A FREE COMMUNITY-BASED DIABETES PREVENTION PROGRAM: AN EXTENSION OF 100 CITIZENS FOR AN AFRICAN AMERICAN POPULATION

A thesis submitted in partial fulfillment of the requirements
For the degree of Master of Science in Kinesiology

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ABSTRACT

A FREE COMMUNITY-BASED DIABETES PREVENTION PROGRAM: AN EXTENSION OF 100 CITIZENS FOR AN AFRICAN AMERICAN POPULATION

By

Jamie Lynn Phillips

Master of Science in Kinesiology

The purpose of this study was to determine the effectiveness of a 12-week, free diabetes prevention program at Robinson Park, Pasadena, CA, a community with a 10.7% population of African Americans. The hypothesis of this study was that the program would yield a 5% to 7% weight loss among participants, thereby reducing or delaying their risk of developing type 2 diabetes by 58%.

Eligibility requirements were age 18-80 years, BMI \( \geq 30 \) kg/m\(^2\), and a score of \( \geq 5 \) on the NDEP Diabetes Risk Test. The independent variables of this study included: resistance training, moderate intensity aerobic training, and the DPP curriculum. The dependent variable in this study was weight. As with the original research, weight is the primary marker of success relative to reduction of diabetes risk.

The protocol was modified from the National DPP curriculum available on the Internet. The 16 sessions were condensed and modified to 10 minute lectures delivered at the end of the 34 sessions over the 12-week period. Some example topics ranged from healthier dietary choices, positive thinking, and basic lifestyle modifications. Greater emphasis was placed on physical activity by having the participants engage in structured group exercise.
circuit training sessions for the first 50 minutes of each session. Each exercise session was completed at a moderate intensity and accommodated to the physical fitness capabilities of each participant.

The dietary guidelines were consistent with the National DPP and participants were encouraged to stay within their weekly calorie targets which are based on their initial body weight. Participants were also instructed to monitor their dietary intake and physical activity in “tracker” logs. Feedback was given as warranted.

There were 7 participants who completed the required program. Fifty-seven percent of the participants achieved the ≥ 5% weight loss goal of the 12-week program which was comparable to the original DPP lifestyle intervention (n = 1,079) results of 50% achieving a ≥ 7% weight loss goal in 24 weeks. These results demonstrated that this modified DPP program could achieve the 5%-7% weight loss at no cost to the participant.
CHAPTER I

Introduction

Diabetes is the 7th leading cause of death in the United States; in 2011 type 2 diabetes affected 25.8 million Americans (American Diabetes Association, n.d.). Furthermore, thirty to forty percent of the population may be at risk for developing type 2 diabetes based on today’s overweight and obesity data, increased prevalence of poor nutrition, and increasingly greater sedentary lifestyles. The upward trend of diabetes and obesity projects that one of three American adults will have diabetes by 2050 (U.S. Centers for Disease Control and Prevention, 2010).

Individuals with type 2 diabetes have elevated blood glucose levels that can contribute to a number of serious complications such as stroke, kidney disease, heart disease, circulatory problems, neurological problems, and blindness. In 2012, there were 79 million Americans with pre-diabetes, characterized by excess glucose circulating in their bloodstream which can contribute to the onset of diabetes (Levi, Segal, St. Laurent, Lang & Rayburn, 2012). Eighty percent of people with type 2 diabetes are overweight, furthermore, excess body weight decreases the effectiveness of insulin, the hormone that transports glucose from the blood into the cells (National Institutes of Diabetes and Digestive and Kidney Diseases, n.d.).

Fortunately, type 2 diabetes can be prevented and treated through increased physical activity, improved dietary choices, and achieving moderate weight loss (CDC, 2011; American College of Sports Medicine, & ADA, 2010). Physical activity and weight loss helps the body react appropriately to insulin which, in turn, helps the body transport blood glucose into the cells.
Compared to the general population, African Americans are excessively affected by diabetes; as of 2011 4.9 million African American adults have suffered from diabetes and are 1.8 times more likely to have diabetes compared to Caucasians (CDC, 2011). Additionally, 31.9% of African American adults do not engage in any leisure-time physical activity (CDC, 2008). Known barriers to physical activity and healthy eating for African Americans include not having an exercise partner, living in an unsafe neighborhood, lack of motivation, and lack of necessary knowledge to implement a healthy diet and exercise regimen (Lynch & Holmes, 2011; Miller & Marolen, 2012).

The prevalence of diabetes in our country is of great concern and that developing strategies to prevent diabetes is a public health priority. Research has indicated that lifestyle interventions are key to preventing or delaying the onset of diabetes. The loss of 5% to 7% of total body weight and participating in 150 minutes per week of moderate physical activity (similar to brisk walking) can reduce the risk of developing type 2 diabetes by 58% (CDC, 2011; Diabetes Prevention Program Research Group, 2002; Levi, Segal, St. Laurent, Lang, & Rayburn, 2012).

While there have been community-based diabetes prevention programs implemented at cost to the participant or supported by grant funding, it is unclear whether a free diabetes prevention program delivered by students in a university Kinesiology program can successfully implement a program and yield comparable results. Therefore, the objective of this study was to determine the effectiveness of a 12-week, free diabetes prevention program at Robinson Park, Pasadena, CA, a community with a 10.7% population of African Americans (U.S. Census Bureau, 2010) with the hypothesis that the
program will yield a 5% to 7% weight loss among participants, thereby reducing or delaying their risk of developing type 2 diabetes.
CHAPTER II

Literature Review

The most revealing information on diabetes prevention was conducted by the Diabetes Prevention Research Group (DPP Research Group, 2002) which was based on a number of observational studies and three intervention studies which all suggested a lifestyle intervention might reduce the risk of developing diabetes. A study by Erriksson and Lindgarde (1991) concluded that a long-term (5-year) diet and exercise intervention was feasible on a large scale and could possibly prevent or delay the onset of type 2 diabetes. Based on these findings the Diabetes Prevention Program Research Group decided to include a lifestyle arm in the trial and focused on modifying body weight and physical activity levels.

Since development of the DPP in 1996, there were two randomized trials that reported positive effects from lifestyle intervention. The first, Da Qing IGT and Diabetes Study (Pan et al., 1997) was designed to determine if diet and exercise interventions in those with impaired glucose tolerance (IGT) would delay the onset of type 2 diabetes and other associated diseases. A total of 577 subjects with IGT were randomized either to a control group or to one of three treatment groups: diet only, exercise only, or diet plus exercise (the exercise component was taught and encouraged, however, not supervised). The conclusion of the study was that diet and exercise led to a significant decrease (31-46%) in the incidence of diabetes over a 6-year period.

The second randomized controlled trial that further demonstrated the efficacy and sustainability of lifestyle interventions as a means for preventing or delaying the onset of diabetes was The Finnish Diabetes Prevention Study (Lindstrom et al., 2003). The
lifestyle intervention offered free supervised, moderate intensity circuit-type resistance training sessions and advised participants to increase physical activity. This study showed a reduction in diabetes incidence by 58 percent for up to 7 years for 522 overweight subjects with IGT (DPP Research Group, 2002; Lindstrom et al., 2003; Piatt, Seidel, Chen, Powell, & Zgibor, 2012). The DPP Research Group (2000) then developed a lifestyle intervention that included improved eating and physical activity that focused on weight loss. This program, known as the Diabetes Prevention Program, or DPP for short, was a 27-center randomized clinical trial to determine whether lifestyle intervention or pharmacological therapy (metformin) would prevent or delay the onset of diabetes in individuals with impaired glucose tolerance and at high risk for diabetes. The final sample size of 3,234 participants (N = 1085 for placebo, N = 1,079 for lifestyle, and N = 1073 for Metformin interventions) were randomized over a 2.7-year period and were followed for a total of 3.3-6.0 years. After completion of the study in May, 2001, it was determined that the lifestyle intervention decreased the incidence of type 2 diabetes by 58%, whereas the metformin-treated group only decreased the incidence of diabetes by 31% (DPP Research Group, 2002). These findings were similar among men and women and in all racial and ethnic groups and were found to persist at the 10-year follow-up study (DPP Research Group, 2009).

Key aspects of the DPP lifestyle protocol involved a goal-based behavioral intervention with two main goals: a weight loss goal of 7% was to be achieved and maintained and a physical activity goal of 150 minutes per week of moderate physical activity similar to brisk walking. The program provided two optional supervised exercise sessions per week for the first 24 weeks to help participants reach their weight loss goal.
All participants were encouraged to reach their physical activity and weight loss goals by the 24th week. Seventy-four percent of participants met the goal of performing at least 150 minutes per week of physical activity at the 24-week mark and 50% reached their 7% weight loss goal.

The DPP offered several resources to their participants to achieve these goals. In addition to the supervised exercise sessions, individual case managers or “coaches” were required to attend a 2-day national training session and were assigned to each participant; often chosen from the same ethnic group as the participant. Most of these coaches were registered dietitians while others had at least a Master’s degree in exercise physiology, behavioral psychology, or health education.

Over the course of the first 24 weeks of the intervention, the participants were required to attend 16 sessions to learn the DPP’s core curriculum of basic information about nutrition, physical activity, and behavioral self-management (self-monitoring tools were provided to the participants). These sessions also included private weigh-ins and a review of self-monitoring records. This core curriculum, known as the “National Diabetes Prevention Program Core Curriculum” is available online on the CDC website at http://www.cdc.gov/diabetes/prevention/recognition/curriculum.htm. To aid in achievement of the weight loss goal, the participants were encouraged to reduce their daily caloric intake by 500-1,000 kcal (depending on their initial body weight) in addition to reducing their total fat intake to 25 percent of calories from fat.

In an effort to maintain the participants’ weight loss, following the initial 24 weeks of the intervention, participants were required to be seen face-to-face at least once every two months and self-monitoring was also encouraged for one week of each month.
Small incentives and motivational campaigns were offered to encourage maintenance, and in some cases a “toolbox” containing problem-solving strategies and reinforcements was used for individual participants if needed.

Both the lifestyle intervention and metformin were successful in preventing or delaying the onset of type 2 diabetes; however the lifestyle intervention decreased the incidence by 58% as compared with 31% in the metformin group. The outcomes of the DPP appear to be sustainable in the long term; a reduction in diabetes incidence by 34 percent was observed in the lifestyle intervention group at the ten-year follow-up (CDC, 2011; Knowler et al., 2009; Piatt, Seidel, Chen, Powell, & Zgibor, 2012). The prevention or delay of type 2 diabetes with the DPP has also been shown to be effective in both males and females and all populations studied (CDC, 2011).

The DPP is now known as the landmark NIH-sponsored study which lends the evidence needed to translate the lifestyle intervention in such a way to curtail this national epidemic that plagues our country. In 2009, the University of Pittsburgh used the internet to translate the DPP into practice (McTigue et al., 2009). This was a one-year pilot program for 50 patients from a large academic general internal practice in Pittsburgh. The program entailed the same core-curriculum from the DPP clinical trial, providing 16 weekly and 8 monthly lessons via the internet. Email prompts for online self-monitoring and automated weekly progress reports were given as well as electronic counseling integrated with primary care practice. Each participant was given a pedometer and a book detailing fat and calorie content of various foods to facilitate self-monitoring at the initial 2-hour orientation session. The resource page on the internet contained supplemental DPP lifestyle intervention materials and other reputable web-
based information. The same physical activity guidelines were recommended, but were not supervised and were self-reported by the participants. This program was also successful; at the end of the year study, 31% of these participants had at least a 5% weight loss and 18% at least a 7% weight loss. The findings noted that the bulk of the weight loss was obtained in the first 3 months of the study and was maintained for the remainder of the year.

Researchers are continuing to work on ways to use technology to make the DPP more accessible and cost-effective. In 2012, UnitedHealth Group partnered up with Comcast to create a video-on-demand pilot study made available to 310 participants in Philadelphia, Pennsylvania and Knoxville, Tennessee test markets (“UnitedHealth Group and Comcast,” 2012). This 16-episode “NOT ME” video-on-demand (VOD) programming uses a reality TV format that follows six adults who are at high risk for developing type 2 diabetes as they go through the DPP. Each VOD episode features a health and wellness coach leading a class of program participants who are working to reach a healthier weight and reduce their risk of developing type 2 diabetes. Between each episode, study participants practiced at home the skills they learn from the program. Study participants also were given tracking assignments each week and opportunities to transfer what they learned into action. Participants have begun to report positive feedback and fidelity to the program, however, full results are to be published soon by Dr. Dineed Vojta, chief clinical officer for the UnitedHealth program.

Entrepreneurs are also making an effort to combat the diabetes epidemic. Omada Health, a San Francisco-based startup and pioneer in the field of digital health, launched Prevent, an online version of the DPP made available to the general public (“Omada
Health Launches Prevent,” 2012). This 230-participant pilot study resulted in an average of 6.4% weight loss after 16 weeks of an interactive web-based DPP program that somewhat resembles Facebook. The cost of this program is $120 for 4 months.

Dr. Jun Ma (2013) and colleagues recently published the results of a three month intervention that put the DPP curriculum on a low-cost DVD for participants. Participants were randomized to either a coach-led group intervention (N = 79), a self-directed DVD intervention (N=81), or usual care (N=81). The DPP-based behavioral weight-loss curriculum was delivered by lifestyle coach-led small groups or home-based DVD over the course of 12 weeks. During the maintenance phase, participants received coaching and support through secure email which resulted in 37% of the participants losing 7% of their body weight over the course of the 12 week program. The conclusion of the study was that the two DPP-based lifestyle interventions were proven effective in a primary care setting, with potential for public health impact.

While these technology driven translations of the DPP are helping to reach a wider demographic, there are people who do not have access to the internet, cable, or who simply do not have the resources or motivation to complete a diabetes prevention program independently in their own home. Ackermann and Marrero (2007) adapted the DPP clinical trial intervention into a cost effective, group-based delivery format for the community. They determined that the adapted DPP intervention would need to be disseminated through an organization that has the resources and ability to deliver the program while having wide access to the community. Hence, they partnered with the YMCA to administer the DEPLOY pilot study (Ackermann, Finch, Brizendine, Zhou, & Marrero, 2008). This program resulted in a 6% reduction of body weight within the first
six months and was maintained for the remainder of the year-long study by delivering the same DPP clinical trial curriculum and encouraging the same physical activity goals. The partnership with YMCA enabled a reduction in the hourly wage of the behavioral experts in the DPP by half and a reduction in the overall personnel costs in half by offering group sessions. The findings of this study recommended that future studies focus on the cost effectiveness of community-based DPP programs by possibly having health plans cover the associated fees for the participants in order to promote sustainability. The same implication was made by Amundson et al. (2009) in their community adaptation of the DPP in Montana.

As reported by the 2011 National Diabetes Fact Sheet, compared to Caucasian Americans, the risk of diagnosed diabetes was 66% higher among Hispanics and 77% higher among African Americans. Furthermore, focus must be shifted to the low-income communities that are typically at most risk for developing type 2 diabetes due to the associated sedentary lifestyles, poor eating habits, and lack of health insurance. Additionally, these individuals may not have access to the costly internet and cable translations of the DPP programs currently available.

The Da Qing China study, the Finnish Diabetes study, the DPP, and other large randomized trials have demonstrated that a structured diet and physical activity intervention achieving modest weight loss in overweight adults at high risk for diabetes can significantly reduce the progression to diabetes. However, the DPP involved enrollment criteria and an intensive, costly lifestyle intervention are challenging to implement and sustain in a community-based setting and was unfortunately designed for efficacy and not for sustainable delivery by a community organization (Ackermann &
Marrero, 2007). While the YMCA Deploy study had great success in reducing the costs of the DPP, a free model of the DPP is the solution needed to truly combat the diabetic epidemic in our country. A synergy of the adapted group-based DPP program and the 100 Citizens program developed by Steven Loy, PhD (Loy et al., 2012) of the Kinesiology department at California State University, Northridge (CSUN) may offer such a solution. The 100 Citizens program is a free exercise program for adults in Recreation Park, San Fernando, CA with the intent to provide an exercise program which exceeds the CDC minimum recommendations of physical activity to improve health and reduce the risks of chronic disease. It is entirely planned and implemented by volunteer CSUN Kinesiology students or student interns with the intention of combatting the obesity epidemic and physical inactivity trends in the United States. Additional replications of 100 Citizens have been successfully implemented in other communities of the greater Los Angeles area and it has been nationally recognized at the White House through Michelle Obama’s Let’s Move! campaign.

This manuscript presents the results of the effectiveness of a 12-week, free diabetes prevention program at Robinson Park, Pasadena, CA, with the hypothesis that the program would yield a 5% to 7% weight loss among participants, thereby reducing or delaying their risk of developing type 2 diabetes.
CHAPTER III
Research Design and Methods

Research Design

The purpose of this study was to determine whether a free community-based diabetes prevention program delivered by undergraduate Kinesiology students could successfully yield a 5%-7% weight loss in adults who are at risk for developing type 2 diabetes. During this one-group, pre-mid-post-test, experimental research study, participants were evaluated in terms of total percent weight loss, muscle endurance, cardiovascular endurance, flexibility, diabetes education knowledge and retention, and program adherence.

Participants

The inclusionary criteria for the participants required them to be between the ages of 18-80 years of age and have a BMI greater than or equal to 30 kg/m² (obese). In addition they were required to be considered prediabetic which is defined as scoring five or greater on the National Diabetes Education Program (NDEP) Diabetes Risk Test which can be retrieved at http://ndep.nih.gov/resources/ResourceDetail.aspx?ResId=252&redirect=true.

The exclusionary criteria in this study were those who answered yes on any of the questions on a modified version of the Physical Activity Readiness Questionnaire (PAR-Q) (unless approved for participation by a physician), pregnancy at the time of evaluation, inability to walk a quarter mile, and an unstable body mass (defined as lost or gained more than seven pounds within the three months prior to the start of the program).
Each participant was given an informed consent form, which was approved by the Institutional Review Board at California State University, Northridge. The purpose and procedures were explained to the participants and all participants gave written informed consent. Because a sample of convenience was used, generalizations to populations should be made with extreme caution.

Nine participants (1 male and 8 female) with a mean age of 55 (SD = 10.1) volunteered to participate in the program at Robinson Park, Pasadena, California. Table 1 presents the baseline participant characteristics that determined qualification of the 9 participants who screened for the study at the pre-test date. The ethnic and racial self-identifications were as follows: One participant was Caucasian, two were Latino, and six were African American.

Table 1.

<table>
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**Research Team**

The team of individuals responsible for the implementation of this research study included a graduate student researcher, undergraduate interns, and a faculty advisor. For the remainder of this document, the interns will collectively be referred to as “assistant
instructors.” Based on an interview process, the faculty advisor selected 12 undergraduate students as assistant instructors with the concurrence of the graduate researcher. The graduate researcher met with the assistant instructors 5 days prior to the face to face participant interactions. In this meeting, the graduate researcher distributed the fitness program, fitness testing protocols, and evaluated and critiqued each assistant instructor’s performance.

Measures

The independent variables of this study included: resistance training, moderate intensity aerobic training, and the modified DPP clinical trial curriculum which consisted of dietary modification recommendations and the health education lessons. The dependent variable in this study was percent weight loss. As with the original research, weight loss is the primary marker of success relative to reduction of diabetes risk.

Procedure

The protocol was similar to the DPP clinical trial curriculum with a few modifications. The DPP clinical trial curriculum can be retrieved at http://www.cdc.gov/diabetes/prevention/recognitition/curriculum.htm. Instead of 16 sessions over 24 weeks, this program was completed by meeting three individual hour long sessions each week for 12 weeks given the current research was to pilot the feasibility of delivery by undergraduate students during a “normal” college semester. The health education curriculum was simplified to ten minute lectures delivered at the end of each session. Sessions were based off the DPP clinical trial curriculum available on the internet. Lessons focused on intervention goals, information about modifying energy intake and increasing energy output and later transitioned to a focus on the psychological,
social, and motivational challenges involved in maintaining positive lifestyle changes. Given the research team’s expertise in exercise that most DPP programs lack, a greater emphasis was able to be placed on the physical activity component.

The participants, led by assistant instructors, engaged in structured group exercise circuit training sessions for the first 50 minutes of each session. Each exercise session was completed at a moderate intensity and accommodated the physical fitness capabilities of each participant.

The nutrition guidelines were consistent with the original DPP and participants were encouraged to stay within their individualized weekly calorie targets (based off their initial body weight). Participants were also instructed to monitor their dietary intake and physical activity in “tracker” logs. Participants were instructed to turn in their trackers each week and feedback was given by the lead researcher. Along with tracking dietary intake and physical activity, participants’ weights were recorded at the end of each week.

A total of two screening sessions were held for all the participants two weeks before the start of the program. Participants were asked to attend one of the two sessions to learn all elements of the study, including the purpose, the format, and the duration. After they were familiarized with the study, they signed an institution approved informed consent form and a bill of rights form. The participants then had their height and weight measured with their clothes on but shoes off in a private area to calculate their BMI. They were then asked to complete the NDEP Diabetes Risk Test. Participants were asked to complete the modified PAR-Q if they had a BMI equal to or greater than 30 kg/m² and a score of 5 or greater on the Diabetes Risk Test. If the participant answered yes to any of the questions on the PAR-Q they were asked to acquire written clearance from a
physician to participate in the program and the participants’ blood pressures were also measured and if their reading was over 144/94 they were asked to receive clearance from a physician before participation in the program.

An orientation session was held one week prior to the start of the program. As the participants arrived, they were asked to do the following:

- Complete a 50 question multiple choice knowledge assessment test developed by the graduate researcher based on the educational material in the DPP.
- Height, weight, and waist circumference were measured individually in a private setting.
- Flexibility was evaluated with a YMCA Sit and Reach test (Kaminsky, 2010).
- Muscle endurance was evaluated with the Push-up test (Kaminsky, 2010).
- Cardiovascular endurance was evaluated with the YMCA step test (Nieman, 2011).
- Food and activity trackers were distributed and a brief lesson on how to use the tracker with the aid of the DPP Fat Counter resource was given.

Participants were instructed to meet in the gymnasium of Robinson Park. The program consisted of 150 minutes of physical activity with a maximum of 75 minutes of strength training and 30 minutes of health education classes divided into three separate sessions a week. Each component was created by the author of this manuscript.

The physical activity began with a 10 minute dynamic warm-up. The participants then transitioned into the physical activity component conducted in a circuit training fashion intended to maintain an elevated heart rate and exercise intensity incorporating aerobic and strength training. Aerobic exercise was performed at a moderate-intensity
similar to brisk walking (4 mph/15 minute mile) (ACSM, 2010). Strength training included the use of resistance bands and body weight exercises with 5-10 exercises for each major muscle group (including upper body, lower body, and core) with appropriate progressions over time. The health education component was a verbal discussion facilitated by the graduate researcher. Each 10 minute lesson was based on the core curriculum of 16 sessions from the Diabetes Prevention Program (http://www.cdc.gov/diabetes/prevention/pdf/handouts.pdf). Sessions 2&3, 4&7, 5&6, 12&15 of the 16 sessions were combined to permit 12-week completion. Sessions included discussion topics revolving around basic nutritional guidelines, physical activity strategies, and behavioral self-management.

All participants received a food and activity tracker and were taught to log physical activity and dietary intake and proper food scaling. The participants were given the Fat and Calorie Counter from the National Diabetes Education Program to help keep track of the fat and calories in the food they consumed. Food and activity trackers were reviewed by the graduate researcher weekly and feedback was provided to the participants if warranted. The participants were asked to follow calorie restrictions and limit their fat intake based on their initial weight:

- Initial weight of 120–170 lbs consumed 1,200 kcal/day (33 g fat)
- Initial weight of 175–215 lbs consumed 1,500 kcal/day (42 g fat)
- Initial weight of 220–245 lbs consumed 1,800 kcal/day (50 g fat)
- Initial weight of over 250 lbs consumed 2,000 kcal/day (55 g fat)
The pace of weight loss targeted for each participant was 1-2 lbs per week. The goal was not to limit calorie intake but the calorie intake limitation was used as a strategy for weight loss.

Participants were also encouraged to engage in a minimum of 30 minutes of brisk walking every day of the week in addition to the 150 minutes of physical activity provided at Robinson Park, Pasadena, CA to thereby exceed the CDC recommendations for physical activity. Each participant was asked to record their daily physical activity in the food and activity tracker.

On the 18th session the participants met for a mid-testing session. At the conclusion of the 12-week study (36 sessions) the participants met for a post-testing session. At both testing sessions the participants followed the same protocol as the screening session.

**Data Analysis**

Individual attendance was measured as the percentage of the possible 34 sessions (2 of the scheduled sessions occurred on holidays) the participants attended. A sign-in sheet was utilized to record attendance each day. The pre-, mid- and post-test assessment data was analyzed using a repeated measures ANOVA to determine if there was any statistical significance between the three trials. The results were considered significant if p<0.05.
CHAPTER IV

Results

Program Adherence

The length of the study was 12 consecutive weeks with a total of 36 possible sessions. Due to government holidays, two sessions were cancelled resulting in a total of 34 actual sessions at the completion of the study. Attendance was taken each day; there was an average of 78% (SD = 0.12) attendance rate for the 9 participants over the course of the program. Figure 1 below displays the attendance percentage for each participant (percentage of the 34 sessions attended). There was 1 participant eliminated from statistical analysis because of receiving an NDEP Risk Test Score of ‘4’ and was, therefore, not considered part of the “prediabetic” inclusionary criteria. Another participant was eliminated from statistical analysis for not adhering to the 75% attendance rate requirement (missing more than 9 sessions) at the end of the 12-week program. At the completion of the study there were 7 participants who qualified for and completed the required program who were considered in the data analysis.

Figure 1. Individual Participation
Percent Weight Lost

An average of 6.14% (SD = 1.2%) of total weight was lost by all participants with a range of 4.6% - 9.0% during the 12-week intervention (Figure 2). Fifty-seven percent of the participants achieved the 5% (or greater) weight loss goal in 12 weeks which was comparable to the original DPP (n = 1,079 participants) results of 50% achieving a 7% (or greater) weight loss goal in 24 weeks (Diabetes Prevention Research Group, 2002). It should be noted that all 7 participants achieved a 4.6% or more weight loss upon completion of the 12-week program. Figure 2 below displays the percent of weight loss for each participant at the completion of the 12-week program.

Figure 2. Percent Weight Lost

Waist Circumference

Measuring the girth of the abdominal region of the body is used as a means to determine obesity from a risk factor assessment perspective. Obesity is defined as having a waist circumference of 40 inches for men and 35 inches for women (Kaminsky, 2010).
A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean waist circumference measurements differed statistically significantly between pre, mid, and post-test time points ($F(1.193,7.161) = 12.126, p<.05$). Post hoc tests using the Bonferroni correction revealed that waist circumference measurements at mid and post-testing were significantly lower than at pre-testing and there was a significant difference between mid and post testing. Figure 3 below displays the mean waist circumference (in.) values for pre-, mid-, and post-test dates. Data are presented as means ± SD, where * indicates significant difference from pre to mid and pre to post and ** indicates significant difference from mid to post (p<0.05). The downward trend shows that the average waist circumference decreased from ~43 inches to ~ 41 inches over the course of the 12-week program.

![Figure 3. Mean waist circumference (in.) values for pre-, mid-, and post-test dates. Data are presented as means ±SD, * significant difference from pre to mid and pre to post, ** significant difference from mid to post (p<0.05).](image)

**Knowledge Assessment Test**

A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean test scores differed statistically significantly between pre-, mid-, and post-
testing \( F(1.068, 6.407) = 5.737, p = 0.05 \). Post hoc tests using the Bonferroni correction revealed that test scores for the knowledge assessment test at post-testing were significantly higher than at mid testing. Therefore, we conclude that between mid- and post-testing, a significant increase is observed in knowledge assessment test scores, showing that the participants as a whole improved their understanding of basic nutritional guidelines, physical activity strategies, and behavioral self-management. Although there was an improvement in knowledge assessment test scores from pre- to mid-testing, it was not significant, statistically speaking. Figure 4 below shows the mean knowledge assessment test (out of 50 points.) values for pre-, mid-, and post-test dates. Data are presented as means ±SD, *significant difference (p<0.05). The upward trend shows that the average test score improved from ~30 out of a total 50 points (a score of 60% or a ‘D’ letter grade) to ~42 (84% or a ‘B’ letter grade).

![Figure 4](image)

*Figure 4. Mean knowledge assessment test (out of 50 points.) values for pre-, mid-, and post-test dates. Data are presented as means ±SD, *significant difference (p<0.05).*
Field Tests

The YMCA Step Test, Push-up Test, and YMCA Sit-and-Reach test were administered at the pre-, mid-, and post-test dates. Unfortunately, the YMCA Step Test and Push-up Test were not able to be performed by all participants. Zero participants were able to perform the YMCA Step Test at the appropriate cadence for the duration of the 3-minute test. Four of the 7 participants were able to perform the Push-up Test. An improvement was observed for the average number of push-ups performed from pre-testing to post-testing time points though the change was not significant. The average number of push-ups at pre-testing was 4 (SD=2.94) and at post-testing was 9.8 (SD=1.7). The results of the Push-up Test are displayed below in Figure 5.

![Figure 5. Push-up Test values for each participant evaluated at pre-, mid-, and post-test dates. Data are presented as actual numbers of push-ups performed.](image)

A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean test scores for “flexibility” differed statistically significantly between time points (F(1.530, 9.178) = 8.918, p=.01). Post hoc tests using the Bonferroni correction
revealed that flexibility was significantly higher at mid-testing than at pre-testing. However, there was no statistically significant improvement in flexibility from mid-testing to post-testing time points. Figure 6 below displays the mean Sit-and-Reach values in inches at pre-, mid-, and post-test time points.

![Figure 6](image)

*Figure 6. Mean sit-and-reach (in.) values for pre-, mid-, and post-test dates. Data are presented as means ±SD, *significant difference (p<0.05).*
CHAPTER V

Discussion

The upward trend of diabetes and obesity represent a public health priority and we must find a viable solution to address the issue. Combining the adapted DPP with the existing 100 Citizens Kinesiology delivered program in partnership with public parks would provide any individual at increased risk for type 2 diabetes with the tools, resources, and support needed to achieve the two main goals of all DPP adaptations as well as the hypothesis of this 12-week study: 5% to 7% of total weight loss and 150 minutes per week of moderate physical activity to decrease the risk of developing type 2 diabetes with the added factor of no cost to participate.

The 100 Citizens program is a collaborative effort between the City of San Fernando Recreation & Community Services and the Kinesiology Department at California State University Northridge (CSUN). The focus of 100 Citizens is to address the obesity epidemic by eliminating barriers many individuals face (e.g., language, cost, convenience, and fitness level); all barriers are addressed by having Kinesiology educated students work directly with participants. Kinesiology students are educated in the science of human movement and can instruct exercises with appropriate progressions and modifications to accommodate the abilities and needs of all individuals. These exercises emphasize improving cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition.

Integration of the DPP with 100 Citizens becomes a viable solution to prevent type 2 diabetes at no cost to the participant. Further, the inclusion of a DPP component is relevant to the Affordable Care Act (ACA); the ACA encourages the public to enroll for
health coverage and the existence of 100 Citizens provides individuals (especially those in underserved communities) with a no cost program that addresses their potential pre-diabetic and/or obesity health status and for others provides ongoing free supervised physical activity programming. The 100 Citizens DPP provides individuals at an increased risk for type 2 diabetes with FREE tools, resources, and support required to successfully reduce their risk of developing type 2 diabetes. Note also that African Americans are disproportionally affected by diabetes as compared to other populations with 18.7% of African American adults having diabetes (CDC, 2011). A 100 Citizens DPP could be located in communities where the need is greatest. Robinson Park in Pasadena, CA in collaboration with Pasadena’s Public Health Department was the location selected to implement the free DPP, as the most frequent users of this park were African-American.

During this experimental pilot study, participants were evaluated in terms of percent total weight loss and waist circumference, overall fitness levels (YMCA Sit-and-Reach, Push-up, and YMCA Step Tests), diabetes prevention education retention (knowledge assessment test), and individual attendance. As the primary goal of the CDC sponsored National DPP, the objective of this study was to have participants lose 5%-7% total body weight and engage in 150 minutes of moderate intensity exercise per week. The DPP clinical trial included several lifestyle changes, but weight loss was the primary determinant of the reduction of type 2 diabetes occurrence (Hamman, et al., 2006). As such, the primary criteria to determine success of this study was percent weight loss and engagement in exercise (which was evaluated with the 75% attendance rate requirement). The attendance rate requirement leads to a commitment from the participant which results
in greater success as documented by weight loss. Although the National DPP’s core curriculum was delivered and evaluated after a 24-week period, this study was delivered over a 12-week period so as to be feasibly run by undergraduate Kinesiology students over a college semester time period. Additionally, the findings of the Internet-based DPP by McTigue and colleagues (2009) noted that the bulk of the weight loss in their program was obtained in the first 3 months of the study and was maintained for the remainder of the year. With these findings, the researchers of this study felt confident that significant weight loss would be achieved in 12 weeks. There was an average of 78% (SD = 0.12) attendance rate over the course of the program and 57% of the participants who completed the required program reached their 5% weight loss goal.

**Strengths of the Current Study**

The current study has several strengths. A small sample size allowed for all participants to be individually supervised by an undergraduate intern during all exercise sessions. It is possible that this allowed for strong interpersonal connections to be made and may have attributed to the high adherence rate.

The program is replicable in the sense that it works to adapt to the community’s needs, it can be modified to account for different fitness levels (advantage of being taught by Kinesiology students), successful extension programs have been implemented in other communities, and it is expandable. As the 100 Citizens DPP gains more participants, the demand for different exercise programs is created and additional programs can be offered at a low-cost, thereby creating additional revenue for the parks. There are 5 wins in this type of programming:
1. The participants benefit from these programs because they can live healthier lives and have a better understanding of health and wellness.

2. The undergraduate Kinesiology students gain practical education which includes, but is not limited to, gaining important experience and interpersonal communication skills in delivering exercise and appreciating what is required to more effectively address the obesity epidemic as well as gaining internship hours that serve as units towards graduation.

3. The parks are able to increase the utilization of park resources and establish its relevance as an integral part of their communities.

4. The community as a whole gains healthier citizens who can act as role models and pass their knowledge to others.

5. Lastly, Kinesiology as a profession gains greater recognition for what kinesiologists can accomplish in the public health arena.

**Limitations**

Although this research lead to the development of a refined, larger scale program in San Fernando, it is not without limitations. A limitation of this study is the small sample size (N=7) and, consequently, poor statistical power. Future studies with greater statistical power (i.e., larger sample size) may reveal stronger findings. There is a greater need for quality marketing and participant recruitment in the Pasadena Parks and Recreation and Public Health departments.

Although it was the intent of this study to analyze the results of muscle endurance and cardiovascular endurance test results, it proved that the YMCA Step Test and Push-up test were a poor choice of field tests for this population. The participants had various
physical limitations due to preexisting injuries (i.e. knee, shoulder, and back issues) and low fitness levels associated with being sedentary and obese that limited their abilities as a whole to conduct these two particular field tests.

Food and Activity Trackers were distributed weekly as an aid for the participants to reach their 5%-7% weight loss goal, however, a challenge presented itself in the attempt to collect these trackers over the course of the program. It was observed that the participants utilized and returned the trackers at the beginning of the program, but neglected to return them towards the completion of the program, despite the efforts of the graduate researcher.

Another limitation of this study is the exclusion of the HbA1c blood test that most DPP programs included. The HbA1c blood test shows an individual’s average blood glucose levels for the previous 3 months. Given that this is a community-based program in an underserved community delivered at no cost to the participant, the costly blood test was eliminated from the study.

Implications

Our results from the 12-week program at Robinson Park, Pasadena demonstrated that our modified DPP program delivered by Kinesiology students could achieve the 5%-7% weight loss at no cost to the participant. Our intention was to identify a successful methodology to establish a final protocol to implement a larger program funded by a Kaiser Permanente Community Benefits Grant targeted at a larger population with the potential to expand the 100 Citizens DPP statewide in the Cal State University system or within the communities surrounding California State University, Northridge. Currently,
there are 62 participants in the San Fernando program this Spring utilizing methods established in the present work.

At face value a 57% success rate may not seem significant. However, when one considers that the annual healthcare costs of an individual without diabetes is projected at $4,400 versus $20,700 for an individual with complications related to diabetes (United Health Care Group, 2012) the potential savings for those 7 individuals is $114,100 annually. There are currently 62 participants in San Fernando; with the same success rate there is a potential to save $570,500 in annual healthcare costs. Now, multiply this for 10 programs in the San Fernando Valley and for 10 programs for every CSU 100 Citizens DPP … a free CSU delivered program can save millions of dollars in annual healthcare and enhance the quality of life for thousands of citizens throughout California. More importantly, the affordability and accessibility of the program to underserved communities is paramount given the success of the Affordable Care Act and the subsequent need for identification of affordable intervention or prevention programs for those who are identified as prediabetic or obese.

**Directions for Future Research**

It is recommended that the Cooper 12-Minute Run/Walk test (Cooper, 1968) be implemented instead of the YMCA Step Test for cardiovascular endurance assessment purposes in future studies. The YMCA Step Test was too advanced for this population (many participants reported pain in their knees during the test or that they were too short of breath) whereas the Cooper 12-Minute Run/Walk test allows the participant to walk or run at their own pace for 12 minutes. The Cooper 12-Minute Run/Walk test also eliminates the variability associated with palpating heart rate that is required for the
YMCA Step Test given the challenge for the undergraduate Kinesiology students to accurately palpate heart rate for this test. It is also recommended that the muscle endurance fitness testing be eliminated as a whole for future studies due to the excessive joint strain these tests tend to pose for an obese and sedentary population. Since the goal of all DPP programs is to have a 5%-7% weight loss and weekly participation in 150 minutes of moderate intensity physical activity, muscle endurance testing is not necessary. However, the challenge with offering a program with an emphasis on physical activity is the potential body composition changes which may reflect an increase in muscle mass which could confound the weight loss results. Being more intrusive with accurate body composition methods though may prove problematic in a community-based program.

Considering the challenge in collecting the weekly Food and Activity Trackers, perhaps the trackers need not be used for the entirety of the 12 weeks. The Trackers should simply be used as a tool to have the participants become aware of their energy intake and expenditure in the initial stage of the study so that they may properly adjust their habits to reach their goals. In addition, it would be recommended that 100 Citizens program implement ongoing weight monitoring as a means to motivate the participants to maintain program weight loss as they transition into the ongoing exercise program.
References


