

BODY MASS INDEX AMONG SEVENTH-DAY ADVENTISTS
LIVING IN JOHNSON COUNTY

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I am submitting herewith a dissertation written by Krystal Rae Hauff entitled "Body Mass Index among Seventh-day Adventists Living in Johnson County." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Health Studies.

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DEDICATION

This accomplishment is dedicated to my mother, who believes that I can do anything so fervently that at times, I almost believe that I can.

ACKNOWLEDGEMENTS

Thanksgiving and praise are given to my Heavenly Father. Without His strength and care this would not have been possible. I especially recognize the individuals He placed in my life at various times for various purposes to assist me in my journey. These include my husband Brian, my advisor and committee chair, Dr. Ward, and the inspiring educators throughout my life, as well as numerous others, many whose significance I don't even realize.

ABSTRACT

KRYSTAL HAUFF

BODY MASS INDEX AMONG SEVENTH-DAY ADVENTISTS LIVING IN JOHNSON COUNTY

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In the past, Seventh-day Adventists (SDAs) have enjoyed longer lives with less disease. With the dramatic increase in body mass index among Americans over the past couple decades, little research has been done to examine the effects among SDAs. The purpose of this research was to study the current health status of SDAs living in Johnson County by using body mass index (BMI). Potential variables responsible for the current health status were also explored.

Results indicated a significantly ($p=.05$) lower BMI among SDAs living in Johnson County than among individuals living in the Texas state health region 2/3, in which Johnson County is located. The mean BMI among the SDA sample, however, was still found to be in the overweight category. BMI was also significantly ($p=.01$) lower among the vegetarian SDAs in this sample compared to the non-vegetarian SDAs. It is possible that it is the vegetarian lifestyle practiced by many SDAs that is responsible for the lower overall BMI. No correlation was found between the BMI of the sample and any of the following variables: age, years as vegetarian, church attendance or years as a baptized member of the SDA church.

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CHAPTER I

INTRODUCTION

Rationale

Seventh-day Adventism (SDA) is a protestant religion that bases its beliefs strictly on biblical principles. It does not rely on church traditions or proclamations from church leaders unless they can be backed by biblical teachings (Ministerial Association General Conference of Seventh-day Adventists, 1988). The SDA religion has adopted certain health practices as a fundamental belief. They take seriously the statement in 1 Corinthians 6:19 that the human body is the temple of God. They, therefore, treat the body as holy, attempting to keep it operating at an optimal level to better serve God and enjoy life.

In *Seventh-day Adventists Believe...* (1988), specific guidelines are given on how best to live in optimal health. These include abstaining from alcohol, tobacco, caffeine, and pork. Many SDAs are also vegetarian. Fresh fruits and vegetables, high fiber and low fat foods are encouraged. Daily exercise, fresh air, plenty of water and rest are also strongly recommended. The SDA religion has the largest Protestant educational system in the United States. These health guidelines are adamantly taught in the educational institutions. SDAs also tend to be very committed to their religion, leading to good adherence to these health practices. Numerous studies have shown that SDAs have a lower rate of heart disease (Alexander, Lockwood, Harris, & Melby, 1999; Berkel & de

Waard, 1983; Fraser & Babaali, 1989; Phillips, Garfinkel, Kuzma, Beeson, & Lotz, and Brin, 1980; Rouse, Armstrong; & Beilin, 1982; Wynder & Lemon, 1958; Wynder, Lemon, & Bross, 1959) cancer (Jensen, 1983; Mills, Beeson, Phillips, and Fraser, 1994; Phillips, Garfinkel, Kuzma, Beeson, Lotz, & Brin, 1980; Snowdon and Phillips, 1985; Snowdon, Phillips, & Choi, 1984; Wynder & Lemon, 1958; Wynder, et al., 1959), diabetes (Alexander, et al., 1999; Snowdon & Phillips, 1985), and respiratory diseases (Lemon & Walden, 1966) and tend to live longer than the normal population (Berkel & de Waard, 1983; Fonnebo, 1992; Fraser & Shavlik, 2001; Fraser, Sumbureau, Pribis, Neil, & Frankson, 1997; Snowdon, 1988).

The lower risk for many chronic diseases among SDAs is typically attributed to their healthy lifestyle, which in turn leads to a decrease in risk factors such as hypertension and cholesterol levels. However, considerably less research has been done on the body mass index (BMI) within the SDA population. BMI is a quick and easy way to estimate one's inclination toward certain diseases related to obesity. BMI is more accurate in estimating an individual's inclination toward chronic disease than height-weight tables but is not as accurate as calculating body fat percentage using skinfold testing or hydrostatic weighing. Obesity related problems begin with a BMI at or above 25 kg/m² for most people. A BMI of 25 kg/m² to 30 kg/m² is classified as overweight and above 30 kg/m² is considered obese (Whaley, Brubaker, & Otto (eds.), 2006).

Statement of the Purpose

The purpose of this study is to compare the average BMI of Seventh-day Adventists living in Johnson County to the average BMI of Texas residents living in the

Health Service Regions 2 & 3. This study will also compare the BMI among vegetarian and non-vegetarian SDAs, as well as the correlation between age, church attendance, years as a vegetarian and years as a church member and BMI among SDAs living in Johnson County.

Hypotheses

The hypotheses that will be addressed in this study are as follows.

1. There is no statistically significant difference in the BMI between SDAs in Johnson County and the BMI of Texas residents living in the Health Service Region 2/3.
2. There is no statistically significant difference between the BMI of vegetarian SDAs and non-vegetarian SDAs living in Johnson County.
3. There is no correlation between age and BMI among SDAs living in Johnson County.
4. There is no correlation between church attendance and BMI among SDAs living in Johnson County.
5. There is no correlation between years as a vegetarian and BMI among SDAs living in Johnson County.
6. There is no correlation between years as a member of the SDA church and BMI among SDAs living in Johnson County.

Delimitations

Delimitations of this study include the following.

1. This study will not include individuals less than 18 years of age.
2. This study is limited to baptized SDA members living in Johnson County.

Limitations

Limitations of this study are as follows.

1. The sample will be a convenience sample.
2. Individuals who weigh less may be more eager to participate than those who weigh considerably more.
3. Participants may round height and weight.

Assumptions

Assumptions of this study are included in the following statements.

1. Participants will understand the survey questions.
2. Participants will answer questions honestly.
3. Participants will know their current height and weight.
4. Individuals with a wide variety of heights and weights will participate in the study.

Definitions of Terms

Body Mass Index (BMI) – Originally named the Quetelet Index, body mass index is calculated by dividing an individual's weight in kilograms by his or her weight in meters squared. It is used to estimate an individual's weight status and utilizes the following categories: <18.5 Underweight; 18.5-24.9 Normal; 25-29.9 Overweight; ≥ 30 Obese.

Lacto-ovo Vegetarian – An individual who abstains from the consumption of all *meat*, but may or may not abstain from eating *animal products* such as milk and eggs.

Member of the Seventh-day Adventist Church – To become a member of the Seventh-day Adventist Church, an individual must, among other factors, be baptized by immersion in water as an adult.

Sabbath – Saturday, the day of weekly church services for the denomination.

Quetelet Index – Previous term for BMI; see Body Mass Index.

Vegan – An individual who abstains from all meat and animal products and those foods that contain meat and/or animal products.

Vegetarian – Usually used to describe lacto-ovo vegetarians in literature unless otherwise specified; see Lacto-ovo Vegetarian.

Importance of the Study

The research conducted up to this point looking at BMI among SDAs has typically been combined with other variables such as blood pressure and blood cholesterol (Alexander, Lockwood, Harris, & Melby, 1999; Fraser & Babaali, 1982; Fraser, Strahan, Sabate, Beeson, & Kissinger, 1992; Fraser, Sumbureru, Pribis, Neil, & Frankson, 1997; Singh, Fraser, Knutsen, Lindsted, & Bennett, 2000). The specific research outlined in this paper is certainly inconclusive as to whether or not a lower BMI exists within the selected religious population. The BMI data that is available is also out-of-date. Most of the research including BMI estimates took place twenty to thirty years ago. Considering how overweight and obesity trends have increased sharply over the last two decades, that data is basically obsolete. However, it is suggested that a lower body mass index may exist among *vegetarian* SDAs.

The Centers for Disease Control and Prevention (CDC) estimates that approximately 65% of the United States population is overweight or obese according to BMI standards (CDC, n.d.). The Texas State Department of Health Services estimates that 57.2% of Texas residents living in the Public Health Administrative Region 2/3 are

overweight (Texas DSHS, n.d.). Further research needs to be conducted to more accurately determine how this compares to the SDA population. If BMI is indeed lower among this specific group of individuals, others outside of the denomination may also benefit from their particular dietary and lifestyle habits.

CHAPTER II

REVIEW OF LITERATURE

The protestant SDA religion emphasizes optimal health as one of its fundamental beliefs in order to better serve God and enjoy life (Ministerial Association General Conference of Seventh-day Adventists, 1988). A vegetarian diet is strongly recommended. Among other guidelines, limiting high fat and/or high sugar goods, eating plenty of fresh fruits and vegetables and other nutritious, high fiber foods are encouraged.

The lower risk for many chronic diseases among SDAs (Alexander, Lockwood, Harris, & Melby, 1999; Berkel & de Waard, 1983; Fonnebo, 1992; Fraser & Babaali, 1989; Fraser & Shavlik, 2001; Fraser, Sumbureau, Pribis, Neil, & Frankson, 1997; Jensen, 1983; Lemon & Walden, 1966; Mills, Beeson, Phillips, and Fraser, 1994; Phillips, Garfinkel, Kuzma, Beeson, & Lotz, and Brin, 1980; Rouse, Armstrong, & Beilin, 1982; Snowdon, 1988; Snowdon and Phillips, 1985; Snowdon, Phillips, & Choi, 1984; Wynder & Lemon, 1958; Wynder, Lemon, & Bross, 1959) is typically attributed to their healthy lifestyle, which, in addition to the previously mentioned dietary recommendations, also includes abstaining from alcohol, tobacco, caffeine, and pork. These healthy lifestyle practices, in turn, lead to a decrease in risk factors such as hypertension and cholesterol levels. However, considerably less research has been done on the body mass index (BMI) within the SDA population.

Increases in BMI among Americans have not been linear over the last 40 years. Numbers have dramatically increased over the last two decades (Hedley, et al., 2004). Herein lies another problem with the research involving Adventists and their BMI. Much of the research is out-of-date. The data need to be more current to accurately represent how Adventists compare to the rest of the U.S. population for BMI. Are they still healthier? Has their BMI increased at the same rate? Has it increased to the alarming degree as the U.S. obesity rates?

BMI is an estimation of one's inclination toward certain diseases related to obesity. It is calculated by dividing body mass in kilograms by height in meters squared.

$$\text{BMI} = \text{mass (kg)} \div \text{height (m}^2\text{)}$$

BMI is more accurate in estimating an individual's inclination toward chronic disease than height-weight tables but is not as accurate as calculating body fat percentage using skinfold testing or hydrostatic weighing. Obesity related problems begin with a BMI at or above 25 kg/m² for most people. A BMI of 25 kg/m² to 30 kg/m² is classified as overweight and above 30 kg/m² is considered obese (Whaley, Brubaker, & Otto (eds.), 2006).

The Center for Disease Control & Prevention (CDC) (n.d.) reports that the average BMI for an adult man living in the U.S. is 26.6 kg/m² and 26.5 kg/m² for women of the same demographics. The latest research on the BMI of Americans is from 2001-2002. Statistics document that 65.7% of U.S. adults are overweight or obese, 30.6% are obese and 5.1% are extremely obese (BMI \geq 40 kg/m²) (Hedley, et al., 2004). Height and weight measurements to obtain BMI were taken from 4390 adults as part of the National

Health and Nutrition Examination Survey (NHANES). Although not significant, numbers in all three categories had increased from the 1999-2000 survey showing at least that the overweight and obesity epidemic in the U.S. is not decreasing, which has been an alarming trend since 1980.

While there was little change in the BMI among adults in the U.S. from 1960-1980, the next two decades were very different (Hedley, et al., 2004). Data from the NHANES 1976-1980 estimated that 47% of Americans were overweight and 15% were obese. By the time the 1988-1994 NHANES data were collected, 56% were overweight and 23% were obese. The next NHANES began only five years later in 1999 and already 65% of Americans were categorized as overweight while the prevalence of obesity was 31%, over double the percent from 1980.

BMI among SDAs

In 1974, a large research project, termed The Adventist Health Study (AHS), involving SDAs living in California, began. Purposes of the study included lifestyle behaviors of SDAs and the morbidity and mortality benefits that accompany them. The target population was SDAs living in California who were a minimum of 25 years of age. A questionnaire was mailed to 63,530 households that met these criteria (Beeson, Mills, Phillips, Andress, and Fraser, 1989). Numerous articles that reflect certain aspects or characteristics of the at-large study have been published. In this particular study, 27,658 non-Hispanic white SDAs who had no known history of heart disease were included (Fraser, et al., 1992). Average BMI among these participants taken about 30 years ago was found to be $24.9 \pm 3.5 \text{ kg/m}^2$ among men and $24.3 \pm 4.7 \text{ kg/m}^2$ among women.

Other research utilizing data from the AHS included 12, 576 non-Hispanic white women who reported never smoking (Linsted & Singh, 1997). Average BMI for this population was similar to the BMI of the previous study at 24.6 kg/m^2 .

Among a Californian SDA black population, Fraser, et al., (1997) found BMI to be 26.02 kg/m^2 for men and 26.99 kg/m^2 for women. The questionnaire, which asked for self-reported height and weight, among other life-style characteristics, was returned by 1740 black SDAs living in California. This research took place in 1976 during the AHS, and the mean age for respondents was 52 years for men and 53.4 years for women.

In a more recent study Singh, Fraser, Knutsen, Lindsted, & Bennett (2001) found BMI to be higher among African-Americans living in California than did Fraser, et al., (1997). One hundred eighteen African-American SDA women and forty-seven African-American SDA men participated. Mean BMI for the women, who had a mean age of 50 ± 15 years, was $28 \pm 6 \text{ kg/m}^2$. Mean BMI for the men, who had a mean age of 48 ± 14 years, was $26 \pm 3 \text{ kg/m}^2$.

Hispanic SDAs may have a lower BMI than Hispanic Catholics, according to Alexander and researchers (1999) in a comparison of the two groups in Denver, Colorado. The mean BMI for Hispanic SDAs was 27.2 kg/m^2 , while the mean BMI for Hispanic Catholics was 31.4 kg/m^2 . The difference between the means was found to be statistically significant. This research involved 74 Hispanic SDAs and 45 Hispanic Catholics.

Fraser and Babaali (1989) compared SDA men and their neighbors for exercise, fish consumption, smoking, alcohol, high density lipoprotein cholesterol and quetelet

index (which uses pounds and inches instead of kilograms and meters). One hundred sixty non-Hispanic white SDA men between the ages of 35 and 55 living in Orange or Los Angeles County, California were randomly chosen. Neighbors were chosen based on age and living distance (at least six doors away) from the SDA men. Three hundred twenty neighbors agreed to participate in the study.

Height and weight were measured for the Quetelet index, and no significant difference was found for the SDA men and their neighbors. The BMI for Adventist men was 27.42 kg/m² while their neighbors had a mean BMI of 26.72 kg/m² (when the Quetelet index was multiplied by 703.07 to convert to BMI). This research was conducted in 1982.

Table 1

Previous SDA BMI Research Results

Research	Year of Data Collection	Sample	BMI-men	BMI-women
Fraser, et al.	~1976	Non-Hispanic White Californians	24.9	24.3
Linsted & Singh	~1976	Non-Hispanic White Californians	N/A	24.6
Fraser, et al.	~1976	Black Californians	26.02	26.99
Fraser & Babaali	1982	Non-Hispanic White Californians	27.42	N/A
Alexander	~1999	Denver Hispanics	27.2*	27.2*
Singh, et al.	~2000	Black Californians	28	26

*Author combined mean BMI

As previously mentioned, most data on SDA BMI are basically obsolete considering the large increase in obesity rates over the past decade. The more recent data is limited to specific sample groups, which does not accurately reflect the overall SDA population, as can be seen in Table 1. In their article “Understanding Obesity in Youth”, Gidding and associates (1996) point out that overweight children and adolescents tend to become overweight adults. This is particularly unsettling considering that over the last two decades, the number of overweight and obese children has continued to increase drastically, much like numbers of overweight and obese adults (Ogden, Flegal, Carroll, & Johnson, 2002). In the 1970’s, the percentage of overweight 6-11 years olds increased from 4 to 7. By the 1999-2000 NHANES, this number was 16, a four-fold increase. Overweight among 12-19 year olds changed little at 5-6% until the 1988-1994 NHANES. At that point the percentage had more than doubled, and by the 1999-2000 NHANES, the percentage had increased even more, to an estimated 16%.

Reviewing data on SDA youth, although not as readily available, may provide some insight as to the future obesity rates among SDA adults. In 1990, Sabate, et al. measured the height and weight and calculated the BMI for 542 boys and 548 girls aged 6-18 attending SDA schools in Southern California, and 609 boys and 573 girls aged 6-18 attending public schools in Southern California. The girls attending SDA schools were found to have a statistically significantly lower BMI than the girls attending public schools, although the difference was only 0.433 kg/m^2 . No statistically significant difference of BMI was seen with the two groups of boys.

Even more years have passed since Persky, et al. (1992) measured BMI, among other variables, for 35 vegetarian, SDA, female adolescents and 40 non-SDA, non-vegetarian, female adolescents. This research took place between 1984 and 1985, and no statistically significant differences were seen between the two groups of adolescent girls.

Results from the two studies suggest that BMI among SDA children is similar to the BMI of non-SDA children, and if trends continue, these SDA children will grow up to have similar BMIs as non-SDA adults. Ogden, et al. (2002) report that between 1988 and 1994 (during the time of the research), obesity among 6-19 years olds was 10.8%. The most recent data from 1999-2002 shows almost a 50% increase to 16%. Unfortunately, more recent BMI data among SDA children is not available.

Vegetarian vs. Non-vegetarian BMI

It may be the vegetarian aspect of the religion which accounts for the lower morbidity rate as more research from the AHS found that as consumption of meat increased, so did weight and BMI (Fraser, 1999). BMI among vegetarians was found to be 24.26 kg/m^2 , BMI among semivegetarians (those who ate fish and poultry, but < 1 time per week) was 25.18 kg/m^2 , and BMI among non-vegetarians was 26.24 kg/m^2 . Differences were statistically significant. It should be noted again, that although BMI is lower than may be expected for all groups, this data was recorded almost 30 years ago.

Using data from the AHS, Knutsen (1994) found BMI to be statistically significantly lower among vegetarian SDAs than among non-vegetarian SDAs. The BMI means were 24.2 kg/m^2 and 25.7 kg/m^2 respectively.

In 1987, black and white SDAs living in the Midwest were measured for height without shoes and weight with light, summer clothing (Melby, Goldflies, Hyner, & Lyle, 1989). Groups included black vegetarians, white vegetarians, black non-vegetarians and white non-vegetarians. Black vegetarians ($n = 55$) had a mean BMI of 26.3 kg/m^2 , while white vegetarians ($n = 164$) had a mean BMI of 24.6 kg/m^2 . Black non-vegetarians ($n = 59$) had a mean BMI of 31.4 kg/m^2 , while white non-vegetarians had a mean BMI of 27.4 kg/m^2 . A statistically significant difference was found between the black non-vegetarian group and each of the other three groups.

More recently, Toohey, et al., (1998) completed research involving 143 African-American SDA lacto-ovo vegetarians and 43 African-American SDA vegans living in the northeast. Subjects were measured for height without shoes and weight with indoor clothing, and also without shoes. The average age of the sample was 45 to 52 years. Results indicated a statistically significant lower mean BMI among vegans (24.7 kg/m^2) when compared to the lacto-ovo vegetarians (26.4 kg/m^2), and no difference between male and female BMI.

Rouse, et al. (1982) compared blood pressure and Quetelet index between vegetarian SDAs and Mormons, another religious group with suggested abstinence of caffeine, tobacco and alcohol. The authors hoped to better understand if it is primarily the vegetarian diet of many SDAs which causes them to have lower blood pressure than the general population or if the difference exists because of other factors such as alcohol, tobacco, religious affiliation, or obesity.

Comparisons were made between 113 Mormons and 98 vegetarian SDAs. None of the participants claimed to currently use alcohol or tobacco. A statistically significant higher Quetelet index among the Mormon non-vegetarians than among the vegetarian SDAs was found. Results suggest that it is the vegetarian aspect of the SDA religion which accounts for lower obesity rates rather than restriction of alcohol, tobacco, caffeine and other factors.

A study by Harman and Parnell (1998) reiterates that it may be the vegetarian component found in many SDA diets which is responsible for a lower BMI among the population. They compared the BMI between non-vegetarian and vegetarian New Zealand SDAs, along with blood pressure, and select vitamin, mineral, and lipid levels. Vegetarian participants included those who ate no meat (red meat, fish or poultry), but did consume dairy products and eggs, as well as vegans, who do not eat any animal derived products, including eggs and dairy products. Their results showed that non-vegetarian SDAs had a BMI higher than the New Zealand national average of 25 kg/m^2 for both men and women, while both genders of vegetarian SDAs had a BMI below the national average. Even though the results would categorize the non-vegetarian mean as “overweight” and the vegetarians as “healthy weight”, the difference between the groups (2.25 kg/m^2) for each gender was not statistically significant. The lack of significance might be attributed to the small sample. Only 11 male non-vegetarians, 12 male vegetarians, 12 female non-vegetarians, and 12 female vegetarians participated.

It is interesting to note that the mean age for the vegetarian men was nine years older than the male non-vegetarians. Vegetarian women were on average, four years

older than their non-vegetarian counterparts. The creeping obesity typically seen among aging individuals was not documented in this study. Perhaps with a larger sample and closer control of age, additional statistically significant results would be seen.

The research conducted up to this point looking at BMI among SDAs has typically been combined with other variables such as blood pressure and blood cholesterol. The specific research outlined in this paper is certainly inconclusive as to whether or not a lower BMI exists within the selected religious population. However, it is suggested that a lower BMI may exist among *vegetarian* SDAs.

Other Variables

As previous research suggests, vegetarian SDAs may increase their health benefits by possessing a lower BMI when compared to non-vegetarian SDAs. Other research suggests that there may be other non-dietary variables that can cause the health of SDA members to vary greatly.

Length of Membership

Length of membership in the SDA church has been shown by some research to have an impact on the health benefits of the SDA lifestyle. Fonnebo (1992) found that Norwegian SDAs had a statistically significant higher rate of cancer mortality if they entered the church over the age of 35 years when compared to those joining the church younger than 35 years of age. Only those members who joined the church under the age of 19 saw a statistically significant reduction in mortality risk compared to the general population. Statistically significant reductions in cardiovascular mortality (56% for men

and 48% for women) were seen only in those persons entering the church before the age of 19.

Nyenhuis, et al. (2003) chose to study a sample of Black SDAs and found that participants adhered well to church health and spiritual practices. However, risk of cardiovascular disease was still high, similar and therefore not statistically significantly different when compared to the general population. Average age of participants was 57.4 years, while the average age of baptized membership was 26.2 years. The lack of statistical significance could be reflective of the high percentage of adult converts and/or the high mean age of participants.

The results of research by Mills, Beeson, Phillips, & Fraser (1991) were unexpected and could not be explained by the authors. Bladder cancer risk was assessed from data obtained from the AHS. In relation to length of membership, it was found that subject who had been baptized at a later age had the lowest risk of bladder cancer compared to lifelong members.

Phillips (1975) also encountered unexpected results when he investigated the roles of lifestyle and dietary habits for cancer risk among SDAs. While stomach cancer was higher among recent converts to the SDA religion, cancer risk was lower among recent converts for colon and breast cancers when compared to life-time members. The author suggested that perhaps individuals new to the religion were more stringent in their adherence to the health principles and that recent health habits were more important than health habits early in life. These assumptions, however, are not supported by data.

Church attendance

Baptized SDA church members in Norway were classified as either active or inactive by Fonnebo (1988). Inactive members were simply described as “persons who had joined the church but had later chosen to not be active members”. Inactive members were found to have diets almost similar to non-SDAs. Inactive members were also found to have similar levels of total cholesterol, HDL-cholesterol, and systolic and diastolic blood pressures to non-SDAs. Total cholesterol, systolic and diastolic blood pressures were even higher among inactive members than among non-SDAs. Results suggest that only those members who are actively involved with the church and the church principles will reap the health benefits.

Healthy Volunteer Effect among SDAs

In their article, Lindsted, Fraser, Steinkohl, and Beeson (1996) test for and discuss the healthy volunteer effect during the AHS. The first questionnaire sent to participants during the AHS involved demographic census information. Two years later, in 1976, households were sent a more extensive lifestyle questionnaire. Researchers found that the non-responders, those who responded to the first questionnaire, but not the second, had a higher mortality rate ratio within the first six years of the second questionnaire than did the responders, those who responded to both questionnaires. This trend gradually decreased during those six years, but was statistically significant. After the six years, in 1982, the mortality rate ratios between the two groups evened out to show little difference. This study also showed that responders were statistically significantly less likely to be single or widowed or have needed medical services during the past year and

were statistically significantly more likely to have more education, attend church more often, and be baptized at a younger age than the non-responders. Unfortunately, morbidity comparisons could not be made between the two groups, since that was the information elicited from the second questionnaire. This research does show, though, that the results of research involving SDAs and health may involve a bias towards those who are healthier.

Validity of Self-Reported Height, Weight, and BMI

Obesity has a profound effect on the development and maintenance of many chronic diseases. To better understand epidemiologic trends of obesity as well as related chronic diseases, measurement of height and weight within the population is necessary. Although height and weight measurements cannot determine an individual's body composition, they can at least assist researchers in estimating the *likelihood* of developing certain diseases. If the same formula, such as BMI, is utilized, these measurements can also identify patterns among the population.

Measuring the height and weight of tens or even hundreds of thousands of people is extremely time consuming, and if a diverse sample is sought in various locations around the country, expensive. Information on these variables can be identified much more efficiently by the use of telephone or mail surveys thereby allowing people to report their own measurements. However, the accuracy of the self-reported measurements needs to be established before the validity of any further research can be established.

Lindsted and Singh (1997) surveyed more than 27,530 SDAs thirty years of age or older, who lived in California, concerning demographics, health and lifestyle

characteristics as part of the AHS. This survey also required the participants to report their height and weight. Within a year, 118 non-Hispanic white random respondents were personally interviewed. Within the interview, height and weight were measured. Correlation between self-reported and measured height and weight was found to be .95. It is also interesting to note that in most trials, participants are typically measured within a few hours of self-reporting weight and height. Participants from the forementioned research were measured up to a year after filling out the survey which asked them to self-report those measurements, yet the correlation was still high.

In Sweden, Kuskowska-Wolk, Karlsson, Stolt, and Rossner (1989) conducted research in which 182 women and 119 men were asked for height and weight during a pre-appointment questionnaire to a primary health care unit. Measured height and weight was then recorded. This research included a large age range, including 20-84 years of age in women and 16-84 years of age in men. Regression lines were drawn using measured parameters and self-reported parameters. Statistically significant differences were found for weight, height and BMI for both men and women. The regression lines showed a pattern of overestimating smaller numbers and the underestimation of larger numbers with greater deviances as the numbers got larger or smaller. Specific tendencies included a larger underestimation of high weight values by younger women; an overestimation of height for all types of women, regardless of actual height; a greater underestimation of height by lighter men than heavier men; and an independent association between age and self-reported parameters among men.

Based on the data, 30% of the obese individuals would have been placed into a lower BMI category based on their self-reported height and weight when compared to their measured height and weight BMI. Thirty percent of the overweight participants would have been wrongly placed into a lower BMI category as well. A 13% misclassification would have been seen among those in the acceptable BMI category. Even the underweight group was not exempt, showing that 20% would have been mistakenly placed into the acceptable weight category. Researchers developed regression equations based on their findings in hopes of getting a more accurate estimation of BMI with self-reported data.

Rowland (1990) utilized data from 11,284 adults aged 20-74 as part of the NHANES of 1976-1980. An interviewer from the US Bureau of the Census obtained self-reported weight and height as well as other demographic information including age, sex, race and education. Technicians then measured the height and weight of the subjects at a mobile examination site, two to six weeks after the face-to-face interview.

Results indicated that, in general, men tended to over report their weight whereas women tended to underreport their weight. However, both underweight men and women over reported their weights while both severely overweight men and women underreported their weight. In relation to age, severely overweight adults aged 20-34 underreported more than adults aged 55-74. Results also indicated an end-digit preference where 60% of those interviewed reported their weight ending in either 0 or 5. The correlation between self-reported and measured weight was .97 for men and .98 for women.

In general, both men and women over reported their heights. Adults aged 45-74 over reported more than adults aged 20-44. Education and race did not cause reporting bias. However, over reporting occurred more often by subjects below the median height, and overweight subjects were also more likely to over report their weight as compared to there lighter counterparts. The correlation between self-reported and measured height was .94 for men and .91 for women.

Research from Stewart, Jackson, Ford, & Beaglehole (1987) also found a high correlation between self-reported and measured height and weight. Correlation for height was .96 and correlation for weight was .98. Authors found no statistically significant difference between self-reported and measured values for either height or weight. The mean difference for height was 1.94 cm while the mean difference for weight was -.58kg. Men reported a greater deviation for both height and weight. For both men and women, as weight increased, underestimation increased. This research included 1,523 subjects from New Zealand.

Villanueva (2001) compared self-reported height and weight to measured height and weight from a U.S. nationally representative sample during the NHANES from 1988-1994. In total, 15,944 subjects were used for data analysis. Four independent variables were examined including sociodemographic variables, weight perception variables, perception of current weight and level of activity.

Results indicated that as age increased so did the probability of discrepancy for both sexes. For men, non-Hispanic blacks and Mexican-Americans were statistically significantly more likely to overestimate their weight compared to non-Hispanic whites.

For females, Mexican-Americans and women of “other” races were statistically significantly more likely to overestimate their weight. If individuals desired to weigh less, there was a two-fold increase in the likelihood they would underestimate their weight, and likewise a two-fold increase in overestimating their weight if the desire was to weigh more. Participants were significantly more likely to underestimate their weight if they were currently trying to lose weight or had attempted to in the last 12 months. Subjects whose BMI was under 18.5 were significantly more likely to over report weight. In the overweight and obesity categories, subjects were significantly more likely to underreport their weights. As BMI increased, so did the likelihood that weight would be underestimated.

To further understand the possible misclassification of self-reported height and weight among obese individuals, research by Nawaz, et al. (2001) included only overweight and obese women. Data were gathered when the women were asked during a telephone interview to report their height and weight. This information was needed to determine if their BMI was high enough for inclusion in a weight loss program. Those whose BMI was 27.3 kg/m^2 to 40 kg/m^2 were accepted into the weight loss program and scheduled for a physical examination within two weeks at which time their height and weight were measured. Results showed a statistically significant underestimation of weight by 2.07%. Similar to other research, under reporting increased as weight increased. Unlike other results, however, no correlation between age and error in reporting was found.

There exist many discrepancies about who is most likely to misreport weight and/or height. One such discrepancy can be found within the variable of age. Kuskowska-Wolk, et al. (1989) and Rowland (1990) found that younger participants tended to underestimate their weight more than older counterparts whereas Villanueva (2001) found that as age increased so did the probability of discrepancy and Nawaz, et al. (2001) found no correlation between age and reporting error. There is also much conflict surrounding self reported height, and those who are most likely to over or under report this value. Most research does suggest that underweight individuals tend to over report weight while overweight individuals tend to under report their weight.

Research is still inconclusive as to whether or not self-reported height and weight are accurate enough to display actual anthropometric measurements, particularly among overweight and obese individuals. However, most times when statistically significant differences were found between self-reported height and weight and measured height and weight, further analysis was not done to determine accuracy of self-reported height and weight to BMI. Hodge (2002) found a statistically significant difference between self reported and measured height and weight, but no statistically significant difference between the calculated BMI from the two values. Her research involved women only aged 20-45 years. It is therefore recommended that additional research be done to determine the accuracy of self reported BMI to actual BMI.

Recommendations for increasing the accuracy of self-reported height and weight includes informing individuals that they will be measured after completion of the questionnaire asking for those measurements (Black, et al., 1998) as well as using

regression equations to predict actual height and weight from self-reported measurements (Kuskowska-Wolk and Rossner, 1989; Kuskowska-Wolk, et al., 1989; Pirie, Jacobs, Jeffery, and Hannan, 1981). Additionally, excluding the word “about” when asking subjects how much they weigh, may reduce the tendency to round the measurements to the closest number ending in 0 or 5. Rowland, (1990) noted in his research that 60% of participants reported their weight in a number ending in one of the two digits.

Conclusion

The research conducted up to this point looking at BMI among SDAs has typically been combined with other variables such as blood pressure and blood cholesterol. The specific research outlined in this paper is certainly inconclusive as to whether or not a lower BMI exists within the selected religious population. However, it is suggested that a lower BMI may exist among *vegetarian* SDAs. Other variables such as length of church membership and church attendance also need to be studied further to uncover their implications on the health status of SDAs.

The CDC estimates that approximately 61% of the U.S. adult population and 16% of children and adolescents are overweight or obese according to BMI standards (CDC, n.d.). Further research needs to be conducted to more accurately determine how this compares to the SDA population. And finally, while further research is also needed to determine if research using self-reported height and weight to calculate BMI is valid, it is at this point considered an acceptable practice.

CHAPTER III

METHODOLOGY

The methodology for this research will be explained in this chapter. More specifically the population, sample, protection of human rights, and data instrumentation, collection procedures, and analysis will be discussed.

Population

This study included a convenience sample from the five Seventh-day Adventist (SDA) churches located within Johnson County. The SDA religion is a protestant religion that bases its beliefs strictly on biblical principles (Ministerial Association General Conference of Seventh-day Adventists, 1988). The SDA religion has adopted certain health practices as a fundamental belief, including abstaining from alcohol, tobacco, caffeine, and pork. Many SDAs are also vegetarian, a variable incorporated into this research. Fresh fruits and vegetables, high fiber and low fat foods are encouraged. Daily exercise, fresh air, plenty of water and rest are also strongly recommended.

Johnson County is located in northern Texas and is bordered by Tarrant County, in which Fort Worth is located, to the north. Johnson County, however, is rural with a population of only 146,400 in the entire 740 square mile area (Johnson County Government, 2004)

The five SDA churches in Johnson County are located in Keene, Alvarado, Joshua, Burleson, and Cleburne. Permission was first granted from the Texas Conference

of Seventh-day Adventists to allow the churches to participate if they wished. Church pastors were then contacted by letter explaining the purpose of the study as well as the requirements for participation. Within two weeks, church pastors were then contacted by telephone to answer questions, and if they agreed to participate, to schedule a Sabbath for survey distribution and collection. Subjects were limited to baptized members of the SDA church, who were 18 years of age or older and currently lived in Johnson County.

Protection of Human Participants

Permission to conduct the study was secured by the Institutional Review Board of Texas Woman's University. The research was granted "exempt" status because it involved an anonymous survey and did not put the subjects at risk of any physical, psychological or social harm. A statement was placed at the top of the survey stating "The return of your completed questionnaire constitutes your informed consent to act as a participant in this research". Therefore, no further consent, written or verbal, was necessary for subject participation.

Data Collection Procedures

Each church pastor chose the Sabbath his church would participate within a five week period. An announcement was written in the bulletin explaining the purpose of the study, assuring anonymity and confidentiality, instructing participants on where to place the completed surveys and thanking those who chose to participate. This announcement can be seen in Appendix A. It was requested that the same announcement be read at the beginning of each selected church service. A large ballot box with yellow signs that

stated “Return Surveys Here. Thank You” on each side as well as the top of the box was placed at the information desk as is stated in the announcement.

A survey was placed in each church bulletin to be handed out during the one predetermined Sabbath. The full survey can be viewed in Appendix B. A total of 2000 survey copies were distributed among the five county churches depending on the number each requested to fill the number of bulletins typically printed each week. However, it is unknown how many bulletins, out of the 2000 printed, were actually handed out to members. Surveys were analyzed and discarded if the participant who completed the survey was under 18 years of age, did not live in Johnson County, or was not a baptized member, leaving 492 surveys. Upon closer review, an additional 28 surveys were excluded due to missing or illegible height, weight, or gender information. This left 464 surveys for use in data analysis (Table 2), well over the study goal of 200 completed surveys.

Table 2

Descriptive Data, Percentages

	n	Percentage
Total	464	100%
Men	199	43%
Women	265	57%
Vegetarian	247	53%
Non-Vegetarian	217	47%

Two hundred sixty-five or 57% of the respondents were women, while 199 or 43% were men (Table 2). Of the women, 153 or 58% categorized themselves as vegetarian while 94 or 47% of the male participants did the same. When combined, 53% of the respondents, regardless of gender, considered themselves vegetarian by the definition outlined on the survey (Table 2). This is consistent with other published information that states approximately 50-55% of SDAs are vegetarian (Beeson, et al., 1989; Fraser, 1999; Knutsen, 1994; Mills, et al., 1988). Among these subjects, the mean length of vegetarianism was 36.4 years with a high variability reflected in the standard deviation of 20.6 years (Table 3).

Table 3

Descriptive Data, Means and Standard Deviations

	Mean	Standard Deviation
Age in Years	54.4	18.6
Years Baptized SDA	36.8	18.2
Monthly Church Attendance	3.86	0.43
Years Vegetarian	36.4	20.6
BMI in kg/m ²	26.25	5.8

Mean age for participants was 54.4 years with a standard deviation of 18.6 years (Table 3). Ages of respondents ranged from 18 to 91 years. On average, members had

been baptized for 36.8 years with a standard deviation of 18.2 years (Table 3). The high variability can partly be accounted for by the large range in ages of the respondents. SDAs living in Johnson County have a high rate of church attendance. On average, these subjects attend regular Sabbath services 3.86 times out of a possible four times per month (Table 3), suggesting a strong commitment to their religion.

Instrumentation

The research instrument consisted of a survey developed by the researcher and included 10 questions. A copy of the survey can be found in Appendix B. Questions one and two were used to determine inclusion in the study, by determining if the participants lived in Johnson County and was a baptized member of the SDA church. Question four, which asked for the age of the participant, was also used to determine inclusion in the study as well as correlation between age and BMI. Questions three and five, which asked for years as a baptized member and average number of times regular Sabbath church services were attended per month, respectively, were also used to determine correlation to BMI.

Question six asked participants whether or not they were vegetarian. Vegetarian was defined as not eating meat. The difference between the average vegetarian BMI and average non-vegetarian BMI were used to test for statistical significance. The next question asked subjects to determine, if they were vegetarian, how long they'd been vegetarian. This information was then used to determine correlation between years vegetarian and BMI.

Questions eight and nine asked for height and weight and were used to determine BMI. Finally, the tenth question asked for the participant's gender.

Summary

The purpose of this research study was to learn more about the current health status of SDAs living in Johnson County through the use of BMI and potential affecting variables. After permission to conduct the study was secured by the Institutional Review Board of Texas Woman's University, a convenience sample was employed at the five churches located within Johnson County. Church members were asked to fill out a 10 question survey anonymously. Statistics were then used to determine if a statistically significant difference between the BMI of SDAs living in Johnson County and the BMI of residents living in the Texas state health regions 2/3 and/or a statistically significant difference existed between the BMI of vegetarian SDAs living in Johnson County and non-vegetarian SDAs living in Johnson County existed. Finally, correlations were calculated for each of the following variables and BMI: age, years as a baptized member of the SDA church, years as a vegetarian, and monthly Sabbath church attendance.

CHAPTER IV

RESULTS

This chapter will begin with a brief description of the raw and descriptive data. Results will then be presented and discussed.

Raw Data and Descriptive Statistics

Two thousand surveys were printed and placed in the Sabbath service bulletins of the five SDA churches in Johnson County. Four hundred ninety-two surveys collected fit the participant criteria of a baptized Seventh-day Adventist (SDA) church member who was at least 18 years of age and living in Johnson County. It is unknown how many of the 2000 surveys were handed out, since churches typically make more bulletin copies than they anticipate needing to ensure they do not run out. With this in mind, participation rate would be over 25%.

Upon closer review, another 28 surveys were excluded from the data analysis due to missing or illegible height, weight, or gender information. Of the remaining 464 survey respondents, 57% were women, while 43% were men. Slightly over half (53%) of the sample were vegetarian. Among the vegetarians, average years as a vegetarian was 36.4 (Table 3). Among all responders, regardless of gender or vegetarian lifestyle, average age was 54.4 years (Table 3), while average church attendance was 3.86 (Table 3) out of a possible four visits per month.

Body Mass Index

BMI was calculated by dividing kilograms of body weight by height in meters squared. This was accomplished by entering height in feet and inches and weight in pounds into a BMI calculator found on the Center for Disease Control and Prevention's website at <http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm>. A t test was then performed to test the null hypothesis that there is no difference between the BMI of SDAs living in Johnson County and the BMI of residents living in the Texas state health regions 2/3. A t test was also performed to determine whether a statistically significant difference existed between the BMI of vegetarian SDAs living in Johnson County and non-vegetarian SDAs living in Johnson County. Finally, correlations were calculated for each of the following variables and BMI: age, years as a baptized member of the SDA church, years as a vegetarian, and monthly Sabbath church attendance.

The mean BMI for SDAs living in Johnson County was 26.25 kg/m^2 with a standard deviation of 5.8 kg/m^2 (Table 5). Mean female BMI was 25.8 kg/m^2 , with a standard deviation of 6.4 kg/m^2 (Table 5), while male mean BMI was 26.8 kg/m^2 , with a standard deviation of 4.8 kg/m^2 (Table 5). When combining genders, the mean BMI for vegetarian SDAs living in Johnson County was 25.3 kg/m^2 , with a standard deviation of 5.0 kg/m^2 , while the mean BMI for non-vegetarian SDAs living in Johnson County was 27.3 kg/m^2 , with a standard deviation of 6.3 kg/m^2 (Table 5). This resulted in a statistically significantly ($p=.01$) lower BMI among the vegetarian sample.

As previously mentioned, the mean BMI for SDAs living in Johnson County was 26.25 kg/m^2 . The mean BMI for Texas residents living in health region 2/3 was 27.0

kg/m² (Texas BRFSS, 2004) (Table 4). When analyzed using a t test, a statistically significant difference (p=.05) was found between the two means. Upon further analysis, no statistically significant difference between the BMI among SDA men living in Johnson County (mean=26.8 kg/m², Table 5) and the BMI among men living in health regions 2/3 (mean= 27.5 kg/m², Table 4) was found. There was also no statistically significant difference between the BMI for SDA women living in Johnson County (mean=25.8 kg/m², Table 5) and the BMI for women living in health regions 2/3 (mean=26.5 kg/m², Table 4).

Table 4

BMI in kg/m² for non-SDAs in Health Service Region 2/3

	Mean	Standard Deviation
Total	27	6.6
Men	27.5	5.9
Women	26.5	7.6

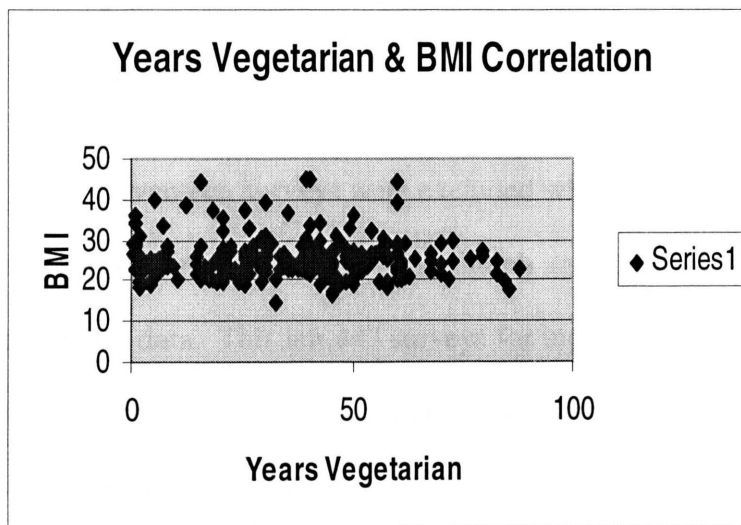
Table 5

BMI in kg/m² for SDAs living in Johnson County

	Mean	Standard Deviation
Total	26.2	5.7
Men	26.8	5
Women	25.8	6.4
Vegetarians	25.3	5
Non-Vegetarians	27.3	6.5

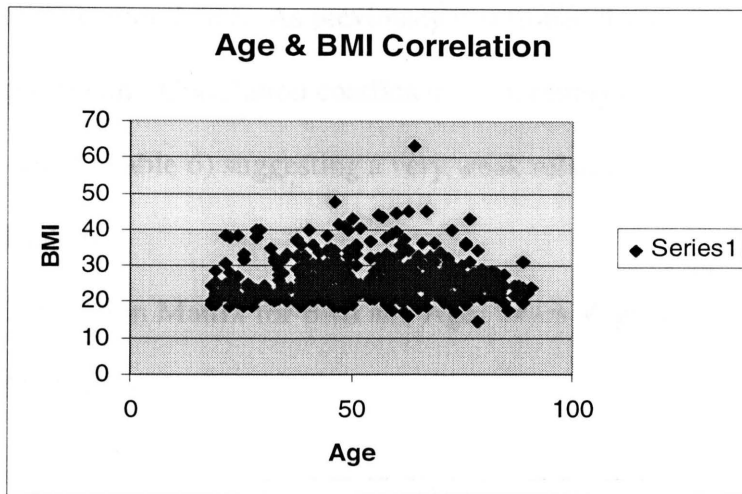
From the 247 respondents who categorized themselves as vegetarian, only 234 could be included in the data analysis to determine if there was a correlation between years as a vegetarian and BMI because of incomplete or illegible data. Correlation coefficient for the two variables was -0.06 (Table 6) suggesting a very weak relationship between years as a vegetarian and BMI (Figure 1).

Figure 1



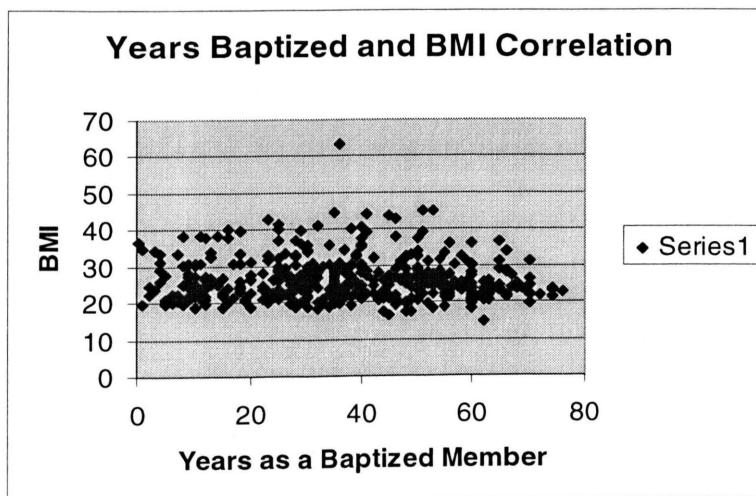
Every participant legibly completed the question which inquired about their age. Therefore, 464 subjects were included in the correlation analysis to determine a correlation existed between age and BMI. The correlation coefficient for the two variables was 0.0096 (Table 6), suggesting a very weak relationship between age and BMI for SDAs living in Johnson County (Figure 2).

Figure 2



Seventeen surveys were excluded when calculating the correlation between years as a baptized member of the SDA church and BMI due to missing, illegible or obviously erroneous data. This left 447 surveys for inclusion in the analysis. The correlation coefficient between the two variables was found to be -0.04 (Table 6), suggesting a very weak relationship (Figure 3).

Figure 3



All 464 subjects responded to the question concerning regular monthly Sabbath service attendance. As previously mentioned the mean was 3.86 out of a possible 4 times per month. Correlation coefficient for monthly church service attendance and BMI was -0.077 (Table 6) suggesting a very weak relationship between the two variables.

Table 6

Correlation Matrix for BMI and Age, Years Vegetarian, Years Baptized and Church Attendance

	Age	Years Vegetarian	Years Baptized	Church Attendance
BMI	0.0096	-0.06	-0.04	-.077

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter will expand on the results featured in the previous chapter by comparing them to the research hypotheses and discussing the importance for SDAs as well as the importance for the non-SDA population. Recommendations for further research will also be included.

Summary

The purpose of this research was twofold. First, using BMI, the health status of SDAs living in Johnson County was compared to Texas residents living in Health Service Region 2/3. Second, variables that may or may not be responsible for the health status of SDAs were also explored. A t test was utilized to compare the BMI of SDAs living in Johnson County to the BMI of individuals living in the Texas state health region 2/3. A t test was also employed to test for a statistically significant difference between the BMIs of vegetarian and non-vegetarian SDAs living in the same area. Finally, correlations between BMI and the following variables were computed: age, church attendance, years as a vegetarian and years as a church member.

All five SDA churches within Johnson County agreed to participate in this research. The pastor from each church chose the Sabbath it would participate. A survey was placed inside every bulletin handed out to members for the selected Sabbath church service. An announcement was written in the bulletin, while the same announcement was

also read at the beginning on the church service to encourage members to participate and explain the purpose of the survey. The survey included ten basic questions. The purposes of these questions were to determine inclusion in the study, determine BMI and gender, and elicit additional information in which to compare BMI, such as years as a baptized member and monthly church attendance. Participants were limited to those baptized members of the SDA church, at least 18 years of age, and living in Johnson County. A total of 464 surveys were available for use in data analysis.

Conclusion

This research began with six hypotheses. The first stated that there is no statistically significant difference in the BMI between SDAs in Johnson County and the BMI of Texas residents living in the health service Region 2/3. Results indicated that the BMI of SDAs living in Johnson County was significantly lower ($p=.05$) than the BMI of Texas residents living in the health region 2/3. The first null hypothesis was rejected (Table 7).

Null hypothesis number two stated that there is no statistically significant difference between the BMI of vegetarian SDAs and non-vegetarian SDAs living in Johnson County. The BMI among the vegetarian sample was found to be significantly lower ($p=.01$) than the BMI of the non-vegetarian sample (Table 7). The hypothesis was rejected.

The next four hypotheses dealt with correlation. The initial correlation hypothesis stated that there is no correlation in age and BMI among SDAs living in Johnson County. The correlation coefficient between the two variables was found to be 0.0096,

Table 7

Disposition of Hypotheses Involving t Tests

Hypothesis	Results	Significance Level
1. There is no statistically significant difference in the BMI between SDAs in Johnson County and the BMI of Texas residents living in the Health Service Region 2/3.	Rejected	p=.05
2. There is no statistically significant difference between the BMI of vegetarian SDAs and non-Johnson County.	Rejected	p=.01

Table 8

Disposition of Hypotheses Involving Correlation

Hypothesis	Results	Correlation Coefficient
3. There is no correlation in age and BMI among SDAs living in Johnson County.	Not Rejected	-0.0039
4. There is no correlation in church attendance and BMI among SDAs living in Johnson County.	Not Rejected	-0.08
5. There is no correlation in years as a vegetarian and BMI among SDAs living in Johnson County.	Not Rejected	-0.06
6. There is no correlation in years as a member of the SDA church and BMI among SDAs living in Johnson County.	Not Rejected	-0.031

suggesting a very weak relationship (Figure 2). The null hypothesis was not rejected (Table 8).

The next hypothesis stated there is no correlation in church attendance and BMI among SDA's living in Johnson County. Statistical analysis found the correlation between monthly church attendance and BMI to be -0.077, suggesting a very weak relationship. The null hypothesis was then not rejected (Table 8).

The third null hypothesis concerning correlation stated there is no correlation in years as a vegetarian and BMI among SDAs living in Johnson County. Only a very weak relationship was found between these two variables as well. The correlation coefficient was -0.06 (Figure 1), and the null hypothesis was not rejected (Table 8).

The final hypothesis stated that there is no correlation in years as a member of the SDA church and BMI among SDAs living in Johnson County. Statistical analysis found the correlation coefficient to be -0.04, again, suggesting a very weak relationship (Figure 3). The null hypothesis was then not rejected (Table 8).

Discussion and Implications

The Adventist Health Study was a large research project that opened the door to a number of published articles highlighting the above average health status of SDAs. Unfortunately, the preliminary data gathering began three decades ago and should now be considered out-of-date. The research also primarily involved only non-Hispanic white men living in California. Since then, and in particular the latter half of the past thirty years, overweight and obesity rates have increased dramatically. The CDC (n.d.) estimates that approximately 65% of the United States population is currently overweight

or obese according to BMI standards. Twenty years ago, 47% of American adults were overweight or obese using the same measurement. At that time, 15% of the U.S. population was obese; that number has now doubled to 31%. Texas is certainly not exempt in this health crisis. The latest data reports a mean BMI of 27.3 kg/m² for the state with 63% of the population overweight or obese, while 25% of the population is obese (Texas DSHS, n.d.).

This issue is even addressed in the Healthy People 2010 objectives. The goals include increasing the number of individuals who are at a healthy weight to 60% and decreasing the number of adults who are obese to 15% (Healthy People, 2010, n.d.). Unfortunately, as previously pointed out, the problem is getting worse. The CDC (n.d.) also states that being overweight or obese can increase the risk for many other diseases including hypertension, high cholesterol, diabetes, heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems and some cancers. The direct and indirect costs of obesity were estimated at \$78.5 billion in 1998, which equates to approximately \$92.6 billion in 2002 (CDC, n.d.). This is not just an economic problem for the individuals who are overweight or obese. The same source estimates that half of those costs were paid by Medicare or Medicaid.

It is imperative that Americans get this trend of increasing obesity under control. If current research can still show that SDAs have above average health, it would certainly be worth the effort to investigate the variables responsible. It is then reasonable to assume that those same variables could help the non-Adventist population improve its health as well.

This research suggests that SDAs may still be healthier than non-SDAs. Within the north central Texas area of Johnson County, they had a statistically significantly lower ($p=.05$) BMI. It should be noted, however, that the mean BMI for the SDA sample used in this study would still be categorized “overweight”, according to BMI standards, at 26.2 kg/m^2 . So even though they have a statistically significant lower BMI than their non-SDA counterparts, they may not actually be “healthy”. This is certainly an issue the church needs to address if it plans to continue advocating healthy eating under the doctrine of Christian behavior (*Seventh-day Adventists Believe...*, 1988).

BMI estimates from the AHS in 1976 were 24.9 kg/m^2 for men and 24.3 kg/m^2 for the women. It would appear as though BMI among SDA has increased considerably in 30 years to 26.6 kg/m^2 for men and 25.8 kg/m^2 for women from the current research. These results need to be considered with caution, however, because the AHS involved a non-Hispanic white and Californian SDA population. California tends to have lower rates of obesity than does Texas (CDC, n.d.), while the non-Hispanic white population tends to have lower BMI means than do other ethnicities (CDC, 2003). Even though a much smaller sample (160 men) was used for the research by Fraser and Babaali in 1982, they found mean BMI to have risen to 27.4 kg/m^2 in just six years using a sample from the same population as the AHS.

Many researchers have suggested that it is the vegetarian aspect of the SDA religion that is responsible for the lower morbidity rates when compared to the non-SDA population. Using data from the AHS, Fraser (1999) found that as meat consumption increased, so did BMI. He also found a statistically significant difference in BMI

between vegetarian and non-vegetarian SDAs. Other studies showing statistical significance between the two groups of SDAs include Knutsen (1994), Melby, et. al., (1989), and Harman and Parnell (1998).

To better understand if it is primarily the vegetarian diet of many SDAs which causes them to have lower blood pressure than the general population or if the difference exists because of other factors such as alcohol, tobacco, religious affiliation, or obesity, Rouse, et al. (1982) compared blood pressure and Quetelet index between vegetarian SDAs and Mormons, another devout religious group with suggested abstinence of caffeine, tobacco and alcohol. None of the participants from either religious group claimed to currently use alcohol or tobacco. A statistically significant higher Quetelet index among the Mormon non-vegetarians than among the vegetarian SDAs was found. Results suggest that it is the vegetarian aspect of the SDA religion which accounts for lower obesity rates rather than restriction of alcohol, tobacco, caffeine and other factors.

Results from the current study support the suggestion that it is the vegetarian aspect of the SDA religion that account for their enjoyment of better health as defined by a lower BMI. The BMI of non-vegetarian SDAs living in Johnson County (27.3 kg/m^2) was compared to the BMI of vegetarians of the same demographics (25.3 kg/m^2) using a t test. A statistically significantly lower BMI was found among the vegetarian group. This is a healthy lifestyle aspect the SDA church should obviously continue to advocate. There is no reason to think that a vegetarian lifestyle would not also help non-SDAs lower their BMI as well.

This research also found the rate of vegetarianism at 53% to be similar to previous research (Beeson, et al., 1989; Fraser, 1999; Knutsen, 1994; Mills, et al., 1988). The vegetarians from the study, while healthier than the non-vegetarian sample according to BMI standards, unfortunately, are still within the “overweight” BMI category at 25.3 kg/m². In a comparison of the BMI of the non-vegetarian SDA sample to the sample from the Texas health region 2/3, the non-vegetarian SDA BMI is actually higher, 27.3 kg/m² compared to 27.0 kg/m², respectively, which is quite alarming.

So while over half the SDA population follows the recommended vegetarian diet, it appears as though few SDAs, vegetarians and non-vegetarians alike, adhere to the recommendation “...to eliminate, or use only sparingly, foods with high fat and/or sugar content.” (*Seventh-day Adventists Believe...*, 1988). This statement is also supported by the results of the correlation analysis between years as a baptized member of the SDA church and BMI. It could be assumed that, especially among converts to the religion and its strong recommendations for healthy eating, as the time in years as a baptized member increased, BMI would decrease. This was not the case, however, as the correlation coefficient between the two variables was found to be -0.04, suggesting a very weak relationship.

Nor was this the case with the lack of relationship between years as a vegetarian and BMI. Again, in particular among converts, or life-long members who weren't always vegetarian, it would not be unreasonable to think that as the length of time as a vegetarian increased, BMI would decrease, but this was not substantiated by the research. The correlation between the two variables was -0.06, suggesting no relationship. The results

from that correlation analysis wouldn't be so perplexing or of such great importance if the BMI among vegetarian SDAs was within a healthier range. Most likely, the vegetarians in this group are hit-and-miss with the other nutritional eating habits. Some adhere to all church guidelines, some adhere to just vegetarianism, some don't adhere to any, and still others are somewhere in the middle in their food moderation. It is also likely that SDAs in this sample are not adhering well to the other modifiable cause of excess body fat: exercise. Like nutritious food, regular exercise is also included as essential to maintaining optimal health, under the doctrine of Christian behavior (*Seventh-day Adventists Believe...*, 1988).

Yet SDAs do appear to be very committed to their religion. In Johnson County they attend regular Sabbath church services, on average, 3.86 times per month. This commitment to religion in attendance does not appear to show itself in the form of compliance to the prescribed health practices. This average may not be representative of the entire SDA population of Johnson County considering it was a convenience sample of members who were at church. Those members, who most often attend church services, would be most likely to be at church at the time of the survey. This presents another important consideration. Perhaps the SDA members who attend church on a regular basis actually do follow the church's healthy eating guidelines to a greater extent than non-attending members, leaving the non-attending members with an even higher BMI. It is also quite possible that because SDAs know they are supposed to be healthier than average, when they came to the question on the survey that asked for their weight, if they felt they were overweight or obese, they chose not to participate. This would be

reminiscent of the Healthy Volunteer Effect Lindsted and researches (1996) found within the AHS.

Age is another interesting variable. One of several results *could* have emerged with this research. Creeping obesity, the excessive fatness that develops slowly throughout adulthood (McArdle, Katch, & Katch, 2000), would have caused a positive correlation between age and BMI, meaning as age increased, so did BMI. This was not the case however. Decreasing BMI with the increase in age could be explained by older SDAs adhering better to the church's health message, possibly because the health prescription is not emphasized as it once was. This trend did not emerge, either. The correlation between age and BMI was 0.0096, suggesting a very weak relationship. Most likely it's the combination of creeping obesity, lack of church emphasis on the health message, and the fact that SDAs, especially non-vegetarians, are not immune to the increased rates of overweight and obesity that is responsible for these results. It is actually possible that all correlations, with the exception of church attendance, were offset by creeping obesity, since they all dealt with, at least partially, age.

Recommendations

Recommendations for future research are made to better understand the health status of SDAs, to better understand the reasons of their health, and to identify contributing factors that should be eliminated, encouraged, and/or changed. These recommendations are as follows.

1. Conduct research to determine the BMI for different age groups among lifelong members. This could potentially help to identify a particular point in time when the

health message lost its impact or was not promoted as heavily. It could also identify those age groups in which to target health promotion attempts.

2. Conduct a similar study design with a change in the sampling. Rather than a convenience sample, use a random sample from church records and call members. This could assist with decreasing or eliminating the healthy volunteer effect by including more members who are not as involved with the church.
3. Conduct a more thorough examination of dietary habits including the consumption of high fat and high sugar foods as well as total caloric intake, fiber and fruit and vegetable consumption in order to pinpoint the areas that need the most promotion or emphasis for change.
4. Conduct a thorough examination of physical activity levels to identify areas needing the most promotion as well as those areas that need change.
5. Conduct a qualitative study in an attempt to understand why the healthy lifestyle recommendations are or are not followed.
6. Conduct a study to test for significance between the BMI of non-vegetarian SDAs and the BMI of non-SDAs.
7. Use researcher measured height and weight data to calculate BMI among SDAs.

Through the use of these recommendations for further research, better health and longevity can hopefully be realized among SDAs. By better understanding the factors that will contribute to this, non-SDAs can also benefit. One final recommendation is that other denominations use the venue of their religion to promote a healthy lifestyle among its members.

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APPENDICES

APPENDIX A

Church Announcement

Church Announcement

Krystal Hauff, assistant professor at SWAU, is conducting research to complete her PhD in Health Studies from Texas Woman's University. Her research involves the body mass index among Seventh-day Adventists living in Johnson County. Inside your bulletin you will find a survey. Participation is voluntary and completely anonymous. If you wish to participate, please fill out the survey according to the instructions and place the completed survey in the box located at the information desk in the foyer. Your time and assistance is greatly appreciated.

APPENDIX B

Participant Survey

Participant Survey

The return of your completed questionnaire constitutes your informed consent to act as a participant in this research.

The purpose of this survey is to elicit information about body mass index (BMI) among Seventh-Day Adventists living in Johnson County. This survey is completely voluntary and completely anonymous. (Thus, please do not write your name anywhere on the survey.) Please answer each question as accurately and honestly as possible. Your participation is greatly appreciated.

1. Do you live in Johnson County, Texas?

☐ Yes ☐ No

2. Are you a baptized member of the Seventh-day Adventist church?

☐ Yes ☐ No

3. If you answered "Yes" to question number two, how long have you been a baptized member?

4. How old are you?

5. On average, how many times per month do you attend regular Seventh-day Adventist Sabbath church services?

☐ Once per month

☐ Twice per month

☐ Three times per month

☐ Four times per month

6. Are you vegetarian? To be considered vegetarian, you must not eat meat.

☐ Yes ☐ No

7. If you answered "Yes" to question number six, how long have you been vegetarian?

8. How tall are you? _____

9. How much do you weigh? _____

10. Please check one.

☐ Male ☐ Female

Thank you for your time and participation. Please place the completed survey in the box located at the information desk.