

B.A.L.A.N.C.E.: EVALUATING THE
EFFECTIVENESS OF A 14-WEEK
WORKSITE WELLNESS PROGRAM
ON REDUCING METABOLIC
SYNDROME RISK FACTORS

By

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The purpose of this study was to determine how successful the 14-week B.A.L.A.N.C.E. program was in reducing risk factors of metabolic syndrome, as well as determine if participants viewed this program as successful in helping them build a healthy lifestyle. A total of 89 Oklahoma State University benefits-eligible employees participated in the program between 2011-2014. Participants applied for the program through Oklahoma State University's Department of Wellness and were accepted based on their level of risk for metabolic syndrome. All participants received three individual counseling sessions with a registered dietitian, attended at least ten nutrition education sessions, and had access a personal trainer for at least 60 minutes a week. After the 14-week intervention, participants were required to attend five monthly group meetings until the one-year mark. At week one, week 14 and one year follow-up, participants completed a health assessment that measured BMI, abdominal girth, cholesterol, triglycerides, HDL cholesterol, LDL cholesterol, systolic blood pressure, diastolic blood pressure, and blood glucose. Fitness (muscular strength, flexibility, VO₂ Max) was assessed at baseline and week 14. Participants were invited to complete a perceptions survey after completion of the program; a total of 40 participants completed the survey. Paired t-tests showed significant reductions in BMI ($p < 0.001$), girth ($p < 0.001$), triglycerides ($p < 0.001$), blood glucose ($p = 0.008$), systolic blood pressure ($p < 0.001$), diastolic blood pressure ($p = 0.015$), flexibility ($p < 0.001$), muscular strength ($p < 0.001$), and VO₂ Max ($P < 0.001$) after 14 weeks. Paired t-tests did not show significant changes in HDL or total cholesterol. From baseline to one-year, paired t-test found significant reductions in BMI ($p < 0.001$), girth ($p < 0.001$), blood glucose ($p = 0.028$), and systolic blood pressure ($p = 0.006$). T-tests showed no significant differences in outcome measures between participants who fully complied with the program and those who did not. Most participants who completed the survey agreed or strongly agreed that participation in the program was beneficial and that they would recommend this program to other employees. Most participants agreed or strongly agreed that they understood more about nutrition and exercise after completing the program. Results from this program show a short-term worksite wellness program was effective in reducing metabolic syndrome risk factors, and that participants perceived the program as being beneficial to their health.

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CHAPTER I

INTRODUCTION

As the U.S. experienced a rise in obesity rates, there was also a rise in cases of metabolic syndrome (Eckel, Grundy, & Zimmet, 2005). Metabolic syndrome is a combination of risk factors that include increased visceral fat, raised triglycerides, reduced HDL cholesterol, raised blood pressure, and raised fasting plasma glucose. Metabolic syndrome puts an individual at an increased risk for both cardiovascular disease (CVD) and type 2 diabetes. The typical westernized lifestyle is the main contributor to the prevalence of metabolic syndrome (Han & Lean, 2010). A lack of physical activity combined with an increased energy intake particularly from high-fat foods leads to the development of the associated risk factors. The typical American diet that is high in fat and sodium can contribute to raised triglycerides and blood pressure, two of the criteria for metabolic syndrome. Most of these risk factors are preventable and modifiable with a healthy lifestyle. Consuming a healthy diet and participating in physical activity can help prevent the development of these risk factors. With the prevention of metabolic syndrome, the risk for CVD and type 2 diabetes can be significantly decreased. Metabolic syndrome can be reversed as well, and risk factors can be minimized.

There have been many lifestyle modification programs put in place with the goal of reducing risk factors of not only metabolic syndrome but CVD as well (Lin, Chiang, Tzeng, &

Chiang, 2014). Lifestyle modification programs focus on health education, and often include nutrition counseling and exercise regimens. Oklahoma State University Department of Wellness offers an employee wellness program for individuals with risk factors for metabolic syndrome. The B.A.L.A.N.C.E. program, Building a Healthy Lifestyle on Activity, Nutrition, Confidence, and Energy, is a 14-week program that includes a pre and post health assessment, weekly nutrition meetings, group exercise activities, and lifestyle modification sessions. The goals of this project were to determine how successful this program was in reducing risk factors of metabolic syndrome, as well as determine if participants viewed this program as successful in helping them build a healthy lifestyle.

Research Questions

- What is the difference in BMI before and after the B.A.L.A.N.C.E. program?
- What is the difference in abdominal girth before and after the B.A.L.A.N.C.E. program?
- What are the differences in cholesterol, triglycerides, HDL, and LDL before and after the B.A.L.A.N.C.E. program?
- What are the differences between systolic blood pressure and diastolic blood pressure before and after the B.A.L.A.N.C.E. program?
- What is the difference in blood glucose levels before and after the B.A.L.A.N.C.E. program?
- What are the differences in flexibility, cardiovascular health, and muscular strength before and after the B.A.L.A.N.C.E. program?
- What are the differences between participants who were compliant with the program versus non-compliant in the reduction of metabolic syndrome risk factors?
- How did the B.A.L.A.N.C.E. program help participants build a healthy lifestyle?

CHAPTER II

REVIEW OF LITERATURE

Metabolic Syndrome

Metabolic syndrome is a group of metabolic disorders, which put an individual at a greater risk for developing cardiovascular disease and type 2 diabetes (Han & Lean, 2010). The incidence of metabolic syndrome has increased over the past couple decades, likely associated with the obesity epidemic (Eckel, Grundy, & Zimmet, 2005). The criteria for metabolic syndrome most commonly used was set by the National Cholesterol Education Program Adult Treatment Panel III in 2001, and included the following metabolic disorders: increased visceral fat, with a waist circumference >102 cm for men and >88 cm for women, raised triglycerides ≥ 1.7 mmol, reduced HDL cholesterol at < 1.03 mmol for men and < 1.29 mmol for women, raised blood pressure $\geq 130/\geq 85$ mmHg, and raised fasting plasma glucose ≥ 6.1 mmol/L (>110 mg/dL) (Han & Lean, 2010). In order to be diagnosed with metabolic syndrome an individual must meet three of the criteria mentioned. The consumption of a Western diet combined with low levels of physical activity plays a strong role in the risk for developing metabolic syndrome.

An individual's dietary choices can influence their risk for developing metabolic syndrome, or components of it. However, the role of the diet in the development of metabolic syndrome has not been well defined. Baxtar, Coyne, and McClintock (2006) believe that there is no one dietary component that is linked to the development of metabolic syndrome,

however overall dietary patterns have been associated with an increased prevalence (Feldeisen and Tucker, 2007).

Dietary patterns that have been associated with an increased incidence of metabolic syndrome include the Western and empty calorie diets. The Western dietary pattern is characterized as being high in refined grains, processed meats, fried foods, red meat, sweets and desserts, hydrogenated fats and sweetened beverages. An empty calorie diet has similar aspects, with increased intakes of total fat, calories, and sweetened beverages with low intakes of fiber and vegetables (Sonnenberg et al., 2005). Sonnenberg and associates (2005) found that the empty calorie diet pattern was associated with the greatest risk for developing metabolic syndrome. The study looked at five different dietary pattern groups and concluded that the prevalence of metabolic syndrome was higher in the empty calorie group in both non-obese and obese women. Esmailzadeh and associates (2007) found that participants in the highest quintile of the Western dietary pattern had significantly higher BMI and prevalence of metabolic syndrome compared to those in the lowest quintile. Participants in the highest quintile of the Western diet also had significantly higher odds of insulin resistance, elevated blood pressure, and low HDL levels (Esmailzadeh et al., 2007). Participants in the healthy dietary pattern (high in fruits, poultry, legumes, vegetables, tea, fruit juice, and whole grains) had a significantly lower risk of developing metabolic syndrome and insulin resistance, as well as having lower BMI. Similar results were found in a study done by Lutsey, Steffan, and Stevens (2008), they evaluated the relationship of diet and metabolic syndrome in participants of the Atherosclerosis Risk in Communities study. Participants in the highest quintile of Western diet pattern had an 18% greater risk of developing metabolic syndrome than those in the lower quintile (Lutsey et al., 2008). Individual diet components of the Western diet were also examined, and it was found that greater consumption of meat, fried foods, and diet sodas were associated with an increased risk (Lutsey et al., 2008). The healthy dietary pattern or prudent diet was not associated with the incidence of metabolic syndrome (Lutsey et al., 2008). Both of these studies link the Western

dietary pattern to metabolic syndrome, with the diet leading to an increased risk for developing the disorder.

Dietary patterns are not the only factor that can influence the development of metabolic syndrome, a sedentary lifestyle also increases the risk for chronic diseases (Edwardson et al., 2012). Previous studies have shown that greater physical activity can lead to a lower weight, decreased visceral fat, decreased triglycerides, increased HDL, decreased blood pressure, and increased sensitivity to insulin (Laaksonen et al., 2002). Laaksonen and associates (2002) looked at the links between leisure-time physical activity and cardio-respiratory fitness and the development of metabolic syndrome. Leisure time physical activity was categorized into three levels: low-intensity (<4.5 METs, walking, yard work, fishing), moderate-high intensity (≥ 4.5 METs, brisk walking, jogging, swimming, bicycling), and high intensity (vigorous activities ≥ 7.5 METs, jogging, skiing, ball sports). This study found that men who participated in more than three hours a week of moderate-high intensity physical activity were 48% less likely to develop metabolic syndrome compared to sedentary men. Sedentary activity was defined as ≤ 60 /min moderate intensity exercise per week. An even larger benefit was seen in men who engaged in at least sixty minutes of vigorous activity, as they saw a two-thirds reduction in the probability of developing metabolic syndrome (Laaksonen et al., 2002). Individuals who have limited physical activity and live a sedentary lifestyle have an increased risk for the development of metabolic syndrome.

Ford, Kohl, Mokdad, and Ajani (2005) also studied the association between physical activity, sedentary behavior and metabolic syndrome. Participants in the NHANES survey were asked about their physical activity and sedentary behaviors. Participants were asked how frequent and for how long they participated in 43 moderate or vigorous leisure-time physical activities, as well as the amount of time they spent watching TV/using a computer. Frequency and duration of leisure-time activities was divided into three categories: 0, <150 minutes/wk, and ≥ 150 minutes/week. The study found that participants who did not engage in any physical

activity had nearly twice the odds of having metabolic syndrome compared to those who participated in ≥ 150 -minutes/week. It was also found that participants who had metabolic syndrome spent more hours watching TV/videos or using a computer than those who did not have metabolic syndrome (Ford et al., 2005).

A more recent study by Saleh & Janssen (2014) looked at whether sedentary time predicted metabolic syndrome. Participants were part of NHANES, with study data used from the 2003-2004 and 2005-2006 cycles. There were a total of 1,371 participants. Sedentary time was recorded using an accelerometer, which measured the volume, intensity, duration, and frequency of minute-to-minute movement. Each minute of data from the device was classified into one of three categories: sedentary (100 counts per minute threshold), light intensity (100-2,020 counts per minute), or moderate-vigorous ($>2,020$ counts per minute). This study also looked at the total amount of screen time per day, which included TV, video, and computer use. Participants were asked on average how many hours a day they watched TV, used the computer, or played computer games over the past 30 days. The total screen time was added together and separated into tertiles: T1= 0-1 hours, T2= 2 hours, T3= 3-6 hours. The study found that the odds of metabolic syndrome were higher in participants classified in the highest sedentary quartile compared to those in the lowest quartile. The odds ratio of metabolic syndrome was also higher in participants in the highest screen time quartile when compared to those in the lowest quartile. Furthermore, it was found that sedentary time and screen time were significantly associated with several components of metabolic syndrome that included a high waist circumference, high triglycerides, and low HDL cholesterol (Saleh & Janseen, 2014).

Insulin resistance is an underlying mechanism that connects metabolic syndrome risk factors, with only about 30% of patients with metabolic syndrome having normal insulin sensitivity (Han & Lean, 2010). While there is no measure of insulin resistance in the definition of metabolic syndrome, it is closely related to metabolic syndrome (Miranda, DeFronzo, Califf, & Guyton, 2005). Insulin resistance causes insulin to fail to suppress glucose production, an

increase in plasma glucose concentration and a decrease in the cellular uptake of glucose. It is thought to have an influence on the development of other metabolic syndrome risk factors through several mechanisms including: hyperglycemia, compensatory hyperinsulinemia, and changes to the insulin signaling pathways (Miranda et al., 2005). Hyperinsulinemia may lead to an increase in triglycerides due to the elevated release of VLDLs (Grundy, Brewer, Cleeman, Smith, & Lenfant, 2004). Hyperinsulinemia can also contribute to a fatty liver, as excess fatty acids from the muscle are directed to the liver (Grundy, 1999). Insulin resistance has a connection to several risk factors, including increased body fat, which is the other key contributor to metabolic syndrome.

Metabolic syndrome is characterized by intra-abdominal fat accumulation. Increased intra-abdominal fat results in increased plasma free fatty acids, which cause an increase in the release of pro-inflammatory cytokines such as interleukin 6 and tumor necrosis factor alpha (Han & Lean, 2010). An increase in these cytokines not only plays a role in causing insulin resistance, but also leads to inflammation and increased blood pressure (Han & Lean, 2010). Elevated fat stores or obesity result in abnormal triglyceride use and storage, which can cause insulin resistance in liver and muscle cells (Miranda et al., 2005). Insulin resistance further contributes to excess free fatty acids in the blood due to the stimulation in lipolysis it produces (Miranda et al., 2005). Excess free fatty acids and pro-inflammatory cytokines are associated with several metabolic disorders that are risk factors for metabolic syndrome. Free fatty acids also increase the synthesis of LDL and VLDL, and inhibit cholesterol esterification, resulting in decreased HDL levels (Han & Lean, 2010). Carr and associates (2004) studied the relationship between insulin resistance and central adiposity together and independently on metabolic syndrome risk factors. It was found that intra-abdominal fat was independently linked to insulin resistance, decreased HDL, increased triglycerides levels, coronary artery calcification, and elevated blood pressure (Carr et al., 2004). Blood pressure is another factor of metabolic syndrome on which insulin resistance has a negative effect. Increased free fatty acids caused by insulin resistance lead to

both an increase in the production of angiotensinogen and enhanced oxidative stress (Miranda et al., 2005).

Management of metabolic syndrome is vital, as all components are modifiable. Weight management is the primary target for treatment of metabolic syndrome, with a 5-10% weight loss reducing CVD and diabetes risk by over 50%. (Han & Lean, 2012). Many different drugs are used to treat one or more components of metabolic syndrome as well. Commonly prescribed drugs include metformin, which is used to help improve glucose tolerance, and anti-obesity drugs such as orlistat to help promote weight loss. Lifestyle modification is preferred in reducing the risk factors of metabolic syndrome and can prevent the development of metabolic syndrome. Lifestyle changes focus on physical activity and dietary changes that include: reduced intake of saturated fats, trans fat, and simple sugars, and an increased consumption of fruits, vegetables, whole grains, and lean meats (Eckel et al., 2005).

A small change in weight can have a substantial effect on health. Losing weight is achieved by decreasing energy intake and increasing energy expenditure. Consuming a healthy diet is a vital part of this equation, and is the center for managing and preventing metabolic disease. One diet that has been shown to reduce metabolic risk factors is the Dietary Approaches to Stop Hypertension (DASH) diet. The DASH diet is characterized by increased fruits and vegetables, low fat dairy, and whole grains, while being lower in saturated fat, total fat, refined grains, red meat, and sweets (Azadbakht, Mirmiran, Esmailzadeh, Azizi and Azizi, 2005). The dietary plan is also lower in sodium than most individual's daily consumption, and higher in calcium, potassium, and magnesium. Azadbakht, et al. (2005) conducted a study comparing the effects the DASH diet had on metabolic syndrome risk factor compared to a weight-reducing diet and control diet. Participants in the control diet were told to eat normally, while the weight-reducing group consumed a diet 500 calories less than their caloric needs. The participants in the DASH group also consumed 500 calories less, but their diet consisted of foods specific to the DASH diet. Participants in the weight-reducing group consumed a diet similar in content to that

of the control, which included more red meat, fat, saturated fat, cholesterol, and sugar than did the DASH group. The DASH diet resulted in higher HDL cholesterol, and lower triglycerides, systolic and diastolic blood pressure, and weight. While the weight-reducing diet group also saw some positive benefits, the prevalence of metabolic syndrome decreased significantly in the DASH group when compared to both the control and weight-reducing group. Therefore the DASH diet was positively associated with decreasing metabolic syndrome risk factors even when controlling for weight reduction (Azadbakht et al., 2005). While weight reduction can have a positive effect on health, the nutrient profile of what a person is consuming plays a vital role in improving one's health.

Worksite Wellness Programs

As the prevalence of obesity and cardiovascular disease has increased significantly over the last decade, so has health care costs. In order to reduce these costs, many worksites have introduced employee wellness programs. Lifestyle modification including behavior changes that target physical activity and a healthy diet have been linked to decreasing risk of chronic disease (LeCheminant & Merrill, 2012). The main focus of many worksite wellness programs is to reduce risk of chronic disease including: lowering excess body weight, lowering cholesterol levels, and lowering high blood pressure (Neville, Merrill, & Kumpfer, 2011). The workplace has been a target place for health promotion, because there is efficient communication, a common culture, and social support. According to Neville et al. (104), an advantage of using the worksite to increase wellness is that it “allows access to employees in a controlled environment through existing channels of communication and social support networks.” Worksite wellness programs offered by the employer can help reduce health risks and reduce health care costs. Health promotion creates a learning experience for employees that increases awareness, motivation, and skills to make positive health changes (Lecheminant & Merrill, 2012).

Employees that are in poor health and have greater health risk are more likely to have lower productivity and performance, and more lost workdays (Carnethon et al., 2009). Increased absenteeism is an expense that results from having health risk factors. Carnethon and associates (2009) found that the number of risk factors for health problems is positively associated with the rate of absenteeism. Poor health has a small effect on lost workdays when compared to the impact it has on productivity. Employees with higher health risk are less productive at work, with productivity losses totaling anywhere from 20-60% of health care cost (Carnethon et al., 2009). This is estimated to cost a total of \$225.8 billion a year for US companies, which is approximately \$1,685 a year per employee (Carnethon et al., 2009). Therefore, employers should focus on prevention, screening, and management of chronic conditions (Sparling, 2010).

Employers can benefit financially by investing in their employees well-being. Creating a worksite wellness program can help companies decrease lost workdays and the associated costs. Baicker, Cutler, and Song (2010) looked at the cost saving benefits of a worksite wellness program, and found that on average, absentee days decreased by 1.7-1.9 days a year. This was found to save a company \$274- \$309 per employee per year (Baicker et al., 2010). The main motivation for companies to implement a wellness program is increasing health care costs, especially with employers paying more than one third of the annual medical bill (Goetzel & Ozminkowski, 2008). Employees with major risk factors have higher medical costs than healthy employees, estimated to total 25-30% of a company's medical costs per year (Carnethon et al., 2009). Common major risk factors include cigarette smoking, obesity, hypertension, dyslipidemia, physical inactivity, and diabetes (Carnethon et al., 2009). Worksite wellness programs have been shown to be able to reduce employers health care cost by 26% (Carnethon et al., 2009). Baicker and associates (2010) found an average return on investment of \$3.27 for every dollar spent on wellness programs. While the return on investment is a driving factor, worksite wellness programs are not widely offered.

Healthy People 2010 outlines a comprehensive worksite wellness program as having the following five components: health education, supportive social and physical environments, integration of the program, linkage to related programs, and health assessments and screenings (Healthy Workforce 2010). The majority of worksites offer some type of health promotion program, however according to the National Worksite Health Promotion Survey (Goetzel & Ozminkowski, 2008), only 6.9% of employers offer programs that integrate all five components.

Several organizations, such as the American Heart Association (AHA) and the Centers for Disease Control and Prevention (CDC), have made recommendations for what a successful worksite wellness program should entail. Both the CDC and AHA state that wellness programs must be available to all employees, and must address the needs of all employees (Carnethon et al., 2009). Programs should fit health promotion activities to employee needs, and should be culturally sensitive (Sparling, 2010). Employees needs vary by individual, which is why programs should include multiple components. Successful programs acknowledge diversity and tailor programs to the needs of both individuals and the whole company (CDC, 2008).

To identify employees' needs and health risks, employers should provide health assessments. Health assessments provide valuable information about a person's health status to their readiness to make changes (Goetzel et al., 2008). Information gathered is used to structure interventions most likely to improve their health risk (Goetzel et al., 2008). The information also allows programs to offer feedback to employees and help them set goals. Regular follow-ups and health assessments can help monitor goals, and can help employees maintain healthy behaviors (Sparling, 2010).

Commitment by the company to employee health is vital. Incorporating wellness programs into a company's business plan and getting support from senior level management leads to more successful programs (CDC, 2008). Involvement from any of level of management helps build a supportive community for the program, and has a positive influence on employees' morale. Another important aspect in developing a successful program is integrating programs

into the structure of the workplace and allotting resources (Carnethon et al., 2009). Worksite wellness programs are developed to help improve the health of employees, and to do this employees must have resources to help them. Resources that can be offered to help employees can include health education resources, as well as environmental changes to the worksite. Health education resources should come from valid sources, and could include services such as meeting with a registered dietitian. Environmental changes that can be made include things such as having attractive stairwells available for employees to use, vending machines that offer healthy options, and locker rooms available for employees to shower and change (Sparling, 2010).

All of these components play a part in making a wellness program successful, however no program will be successful without employee participation. There are a couple ways to increase employee participation. One suggested way is to involve employees in the development and execution of the program (CDC, 2008). By involving employees in the design, it allows them to create a program in which they would want to participate. More commonly, employers use incentives or rewards to encourage employee participation. Incentives and rewards could include financial rewards, time off, lower health insurance premiums, or some form of recognition for participation (CDC, 2008).

Many worksite wellness programs have been studied and have been shown to be effective in increasing health and reducing risk factors for chronic disease in employees. The more successful programs include multifaceted health promotion programs. Components that are most frequently included in wellness programs are: cardiovascular disease education, tobacco cessation and prevention, early detection and screening for cardiovascular disease weight management, nutrition, physical activity, and stress management (Carnethon et al., 2009). Tobacco use alone costs employers almost ninety-two billion dollars a year, primarily due to lost production time (Carnethon et al., 2009). Interventions to reduce cigarette smoking not only benefit smokers, but also staff exposed to second-hand smoke at the worksite. Stress management is an important

factor to address because it not only affects work performance, it also is associated with the onset of cardiovascular risk factors (Carnethon et al., 2009).

Arguably, the most essential component in wellness programs is weight maintenance, focusing on both physical activity and nutrition. Medical cost for patients that are obese compared to those of normal weight is increased by approximately \$1,429 a year, based on data from 2006 (Finkelstein, Trogon, Cohen, & Dietz, 2009). The CDC stated that a reduction in weight can lead to medical cost savings due to the decreased treatment cost for chronic diseases (Carnethon et al., 2009). Even minor changes in dietary choices combined with increased physical activity can have positive effects on health. Not only does the AHA believe that practicing a healthy diet/lifestyle is the foundation for the prevention and treatment of chronic disease, but employees themselves reported that programs centered on nutrition had the largest influence on their health (Carnethon et al., 2009). As mentioned before, employees needs vary and one specific intervention style may not suit everyone. Having a comprehensive program aimed to offer a variety of services paves the way for a successful worksite wellness program.

Worksite Opportunities for Wellness, WOW, was a 1-year program that compared an assessment only to an intervention in reducing the prevalence or severity of obesity and CVD risk factors (Racette et al., 2009). Sixty-eight subjects in the intervention group participated in a multi-faceted health promotion program that included nutrition components, physical activity components, and incentives to promote a healthy diet and exercise. Social support involved many group activities to promote participation such as group exercise, lunchtime seminars, team competitions, and participation rewards among other things. The study found that the comprehensive intervention program was feasible and effective in reducing CVD risk factors among employees. The intervention group had greater reductions in body weight, BMI, and fat mass compared to the control, and had an increase in daily physical activity and fruit and vegetable consumption. These are all components of making a lifestyle behavioral change that improves health.

The PREMIER trial studied the effect of a behavioral intervention on blood pressure, lipids, and insulin resistance in participants with and without metabolic syndrome (Lien et al., 2007). Participants were recruited by four clinical centers using media, mailing announcements, and through community screenings (Appeal et al., 2003). Participants were divided into three groups: a control group, a behavioral intervention group, and an intervention group plus DASH diet (Lien et al., 2007). The control group, or advice only group, received one 30-minute counseling session, while both intervention groups received eighteen individual counseling sessions. There were two intervention groups, one that received the behavioral intervention and one that received the behavioral intervention plus DASH diet guidelines (Lien et al., 2007). The study compared results between participants who had metabolic syndrome and those who did not. Participants with metabolic syndrome in the intervention+DASH group had significant reductions in systolic blood pressure compared to the control group. Participants without metabolic syndrome had significantly reduced systolic blood pressure in both intervention groups. Participants in the intervention group had significantly reduced triglyceride levels compared to the control group, regardless of metabolic syndrome status, however the intervention+DASH group did not show any significant change in triglycerides. Furthermore while not significant, both intervention groups saw a trend toward a reduction in fasting insulin, regardless of metabolic syndrome status (Lien et al., 2007). This study showed significant improvements in the primary outcome, systolic BP, in both intervention groups, however only small reductions were seen in the other outcome measures.

Lifestyle modification programs can include physical activity and nutrition component, or only one of those aspects. Modification can also include considerable changes or simple small steps in changing one's lifestyle. In a study by Kim et al. (2012), the effects of a 1-year lifestyle-based physical activity program on metabolic syndrome and its factors in overweight Japanese male employees from 12 different worksites was examined. A total of 365 men, who were overweight with at least one component of metabolic syndrome were included. All employees

participated in an intervention in which they were instructed to include at least ten minutes of brisk walking into their daily schedule. Participants tracked steps with a pedometer, aiming for at least 3,000 steps a day. They received reports each month to track their adherence, and physical activity was measured daily throughout the intervention. The study found that after one year, the participant's BMI, waist circumference, systolic blood pressure, triglycerides, and fasting blood glucose were significantly lower when compared to baseline measurements. The prevalence of metabolic syndrome and its components significantly decreased after one year of a physical activity intervention that focused on brisk walking (Kim et al., 2012). While a more intensive exercise and nutrition program may result in more advanced improvements in metabolic syndrome, a small increase in physical activity by simply walking for ten minutes a day can significantly reduce the prevalence of metabolic syndrome and its components.

While the previous study focused only on increasing physical activity, a study conducted in a university setting focused on weight management through diet and exercise. A study by Touger-Decker, O'Sullivan-Maillet, & Byham-Gray (2008), measured the impact a twelve-week weight management program had on health risks of campus faculty. Full-time faculty volunteered to participate in the program, with a limit of thirty-five employees per intervention. Participants attended twelve 50-minute sessions led by a registered dietitian, along with three individual sessions. Topics covered in the weekly meetings comprised of healthful eating, portion control, exercise, dining out, stress and food, etc. Participants were given personalized diet recommendations based on the USDA's Dietary Guidelines for Americans and the DASH diet, and pedometers were given to record weekly steps. There was no requirement for weekly physical activity or adhering to diet recommendations. Participants were included in the data analysis if they completed the program, which required them to attend all individual and some group sessions (number not disclosed). It was found that participants who completed the program saw significant reductions in body weight, BMI, percent body fat, waist circumference, waist-hip ratio, total cholesterol, and systolic/diastolic blood pressures (Touger-Decker et al., 2008). This

wellness program did not have any requirements for participation and was held during the lunch hour, which allowed employees to incorporate the program into their schedule without interfering with work. This study is an example of how a simple short-term health education program can be successful.

A similar study was conducted at BMW of North America, LLC to reduce metabolic risk factors of employees. The Health FirstSM program was a lifestyle and weight management program designed to decrease metabolic risk factors with individual objectives that included losing weight, decreasing blood pressure, improving lipid levels, etc. (Daubert, Ferko-Adams, Rheinheimer, & Brecht, 2012). Employees volunteered for the program in which they completed a pre-program assessment and set individual goals based on their needs. The Health FirstSM program was a twelve-week team based competition program that included both onsite and online components. Participants attended eight lunch hour informational sessions led by a registered dietitian, and had access to education materials and presentations online. Informational sessions covered topics such as proper nutrition, portion control, snacking, exercise, and information on meal plans including the DASH diet plan. The Health FirstSM website also allowed participants to review their own health records as well as keep track of team points. Teams were awarded points for various reasons that included losing weight, meeting exercise or health goals, and attending weekly sessions. While this program did not include any physical activity requirements or access to fitness facilities/trainers, it did encourage participants to be physically active by providing them with educational material on exercise. A total of 87 participants met the criteria for data analysis, which included completing initial, midpoint, and final biometric/hematological measurements, completing pre/post evaluations, attending at least 6/8 weekly meetings, exercising at least 6 weeks, and receiving individual coaching sessions. There were significant reductions in waist circumference, weight, BMI, diastolic BP, and systolic BP at the conclusion of the study. Fasting blood glucose, non-fasting blood glucose, triglycerides, HDL, LDL, and total cholesterol were measured as well, however changes in those outcomes were not significant.

There were 14 participants who had metabolic syndrome at the beginning of the program, which was reduced to 8 by the end of the program. Of the participants who completed the program's post-evaluation, 91% reported they had improved their eating habits, and 83.6% reported they had improved their exercise habits (Daubert et al., 2012).

Summary

The research presented in this literature review shows that certain dietary patterns, such as the Western diet, and a sedentary lifestyle are associated with an increased risk for developing metabolic syndrome. Both of these factors are modifiable, and are the key components addressed in prevention and treatment of metabolic syndrome. Employers can implement worksite wellness programs to help decrease the prevalence and risk of chronic diseases in employees, while also helping reduce medical care costs. The research presented has shown that worksite wellness programs that focus on diet, exercise, or lifestyle changes have been effective in reducing those risks. The B.A.L.A.N.C.E. program implemented a short-term intervention focused on nutrition and exercise education that successfully reduced metabolic risk factors. Nutrition education was provided by a registered dietitian, and exercise education was provided by a personal trainer/fitness expert. The purpose of this study was to determine if the implementation of this worksite wellness program helped participants create a foundation for making healthy lifestyle choices, and if they perceived the program as being beneficial to improving their health.

CHAPTER III

METHODOLOGY

The purpose of the study was to determine the effectiveness of the B.A.L.A.N.C.E. program (Building a Lifestyle on Activity, Nutrition, Confidence, and Energy), by determining the program's success at reducing participants' risk factors for metabolic syndrome and evaluating the participants' perceptions of the program. Quantitative data was previously collected by B.A.L.A.N.C.E. staff from the years 2011-2014. Each participant was required to complete a health and fitness assessment during week 1 and week 14, and a health assessment after one year. A survey was administered to collect the participants' perceptions of the program, and was administered through an online survey system, SurveyMonkey.com (see Appendix A). The Oklahoma State University Institutional Review Board approved the research as exempt on April 8, 2015. The letter of approval from Oklahoma State University is shown in Appendix B.

Participants

The B.A.L.A.N.C.E. program was available to Oklahoma State University –Stillwater benefits-eligible employees who had not previously participated in the program or the Naturally Slim ® program. The program was offered twice a year, and applications were available on the Department of Wellness's website. Participants were selected based on their level of risk for metabolic syndrome; applicants with the most risk factors were given priority for selection. For this study, there were a total of 89 participants assessed for the quantitative data analysis. All

former participants of the B.A.L.A.N.C.E. program were invited by email to participate in the survey of perceptions.

Employee Wellness Program at OSU

Oklahoma State University Department of Wellness offers an employee wellness program, B.A.L.A.N.C.E., a 14-week program designed for individuals with measurable risk factors for metabolic syndrome. The wellness team consisted of a registered dietitian, a personal trainer, and a health educator, who worked together to create an individualized program for participants. Participants were required to comply with the program components to continue in the program. To be in compliance with the program, participants agreed to the following components: complete a health and fitness assessment during week 1 and week 14, participate in at least 150 minutes of physical activity during at least 10 weeks of the program with at least 60 minutes completed in Department of Wellness group exercise, participate in three individual nutrition consultations, attend 10 group nutrition programs with a weekly weigh in, attend at least two lifestyle modification sessions, and attend 5 monthly follow up meetings within a year of completing the program.

This program was offered to employees at OSU-Stillwater who were benefits eligible at no cost, however there was a \$200 charge for participants who did not comply with the components listed above. Throughout the program, participants had access to up to five personal training sessions a week with Department of Wellness personal trainers. Weekly group nutrition meetings provided participants with information on reading food labels, portion size control, and building a balanced meal. Department of Wellness cookbooks were given to each participant, and meals from the cookbook recipes were provided at each weekly nutrition meeting. A final component of the program was a series of lifestyle modification programs that covered topics such as managing stress, nutrition and mental health, and standing up for your health. These programs were open to current B.A.L.A.N.C.E. participants, and those that had completed the 14

weeks. Following the completion of weekly group meetings, each B.A.L.A.N.C.E. group met monthly until the one-year mark.

Materials and Methods

Quantitative data was previously collected by B.A.L.A.N.C.E. staff from the years 2011-2014. Each B.A.L.A.N.C.E. participant was required to complete a health and fitness assessment during weeks 1 and 14 and a health assessment one year after the end of the program. The fitness assessment measured flexibility, muscular strength, and cardiovascular health. A sit and reach test measured participant's hamstring flexibility, and was measured in centimeters. To test muscular strength, participants completed a YMCA bench press test. The YMCA bench press test measured the number of repetitions participants could complete at a pace of one second up and one second down. Women lifted thirty-five pounds and males lifted eighty pounds. The final fitness test was for cardiovascular health, participants completed a modified maximum oxygen uptake test (VO₂ Max test). Participants who were on blood pressure medication were unable to complete the modified VO₂ Max test. The health assessment included a blood test to measure total cholesterol, HDL, LDL, triglycerides, and fasting blood glucose. Other measurements included in the health assessment included height, weight, blood pressure, and abdominal girth measured by the health educator and fitness specialist.

Compliance with the requirements of the program was defined as completing required assessments, physical activity participation, attending nutrition meetings, attending lifestyle modification meetings, and attending monthly follow-up meetings. Participants were required to complete a health and fitness assessment at week one, week 14, and a one-year follow up health assessment. A minimum of 150 minutes of physical activity was required for at least ten of the 14 weeks. Participants had to complete 60 of the 150 minutes in a Department of Wellness group exercise activity. For the nutrition component, they had to participate in three individual consultations with a registered dietitian, attend at least ten of the group nutrition programs with a

weigh in, and record and submit a food journal for ten of the 14 weeks. Furthermore, participants had to attend at least two of the lifestyle modification programs offered and five of the monthly follow-up meetings after the initial fourteen weeks.

A survey was used to reflect the participants' perceptions of the program (see Appendix A), and was administered through an online survey system, SurveyMonkey.com, in May 2015. An email was sent that included an introduction to the study and an invitation to participate with a link to the survey (see Appendix C). The survey was sent to all employees who had participated in the B.A.L.A.N.C.E. program. Questions were aimed to evaluate the participants' perceptions and perceived benefits of the program. Questions 1-3, 5-6, 9 and question 11 used a Likert scale, with the highest rating being strongly agree and the lowest being strongly disagree. Questions 2-5 asked the participants about the influence the program had on creating a better understanding of nutrition and preparing a healthy balanced meal. Questions 6-7 asked participants about their knowledge of exercise and frequency of physical activity. Questions 1, 8, and 11 asked participants about whether they thought the program was beneficial and if they would recommend others to participate. Question 8 asked participants what benefits they experienced, by checking any benefit that applied to them. Finally, questions 12 and 13 were open-ended questions addressing how the program made a difference and what could be improved. Participants' answers were recorded anonymously by SurveyMonkey. Two emails were sent to remind participants to complete the survey. The first reminder email was sent after one week of the initial invitation, and the second was sent about one month after.

Statistical Analysis

- What are the differences in BMI before and after the B.A.L.A.N.C.E. program?

Paired t-tests were used to compare BMI values pre- and post- intervention at 14 weeks and after one year.

- What is the difference in abdominal girth before and after the B.A.L.A.N.C.E. program?

Paired t-tests were used to compare abdominal girth pre- and post intervention at 14 weeks and after one year.

- What are the differences in cholesterol, triglycerides, HDL, and LDL before and after the B.A.L.A.N.C.E. program?

Paired t-test were used to compare triglyceride, HDL, and LDL levels pre- and post- intervention at 14 weeks and after one year.

- What are the differences in systolic blood pressure and diastolic blood pressure before and after the B.A.L.A.N.C.E. program?

Paired t-test were used to compare systolic and diastolic blood pressures pre- and post- intervention at 14 weeks and after one year.

- What is the difference in blood glucose levels before and after the B.A.L.A.N.C.E. program?

Paired t-test were used to compare blood glucose levels pre- and post intervention at 14 weeks and after one year.

- What are the differences in flexibility, cardiovascular health and muscular strength before and after the B.A.L.A.N.C.E. program?

Paired t-test were used to compare cardiovascular health and muscular strength pre- and post- intervention at 14 weeks and after one year.

- What are the differences between participants who were compliant with the program versus non-compliant in the reduction of metabolic syndrome risk factors: increased visceral fat, elevated triglycerides, reduced HDL cholesterol, elevated blood pressure, and elevated fasting blood glucose?

T-test was used to determine the differences in the reduction of metabolic syndrome risk factors between participants who were compliant versus non-compliant.

- How did the B.A.L.A.N.C.E. program help participants build a healthy lifestyle?

Descriptive statistics were used to characterize participants' responses to the post intervention survey. Open-ended questions were examined with qualitative analysis.

CHAPTER IV

FINDINGS

A total of 89 employees at Oklahoma State University- Stillwater participated in the B.A.L.A.N.C.E. program. Participants completed a health and fitness assessment pre and post intervention; at week one and week 14, as well as a one-year follow up health assessment. The number of participants included in the analysis varied for each variable. Some participants did not complete the program or health factors prevented them from being able to participate in that component of the assessment. Participants were primarily women (n=61), with a mean age of 49 ± 10.7 years.

Table 1 shows the results for all outcome parameters. Using paired t-tests, changes from baseline (week 1) to completion (week 14) in all outcomes were assessed. There were significant reductions in outcome measures including BMI ($p<0.001$), girth ($p<0.001$), triglycerides ($p<0.001$), blood glucose ($p=0.008$), systolic blood pressure ($p<0.001$), diastolic blood pressure ($p=0.015$), flexibility ($p<0.001$), muscular strength ($p<0.001$), and VO_2 Max ($p<0.001$). Changes in HDL ($p=.353$), LDL ($p=.889$), and total cholesterol ($p=.154$) were not significant.

Four of the five risk factors for metabolic syndrome were reduced significantly from baseline to week 14. The mean girth decreased by 2.24 *cm* or 5%. Triglyceride levels showed

a significant reduction, and decreased by 31.61 mg/dL or 16.6%. The third risk factor that was significantly reduced was blood pressure, including both systolic and diastolic blood pressure. Systolic blood pressure decreased by 5.39 mm/Hg (4.1%), while diastolic blood pressure decreased by 2.54 mm/Hg (3%). Fourth, blood glucose was reduced by 8.38 or 7%.

The main part of the B.A.L.A.N.C.E. Program was conducted for fourteen weeks, however participants were required to attend follow up meetings and complete a one-year assessment. Table 2 shows the changes in outcome measures from baseline (week 1) to one year, for the 70 participants who completed the one year assessment. Four outcomes were significantly different from baseline to one year, BMI ($p < .001$), girth ($p < .001$), blood glucose ($p = 0.028$), and systolic blood pressure ($p = 0.006$). Triglycerides ($p = 0.063$), cholesterol ($p = 0.059$), and diastolic blood pressure ($p = 0.108$) tended to be reduced but not significantly.

When comparing differences in participants who complied with the program ($n = 70$) and those who did not ($n = 16$), there were no significant differences in the metabolic syndrome risk factors after fourteen weeks. While there were no significant differences, participants that were compliant tended to have a larger reduction in weight ($p = .052$) and triglycerides ($p = .063$) (Table 3).

Survey responses

All 89 B.A.L.A.N.C.E. participants were invited to participate in the perceptions survey. Five of the participants had invalid email addresses recorded, therefore 84 participants received the invitation. A total of 40 participants completed the survey in May or June 2015, representing a 48% response rate. Survey responses are presented in Table 4 and Appendix D.

Almost all (97.5%) of the participants agreed or strongly agreed that participation in the B.A.L.A.N.C.E. program was a beneficial experience. Most (95%) of the participants agreed or strongly agreed that they “would recommend other OSU employees participate in the

B.A.L.A.N.C.E. program”. Since the program ended, most (55%) participants agreed or strongly agreed that they “have maintained a healthy lifestyle”.

Several questions were purposefully written for determining to get participant’s opinions on the nutrition component of the program. Most (90%) participants agreed or strongly agreed they “understand more about nutrition after completing the program”. While a large number (70%) of participants stated they understand more about nutrition, fewer stated they “feel more confident in my ability to eat a balanced meal after the program”. Less than half (47.5%) of the participants agreed or strongly agreed that they “have continued preparing healthy meals since the program ended”. Just under half (47.5%) of the participants stated they consumed 1-2 servings of fruits and vegetables a day. An equal number of participants (47.5%) stated they eat 3-5 servings a day, and a small percentage (5%) consume more than 5 servings of fruits and vegetables a day.

Most (90%) participants agreed or strongly agreed they “understand more about exercise after the program”. A majority of the participants (55%) stated they exercised at least 3 times a week, 25% exercised 1-2 times a week, and a few participants (20%) stated that they have discontinued exercising.

Participants were asked to check any benefits they experienced through the program. The most participants (77.5%) stated they had more strength after the program. A majority of participants (67.5%) also stated they made healthier food choices, lost weight (65%), had more energy (57.5%), had more flexibility (55%), and decreased total cholesterol (52.5%). Several participants stated they had reduced stress (32.5%) and decreased medication use (20%). One participant stated they experienced no benefits through the program (2.5%).

Of the twelve survey questions, three were open-ended questions (verbatim responses to the open-ended questions are presenting in appendix D). Most (33 of the 40, or 82.5%) participants who took the survey also completed the question “which aspect of the program do you continue to think about?” The majority (n=22, 66.7%) noted they continue to think about the exercise portion of the program, and five (15.15%) of the participants mentioned they

continued to work out with a trainer after the program had ended. Second to exercise, many participants (n=15, 45.5%) continued to think about making healthier food choices and the importance of nutrition.

Most (n=35, 87.5%) of the survey respondents answered the question that asked if the B.A.L.A.N.C.E. program made a difference in their life. All but one of the participants stated the B.A.L.A.N.C.E. program made a difference in their life. Different ways the program changed participants lives included: helping them make healthier food choices, helping make a commitment to improving their overall health, increasing their activity or exercise, and building friendships and support systems. Several participants (n=7, 20%) attributed the nutrition portion of the program to helping them consume a healthier diet. Others (n= 7, 20%) were able to build new and lasting relationships with other participants, which helped them gain support. Many participants (n=14, 40%) reported the exercise portion of the program was beneficial. A total of 9 (25.7%) participants said the B.A.L.A.N.C.E program helped them begin to make a lifestyle change and commitment to improving their health.

A total of 26, representing 65% of the participants who completed the survey, also answered the question about improving the program for future participants. Several participants (n=7, 38.5%) stated the program could be improved by having more support and accountability after the 14-week program ended. Several participants (n=6, 23%) stated they would like group exercise sessions to continue or to provide more support in transitioning to exercising on their own. Several participants (n=6, 23%) had suggestions to improve the nutrition portion of the program including: instructions on using different apps for nutrition tracking, providing recipes including more common and practical foods, and increasing information about eating healthy.

Table 1 Differences in biochemical, anthropometric and fitness parameters between baseline and week 14

Parameter	N	Baseline		Week 14		P-value
		Mean	SD	Mean	SD	
Body Mass Index	85	38.2	8.7	36.7	8.4	<0.001
Girth, cm	84	44.2	6.8	42.0	6.6	<0.001
Triglycerides, mg/dL	86	190.5	97.3	158.9	87.5	<0.001
HDL, mg/dL	86	46.4	13.4	45.5	11.8	0.353
LDL, mg/dL	86	89.7	34.0	89.2	29.1	0.889
Cholesterol, mg/dL	86	173.9	40.1	168.2	33.9	0.154
Blood Glucose, mg/dL	86	115.3	45.7	106.9	35.7	0.008
Systolic Blood Pressure, mm/Hg	86	130.9	15.4	125.6	13.7	<0.001
Diastolic Blood Pressure, mg/Hg	86	84.3	10.2	81.8	8.1	0.015
Flexibility, cm	82	14.6	3.6	15.9	3.0	<0.001
Muscle Strength, repetitions	71	25.9	18.4	32.8	20.7	<0.001
VO ₂ Max, ml/kg/min	59	32.2	8.7	37.0	8.9	<0.001

Table 2 Differences in biochemical and anthropometric parameters between baseline and one year

Parameter	N	Baseline		One Year		P-value
		Mean	SD	Mean	SD	
BMI	69	38.1	8.3	36.7	7.6	<0.001
Girth, cm	67	44.4	7.1	42.7	6.5	<0.001
Triglycerides, mg/dL	69	192.2	101.3	170.3	88.1	0.063
HDL, mg/dL	69	46.9	13.1	46.3	12.0	0.685
LDL, mg/dL	69	93.0	35.2	89.3	32.5	0.275
Cholesterol, mg/dL	69	178.0	42.7	170.1	38.1	0.059
Blood glucose, mg/dL	70	116.1	45.8	111.1	40.6	0.028
Systolic Blood Pressure, mm Hg	69	130.4	16.0	125.5	14.3	0.006
Diastolic Blood Pressure, mm Hg	69	84.5	10.4	82.5	9.4	0.108

Table 3 Differences in changes in biochemical and anthropometric parameters between compliant versus noncompliant participants after the 14-week study

Parameter	Compliant			Noncompliant			P-value
	N	Mean Change	SD	N	Mean Change	SD	
Body Mass Index, weight/height ²	70	-1.6	1.2	15	-0.9	1.3	0.052
Girth, cm	69	-2.4	2.6	15	-1.3	1.6	0.122
Triglycerides, mg/dL	70	-38.1	65.4	16	-3.1	73.9	0.063
Systolic Blood pressure, mm/Hg	70	-6.2	13.2	16	-2.1	13.0	0.264
Diastolic Blood pressure, mm/Hg	70	-3.1	9.3	16	0.1	9.8	0.213
Blood Glucose, mg/dL	70	-9.9	30.7	16	-1.6	13.7	0.294
HDL, mg/dL	70	-1.6	9.0	16	2.2	8.5	0.128

Table 4 Perceptions of B.A.L.A.N.C.E. participants about the program

Variable	N	%
Participation in the B.A.L.A.N.C.E. was a beneficial experience.		
Strongly Agree	26	65.0
Agree	13	32.5
Neutral	0	0.0
Disagree	1	2.5
Strongly Disagree		
I understand more about nutrition after completing this program.		
Strongly Agree	15	37.5
Agree	21	52.5
Neutral	2	5.0
Disagree	1	2.5
Strongly Disagree	1	2.5
I feel more confident in my ability to eat a balanced meal after this program.		
Strongly Agree	10	25.0
Agree	18	45.0
Neutral	9	22.5
Disagree	1	2.5
Strongly Disagree	2	5.0
How many servings of fruits and vegetables do you eat on a typical day?		
None	0	0.0
1-2 servings	19	47.5
3-5 servings	19	47.5
More than 5 servings	2	5.0
I have continued preparing healthy meals since the program ended.		
Strongly Agree	3	7.5
Agree	16	40.0
Neutral	14	35.0
Disagree	6	15.0
Strongly Disagree	1	2.5
I understand more about exercise after this program.		
Strongly Agree	19	47.5
Agree	17	42.5
Neutral	1	2.5
Disagree	2	5.0

Strongly Disagree	1	2.5
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Table 4, Continued

Variable	N	%
How often do you exercise?		
Not at all	8	20.0
1-2 times a week	10	25.0
3-5 times a week	16	40.0
More than 5 times a week	6	15.0

Indicate the benefits you've experienced through this program. Check all that apply.		
More strength	31	77.5
Lost weight	26	65.0
More flexibility	22	55.0
Decreased total cholesterol	21	52.5
More energy	23	57.5
Made healthier food choices	27	67.5
Reduced stress	13	32.5
Decreased medication use	8	20.0
No benefits	1	2.50

I have maintained a healthy lifestyle since the program ended.		
Strongly Agree	7	17.5
Agree	15	37.5
Neutral	9	22.5
Disagree	8	20.0
Strongly Disagree	1	2.5

I recommend that other OSU employees participate in the B.A.L.A.N.C.E. program.		
Strongly Agree	26	65.0
Agree	12	30.0
Neutral	0	0.0
Disagree	1	2.5
Strongly Disagree	1	2.5

CHAPTER V

DISCUSSION

Participants in the B.A.L.A.N.C.E. program had significant reductions in BMI, girth, triglycerides, blood glucose, systolic blood pressure, diastolic blood pressure, flexibility, muscular strength, and VO₂ Max after a 14-week worksite intervention. Several studies reviewed also recorded reductions in similar parameters through the implementation of wellness programs. Touger-Decker et al. (2008) and Daubert et al. (2012) both had 12-week worksite wellness programs, similar to this study that focused on reducing metabolic risk factors and improving employee health. Both of these studies included educational sessions covering nutrition related topics and exercise, however neither program included any participation in physical activity. Similar to this study, Daubert et al. (2012) found significant reductions in weight, BMI, waist circumference, and blood pressure. Program requirements were similar to those of this study, but for a shorter period of time, 6 required meetings versus 10 required meetings. The intervention by Daubert et al. (2012) did not result in significant reductions in blood glucose or lipid panel measurements, but the B.A.L.A.N.C.E. program showed significant improvements in these measurements. While physical activity was required by the Daubert et al. (2012) study, no personal trainers or facilities were provided, unlike the current study. Touger-Decker et al. (2008) found significant reductions in all outcome measures including body weight, BMI, percent body fat, waist circumference, waist-to-hip ratio, cholesterol, systolic blood pressure, and diastolic blood pressure. The study focused on weight reduction and chronic disease risk, but not specifically metabolic syndrome. Touger-Decker et al. (2008) also found the number of group sessions attended was not significantly associated with the amount of weight lost.

Similar to the methods of this study, Daubert et al. (2012) collected a post intervention survey that looked at eating and exercise behaviors after program completion. A majority of the participants self-reported they had improved eating habits (91%), as well as improved exercise habits (83.6%) compared to before the program. The current study had almost identical results to Daubert et al. (2012), in that a majority of participants stated “they understand more about nutrition after the program”. The current study saw a higher percentage of participants that “understand more about exercise after the program” compared to the Daubert et al. (2012) intervention, likely due to participants in this study receiving personal training.

Kim et al. (2012) looked at the effect of a physical activity intervention only on decreasing metabolic syndrome risk factors in overweight males. The physical activity participants engaged in was different than this study, but saw similar results. Participants in the Kim et al. (2012) study exercised by increasing their daily steps by 3,000 steps, of which at least 2,000 steps was brisk walking, for one year. The study found significant decreases in BMI, waist circumference, systolic blood pressure, triglycerides, and fasting plasma glucose (Kim et al., 2012). While Kim et al. (2012) did not measure any changes in flexibility, muscular strength, or VO₂ Max like this study, it can be suggested that physical activity is a factor in helping reduce metabolic syndrome risk factors.

A study conducted by Baghurst, Tapps, Mwavita, Volverding, and Jayne (2014) looked at some of the same participants as this study. Baghurst and associates looked at the first four groups of the B.A.L.A.N.C.E. program, which was 68 participants, after the 14-week intervention. The study found the same results as the current study, with the exception of total cholesterol. Baghurst and associates found significant improvements in total cholesterol ($p=.05$), whereas the current study did not find significant reductions ($p=.154$). It was expected that this study and the current study would find nearly identical results because they are looking at a portion of the same population of participants. The Baghurst et al. (2014) study however did not

look at any changes in muscular strength, flexibility, VO₂ Max, or the participant's perceptions of the intervention.

Overall this study found remarkably positive changes in a majority (nine of the twelve) of the outcome measures. The B.A.L.A.N.C.E. program was a successful worksite wellness program in reducing the risk factors for metabolic syndrome and increasing participant's overall health. Based on the perceptions survey, participants in this program now understand more about nutrition and exercise, and believed this program was beneficial.

Limitations

There are several limitations to this study, one being the lack of control group. Without a control group, outside influences that may have affected the results are hard to determine. One outside influence that was not adjusted for was medication taken by participants. While participants reported medication use at the beginning of the study, their medications were not recorded at the end of the fourteen weeks. Therefore, they were not adjusted for and could be a confounding factor in the decrease of blood glucose, triglycerides, cholesterol, etc. Participants had to apply for the program, which contributes to selection bias. Those who are willing to participate in the program were likely to be more willing to make lifestyle changes than employees with metabolic syndrome who did not apply to participate in the program. Another limitation to this study was changes that were made in the program throughout each cycle of participants. The first two groups to participate in the program had 20-24 participants, whereas the rest of the groups had 12 or fewer participants. Having fewer participants in a group may have allowed for more individual advice compared to a larger group, yielding more positive results. A second variable that changed over the years was the fitness expert in charge of working with the participants; different experts may have conducted different exercise regimens. The length of the study was only fourteen weeks, a longer length of intervention could have improved results. The study found that at one-year after the program there were only four outcomes with

significant improvements compared to nine at the end of the fourteen weeks. Increased participation requirements and accountability after the end of the fourteen weeks may help improve positive long-term health improvements. Only about 80% of participants completed one-year post testing on all outcome measures and participants who did not complete the one-year follow up were less likely to continue to comply with program recommendations. Therefore, results at one-year may be overvalued, because participants who completed the one year follow-up were likely to have seen better results after the 14 weeks than those who did not. Despite several limitations, this study found positive improvements in the majority of outcome measures.

Implications for Practice and Further Research

For employers who are trying to improve employees' health, focusing on lifestyle behavior changes, such as dietary intake and physical activity seems to be effective. Interventions as short as 14-weeks have been shown to significantly decrease metabolic syndrome risk factors. This program can be used as a model to other worksites to help develop a wellness program for employees. Including both nutrition education and physical activity into a wellness program allows the program to target a wide variety of health goals, from weight loss to the management of chronic diseases. The value of implementing a wellness program can be seen by the changes in outcomes measures between baseline and week 14 assessments. Worksite wellness programs may offer employers an opportunity to improve employee health, which could help lower medical costs, decrease absentee days, and improve employee productivity.

Future research in this area, with the use of a control group is needed. Confounding factors outside of the program could be contributing to reductions in the outcome measures. Research looking at both a larger sample and longer intervention time is needed. This program was limited to a maximum of twenty-five participants per intervention time, which was reduced to twelve in the most recent program groups. Studies with larger numbers of participants might see different results in reducing outcome measures. The length of the intervention may also

affect outcome measures, with the thought that longer programs may be more effective in maintaining behavior changes.

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APPENDICES

Appendix A

Perceptions Questionnaire

Please take this confidential, anonymous survey and provide any comments that will help improve the B.A.L.A.N.C.E. program. Your input is greatly appreciated!

Please indicate how strongly you agree or disagree with the following statements about the B.A.L.A.N.C.E. program.

1. Participation in the B.A.L.A.N.C.E. program was a beneficial experience.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree

2. I understand more about nutrition after completing this program.
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

3. I feel more confident in my ability to eat a balanced meal after this program.
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

4. How many servings of fruits and vegetables do you eat on a typical day?
 - a. None
 - b. 1-2 servings
 - c. 3-5 servings
 - d. More than 5 servings

5. I have continued preparing healthy meals since the program ended.
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

6. I understand more about exercise after this program.

- a. Strongly agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly disagree

7. How often do you exercise?

- a. Not at all
- b. 1-2 times a week
- c. 3-5 times a week
- d. More than 5 times a week

8. Please indicate the benefits you experienced through this program. Check all that apply

<input type="checkbox"/> More Strength	<input type="checkbox"/> More Energy
<input type="checkbox"/> Lost Weight	<input type="checkbox"/> Made Healthier Food Choices
<input type="checkbox"/> More Flexibility	<input type="checkbox"/> Reduced Stress
<input type="checkbox"/> Decreased Total Cholesterol	<input type="checkbox"/> Decreased Medication Use
<input type="checkbox"/> No Benefits	

9. I have maintained a healthy lifestyle since the program ended.

- a. Strongly agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly disagree

10. If you have not maintained a healthy lifestyle, which aspects of the program have stuck with you?

11. I recommend that other OSU employees participate in the B.A.L.A.N.C.E. program.

- a. Strongly Agree
- b. Agree
- c. Neutral
- d. Disagree

e. Strongly Disagree

12. Did the B.A.L.A.N.C.E. program make a difference in your life? If so, how?

13. How could the program be improved for future participants?

Appendix B

IRB Approval Letter

Oklahoma State University Institutional Review Board

Date: Wednesday, April 08, 2015
IRB Application No HE1513
Proposal Title: B.A.L.A.N.C.E.: Evaluating the effectiveness of a 14-week worksite wellness program on reducing metabolic syndrome risk factors

Reviewed and Processed as: Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 4/7/2018

Principal Investigator(s):

Melissa Manni Gail Gates
301 HES
Stillwater, OK 74078 Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,



Hugh Crethar, Chair
Institutional Review Board

Appendix C

Consent form and email invitation for survey participation

Dear B.A.L.A.N.C.E. Participant,

My name is Melissa Manni and I am currently completing my Master's in nutritional sciences here at OSU. I am conducting a survey to collect research for my thesis. Please read the following information about my research. I invite you to complete this short anonymous survey, your participation is greatly appreciated. A link to the survey is provided below.

Investigators: Melissa Manni and Gail Gates, PhD

Purpose: The purpose of this study is to evaluate the effectiveness of the B.A.L.A.N.C.E. program on reducing metabolic syndrome risk factors and participants' perceptions of the program.

What to expect: The research study is administered online. Participation in this research will involve the completion of one questionnaire. The questionnaire questions will address your perceptions of the B.A.L.A.N.C.E. program. It should take approximately 10-15 minutes to complete.

Risks: There are no risks associated with this project which are expected to be greater than those encountered in daily life.

Benefits: There are no direct benefits to you. However, you may gain an appreciation and understanding of how research is done. The results of this survey will help the Department of Wellness improve the B.A.L.A.N.C.E. program for future participants.

Compensation: No compensation will be given.

Your rights and Confidentiality: Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation at any time.

Confidentiality: The records of this study will be kept private. The questionnaire will be anonymous and will not include information that will identify you. Research records will be stored on a password-protected computer and only researchers and individuals responsible for research oversight will have access to the records.

Contacts: You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Melissa Manni, Seretean Wellness Center, Department of Wellness Oklahoma State University, Stillwater, OK 74075, mmanni@okstate.edu, or Gail Gates Ph.D., 314 Human Sciences, College of Human Sciences, Stillwater, OK 74075, 405-744-3845.

If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

If you choose to participate, please click on the link to open the questionnaire. By clicking on the link, you are indicating that you freely and voluntarily agree to participate in this study and you also acknowledge that you are at least 18 years of age. The completion of the questionnaire will be considered to be consent.

Sincerely,
Melissa Manni
Graduate Assistant, Department of Wellness

Oklahoma State Univ.
IRB
Approved 4-8-15
Expires 4-7-17
IRB # HS-15-13

Appendix D
Survey responses to open-ended questions

Q10 Which aspect(s) of the program do you continue to think about?

Answered: 33 Skipped: 7

1 food choices
2 How I need to get back to working out - perhaps hire a trainer again.
3 I need to keep excising, but I don't
4 I continued the work out program for about 1 1/2 years but I am not currently workout in a group.
5 Diet and exercise
6 Exercise options. Food choice. The importance of overall life balance.
7 The program is very intense. The nutrition meeting every Tuesday was stressful. I think having it every other week or once a month would be more beneficial and less stressful. It was interesting learning how very different the nutrition part of it was compared to the Weight Watcher program. My husband is a diabetic and the nutrition balance program recommended not using a sugar substitute and cook with regular sugar instead. We can't do that. The nutrition part of it was not flexible. That was the only portion which made this program stressful. The food at the weekly meetings was great but it was too much time out of my daily schedule.
8 I learned a lot during the program. It has been very beneficial to have the monthly meetings. I had the best results during the original 12 weeks, but it did get things started for me. There have been ups and downs, but I am continuing on this journey.
9 importance of exercise giving me energy and confidence
10 All
11 None
12 Food choices while grocery shopping
13 I continually try to increase my activity daily
14 I have continued to work with a trainer. I have realized that unless I have someone giving me a list of exercises to perform I will not work out properly.
15 that I should exercise more but I am limited because of bone degeneration
16 Healthy eating and exercise. I have not been good at continuing, but I know I have the tools I need and the positive impact it has when I do them.
17 I still participate in weight training through the seretean wellness center with a personal trainer 2 mornings a week and have completed two 5k races this past April (both jogged the full duration and improved completion times in both races). I have signed up for ROSU in June to increase my frequency and consistency with jogging. I don't prepare meals at home as often as I did during BALANCE, however, this past weekend my sig other and I made a commitment to lose more weight and eat healthier at all (including more cooking at home).
18 I read food labels. I exercise with a trainer. I pretty much cut out desserts. I think about vegetables more.
19 Activity of all sorts especially strength training and the need to do more aerobic activity. Nutrition is an ongoing issue for me. If I am not vigilant backsliding is exceptionally easy
20 focusing on what to eat instead of what not to eat the benefits of exercise
21 I found the nutritionist to be condescending.
22 The information about balanced meals.
23 Making healthy food choices.
24 I work out with a trainer 3 times a week. I don't believe that I would have continued to work

out if I had not been on the program. I enjoyed the exercise portion of the program very much. The food meal portion of the program didn't have enough info with it. The sessions/ classes were good info but needed more practical info. Food choices...menus. I the best food class was the final get-together where everyone brought a dish. I still use some of the recipes from that last session.
25 Learning that is exercise is the key to the program for me. I had always tried to lost weight and be healthier, but it wasn't until I started the exercise part of the program that I finally lost weight.
26 exercise and weight training
27 Exercise and nutrition benefits.
28 nutrition, I've always been fairly active
29 Exercise
30 Eating more fruits and vegetables and drinking more water.
31 food choices and exercise
32 The exercise was the only beneficial part of the program for me and even that had several problems. Terrible disrespectful trainer who was late and left early. What the program did was jump start me back into an exercise program.
33 Losing weight

Q12 Did the B.A.L.A.N.C.E. program make a difference in your life? If so, how?

Answered: 35 Skipped: 5

1 Yes I make better food choices
2 Made me more aware of what I should be doing.
3 It did until I had to have Spine Surgery right after it ended, and have had tough time getting back into Excising. I had to quit some of my weights during the program due to Spine injury
4 Yes, it helped me see how important it is to just get up and move.
5 Yes. Got me to focus
6 Yes. It gave me the boost I needed to get in a more healthy position. I lost a great deal of weight and reduced my dependence on some medications.
7 I made some good friendships
8 Yes. It did make a difference. Working with a trainer made me see how much i could push myself. I am going to continue working with a group this summer to stay motivated. I appreciated this part of the program so much!!!
9 It has helped me start addressing my weight, increase exercise, and eat healthier. I needed to learn more about
stress relief and have carried many of the lessons into my daily life.
10 It did and I would go back if I could very beneficial. Could be more informative about nutrition than it was, but other than that it was a great experience.
11 I think the group workout sessions were a great advantage and helped me become more comfortable in a gym setting.
12 Lost 45 lbs and have made a significant lifestyle change overall
13 No
14 Being in the program has connected me with people who have helped not only myself but my family.
15 I enjoy working out and look forward to it every day
same old stuff.
17 To a point. I know I should exercise and eat right but without motivation, I don't.
18 Reduced medications, more energy and feeling better about myself.
19 Lost weight, more confident in the gym, healthier food choices at home and eating out, i can share what I learned with others trying to make healthy changes in their lives

20 It reduced my glucose level, which was my main reason for wanting to join.
21 The comprehensive nature of the program was very helpful as I have tried numerous times to become more fit, health, loose weight, etc. It is also apparent that if one does not keep up the multiple activities during the week it is very easy to lose the gains. So, I may not have actually embraced the "lifestyle."
22 Yes, improved my numbers on the tests substantially. Refreshed my commitment to improving my health.
23 It did for a short time. The accountability was very helpful.
24 Showed me that I can make a change in my life. No I need to get the will power to continue it on my own.
25 Yes. Exercise. Friendship. I still work out with a person that I met in the BALANCE program. We are beginning 3 years of working out together.
26 I lost 30 pounds and all of my health number went down and I was able to use less medicine for my diabetics.
27 I enrolled in additional cooking classes that helped me cook with vegetables. I still participate in the small workout group.
28 Some. The exercise program is still somewhat with me. Again, the trainers were young and not used to working with older people. I felt that they were to advanced for the middle-aged person. I stopped exercising altogether after the program because it was "too rigid" of a program. My recommendation would be to have several "levels" of the program. Beginner, moderate, advanced for both nutrition and for exercise. Someone could be in the beginner nutrition classes and maybe the advanced exercise. The one size fits all did not really help anyone.
29 Yes. I found that exercising wasn't as boring as I thought it would be. I met a lot of new people!
30 yes
31 Yes, I've developed a friendship with someone from the program and we now have been workout buddies for more than 2 years.
32 Yes. It taught me new things about exercise and how to eat healthier.
33 Yes, I found support that I need to get on a healthy life style
34 not other than the exercise previously mentioned.
35 I am in better shape and continuing to exercise,

Q13 How could the program be improved for future participants?

Answered: 26 Skipped: 14

1 unsure
2 To not stop people cold turkey from working out 5 days a week of exercise. I think that it after 16 weeks there should be a program set up that would allow people in the B.A.L.A.N.C.E program to continue to workout in groups.
3 Right now the program does not take into account recidivism. It is possible the program should permit re entry after say a year. Some people need more help than others. The cohort groups were a good way of getting support.
4 One beneficial part of the program for me was working with other participants where we could push each other. Once the program ended, that support vanished, which diminished the accountability piece of the program. Perhaps some longer term effort to partner workout groups for continued exercise programming with a trainer would be beneficial.
5 Group exercise sessions need to continue as part of the employee exercise benefit. Having someone required to exercise with is motivating. There needs to be an emotional and mental aspect that far exceeds the period. Meeting with a psychologist would be beneficial.
6 One suggestion is to not have weekly nutrition meetings. Another suggestion is to be able to use

<p>Myfitnesspal app or some kind of electronic form of logging what you eat. I felt like we had been pushed back into 20 years using paper form. Thank you for choosing me as a participant. I didn't lose weight but gained knowledge about everything. Now I look forward to meet with a trainer and logging into food into the app and also sync my steps with the Pacer app. The two together are awesome.</p>
<p>7 It would be better to have a little more support once the 14 weeks end. I think that period is introducing new habits and it would help to have additional workout support to keep the habits solid. The monthly meeting is very helpful, but it would be nice to have more frequent meetings.</p>
<p>8 Focus more on the nutrition aspects and give participants more information regarding eating healthy. I was in the very first program, so I'm sure it changed.</p>
<p>9 Have exercise trainers that actually care about their clients</p>
<p>10 More emphasis on individual changes. More time spent with Elizabeth individually.</p>
<p>11 Let the people who have already been in it go for another round.</p>
<p>12 Program was great and a success when I did it. For me the disconnect happened after the program ended, however, the program gave me the support and tools I needed to continue. I just need to make it (me) a priority again.</p>
<p>13 I thought it was well organized and contained many different aspects to promote health overall. Sometimes the weekly tuesday lunches were a time crunch for me b/c I had to teach a 1pm class on Tuesday afternoons.</p>
<p>14 It is excellent.</p>
<p>15 Please add formal transitional section between the personal trainers each day during the 12 weeks and the start of one's own personal training sessions. Currently, you have to wait to begin with a personal training until the end of the semester.</p>
<p>16 The cooking classes were informational but most simply weren't practical. The cooks talked about going to Whole Foods in OKC to buy the right foods. Who has the time AND money to shop at Whole Foods all the time. The meals were not very practical for someone who works 10-12 hours and then goes home to take care of kids. The food segment was for people who have the time and money to not be fat. Come on folks. How about helping those of us who struggle with enough time to cook a meal. Help US with ways to cook healthy foods on a tight budget. Otherwise, you should ask for the income of the applicants to make sure that the person can afford to shop at Whole Foods or order special foods at Pyramid. Out of touch the realities of the people in the class!</p>
<p>17 A longer commitment to the program. Instead of once a month for a year. Maybe keep it going for two.</p>
<p>18 More menu/recipe choices. More about calories. More food info... eat this not that. More attention needs to be paid to emotional eaters... and boredom eaters.</p>
<p>19 NA</p>
<p>20 Teach participants about the different activity trackers and how to use them.</p>
<p>21 The nutrition part of the program could be improved. There were too many "funky" foods introduced in the program. I understand that they are more healthy, but it was impossible for me to stay on the diet after the program. This is great for people who already eat healthy and want to move to the "next level" of nutrition. But, for the person who is just trying to make better choices I think you need to stay with typical foods in Oklahoma.</p>
<p>22 My biggest problem was the uncooperative attitude of my boss who was not supportive at all. It was difficult for me to fit the exercise sessions and required meetings into my day without having to take vacation time. It made for a stressful situation at my job. If only OSU could make the people in charge care something about the health of the people they supervise!</p>
<p>23 I believe the trainers should be more assertive.</p>
<p>24 It think it was great! I was part of the very first group. I'm sure its even better now, than it was the first time around.</p>

25 The programs we had were mostly silly. Either they were way over everyone's head or irrelevant. She even repeated one of the sillier ones because she apparently did not have anything else prepared. Meeting days kept being moved. Get someone else to run it and teach her assistant some email courtesy.

26 More effort needs to be placed on behavior modification. I need a plan for exercise and diet to follow but no plans were provided.

VITA

Melissa Marie Manni

Candidate for the Degree of

Master of Science

Thesis: B.A.L.A.N.C.E.: EVALUATING THE EFFECTIVENESS OF A 14-WEEK
WORKSITE WELLNESS PROGRAM ON REDUCING METABOLIC SYNDROME
RISK FACTORS

Major Field: Nutritional Sciences

Biographical:

Education:

Completed the requirements for the Master of Science in Nutritional Sciences at
Oklahoma State University, Stillwater, Oklahoma in, May, 2016.

Completed the requirements for the Bachelor of Science Nutrition/Dietetics at Auburn
University, Auburn, AL in May 2014.

Experience:

Graduate Research Assistant- Department of Wellness
August 2014 – December 2015

Professional Memberships:

Academy of Nutrition and Dietetics
California Academy of Nutrition and Dietetics