are associated with low levels of health promoting behaviors. Strine, et al. (2008) discovered a dose response relationship between physical activity and depression. Individuals who had a lifetime diagnosis of depression or an anxiety disorder were significantly more likely to be physically inactive (Strine, et al., 2008). Overall, individuals who are depressed and anxious tend to smoke, overeat, sleep less and have sedentary lifestyles (Anton & Miller, 2005). Chesney, et al. (2005) noted that negative emotions are detrimental to health behaviors, and as such predict increased smoking, physical inactivity and the consumption of alcohol. Negative emotions such as job stress, which have been linked with anxiety and depression, were found to be

associated with lower levels of healthy behaviors (Nomura, et al 2010). Positive and negative emotions may co-occur but an excess of one or the other is of importance in predicting health behaviors (Folkman & Moskowitz, 2000). As such, there may be a relationship between the positivity ratio (PR, ratio of positive to negative emotion) with physical activity. Higher PR's have predicted improved subjective well-being, marital relationships, and business team performance (Barber et al, 2010). Measuring positive and negative emotions simultaneously may be important because the ratio of positive and negative emotions may help describe the affective quality of an individual's life (Fredrickson & Losada, 2005). Specifically, Fredrickson and Losada found that a PR above 2.9 is associated with an individual who exhibits optimal functioning called "flourishing." To date there have been no studies that have examined the relationship of PR with physical activity.

There have been several studies that examined a construct of mental health called flourishing (Fredrickson and Losada, 2005; Keyes, 2002). Keyes (2002) reported that there is mental health continuum from mental illness to mental health: (a) languishing and depression, (b) depression, (c) languishing, (d) moderate mental health, and (e) flourishing. Flourishing is synonymous with optimal functioning and is the highest level of mental health on this continuum. It is comprised of two constructs: psychological functioning and social functioning (Fredrickson & Losada, 2005). In Fredrickson and Losada's work, psychological functioning includes the domains of self-acceptance, purpose in life, environmental mastery, positive relations with others, personal growth and autonomy. Social functioning includes social coherence, social integration, social acceptance, social contribution, and social actualization.

Emotions and physical activity are interrelated with BMI (Hawker, 2012). Individuals with anxiety are 30% more likely to be obese than non-anxious individuals. Strine, et al. (2008) found that individuals who are severely obese are more likely to have depression. Faith, et al. (2002) point out that longitudinal studies support causal directions of obesity to depression and that of depression to obesity, thus indicating bidirectional causation. In general, the association between BMI and physical activity is very difficult to measure because of multiple confounding variables. However, there is much support that these two variables are inversely associated. In addition, being physically inactive tends to increase the risks of being obese in comparison with individuals who engage in light, moderate or vigorous physical activity (Anderssen et al., 2008).

The principal aim of this study was to examine the relationships of PR and flourishing with physical activity. Second, we aim to examine whether flourishing mediates the relationship between PR and physical activity. We hypothesize that both PR and flourishing will be positively associated with physical activity habits and that flourishing will mediate the relationship of PR to physical activity. In addition, we propose that PR will mediate the flourishing to physical activity association.

Methods

Participants and Procedures

The Adventist Health Study-2 (AHS-2) is a prospective study of approximately 96,000 members of Seventh-day Adventist churches from Canada and the United States (Butler, et al., 2008). A sample of 20,000 AHS-2 participants were randomly selected to receive the Biopsychosocial Religion and Health Study (BRHS) questionnaire; of these,

10,988 responded. Those who were not SDA (n = 253), under age 35 (n = 134) and not White or Black (n = 700) and those missing data on any of the variables of interest were excluded because they were outside the original AHS-2 sampling frame. Individuals who currently drank alcohol (n = 537) or who smoked (n = 75) were also excluded because they were atypical of the Seventh-day Adventist sample as a whole and because these health behaviors might be confounded with the primary outcome of PA in this study. This left a total of 9,222. Finally 715 individuals who were missing more than two of the variables making up the positivity/negativity ratio or the flourishing variables were excluded leaving a total of 8,507 individuals for analysis. To have excluded all individuals missing any of this data would have left us with a sample of only 6,624 since so many of these missing variables were not on the same individuals. Thus, we decided to use the SPSS expectation maximization procedure to impute the missing values on the scales making up the flourishing and positivity/negativity ratio variables to keep data loss to a minimum. Following Schafer and Graham's recommendations (2002) we used all available demographic and study variables except the outcome variables in this imputation allowing information from other data in our data set to provide information for variables that were correlated with them. Table 4.1 shows selected demographics for the sample.

Measures

Positive and Negative Emotions. Positive and negative emotions were measured by the short form of the Positive and Negative Affect Schedule (PANAS) (Mackinnon, et al., 1999). This 10-item scale includes five items on positive emotions: inspired, alert, excited, enthusiastic, and determined and five items on negative emotions: afraid, upset,

nervous, scared and distressed. Each of these adjectives were rated on a 0-4 point scale (*very slightly/not at all* to *extremely)* as to "what extent you have felt these emotions in the past year." Cronbach's alphas in the BRHS sample were .85 for positive affect and .87 for negative affect.

Calculation of the Positivity Ratio. Positive and negative affect were calculated as the sum of the individual responses to all of the five items on each affect scale rated on *very slightly/not at all* (0), *a little* (1), *moderately* (2), *quite a bit* (3), to *extremely* (4) scale. Thus, a maximum score of 20 and minimum score of 0 was possible for positive and for negative affect. The PR was calculated as the ratio between the positive score and the negative score. There was no need to correct for a negative affect score of zero because there were no such cases. This method differed from Fredrickson and Losada who took a count of the number of times over each of 28 days the participant reported experiencing a positive emotion and then divided that by the number of times they reported experiencing a negative emotion. However, our approach is similar to Shira et al. (2011) who used the Affect Balance Scale and divided the mean frequency of positive affect in the last week by the mean frequency of negative affect to obtain a PR. Mean and 95% confidence limits for PR are in Table 4.2

Flourishing. The scales selected to assess flourishing were divided into two domains: social and psychological functioning.

Social Functioning. There were six measures of social functioning taken from two different scales.

Positive and Negative Social Exchanges (PANSE). The PANSE assesses two broad domains of social exchanges—positive and negative. The overall Cronbach's

alphas for our data were .87 for positive exchanges and .86 for negative exchanges. This scale assesses social exchanges over a 4-week period (Newsom, et al., 2005). Participants rated each of the items from *never* to *very often* on a 5-point scale.

Religious Support Scale. Three-item subscales of emotional support received, emotional support given, anticipated support and negative interaction were used to assess social integration within a congregation on a 5-point scale (*never* to *always*; Cronbach alphas = .78, .82, .91 and .74, respectively) (Krause, 1999).

Psychological Functioning. Psychological functioning was assessed with four scales.

Mastery. This scale measures the degree of which individuals believe they can influence their environment and cause a desired outcome to occur. Respondents rated four items on a 7-point scale (*not true* to *true*; Cronbach's alpha = .73) (Pudrovska, et al. (2005).

Rosenberg Self-Esteem Scale. This scale is widely used and is a reliable and valid measure of self-worth and acceptance (Robins, et al., 2001). We used a 4-item short form with ratings on a 7-point scale (*not true* to *very true*; Cronbach's alpha = .77).

Spiritual Meaning Scale. Mascaro, et al. (2004) developed the 14-item Spiritual Meaning Scale (SMS) to assess purpose in life. Five items with the largest factor loadings in Macaro et al.'s study were selected for use in the BRHS—Cronbach's alpha of .71. Participants provided ratings on a 3-point scale (*not true,* to *very true*).

Perceived Stress Scale. Cohen, et al. (1983) developed the Perceived Stress Scale (PSS). The 4 item version was used in the BRHS to assess the degree that situations in

one's life are perceived as stressful on a 5-point scale (*never* to *very often;* Cronbach's alpha of .77).

Calculation of Flourishing. Fredrickson and Losada (2005) defined flourishing to include two constructs: psychological and social functioning. In the present study we conceptually matched Fredrickson and Losada's two constructs with the available subscales in the BRHS dataset. In our study, flourishing was composed of four psychological functioning domains (mastery, self-esteem, purpose in life, and perceived stress), and six domains of social functioning (positive social exchanges, negative social exchanges, and the four religious support scales described earlier), which matched 7 out of the 11 areas of Fredrickson and Losada's model (2005) with 10 scales. Each negative scale was rescaled into a positive scale by multiplying the scale by minus one. We standardized each of the 10 subscales and summed the standardized scores. We calculated the range of flourishing scores. Our method differed from Fredrickson and Losada's (2005) in that they used 11 psychological and social functioning scales, and categorized an individual as flourishing if he/she scored in the upper tertile of 6 out of the 11 scales. Our methodology was similar to that of Diener et al. (2010) where the flourishing scale was summative though in their case they only summed eight items rather than standard scores (z-scores) over 10 subscales/scales. Mean and 95% confidence limits for flourishing are in Table 4.2.

Physical Activity. The physical activity questionnaire used in this study was previously validated in non-Black and Black subjects (Singh, et al., 1996). Physical activity was assessed by days per week, and amount of time exercised vigorously (i.e. brisk walking, jogging, bicycling, etc.) each day. Minutes of exercise per session was

categorized as such. None was assigned a weight of 0; ≤10 minutes was assigned a weight of 5; 11-20 minutes was assigned a weight of 15; 21-30 minutes was assigned a weight of 25; 31-40 minutes was assigned a weight of 35; 41-50 minutes was assigned a weight of 45; 51-60 minutes was assigned a weight of 55; ≥ 1 hour was assigned a weight of 65. Frequency categories included: *never engage in activities this vigorous* = 0; *less than once per week* = .5; *1 time per week* = 1; *2 times per week* = 2; *3 times per week* = 3; *4 times per week* = 4; *5 times per week* = 5; *6 or more times per week* = 6.5. Items on the questionnaire were transformed into and analyzed as a single scale by multiplying the midpoint value of the weighted minutes per exercise session with the weighted frequency to obtain minutes of vigorous exercise per week. Mean and 95% confidence limits for physical activity are in Table 4.2.

Control Variables. Control variables included gender, age, education, economic status, BMI, and ethnicity (Black or White). Economic status was assessed by the question, "how difficult was it for your family to meet expenses for basic needs like food, clothing, and housing, in the past year," to which individuals responded to a 5-point rating scale (*not at all* to *very*) (Pudrovska, et al., 2005). As indicated earlier, information about the distribution of these variables is found in Table 4.1.

Data Analysis

To test the association of PR with flourishing we used partial correlation. The effect of PR and flourishing on physical activity was analyzed by using multiple linear regression while controlling for gender, ethnicity, age, education, and difficulty meeting expenses. We then tested for mediation of PR on the relationship of flourishing with physical activity by comparing differences between β coefficients when PR and

flourishing were regressed separately and together. We analyzed these relationships with and without control for BMI. Finally, interactions with gender and ethnicity on PR and flourishing in predicting physical activity were tested using multivariate regression with a statistical significance cutoff of $p \leq .01$. A significance level cutoff of .01 was used in this study due to the large sample size.

Results

Associations of Physical Activity with Positivity Ratio and Flourishing

Table 4.3 outlines multiple linear regressions on the physical activity variable with PR and flourishing. PR was positively associated with physical activity after controlling for gender, ethnicity, age education, and economic status. When we added flourishing as a covariate, the β coefficient of PR dropped from 0.131 to 0.118, but remained significant ($p<.001$). Similarly, flourishing was positively associated with physical activity. When PR was added as a covariate the β coefficient of flourishing weakened (from 0.085 to 0.026), and was no longer statistically significant based on our $p <.01$ criterion ($p=.042$).

In a separate regression analysis, we adjusted for BMI. Again, we found that physical activity was significantly related to PR and to flourishing. When flourishing was included in the regression with PR, the β coefficient of PR remained significant with and without control for BMI (β=.118, $p=<.001$ and β=.116, $p=<.001$, respectively). On the other hand, when PR was included in the regression of physical activity on flourishing, the β coefficient of flourishing was no longer significant indicating partial mediation by PR of the flourishing and physical activity relationship with (β=.019, $p=.13$) and without (β=.026, $p=.042$) control for BMI. The partial correlation between PR and flourishing,

when controlling for age, ethnicity, economic status, and BMI was significant (r=.502, p<.001). There were no interactions found of gender and ethnicity with PR and flourishing when predicting physical activity.

Discussion

We found both PR and flourishing to be positively related to physical activity. PR and flourishing were significantly correlated with each other, and flourishing partially mediated the relationship of PR with physical activity. Although previous studies did not examine the relationship between PR and physical activity, there has been support that increasing levels of PR result in positive health behaviors (Fredrickson & Losada, 2005. Kiviniemi et al. (2011) explain that if one is experiencing negative emotions he/she would most likely prefer to engage in behaviors that provide positive feelings. Furthermore, an individual may choose other activities over physical activity because one would prefer to engage in other leisure goals. In this scenario an individual weighs their behavioral options and it has been found that enjoyment is correlated with sedentary behavior (Rhodes & Dean, 2009).

On the other hand, a likely reason for a positive relationship of PR and physical activity would be that positive emotion leads to improved self-regulation (Tice et al, 2007) and increases in one's energy level, thus individuals are better able to engage in healthier behaviors, such as increased physical activity (Anderson et al, 2007; Reichert et al, 2007). The ability to regulate emotion has been found to be related to increased physical activity levels (Hawkley et al, 2009), although there have been several studies that suggest that physical activity leads to enhanced positive emotion (Wichers, et al., 2012; Pasco, et al., 2011).

Because previous research was based on either positive or negative emotion, not PR, this study yields new information. Previous research has relied on examining the association of either negative or positive emotion with health behavior, the PR and flourishing variables provide a complete picture of how much more positive emotion is required to balance the effects of the negative affect to improve mental health and PA.

The second hypothesis was that flourishing would be positively associated with physical activity and this was supported. Our flourishing variable was unique and robust. Even though previous studies have used different scales to measure flourishing, we built our flourishing scale to be conceptually similar to past studies (Fredrickson & Losada, 2005; Keyes, 2002). What our scale added is a religious support scale and a spiritual meaning scale, which is likely of importance to our sample of Seventh-day Adventists. However, these facets of mental health may be similarly important in other populations and may add to the definition of flourishing by broadening the assessment of mental health (Unterrainer, et al., 2010). Religiosity predicts physical activity and aspects of flourishing, such as self-esteem, social support, mastery, and purpose in life (Son & Wilson, 2011). Also religiosity has been shown to be associated with enhanced mental health in general (Hackney and Sanders, 2003). Social integration within a faith community may be an integral part of flourishing for some and more work should follow regarding this facet of flourishing.

Based on Fredrickson and Losada (2005), we expected PR to be directly related to flourishing and this hypothesis was again supported here. Conceptually, PR and flourishing are both facets of mental health status though PR is a more basic measure of mental health and flourishing a more omnibus assessment of higher functioning. The

result that PR partially mediated the flourishing and physical activity relationship suggests that PR is the mechanism by which general mental health functioning leads to the emission of health behaviors – in this case of improved physical activity.

However, though PR and flourishing were associated with physical activity, the causal direction is uncertain because the data is cross-sectional though longitudinal data is forthcoming in the BRHS and that could be used to examine causality. Other limitations include the self-report nature of the questionnaire in which participants may have over or underrepresented their mental health and/or physical activity levels though it is unlikely this is systematically biased in any demographic group as the relationships remained after controlling for these variables. Another limitation is that all of the subjects are either Black or White, limiting our ability to generalize to other ethnic groups. The abbreviated physical activity questionnaire gives a somewhat limited definition of physical activity and may therefore underestimate these effects. Our sample included only Seventh-day Adventist's, who on the whole subscribe to healthy lifestyles (Nyenhuis et al. 2003), thus this may be a reason that the physical activity levels were higher than reports in the general population.

This study used a novel approach in examining physical activity with both PR and flourishing. Additional research should be conducted in this area to validate the results and determine whether interventions aimed at changing PR and flourishing may also improve physical activity levels or vice versa. Assuming that future studies suggest that the causal direction is from PR to physical activity, results from this study may be used by practitioners and researchers in designing appropriate interventions (e.g. emphasizing positivity in health education classes) to influence physical activity patterns.

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Table 4.1
Demographics

		%	*n*
Gender			
	Female	67.1	5,705
	Male	32.9	2,802
Ethnicity			
	White	63.8	5,429
	Black	36.2	3,078
Age			
	35-44	10.3	874
	45-54	21.1	1,797
	55-64	26.4	2,250
	65-74	22.8	1,941
	75-84	15.3	1,302
	85-101	4.0	343
Level of Education			
	Trade or High School or Less	22.8	1,936
	Some College or Associate Degree	33.5	2,839
	Bachelor's Degree	22.9	1,944
	Master's or Doctorate	20.7	1,756
Difficulty meeting expenses for basic needs last year			
	Not at all	70.5	6,001
	A little	15.8	1,347
	Somewhat	6.2	525
	Fairly	4.4	372
	Very	3.1	262
BMI			
	Underweight	1.9	158
	Healthy Weight	38.3	3,257
	Overweight	34.1	2,901
	Obese	22.0	1,873
	Severely Obese	3.7	318

Table 4.2

Means for Physical Activity, Positivity Ratio, and Flourishing (N=8,507).

		95% Confidence Interval	
	Mean	Lower Bound	Upper Bound
Physical Activity[a]	78.35	0	422.50
Positivity Ratio[b]	2.40	2.37	2.42
Flourishing[c]	0.01	-0.01	0.02

[a]Minutes of vigorous activities per week.

[b]Positivity Ratio is Positive Affect/Negative Affect.

[c]Flourishing is the sum of z-scores on mastery, self-esteem, meaning in life, perceived stress (reversed), positive social exchanges, negative social exchanges (reversed), and congregational support (emotional support given, emotional support received, anticipated support and negative interactions [reversed]).

Table 4.3

Regression of Physical Activity Variable on Positivity Ratio and Flourishing

	Age, Education, Expenses Controls		BMI Control Added	
	β	*p*	β	*p*
Regressed separately				
Flourishing	.085	<.001	0.077	<.001
Positivity Ratio	.131	<.001	0.125	<.001
Regressed together[a]				
Flourishing	.026	.042	0.019	0.13
Positivity Ratio	.118	<.001	0.116	<.001

[a]Positivity ratio was included as a covariate when flourishing was regressed with the dependent variable. Flourishing was included as a covariate when positivity ratio was regressed with the dependent variable.

CHAPTER 5

SECOND PUBLISHABLE PAPER

The Ratio of Positive to Negative Affect, Flourishing, And Dietary Intake

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Abstract

While positive and negative emotions have been associated with dietary intake, little is known about the relation between a ratio of positive to negative emotion (Positivity Ratio, PR) and flourishing (optimal functioning of emotional, psychological and social well-being) with dietary intake. This study investigates these relationships. Cross-sectional analysis was performed using the Biopsychosocial Religion and Health Study (BRHS) (n=8,507) data; a study of the religion-health connection. Multivariable linear regressions were used to determine the relationships of PR and flourishing with dietary intake, controlling for gender, ethnicity, age, educational level, and economic status in all analyses while also exploring the model with and without BMI. PR was related to fruit, leafy green vegetable, and meat intake with control for BMI (β=.103, p<.001, β= .107, p<.001 and β= -.058, p<.001, respectively) and without control for BMI (β=.108, p<.001, β=.108, p<.001, and β= -.068, p<.001, respectively). Flourishing was related with fruit, leafy green vegetable, and meat intake with (β=.122, p<.001, β=.100, p<.001, and β= -.044, p<.001) and without control for BMI (β=.128, p<.001, β=.101, p<.001 and β= -.058, p<.001 respectively). PR was significantly associated with flourishing (r=.502, p<.001). Although flourishing did not mediate the relationship of PR with dietary intake, PR partially mediated the flourishing and meat intake relationship after controlling for BMI. No significant gender or ethnic differences were found of PR or flourishing predicting dietary intake. Findings suggest that dietary intake, emotion and flourishing are interrelated. Whether interventions designed to increase PR and flourishing will promote healthy behaviors requires further study.

Keywords: affect, positivity ratio, flourishing, health behavior, dietary intake

The Ratio of Positive to Negative Affect, Flourishing, and Dietary Intake

Dietary patterns affect morbidity and mortality of individuals worldwide (Berrigan, et al., 2003). This modifiable health behavior has been associated with many chronic diseases and a healthier diet rich in fruits and vegetables can prevent chronic illness and prolong life (Reeves & Rafferty, 2005). Mental health positively influences dietary intake patterns. Specifically, both positive and negative emotions are associated with diet; however, data is limited on the effects of positive emotion on dietary intake (Macht, 2008). Of the few investigations thus far, Dube, et al. (2005) found that prior to eating comfort foods (e.g., high-calorie sweet foots), men reported having positive and women negative emotions. In fact, this effect is so strong that simply imagining a positive or negative emotion can influence food choice. As such, healthy food choices were associated with imagining positive emotions (Lyman et al., 1982).

There is evidence that negative emotions mediate the mental health and diet relationship. Kiviniemi et al. (2011) report negative affect and depressive symptoms relate to decreased fruit and vegetable intake and similarly depression and perceived stress are inversely related to fruit intake (Liu, et al. 2007; Oliver & Wardle, 1999) while Griffin, et al, (1993) find positive affect increases fruit intake.

In general, anxiety is linked to lower vegetable intake (O'Connor, et al., 2008) and daily hassles to less consumption of vegetables (O'Connor et al, 2008). Leafy green vegetable (LGV) intake in particular has been shown to be protective of depression (Akbaraly, et al., 2009); however, there is very limited data on how positive and negative emotions relate to LGV intake.

Likewise, few studies have examined the relationships of positive and negative affect with consumption of meat intake. Some research suggests that meat intake is positively related to anxiety, major depressive, dysthymic and bipolar disorders (Jacka, et al., 2012). There have been other studies suggesting that meat intake is related to negative emotion. For example, increased levels of stress are associated with increased consumption of meat for men but not for women (Steptoe, et al.,1998). Furthermore, Yannakoulia, et al. (2008) found that the women who were less anxious displayed a vegetarian type eating pattern, consuming the lowest amounts of red meat.

Evidence does support the notion that emotions influence eating behavior at higher rates in obese versus non-obese individuals, as well as individuals on diets compared to non-dieters (Canetti, et al., 2002). Individuals with anxiety symptoms are 30% more likely to be obese than non-anxious individuals. In addition, individuals that are severely obese are more likely to be depressed (Strine, et al., 2008).

Flourishing

We examined the associations of another mental health marker, flourishing, with dietary intake. Keyes (2002) reported that there is a mental health continuum from illness to wellness: (a) languishing and depression, (b) depression, (c) languishing, (d) moderate mental health and (e) flourishing. Flourishing is synonymous with optimal functioning and is the highest level of mental health on this continuum. It is comprised of two constructs: psychological functioning and social functioning (Fredrickson & Losada, 2005). In Fredrickson and Losada's work, psychological functioning includes the domains of self-acceptance, purpose in life, environmental mastery, positive relations with others, personal growth, and autonomy. Social functioning includes social

coherence, social integration, social acceptance, social contribution, and social actualization. Flourishing has been shown to be strongly associated with PR (Fredrickson & Losada, 2005). To date there is no research examining the relationship between flourishing and diet.

The Positivity Ratio and Flourishing

Researchers find that both positive and negative emotion can co-occur (Folkman & Moskowitz, 2000). A large segment of health behavior research has focused on the consequences that negative emotions have on health behaviors, and more recent research has focused of positive emotions and health behaviors. There may be a relationship between the positivity ratio (PR, ratio of positive to negative emotion) with dietary intake that has yet to be investigated. Higher PR's have predicted improved subjective well-being, marital relationships, and team performance of businesses (Barber et al, 2010). Frerickson and Losada (2005) found that a PR above 2.9 is associated with flourishing. This association indicates that the co-occurrence of positive and negative emotion is significantly correlated with flourishing. As such, PR may mediate a relationship of flourishing with dietary intake. To date there have been no studies that have examined the relationship of PR with dietary intake.

Dietary Intake

Dietary intake can be used as a coping strategy to decrease frequent negative affect as explained by the negative affect-mood repair hypothesis (Kiviniemi et al, 2011). This hypothesis posits that individuals consume foods at a higher rate if the foods are associated with positive feelings and consume foods at a lower rate if they are associated with negative feelings. For example, the presence of negative emotion has been linked to

the consumption of high calorie sweet foods (ice cream, cookies, and chocolates) to enhance positive feelings (Dube, et al. 2005). Kiviniemi et al. (2011) believe there is a social cognitive mechanism of decision making involved in food choices such that when an individual is experiencing negative emotion they will likely engage in behaviors that are associated with positive feelings. Kiviniemi and Duangdao (2009) showed that the association between individuals' beliefs about the benefits and barriers of fruit and vegetable consumption was mediated by whether the individuals had positive or negative affective associations regarding fruits and vegetables. Those with a lower PR may be inclined to eat meat because they have a positive association with meat. Dube et al. (2005) report that meat has been shown to be a comfort food especially for men because it alleviates negative feelings by increasing serotonin or opioid levels in the brain (Dube et al., 2005). In addition, positive emotions lead to improved self-regulation (Tice et al, 2007), and as a result, individuals are able to engage in healthier eating, such as increased fruit and vegetable intake (Anderson et al, 2007).

There is limited data on the relationships between emotions and dietary intake and no data on PR, flourishing and dietary intake patterns. Thus, the principal aim of this study is to examine these relationships. We hypothesize that both PR and flourishing will be positively associated with fruit and LGV intake, and inversely associated with meat intake. In addition, we will examine whether PR mediates the relationship between flourishing and dietary intake.

Methods

Participants and Procedures

The Adventist Health Study-2 (AHS-2) is a prospective study of approximately 96,000 members of Seventh-day Adventist churches from Canada and the United States (Butler, et al., 2008). A random sample of 20,000 AHS -2 participants were randomly selected to receive the Biopsychosocial Religion and Health Study (BRHS) questionnaire, of which 10,988 responded. A cross-sectional research design was used to examine archival data from the BRHS collected from September 2006 to August 2007. Those who were not SDA (n = 253), under age 35 (n = 134) and not White or Black (n = 700) and those missing data on any of these variables were excluded because they were outside the original AHS-2 study parameters leaving 9,759. Individuals who currently drank alcohol (n = 537) or who smoked (n = 75) were also excluded because they were atypical of the Seventh-day Adventist sample as a whole and because these health behaviors might be confounded with the primary outcome variables in this study. This left a total of 9,222 for possible study inclusion. Finally, 715 individuals who were missing more than two of the variables making up the positivity/negativity ratio or the flourishing variables were excluded leaving a total of 8,507 individuals in the analysis data set. To have excluded all individuals missing any of this data would have left us with a sample of only 6,624 since so many of these missing variables were not on the same individuals. Thus, we used the SPSS v 20 expectation maximization procedure to impute the missing values on the scales making up the flourishing and positivity/negativity ratio variables to keep data loss to a minimum. Following Schafer and Graham's recommendations (2002) we used all available demographic and study

variables except the outcome variables in this imputation allowing information from other data in the data set to provide information for variables that were correlated with them.

Measures

Positive and Negative Emotions. Positive and negative emotions were measured by the short form of the Positive and Negative Affect Schedule (PANAS) (Mackinnon, et al., 1999). This 10-item scale includes five items on positive emotions (inspired, alert, excited, enthusiastic, and determined) and five items on negative emotions (afraid, upset, nervous, scared and distressed). Each of these adjectives was rated on a 0-4 point scale (*very slightly/not at all to extremely)* as to "what extent have you felt these emotions in the past year?" Cronbach's alphas were .85 for positive affect and .87 for negative affect.

Flourishing. The scales selected to assess flourishing were divided into two domains: social and psychological functioning.

Social Functioning. There were six measures of social functioning taken from two different scales.

Positive and Negative Social Exchanges (PANSE). The PANSE assesses two broad domains of social exchanges—positive and negative. This scale assesses social exchanges over a 4-week period (Newsom, et al., 2005). Participants rated each of the items from *never* to *very often* on a 5-point rating scale.

Religious Support Scale. Three-item subscales of emotional support received, emotional support given, anticipated support and negative interaction were used to assess social integration within a congregation on a 5-point scale (*never* to *always*) (Krause, 1999).

Psychological Functioning. Psychological functioning was assessed with four scales.

Mastery. This scale measures the degree of which individuals believe they can influence their environment and cause a desired outcome to occur. Respondents rated four items on a 7-point scale (*not true* to *true*) (Pudrovska, et al. (2005).

Rosenberg Self-Esteem Scale. This scale is widely used and is a reliable and valid measure of self-worth and acceptance (Robins, et al., 2001). It consists of 4-items with ratings on a 7-point scale (*not true* to *very true*)

Spiritual Meaning Scale. Mascaro, et al. (2004) developed the Spiritual Meaning Scale (SMS) comprised of 14 items to assess purpose in life. Participants provided ratings on a 3-point scale (*not true,* to *very true*). Five items with the largest factor loadings in Macaro et al.'s study were selected for use in BRHS.

Perceived Stress Scale. Cohen, et al. (1983) developed the Perceived Stress Scale (PSS). The 4 item version was used to assess the degree that situations in one's life are perceived as stressful on a 5-point scale (*never* to *very often).*

Dietary Intake. Respondents were asked to estimate their frequency of intake over the past 12 months for various food items. Frequency categories were converted to weekly intake, thus *never or rarely* was assigned a weight of 0; *1-3 per month* was assigned a weight of 0.5; *1 times per week* was assigned a weight of 1; *2 to 4 times per week* was assigned a weight of 3; *5 to 6 times per week* was assigned a weight of 5.5; *1 time per day* was assigned a weight of 7; *2 to 3 times per day* was assigned a weight of 17.5; *4 or more times per day* was assigned a weight of 32.5. Weighted frequencies under each of the food groups were summed to produce a total score. Factor analysis on

the 14-item food frequency questionnaire revealed three main food groups. These included fruit, LGV, and meat. Fish, vegetarian protein, soy milk, and dairy-based cheese intake did not load high with these foods and therefore were not included as part of the dietary intake patterns examined. Fruit included any kind of frozen, canned or dried fruit, as well as raw or cooked fruits. Leafy green vegetables consisted of broccoli, cabbage, brussel sprouts, kale, collards, mustard greens, poke salad, ruccola, and other LGV. Meat included red meats, turkey and chicken. Means and confidence limits for the diet variables are found in Table 5.3.

Control Variables. Control variables included gender, age, education (5-point scale from < high school to doctoral degree), economic status, ethnicity (Black or White) and self-reported BMI. Economic status was assessed by the question, "how difficult was it for your family to meet expenses for basic needs like food, clothing, and housing, in the past year," to which individuals responded to a 5-point rating scale (*not at all* to *very*) (Pudrovska, et al., 2005). Information on the sample demographics is shown in Table 5.2.

Data Analysis

Calculation of the Positivity Ratio. Positive and negative affect were calculated as the sum of the individual responses to all of the five items on each affect scale from *very slightly/not at all* (0), *a little* (1), *moderately* (2), *quite a bit* (3), *or extremely* (4). Thus, a maximum score of 20 and minimum score of 0 was possible for each affective valence. The PR was calculated as the ratio between the positive score and the negative score. There was no need to correct for a negative affect score of zero because there were no such cases. Means and 95% confidence limits for PR are in Table 5.3.

This method differed from Fredrickson and Losada (2005) who had participants rate how they felt every 24 hours to the extent of both positive and negative emotions from not at all to extremely (5 point rating scale) for 28 days. They divided the total number of positive emotions by the negative emotions for the month indicating the positivity ratio. Our PR measurement was similar to Shrira et al. (2011) who measured positive and negative affect with the Affect Balance Scale that included 5 positive affect and 5 negative affect items. The positivity ratio was calculated by dividing the mean positive affect by mean negative affect whereas we used the sum rather than the means for this ratio calculation.

Calculation of Flourishing. Fredrickson and Losada (2005) defined flourishing to include two constructs: psychological and social functioning. In the present study we conceptually matched Fredrickson and Losada's two constructs with subscales in the BRHS dataset. In our study, flourishing was composed of four psychological functioning domains (mastery, self-esteem, and purpose in life, and perceived stress), and 6 social functioning domains (positive social exchanges, negative social exchanges, and the four religious support scales described earlier). These 10 seemed a good match for 7 of the 11 positive functioning areas of Fredrickson and Losada's model (2005) as we show in Table 5.1. In total, there were 10 scales that made up the flourishing construct in our study. Each negative scale was rescaled into a positive scale by multiplying by minus one. We converted each of the 10 subscales to standard scores (z-scores) and summed these scores.

Our method differed from Diener et al. (2010) who used an eight item scale including positive relationships, having positive meaning and purpose, feelings of

competence, being engaged and interested in daily activities. Our construct of flourishing was similar to that of Fredrickson and Losada's (2005) where we used both psychological and social functioning scales though we used a sum of standardized scores rather than a count of the number of scales that were in the top tertile. We also tried the tertile method but the results, while consistent with what we found with our method, were weaker as might be expected since the tertile method discards information. Means and confidence limits for the flourishing variable are in Table 5.3.

Plan for Statistical Analysis. To test the association of PR with flourishing we used partial correlation. The effect of PR and flourishing on dietary intake was analyzed by using multiple linear regression while controlling for gender, ethnicity age, education, and difficulty meeting expenses. We then examined the mediating effect of PR on flourishing, in influencing dietary intake by comparing differences between β coefficients when PR and flourishing were regressed separately and together. We analyzed these relationships with and without control for BMI. Finally, interactions with gender and ethnicity on PR and flourishing in predicting dietary intake were tested. A significance level cutoff of .01 was used in this study due to the large sample size.

Results

Associations of Diet with Positivity Ratio and Flourishing

Results from regression analyses are shown in Table 5.4. A higher PR was associated with increased fruit, and LGV intake, and lower meat intake after controlling for gender, ethnicity, age, education, and difficulty meeting expenses. When we added flourishing as a covariate, the β coefficient of PR dropped from 0.108 to 0.058 for fruit intake, from 0.108 to 0.076 for LGV intake, and from -0.068 to -.051 for meat intake, but

remained significant (p<.001) for each of these associations. Similarly, flourishing was significantly associated with all dietary intake variables. When PR was added as a covariate the β coefficient of flourishing dropped for both fruit and LGV intake (0.128 to 0.099, and 0.101 to 0.063, respectively), but remained significant (p=<.001). For meat intake the β coefficient weakened (from -0.058 to -0.033) and became non-significant (p=0.10).

In a separate regression analysis, we made additional adjustment for BMI. Again, we found that each dietary intake was significantly related to PR and flourishing. When we added flourishing as a covariate, the β coefficient of PR dropped from 0.122 to 0.093 for fruit intake, from 0.100 to 0.062 for LGV intake, and from -0.058 to -0.047 for meat intake, but remained significant (p<.001) for all associations. When PR was added as a covariate the β coefficient of flourishing dropped for both fruit and LGV intake (0.128 to 0.099, and 0.101 to 0.063, respectively); however, remained significant (p<.001). For meat intake the β coefficient weakened (from -0.044 to -0.020) and was no longer significant (p=0.103). The association between PR and flourishing, when controlling for age, gender, ethnicity, and economic status, was significant (r=.502, p<.001).

Figure 5.1 demonstrates that flourishing increases as PR does, and when PR reaches approximately 1.9, flourishing levels still appear to increase, but not as sharply. We found that the mean for PR in our study was 2.4 (CI=.23, 5.0; SD=1.02). The mean (z-score) of flourishing was .006 (CI=-.242, 1.45; SD=.52). There were no interactions found for gender and ethnicity with PR and flourishing when predicting dietary intake.

Discussion

We found dietary intake to be significantly associated with PR and flourishing. We also found that PR and flourishing were significantly correlated, and that PR but not flourishing had and an independent negative association with meat intake.

Although PR has not been examined with dietary intake in previous studies, there is evidence that increasing levels of PR result in positive behaviors (Fredrickson & Losada, 2005). It should be noted that with lower PR levels, negative emotion may become more of an influential factor affecting dietary intake decision making because the negative emotion effects are not offset by positive emotions. In this case, individuals may choose foods other than fruits and vegetables, which are associated with positive feelings and feeling enhancing one's mood (Kiviniemi et al., 2011), such as sweet foods (e.g. ice cream, cookies) or meat (Dube et al., 2005), though these sweet foods were not examined here. The inverse relationship of PR with meat intake supports the idea that meat intake may be associated with more negative emotions, although we found no gender differences as in a previous study (Yannokoulia, 2008). However, only about half of these Seventh-day Adventist study participants eat any meat as the religious doctrine dictates a vegetarian diet; as such, those who eat meat may be different than those who do not in this study group (Nyenhuis et al. 2003). As with PR, flourishing was significantly associated with all dietary variables giving us new information about these relationships.

The contribution that religious support had as part of the flourishing construct may be significant. Son and Wilson (2011) found that religiosity and health behavior are related (Son and Wilson, 2011). They also go on to say that religion boosts many of the aspects of flourishing that we measured, such as self-esteem, social support, mastery, and

purpose in life. Furthermore, they indicate that religion provides for healthier lifestyles. Faith may be an integral part of why individuals have increased PR's and flourishing levels in this SDA population. It would be important to examine in future studies whether PR and flourishing are enhanced by religious support or religiousness in general.

The present study corroborates findings from other studies that report PR to be directly related to flourishing (Fredrickson and Losada, 2005). Conceptually, PR and flourishing are similar because both are measures of mental health. Because previous research was based on positive or negative emotion, and not a PR, this yields new information related to PR with health behavior. Individuals with PR $\geq$ 2.9 are considered to be flourishing or achieving an optimal level of well-being (Fredrickson and Losada, 2005). We found that 29.4% of the participants in our study had PR's of 2.9 or greater. To investigate the form of the relationship between PR and our flourishing score we created a scatterplot of all individuals in our sample (N=8507) and then used a locally weighted scatterplot smoothing (LOESS, Cleveland, 1979) to investigate the relationship between PR and flourishing in our sample. Our results support Fredrickson and Losada's findings that for flourishing to occur, the positivity ratio must be larger than some value but in our case the inflection point is at 1.9 rather than 2.9. This difference could simply be due to the different metrics we used to assess the positivity ratio. Our results, on the other hand, do not support the idea that at a given positivity ratio flourishing occurs, and below that there is no flourishing. Instead, flourishing appears to be a relatively rapidly increasing function of the positivity ratio but at some point increased positivity ratio starts having a less decided association with flourishing. It should be noted that Fredrickson and Losada (2005) found that once the positivity ratio reached 11.6

flourishing begins to disintegrate. However, in our sample the method precluded a positivity ratio above 5.0 so we could not test this prediction.

When examining mediating effects, we found that flourishing did not mediate the relationship between PR and dietary intake, further confirming the independent effect of PR on dietary intake. On the other hand, we found that PR partially mediated the relationship of flourishing and meat intake.

The study has limitations. Although we found associations of PR and flourishing with dietary intake, the causal direction is unknown due to the cross-sectional nature of the study. This relationship could be demonstrated with longitudinal data which is forthcoming in the BRHS. Other limitations include the self-report nature of the questionnaire in this study in which responders may have misrepresented details of their mental health status and dietary habits. Another limitation may be that our sample included only Seventh-day Adventists and the results may not be generalizable to the non-Seventh-day Adventists. The abbreviated diet questionnaire is a limitation because it does not represent the full spectrum of the diet.

This study used a novel approach in examining both PR and flourishing with dietary intake. Additional research should be conducted in this area to validate the results and determine whether interventions aimed at enhancing flourishing and PR would improve dietary intake patterns. Assuming that future studies suggest that the causal direction is from PR to dietary intake, results from this study may be used by practitioners and researchers in designing appropriate interventions (e.g. emphasizing positivity in health education classes) to influence dietary intake.

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Table 5.1

Comparison of Flourishing Scales

Categories	Keyes (2002)	Fredrickson and Losada (2005)	Current Study	Cronbach's Alpha of Current Study
Emotional Functioning:				
Presence of Positive Affect	✓			
Absence of Negative Affect	✓			
Psychological Functioning				
Self-Acceptance	✓	✓	✓ (Rosenberg Self-Esteem Scale)	0.77
Purpose in Life	✓	✓	✓ (Spiritual Meaning Scale)	0.71
Enviromental Mastery	✓	✓	✓ (Mastery)	0.73
Positive Relations with Others	✓	✓		
Personal Growth	✓	✓		
Autonomy	✓	✓	✓ (Perceived Stress Reversed)	0.77
Social Functioning				
Social Coherence	✓	✓	✓ (Some Religious Support Scales)	.78, .82, .91, .74
Social Integration	✓	✓	✓ (Religious Social Support/	.78, .82, .91, .74/.87, .86
Social Acceptance	✓	✓	Positive and Negative Social Exchanges)	
Social Contribution	✓	✓	✓ (Religious Social Support/	.78, .82, .91, .74/.87, .86
Social Actualization	✓	✓	Positive and Negative Social Exchanges)	

Table 5.2
Demographics

		%	*n*
Gender			
	Female	67.1	5,705
	Male	32.9	2,802
Ethnicity			
	White	63.8	5,429
	Black	36.2	3,078
Age			
	35-44	10.3	874
	45-54	21.1	1,797
	55-64	26.4	2,250
	65-74	22.8	1,941
	75-84	15.3	1,302
	85-101	4.0	343
Level of Education			
	Trade or High School or Less	22.8	1,936
	Some College or Associate Degree	33.5	2,839
	Bachelor's Degree	22.9	1,944
	Master's or Doctorate	20.7	1,756
Difficulty meeting expenses for basic needs within the last year			
	Not at all	70.5	6,001
	A little	15.8	1,347
	Somewhat	6.2	525
	Fairly	4.4	372
	Very	3.1	262
BMI			
	Underweight	1.9	158
	Healthy Weight	38.3	3,257
	Overweight	34.1	2,901
	Obese	22.0	1,873
	Severely Obese	3.7	318

Table 5.3

Means for Diet Variables, Positivity Ratio, and Flourishing

		95% Confidence Interval	
	Mean	Lower Bound	Upper Bound
Fruit[a]	12.36	12.18	12.55
Leafy Green Vegetables[a]	9.35	9.16	9.55
Meat[a]	1.50	1.43	1.56
Positivity Ratio[b]	2.40	2.37	2.42
Flourishing[c]	0.01	-0.01	0.02

[a]Fruit, Leafy Green Vegetable, and Meat Intake is times consummed per week.

[b]Positivity Ratio is Positive Affect/Negative Affect.

[c]Flourishing is the sum for z-scores on mastery, self-esteem, meaning in life, perceived stress (reversed), positive social exchanges, negative social exchanges (reversed), and four kinds of support from one's congregation (emotional support given, emotional support received, anticipated support and negative interactions [reversed]).

Table 5.4

Regression of Dietary Intake Variables on Control Variables, Positivity Ratio and Flourishing

	Fruit		Green Leafy Vegetables		Meat	
	β	*p*	β	*p*	β	*p*
Controlled for gender, ethnicity, age, education and difficulty meeting expenses						
Regressed separately						
Flourishing	0.128	<.001	0.101	<.001	-0.058	<.001
Positivity Ratio	0.108	<.001	0.108	<.001	-0.068	<.001
Regressed together[a]						
Flourishing	.099	<.001	.063	<.001	-.033	0.10
Positivity Ratio	.058	<.001	.076	<.001	-.051	<.001
Controlled for gender, ethnicity, age, education, difficulty meeting expenses, and BMI						
Regressed separately						
Flourishing	0.122	<.001	0.100	<.001	-0.044	<.001
Positivity Ratio	0.103	<.001	0.107	<.001	-0.058	<.001
Regressed together[a]						
Flourishing	.093	<.001	.062	<.001	-.020	0.103
Positivity Ratio	.056	<.001	.076	<.001	-.047	<.001

[a]Positivity ratio was included as a covariate when flourishing was regressed with the dependent variable. Flourishing was included as a covariate when positivity ratio was regressed with the dependent variable.

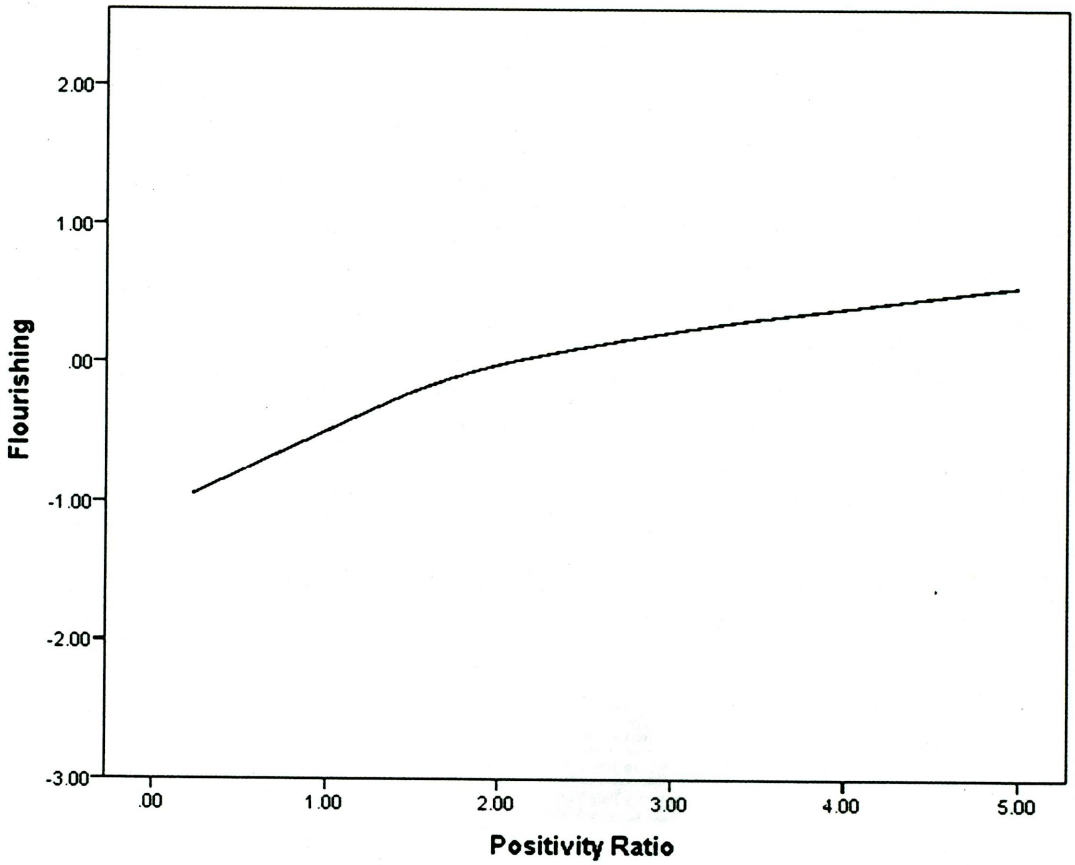

Figure 5.1 Loess smoothing of the scatterplot showing the relationship of the positivity ratio with flourishing (N = 8,507)

CHAPTER 6

CONCLUSION

A. Overview

Prior studies have focused on individual components of affect, both positive and negative, with health behavior; however, since individuals experience both positive and negative emotion on a daily basis it is important to explore how the ratio of positive to negative emotion (PR) affects health behavior outcomes. In addition, there appear to be no studies thus far that have examined the associations of both positivity ratio and anoth mental health marker, flourishing, with health behavior since they are both relatively new concepts. While previous studies by Fredrickson and Losada (2005) have found a robust association between the positivity ratio and flourishing no studies related the two constructs with physical activity and dietary intake. Furthermore, gender and ethnic differences were examined in the above associations.

B. Research Questions

- How is PR associated with:
    - Physical Activity? Physical activity measured by examining minutes of vigorous exercise per week was found to be positively associated with PR.
    - Dietary Intakes of Fruit, LGV and Meat Intake? The PR was positively associated with fruit and LGV intake, and inversely associated with meat intake.
- How is flourishing related to physical activity and fruit, LGV, and meat

intake? Flourishing was directly related all of the health behaviors examined.

- Are PR and flourishing significantly associated with one another? We found that PR was significantly associated with flourishing.
- Are associations of PR with health behaviors mediated by flourishing? There were no mediating effects found for these relationships.
- Are associations of flourishing with health behaviors mediated by PR? PR partially mediated the relationship of flourishing with physical activity and with meat intake (with and without controlling for BMI).
- How do gender and ethnicity influence the above associations? No gender and ethnic differences were found in the above associations. Interactions of gender and ethnicity with PR and flourishing in predicting physical activity and dietary intake were not found.

C. Limitations of the Study

Although we found both PR and flourishing were associated with physical activity and dietary intake, the direction of these relationships is unknown due to the cross-sectional nature of the study. Future studies could elucidate the connections between these variables with longitudinal data which is forthcoming in the BRHS. Our flourishing construct may not have been as comprehensive as those in previous studies, which may have affected the outcomes. Other limitations include the self-report nature of the questionnaire in this study in which responders may have misrepresented details of their mental health status, physical activity and dietary habits. Another limitation is that all of the subjects are either Black or White, making the sample non-representative of

other races. The abbreviated diet questionnaire is a limitation because it does not represent the full spectrum of the diet. Also, the length of the questionnaire possibly influenced subjects' decision to participate in the study.

D. Future Directions

Being that this is likely the first study of its kind to examine the associations of PR and flourishing with health behaviors, additional studies, both cross-sectional and longitudinal, could yield new information concerning these associations. Future studies should include a uniform approach to measuring the constructs of PR and flourishing, as well as the health behaviors of physical activity and dietary intake. Since the data was collected on Black and White Seventh-day Adventists, other ethnicities and religious groups could be examined.

E. Implications for Preventive Care and Psychology

Several outcomes from this study may be helpful in providing guidance for future interventions to increase healthy behaviors throughout the population. Additional research should be conducted in this area to validate the results and determine whether interventions aimed at enhancing flourishing and PR would improve physical activity and dietary intake patterns. The results may better inform both psychologists and preventive care specialists with regard to the associations between mental health and health behavior. The findings from this study serve to reinforce the idea that enhancing positivity and mental health in adulthood may increase positive health behaviors, though it may be that positive health behaviors enhance emotional health. Educational seminars could be developed to enlighten the public about the associations of emotion, psychological and social functioning on physical activity and dietary intake. In addition,

coping strategies for negative emotion may booster health behaviors. If interventions aimed at increasing PR and flourishing are found to improve health behaviors, health care professionals could be educated on the above associations, thus making them better equipped and aware in treating their patients.

F. Conclusion

This study was novel in that it is likely to be the first to examine how PR and flourishing affect health behavior. Because our results showed that PR and flourishing are both associated with health behavior, it would be advantageous for researchers to look at the specific results of this study and create study designs to test possible causal connections. Future studies could also examine associations of religiosity with the positivity ratio, flourishing and health behavior. Finally, there needs to be additional research studies conducted in this area to validate the results.

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