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# The Effects of an Exercise Program on Cardiovascular Risk Factors at a Faith Based University

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## Introduction

According the World Health Organization, physical inactivity is the fourth leading risk factor for global mortality (WHO, 2013). Globally, 6% of deaths are attributed to physical inactivity. This follows high blood pressure (13%), tobacco use (9%) and is equal to high blood glucose (6%). Moreover, physical inactivity is the main cause of approximately 21–25% of breast and colon cancers, 27% of diabetes incidence and 30% of ischemic heart disease burden (WHO, 2013). In an effort to improve the level of physical activity in individuals, studies have been done to determine the type of activity that improves health and has a high adherence rate. The results demonstrate that walking as a mode of exercise improves health and has a very high adherence rate (Dishman, 1994).

One study found that a walking program caused a decrease in total cholesterol, lowered fasting blood glucose and reduced blood pressure in college faculty and staff (Haines, 2007). Due to the rising cost of health insurance and the recent implementation of the Affordable Care Act, many businesses and universities are developing wellness programs in an effort to lower employee healthcare costs. With these recent developments in mind, the purpose of this study was to determine if a walking program would lower cardiovascular risk factors for faculty and staff who adhere to a faith based values lifestyle. Our aim was to use the results of this research to provide a foundation for the future development of a wellness program.

## Literature Review

Companies have become more aware of the rising costs incurred by unhealthy employees and how poor health increases employee sick days and insurance costs. A study by Alexander (2011) looked at the University of Alabama's employee wellness program, "WellBama," which works to improve employees' health status by providing onsite health screenings, health advising

sessions and help with monitoring and setting goals (Alexander, 2011). The result of the study showed that employees who incurred the largest healthcare costs were at high health risk in seven categories: depression, stress level, hypertension, body weight, tobacco use, blood glucose, and sedentary lifestyle. The study also found that for every dollar spent toward the corporate wellness programs, employee's medical costs fell $3.27 (Alexander, 2011).

A study conducted by Fujieda (2007) that analyzed employees from six Japanese companies concluded that excessive alcohol consumption contributes to increased BMI and hypertension. Current tobacco usage, or usage of tobacco in the recent past, also increased the likelihood of hypertension in participants. Therefore, since participants in our study were non-smokers and non-drinkers, their risk for obesity and hypertension are lower than that of individuals who drink excessively or smoke.

Boone-Heinonen (2011) examined a cross-sectional study that looked at the benefits of active commuting (walking or cycling) when compared to driving. For those who actively commuted throughout the study there was improvement in dyslipidemia, triglycerides, diastolic BP, and fasting insulin levels in participants who increased activity by 3,000-5,000 steps. They also found a 8.4% drop in overall medical costs for those participants who had a 3,000-5,000 step increase.

Brown's (2009) meta-analysis involved 38,231 individuals and determined that 27% of studies included supervised exercise and 80% used motivational or educational sessions. In studies that tracked daily steps, the intervention group averaged 612 more steps per day. Additionally, the study found that exercise interventions reduced the risk of diabetes.

A study conducted by Mayo (2014) at McGill University Health Center consisted of an eight week walking intervention for advanced cancer patients who experienced extreme fatigue.

This pilot study measured the fatigue level prior to treatment and then gave the participants the option to walk during or after treatment. The researchers looked at two different aspects, physical function, and well-being. It was concluded that patients' physical function measures increased on average by 1.40 (95%CI: 0.41- 4.79) and 2.36 (95%CI: 0.66-8.51) for the well-being measures respectively (Mayo 2014). The researchers hope to further research the benefits of walking for advanced cancer patients with a larger group of participants.

As demonstrated by these studies, there is strong evidence that employee wellness programs that include walking interventions save money on healthcare costs. Each of these studies has described the numerous benefits of a walking program. However, the known absence of participants who smoke or consume large amounts of alcohol represents a research gap that this study addressed.

## Methods

Before the research and data collection began, the study received IRB approval from the university. Additionally, a grant was obtained to offset various research costs. This grant was used to purchase blood glucose monitors, testing strips and CardioCheck Blood Testing Devices.

Participants were recruited from the faculty and staff at the university. A campus-wide recruitment email was sent out to all faculty and staff and 47 faculty/staff participated in the study. The study consisted of 31 females and 16 males. The mean age of the participants was 49 years old. Of these participants, 73% stated that they exercised on a regular basis at an average frequency of three times per week. Each university employee adheres to a faith-based values lifestyle and does not smoke or drink. It is important to note that the participants did not adhere to this lifestyle exclusively for the purpose of the study, but rather due to the terms of their employment contract. The participants filled out the PAR-Q, a health history questionnaire and

an informed consent form. They listed their current medications and the average amount of time they exercised each week.

Subjects reported to the lab for their pre-test measurements which included fasting blood work measurements of total cholesterol, HDL, LDL, glucose, triglycerides, and TC/HDL ratio. Additional measurements included resting blood pressure and a waist circumference measurement. Participants were then instructed to exercise for at least 30 minutes a day, four days a week for 12 weeks. While walking was the recommended form of aerobic activity, subjects were allowed and encouraged to participate in the aerobic activities of their choice. Participants self-reported their aerobic exercise frequency online throughout the study. At the end of 12 weeks, participants returned to the lab for their post-test measurements. Each participant's biometrics were retaken after the exercise intervention and compared to the baseline data.

## Results

IBM's SPSS version 22 was used to analyze the data. The baseline and post-intervention data were compared using a repeated measures analysis of variance (ANOVA). The repeated measures ANOVA compared the baseline and post-test data for fasting glucose, waist circumference, triglycerides, total cholesterol, LDL, HDL, TC/HDL ratio, systolic blood pressure and diastolic blood pressure. For each statistical test, the alpha level was set at $p=0.05$.

Participants logged their exercise activity online. The exercise recommendation was a total of 48 days during the intervention. On average, the participants logged 49 days of exercise over the 12 week program, indicating a high adherence rate in those who completed the exercise intervention. According to the online exercise logs, 57% of participants completed at least the recommended 48 days of exercise. Comparing this adherence rate to other studies is difficult

because previous exercise interventions for university faculty and staff measured adherence with a pedometer and did not record how many days participants exercised. Nonetheless, since 57% of the participants logged the recommended amount of exercise, and since the mean amount of exercise exceeded the recommended amount of exercise, adherence to the program was satisfactory. The participants' high exercise volume during the intervention produced the positive biometric changes observed. Since most participants exercised on a regular basis before the 12 week program, exercising four days a week was not a significant lifestyle change for most. This factor positively contributed to the high adherence rate observed in the study.

Overall, the subjects' biometrics improved over the course of the 12 week intervention. Though most measured risk factors only tended towards improvement, both blood pressure measurements demonstrated statistically significant improvement. The test group's mean systolic blood pressure dropped from 123 mm Hg before the exercise intervention to 114 mm Hg after the 12 week program while the group's mean diastolic blood pressure improved approximately 7 points, dropping from 83 mm Hg to 76 mm Hg. The improvement in systolic blood pressure was unquestionably significant ($p=0.00008$) while a clearly significant diastolic change was also observed ($p=0.001$). The data also indicated small improvements in total cholesterol, triglycerides, fasting glucose, and waist circumference. Total cholesterol improved slightly, decreasing from 164.0 mg/dL to 159.1 mg/dL over the course of the study ($p=0.255$). Likewise, fasting glucose decreased a very small amount, from 103.7 mg/dL to 103.1 mg/dL ($p=0.806$). Triglyceride levels improved by 13.0 mg/dL during the exercise intervention ($p=0.138$). An improvement in mean waist circumference (34.6 inches to 34.1 inches) also approached statistical significance ($p=0.132$). HDL significantly decreased during the course of the study,

contrary to the findings of previous research (Kodama, 2007). The unusual HDL results were likely caused by measurement error. Chart A summarizes that statistical results of the study.

| | Pre-test | Pre-test σ | Post-test | Post-test σ | Significance |
|---|---|---|---|---|---|
| HDL | 52.70 | 15.388 | 49.26 | 15.514 | 0.028* |
| LDL | 94.88 | 33.08 | 96.88 | 37.69 | 0.720 |
| Total Cholesterol | 163.98 | 31.29 | 159.11 | 40.23 | 0.255 |
| Fasting Glucose | 103.66 | 17.157 | 103.09 | 17.705 | 0.806 |
| Systolic BP | 123.34 | 16.411 | 113.74 | 11.182 | 0.000081* |
| Diastolic BP | 82.72 | 13.31 | 75.85 | 8.68 | 0.00096* |
| Triglycerides | 104.45 | 59.71 | 91.45 | 48.63 | 0.138 |
| TC/HDL Ratio | 3.379 | 1.166 | 3.440 | 1.129 | 0.614 |
| Waist Circumference | 34.60 | 5.44 | 34.13 | 5.31 | 0.132 |
| * indicates significance ($p<0.05$) | | | | | |

Chart A

Of the 64 participants who began the study, 47 completed the exercise intervention, representing an attrition rate of 26.6%. Considering the high rate of dropout with most exercise programs and the importance for participants to motivate themselves, the attrition rate was neither surprising nor unexpected. Since participants who dropped out could not be contacted for post-intervention testing, exit interviews were not conducted to determine causes of dropout.

## Discussion

The results from the study offer compelling evidence for the effectiveness of a low to moderate intensity walking program in improving health and lowering cardiovascular risk factors in non-smoking, non-drinking university faculty and staff. Unlike some exercise interventions that target sedentary individuals, this study primarily consisted of regularly exercising adults.

73% of participants reported exercising at least once per week before the study, and these participants exercised an average of 3 days per week. The results of this study indicate that even for non-drinking, non-smoking university employees who exercise several times per week, a walking program is beneficial for lowering blood pressure and potentially improving other biometrics related to cardiovascular health. Likely, a lengthier or more intense exercise intervention would have produced greater biometric changes and more statistically significant health improvements.

The study was not without limitations. First, the relatively high attrition rate, approximately a quarter of the participants, indicates that a fair percentage of individuals may be unable to complete even a low-intensity exercise program. Also, since the subjects neither smoke nor drink, the findings can only be accurately applied to individuals with similar lifestyles. Finally, multiple factors caused several outliers in the data. While measurement error likely explains most of the outliers, one woman went off of her cholesterol medication during the study, causing her post-test numbers to be much higher than her baseline, even though she was healthier after completing the program.

Despite the study's limitations, its findings strongly support to the implementation of university health and wellness programs that include walking programs. If faculty and staff who have fewer risk factors (i.e. not smoking and not drinking) benefit from a 12 week walking program, greater improvements could be expected in individuals with more risk factors. Additionally, in order to comply with the American College of Sports Medicine (2013) current guidelines for aerobic exercise, participants would have needed to exercise at a moderate intensity for at least 150 minutes a week. Therefore, more significant benefits are expected if individuals exercised for longer than 30 minutes, more than 4 days per week, or used an exercise

mode of a higher intensity than walking. Nonetheless, the results of this study indicate the effectiveness of a short-term walking program for improving health and biometrics for cardiovascular risk among faculty and staff at a faith-based university.

## Future Research

Future studies could include a longer intervention period, such as an exercise intervention spanning two semesters (approximately 30 weeks) instead of just one. This would enable researchers to more accurately determine the long-term effects of an exercise intervention. Also, testing a larger population in a similar study would increase the validity of the findings. The minimum amount of exercise could be increased by increasing the frequency, time, or intensity of exercise. Moderate to vigorous exercise intensity could be required. When future studies are conducted, more social support such as weekly meetings should be required to increase program adherence (Resnick, 2002).

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