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# A Correlational Study of Religiosity and Total Body Fat Composition in Collegiate Populations

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# A Correlational Study of Religiosity and Total Body Fat Composition in Collegiate Populations

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**ABSTRACT**

Previous research indicates rising levels of body fat composition in Americans. One contributing factor may be an individual's degree of religiosity. Although not all, most studies have found religiosity to negatively impact body mass index (BMI) and obesity levels. Minimal research has been conducted regarding the relations between religiosity and body fat percentage. Not only do the overall increasing trends in body fat composition cost the American people between $48 and $68 billion per year in medical care, but excess body fat increases the risk for diabetes, cardiovascular diseases and cancer. Religious factors have been shown to play a role in body fat composition, and thus determining the relations between religiosity and total body fat percentage will provide additional strategies in decreasing health risks and diseases among various population groups. **Purpose:** The aim of this study is to describe and analyze the relations between an individual's total body fat percentage and their religiosity. **Methods:** 23 subjects between the ages of 18 and 90 (Mean=20.1 years, SD=2.36) were recruited to participate in this study. Upon arriving at the Biokinetics assessment space, subjects were given the IRB; completed the Duke University Religion Index (DUREL); were measured for height (Mean=85.02kg, SD=36.24), weight (Mean=85.02kg, SD=36.24), and blood pressure (Mean=120.9/73, SD=10.79/8.56); and were scanned by the Dual-energy X-ray Absorptiometry machine (DXA). The DUREL is a five question assessment used to assess each subject on three major dimensions of religiosity. All data collection was completed in one, thirty-minute session. Once data collection was complete, SPSS was used to assess the relations between the DUREL scores and the DXA body composition measurements to produce a Pearson correlation coefficient. **Results:** A Pearson Correlation Coefficient was conducted between each of the three religiosity variables- organized religious activity (ORA), non-organized religious activity (NORA), and intrinsic religiosity (IR)- and both the total body fat composition percentage (body fat %) and the android mass percentage to gynoid mass percentage ratio [Android (%)/Gynoid (%)] were measured. No significant relations were found between the ORA and NORA aspects with either body measure nor between IR and Android (%)/Gynoid (%) ($p>0.05$). Significance was found between body fat % and IR and produced a moderately-strong, positive correlation value ($p= 0.027$ and $r=0.459$). **Conclusion:** The lack of significance and weak correlation values between the ORA and NORA components and the body composition measures prevent any conclusive relations. The significant and moderately strong correlation between IR and body fat %, however, may indicate that those with a higher degree of internal religious motivation also have a higher total body fat percentage. Thus, individuals with a high degree of religious motivation may have less motivation for maintaining physical health.

## Introduction

Previous research has revealed rapidly increasing trends in body fat composition of the American population most notably within the last couple of years. For this study's purposes, body composition is defined as the total amount of bodily adipose tissue represented as a percentage of total tissue mass. Adipose tissue, a subtype of loose connective tissue, is composed of adipocytes that synthesize and store energy in the form of triacylglycerol lipid

droplets in addition to protecting and insulating vital organs. It is mainly located under the skin but can also be deposited around the heart, in between muscles and intestinal membrane folds, and in bone marrow. Also known as visceral adipose tissue, abdominal fat has been correlated with multiple adverse effects for both the individual and society as a whole. In addition to costing between $48 and $68 billion per year in medical care costs, increased amounts of visceral body fat greatly heightens the risk for diabetes, cardiovascular diseases (CVD), and cancer (Wang et al., 2011). Visceral body fat is also the principal component of metabolic syndrome, a disease characterized by hyperglycemia, dyslipidemia, and hypertension. Those suffering from metabolic syndrome are also at a higher risk of experiencing morbidity and mortality as a result of of a CVD (Park & Lee, 2005). Mechanistically, visceral fat not only promotes gluconeogenesis and fasting hyperglycemia, but it has recently been classified as endocrine tissue due to its role in cytokine secretions. These secretions affect tissue sensitivity to insulin as well as impact the body's metabolism of glucose. Visceral fat tissue additionally plays a role in free fatty acids flux from the liver, requiring increased synthesis of low-density lipoprotein (LDL) in the blood and increasing the risk of vascular blockage (Gastaldelli et al., 2011).

With such increasing trends in the public's body fat composition and consequently increasing disease risk, it is crucial that the underlying factors be identified and analyzed. One potential factor that may be contributing to a higher body fat composition is an individual's degree of religiosity (Cline & Ferraro, 2006). Religiosity, for this study, incorporates the three major dimensions of religiousness: Organizational Religious Activity (ORA), Non-Organizational Religious Activity (NORA), and Intrinsic Religiosity (IR). ORA includes religious attendance and any participation in religion-associated social groups or events, while NORA accounts for all individual religious practices, such as prayer and reading Scripture. The third dimension, IR, assess an individual's internal religious pursuit or motivation. Previous research has indicated the presence of a relationship between religiosity and physical health, commenting on certain religious teachings and activities that affect an individual's physical well-being (Levin, 2001). For example, Lyman mentioned the importance of Christian teachings to avoid the seven deadly sins, including the sin of gluttony (Lyman, 1978). In addition, Holt and McClure found that greater degrees of religiosity were correlated with healthier physical habits, such as the avoidance of alcohol, recreational drugs, and cigarettes. They also found a correlation to improved psychological health, showing lower levels of anxiety and depression and improved social interaction in those with a greater degree of religiosity (Holt & McClure, 2006). The reported relationship of religiosity and physical health, however, is not as defined. While some studies have identified religiosity as positively impacting aspects of physical health (Strawbridge et al., 2001), others have found religiosity to negatively impact certain components of physical health (Cline & Ferraro, 2006). Thus, further research is needed to describe which dimensions of religiosity affect identifiable areas of physical health in the general public. The purpose of this research, then, is determine the presence of a relationship between the previously mentioned dimensions of religiosity and total body fat composition.

Due to its quantitative and applicable nature, this research uses total body fat composition as its measure of physical health. The amount of body fat, especially the amount of visceral tissue, directly reflects an individual's risk for numerous diseases and can be measured using Dual-energy X-ray Absorptiometry (DXA) technology. A more recent measurement technique, DXA has been incorporated in relatively few studies but was shown to produce quick, accurate results with the least X-ray exposure. DXA technology utilizes x-ray sources to produce precise, high-quality images, and its measurement capabilities include: site specific or

whole body bone density, vertebral fracture risk, and scanning neonates for bone density and body composition (Pintauro et al., 1996).

While some studies have found aspects of religiosity to improve physical health (Strawbridge et al., 2001), most others have reported the negative impact religiosity has on body mass index (BMI) and obesity levels (Cline & Ferraro, 2006). Therefore, it is hypothesized that a greater degree of religiosity will result in higher amounts of total body fat tissue in the tested population. The collected data will hopefully provide insight into the relationship between certain dimensions of religiosity and body fat composition, highlighting areas that would benefit from specific interventions to decrease body fat tissue and subsequently CVD health risks among the public.

**Methods**

**Participants:** During the fall and spring semesters of the 2016-2017 school year, 300 subjects between the ages of 18 and 90 years old were recruited to participate in this study. All subjects met inclusion criteria which was verified by the informed consent and health history form. The inclusion criteria required that the participants be available for a 30-minute appointment as well as submit to the informed consent and fall within the age range of 18 and 90 years old. Additionally, none of the subjects were pregnant or had the possibility of becoming pregnant at the time of participation. None of the subjects had suffered from a major injury within 6 months of the measurement taking place. All individuals were free of any permanent metal implants which included surgical equipment and body art. None of the individuals had taken calcium supplements within 48 hours of being scanned by the DXA. None of the individuals had been taking glucocorticoids and/or corticosteroids. None of the individuals had been exposed to more than 0.1 rem per year of exposure to radiation. None of the individuals had a bone densitometry X-ray on their spine in the last year or on their femur on the last 2 years. None of the individuals were deemed high risk (one or more symptom or condition) according to the Exercise Pre-Participation Health Screening Questionnaire and who did not obtain signed clearance documentation from a licensed physician

**Protocol:** After recruitment, each participant came in for one appointment lasting 30 minutes. Participants came to the Biokinetics exam room at Bethel University. The appointment included the informed consent process, a verbal reading, a visual reading, the signing of the document, and a review of the exclusion criteria between a co-investigator and the subject. Also, prior to signing the document, a proper explanation of the purpose, procedures, and any benefits or potential risks to participation was stated. Subjects were then asked to fill out a health history form, including information that co-investigators used to determine each subject's risk stratification level per American College of Sports Medicine's guidelines. After determining and documenting each subject's risk stratification level, anthropometric measurements were taken and recorded using an assigned identification number for confidentiality. All data was recorded in a confidential computer folder specific to each individual that only the co-investigators and the research advisor had access. Anthropometric measurements included height and weight using a meter stick and scale, blood pressure using a sphygmomanometer, and resting heart rate taken manually with the assistance of a stopwatch. Next, subjects were asked to fill out a religiosity questionnaire quantitatively measuring their level of daily spiritual experience. The questionnaire administered was the Duke University Religion Index (DUREL), first published in 1997, and assessed each subject on the three major dimensions of religiosity: organized religious activity (ORA), non-organized religious activity (NORA), and intrinsic religiosity (IR).

The DUREL contained a total of five questions and was a comprehensive, non-offensive analysis that has been proven a valid assessment of an individual's religious well-being (Koenig & Büssing, 2010). The scoring provided three subscale values that were not totaled in order to avoid inaccurate and conflicting results. The first question asked, "How often do you attend church or other religious meetings?" Six possible answers were listed, ranging from "More than once per week" to "Never." This resulted in a reverse subscore and reflected each subject's ORA religiosity. The second question assessed each subject on NORA and asked, "How often do you spend time in private religious activities, such as prayer, meditation or Bible study?" Responses ranged from "More than once a day" to "Rarely or never," and the reverse subscore possibilities were one through six. The last subscore was a combined total of three statements which evaluated the subject on IR, including, "In my life, I experience the presence of the Divine (i.e., God)," "My religious beliefs are what really lie behind my whole approach to life," and "I try hard to carry my religion over into all other dealings in life." There were five response options that ranged from "Definitely true of me" to "Definitely *not* true of me." Each subscore was a reverse subscore and was separately examined using a regression model. Thus, a total of three religiosity scores were obtained from each subject and used for correlation analysis. The DUREL used language most appropriately suited for Western religions but can be modified to suit other global religions as well (Koenig & Büssing, 2010). Subjects for this study were assumed to practice a Western religion, but any subject who needed specific language adaptation was accommodated. Due to the brief, comprehensive nature of this questionnaire, an in-depth analysis of subject religiosity was not analyzed in this study. Each subject was fully briefed on the purpose, expectations, radiation exposure risks, and proper clothing attire needed for the body fat assessment. Proper clothing included a gym shirt and shorts, preferably material that remained tight around the body, and all metal jewelry or body art was removed prior to arrival of the body fat assessment. The purpose was to assess each subject's total body fat composition. Body fat composition was analyzed using Bethel University's Dual-energy Absorptiometry (DXA) technology. Dr. Seth Paradis, who has been certified by the American Registry of Radiologic Technologists, was the only one operating the DXA machine. The DXA is a safe yet accurate 3-compartment measurement technique that utilizes highly precise X-ray beams to measure bone density and body fat distribution. This test lasted between 6 to 10 minutes on fast scan mode and exposed the subject to minimal radiation, resulting in a biologically important effective dose of just 0.037 mrem. Utilizing the fast scan mode decreased the amount of radiation exposure for the subject, as radiation exposure is proportional to the total amount of scan time. Additionally, Bethel's DXA equipment is a pencil-beam scanner that requires less radiation exposure to function. Radiation protection protocol was followed to abide by the general principle of reducing radiation exposure to as low as reasonably achievable. To avoid unnecessary radiation exposure to the public, traditional X-ray warning signs were posted on the entrance to the exam room and entry into the room was restricted. Each subject was asked about any previous exposure to bone study techniques, where and when it was done, and the specific machine used before the scanning procedure begins. Subjects who had any bone study techniques within the last year were not eligible to participate, as exposure to more radiation was considered unnecessary. The PI further protected each subject by correctly positioning the subject and choosing the proper scan mode settings. Any subject that was not able to be positioned correctly was not able to participate in this study. Signs that prompted female subjects to disclose a pregnancy or the possibility of a pregnancy were posted in the exam room, stating "Pregnant? If you are pregnant, or think you may be, tell the X-ray technologist before having an X-ray taken" in both English and Spanish. Researchers did not assume each subject

had read the posted sign, however, and directly inquired about the potential risk prior to the subject's scan. The PI was the only technologist in the exam room with the subject during the scan and not only chose the shortest appropriate scan speed to reduce radiation exposure but stood at least 3 feet away from the device with a protective shield during machine operation. Only when the scanning procedure was completely finished was the PI allowed to move within 3 feet of the machine.

In terms of body composition, a DXA scan is able to measure total body fat mass, distinguish between fat and lean mass, and evaluate the distribution of fat tissue in the subject. For the purposes of this study, the subject's total fat percentage (tissue fat %) as well as the android fat percentage to gynoid fat percentage ratio were the data used for analysis. Before the beginning of subject measurement, the PI calibrated the machine using phantom scans and re-calibrated it once a week during the data collection period. Each subject, after arriving for their appointment, again was verbally read the risks of the DXA equipment and also signed a written form of the risks. With the proper attire and all metal removed from the subject's body, each participant was asked to remove their shoes in preparation to again take height and weight, using a meter stick and electronic scale, respectively. The co-investigator lead the subject from the preparation room into the exam room with the DXA equipment where the participant lay flat on the scanner and was given thorough instructions of the subject's role during the scan by first the co-investigator and then the research advisor. Due to the research advisor's training, he alone administered the DXA scan on each subject while the co-investigator waited outside the exam room. All results were recorded using the subject's identification number and then saved in a confidential, computerized folder. Results published only reflect the subject group as a whole and omit the possibility of subject identification. After completion of the DXA scan, participants met the requirements for research participation. Data analysis included a Pearson Correlation between the quantitative religiosity questionnaire scores and the total body fat percentage values.

**Statistical Analysis:** Descriptive data was collected including; height, weight, blood pressure, body fat percentage and the percentage of android fat tissue to percentage of gynoid fat tissue ratio. Once data collection was complete, SPSS was used to assess the relationship between the DUREL scores and the DXA body composition measurements to produce a Pearson correlation coefficient. Data was considered significant if a p-value of less than 0.05 was achieved.

**Results**

A Pearson Correlation Coefficient was conducted between each of the three religiosity variables; organized religious activity (ORA), non-organized religious activity (NORA), and intrinsic religiosity (IR); and both the total body fat composition percentage (body fat %) and the android mass percentage to gynoid mass percentage ratio [Android (%)/Gynoid (%)]. No significance was found between ORA and body fat % nor between NORA and body fat % ($p=0.513$ and $p=0.625$, respectively). These variables further revealed a weak correlation with a slightly negative correlation between NORA and body fat % ($r=0.144$ and $r=-0.018$, respectively). No significant relations were found between ORA and Android (%)/Gynoid (%), NORA and Android (%)/Gynoid (%), nor IR and Android (%)/Gynoid (%) ($p=0.519$, $p=0.885$, and $p=0.231$, respectively). In addition, a weak correlation was shown between ORA, NORA, and IR and the Android (%)/Gynoid (%) ($r=0.142$, $r=0.032$, and $r=0.260$, respectively). Significance was found, however, between body fat % and IR scores, and these variables produced a moderately-strong, positive correlation value ($p= 0.027$ and $r=0.459$).

## Discussion

Due to the lack of significance and weak correlation values between the ORA and NORA components and the DXA measurements obtained, no conclusive relations can be formed. The relations between IR and total body fat composition, however, revealed a statistically significant p-value ($p=0.027$) as well as a moderately strong correlation in the positive direction ($r=0.459$). This indicates that those with a greater degree of personal religious commitment or motivation tend to have a higher total body fat percentage. Not only are these findings supported by Cline and Ferraro's research with religiosity and body mass index, but the results add to a growing field of research seeking to understand the relationship between physical health and certain religiosity factors (Cline & Ferraro, 2006). While no significant correlation was found between ORA and NORA religiosity factors with body composition measurements, the positive correlation between IR and total body fat percentage indicates that individuals with a high degree of religious motivation may have less motivation for maintaining physical health. These individuals may benefit from education on the importance of nutrition and physical exercise, emphasizing an overall balance. On the other hand, those with a lower degree of IR may place too much emphasis on physical health and would equally benefit from ways that increase religiosity motivation. To conclude, then, the initial hypothesis that religiosity and body composition are positively correlated is supported by the above results and allows for rejection of the null hypothesis.

Although this research study did show statistically significant results, we must not forget to mentions the limitations to the research. Due to the fact that Bethel University is a religiously affiliated institution, specifically consisting of primarily the evangelical Christian demographic, this would make it unlikely that any of the participants would not be religious. This could cause a significant relationship to be show that may be due to the skewed scores on the religiosity questionnaire. Another limiting factor to the research could be due to the integrated male and female data. Males and females are known to have biological differences in average body fat percentage, specifically, women are known to have a higher overall body fat. As a result the average body fat percentage that was measured in our research may have been higher than the actual due to the large amount of females in the study. Our research was also not exempt from self serve bias, as the questionnaire is self-reported which incorporates an automatic bias in how different individuals perceive their own religiosity. Lastly, prior to the religiosity questionnaire being administered participants were informed of the goals of the study. This may have skewed the results and participants may have purposely scored higher on the religiosity questionnaire if they perceived themselves as overweight to try and solidify the correlation that researchers were looking for.

## Acknowledgments

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