PHYSICAL ACTIVITY INTERVENTION IN ADULTS WITH INTELLECTUAL DISABILITIES

by

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ABSTRACT

The purpose of this study was to evaluate the effectiveness of a once-weekly, 60 minute group exercise session on improving overall physical fitness in populations with developmental and intellectual disabilities. 14 adults (8 females, ages 20-23, 84% overweight or obese) from MHMR of Tarrant County and Crowley Independent School District completed the Brockport Physical Fitness Test (BPFT), consisting of a PACER test, sit-ups, push-ups, leg press, and chest press. Although not significantly different, Cohen's d effect size demonstrated small to moderate effects as a result of the training protocol. Following 8 weeks of training, participants improved in the chest press (d=0.34, effect size = -0.33, -14%) and leg press (d=0.44, effect size = -0.37, -17%). Minimal to no improvements were found in the PACER (d=0, effect size = 0.03, 0%), push-ups (d=0, effect size = -0.03, 0%), & sit-ups (d=0.13, effect size = 0.10, 7%). While the sample group was limited, these results suggest that strength can be improved in similar interventions. Further research should examine how cardiovascular performance can be likewise improved, and whether the specificity of training could have resulted in improved muscle strength or better ability to recruit muscles to achieve movements.

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INTRODUCTION

Intellectual disabilities (ID) are characterized by significantly limited intellectual functioning and adaptive behavior (Temple, Frey, & Stanish, 2005). Current health disparities between these individuals and the general population are emerging continually as ID lifespans increase and subsequent chronic diseases develop. This population includes several subgroups, including those with Down syndrome (DS), cerebral palsy (CP), and Autism Spectrum Disorders (ASD), who inherently experience significant health deficits related to disease-specific symptoms and conditions. While the clinical manifestations of these disorders may differ, individuals with ID participate in less physical activity than their normally developing counterparts, leading to exacerbated health conditions and decreased longevity.

Health Issues in Populations with Intellectual Disabilities

Intellectual disabilities are wide-ranging in severity and associated symptoms, based on causes such as genetic abnormalities, birth complications, and diseases or exposures that can eventually manifest in ID (NICHCY). Overall, individuals with ID are at an increased risk for developing chronic diseases and usually do not participate in regular physical activity, further increasing their risk of obesity, diabetes, and cardiovascular disease (Carmeli, Barak, Morad, & Kodesh, 2009; Davis, Proulx, Van Schrojenstein Lantman-de Valk, 2014). These increased risks and decreased participation in physical activity can lead to decreased mobility, ability to care for self, and quality of life as the individual grows older (Fernall & Pitetti, 2001). Adults with ID are emerging as a significant portion of aging adults, and addressing the physical activity needs of these individuals has become increasingly important as national legislation seeks to promote more health-

ful lifestyles among all populations (Dixon-Ibarra, Lee, & Dugala, 2013). Past research has concluded that targeting both physical activity and sedentary lifestyles in these populations will be the most effective way to promote longer lives with maximum functionality and quality of life (Dixon et al, 2013).

ID is an umbrella-term for a multitude of individuals who experience some form of intellectual and adaptive deficits; the variety of health problems discussed above offers a broad overview. While many individuals with ID experience differing degrees of these health issues, specific subcategories of the population have elevated risks for various complications due to the etiology of their disorder (Davis et. al, 2014).

Down Syndrome

Down syndrome (DS), caused by a trisomy of chromosome 21, is commonly associated with congenital heart defects, increased risk of infections, decreased muscle tone and strength, joint instability, and lower levels of cardiovascular fitness (Shields, Dodd, & Abblitt, 2009; Latash, 2008). These health concerns adversely impact quality of life and overall longevity, resulting in high instances of obesity, type 2 diabetes, and other related health problems like Alzheimer's disease (Li, Chen, How, & Zhang, 2013; Latash, 2008). While life expectancy has increased markedly over the past century, individuals with DS still have shorter lifespans than the general population, with deaths caused largely by cardiovascular diseases, infections, and cancers (Bittles, Bower, Hussain, & Glasson, 2006).

Increased age in these populations is accompanied by the decreased ability to maintain autonomy and independence, largely through diminished muscle strength and limited cardiovascular functioning (Gonzalez-Aguero, Vicente-Rodriguez, Moreno,

Guerra-Balic, & Casajus, 2010; Janicki, Dalton, Henderson, & Davidson, 1999). Specifically, pre-existing conditions such as decreased oxygen consumption and muscular strength can limit overall health and ability to improve physical fitness (Mendonca, Pereira, & Fernhall, 2011). Studies have shown various strategies to improve body composition in these subjects, but have been yet unable to conclusively determine an appropriate exercise regimen that improves cardiovascular functioning significantly. Evidence reviewed by Gonzalez et al (2010) has suggested, however, that increased, longer-term physical activity can benefit these individuals in specific areas of cardiovascular endurance, muscular strength, and body composition.

Cerebral Palsy

Cerebral palsy (CP) is a group of conditions characterized by permanent, non-progressive brain abnormalities or damage, typically occurring during fetal development or during the birthing process (Laskin, 2009). Depending on the location of brain damage, muscle tone and spinal reflexes can be affected, resulting in decreased mobility, balance, and postural control. Among individuals with CP, these motor deficits can limit social and physiological development across their lifespans, contributing to decreased independence and functionality (Moll & Cott, 2013). Furthermore, research indicates that this clinical population experiences musculoskeletal changes that further limit their ability to walk and participate in activities of daily living as they progress through adolescence and early adulthood. This physical deterioration, in conjunction with decreased participation in physical activity decreases quality of life and longevity in individuals with CP (Van Wely et al., 2014). Current rehabilitation practices for individuals with CP focus on interventions during childhood and adolescence, but physical activity across the

lifespan can be more effective for these individuals to adapt to physiological changes they may experience and to participate more efficiently in activities of daily living.

Autism Spectrum Disorder

Autism spectrum disorder (ASD), more commonly known as autism, is a wide range of neurodevelopmental disorders characterized by social interaction deficits and repetitive, restricted interests and behaviors (Srinivasan, Pescatello, & Bhat, 2014). The exact cause of autism is unknown, but research indicates that likely causes may include genetic factors, brain structure abnormalities, and environmental components. Gross motor problems related to autism include decreased muscle tone, strength and balance and gait issues. Like other individuals with ID, adults with ASD are susceptible to developing chronic diseases such as obesity, diabetes, cardiovascular diseases, and certain types of cancers, but may have elevated risks due to decreased availability to appropriate physical activity programming (Chessen, 2013). As with typically developing adults, regular physical activity participation can reduce the likelihood of developing these conditions and can enhance quality of life and overall functioning.

Physical Activity

Physical activity, defined as "any bodily movement produced by skeletal muscles that results in energy expenditure," encompasses leisure activities, work-related and domestic chores, and exercise (Caspersen, Powell, & Christenson, 1985; Winnick & Short, 1999). Physical activity has been empirically shown to improve long-term health and functioning, including increased cardiovascular health and healthier body weights (Barnes, Howie, McDermott, & Mann, 2013). As discussed by Barnes et al (2013), a large majority of adults with ID do not meet the recommended amounts of physical activ-

ity, as shown by exacerbated health complications and limited functionality. Additionally, physical activity levels decline even more in individuals with ID as they age, leading to greater risk for exacerbated health conditions (Temple et al, 2005). Serious obstacles to improving health among these individuals include prevalent sedentary lifestyles, lack of health knowledge, decreased motivation to exercise, and limited transportation to exercise facilities (Bodde, Seo, Frey, Van Puymbroeck, & Lohrmann, 2012; Davis et al, 2013). Studies have indicated that this is a widespread problem across the United States and the world, and one of the most crucial issues at hand is the lack of health education and participation in related exercise programs that can improve physical fitness and reduce the incidence of these comorbidities (Davis et al, 2013; Haider, Ansari, Vaughn, Matters, & Emerson, 2013; Martinez-Leal et al, 2011). Researchers believe that these problems can be combatted with appropriate outreach and education programs and need to be implemented immediately to reduce morbidity (Martinez-Leal et al, 2011).

As mentioned before, individuals in the ID population have significant deficits in health knowledge, which is often an indication of overall health habits, including physical activity. Bodde et al (2012) indicate how various methods of demonstrating exercises to these individuals can be used to promote health knowledge and physical activity. When partnered with similar health curriculum, exercise programs will likely have even more significant improvements upon the physical wellness of these populations. Exercise programs that partner with other advocate organizations, such as this physical activity intervention with Mental Health Mental Retardation of Tarrant County and the Crowley Independent School District, can hopefully facilitate access to health education and fitness instruction for these individuals. Through these community partnerships, adults with ID

will be able to learn appropriate activities and exercises as well as gain the motivation and support needed to continue a more healthy lifestyle that is supported with increased knowledge and understanding of personal fitness and health.

Beyond physical health deficits, individuals with ID experience significant health issues that limit functional ability as well as quality of life. Physical activity can expand the functional capacities of these persons by improving cardiovascular and muscular strength, but current research indicates that these individuals do not meet physical activity recommendations. Effective strategies to increasing physical activity participation include interactive, community interventions that employ exercise programs coupled with organizations to which these individuals already belong, such as mental health resource groups and support and advocacy programs.

Brockport Physical Fitness Test

The Brockport Physical Fitness Test, designed by a research study funded by the United States Department of Education, measures physical fitness among young people with disabilities by comparing their fitness levels against health-related standards, instead of skill or physical performance (Winnick & Short, 1999). This test, known as the BPFT, enables test administrators to identify specific health and fitness-related concerns among the selected population and to determine the current level of physical fitness among participants based on appropriate exercises and predetermined standards. The BPFT can be personalized for a variety of populations, including individuals with and without intellectual disabilities, and for this reason, was chosen for this intervention.

Individuals with intellectual disabilities may require an extensive range of support and other modifications to perform some exercises. The BPFT manual addresses specific modifications for various populations, including those with mental retardation, providing a variety of exercises appropriate for participants with varying limitations and disabilities (Winnick & Short, 1999). The test items selected for this intervention were a 20-meter PACER, push-ups, curl-ups, one-repetition maximum chest press, and one-repetition maximum leg press. These test items correlate to two main areas of physical fitness discussed by the BPFT manual: aerobic functioning and musculoskeletal functioning. Aerobic functioning pertains to an individual's ability to maintain activities of higher intensity that utilize more and larger muscles. Physiological and functional health are associated directly with increased aerobic functioning. An elevated aerobic capacity indicates a greater amount of oxygen that a person consumes while exercising and a higher level of fitness. Adequate aerobic capacities are associated with decreased risks of heart disease, obesity, and diabetes, complications discussed above as major issues faced by individuals with ID. Within this intervention, the 20 meter PACER measured the aerobic capacity of each subject. The second physical fitness component of the BPFT, musculoskeletal functioning, is particularly related to the maintenance of an active, independent lifestyle with strengthened muscles and flexibility for needed motion. This component of fitness was tested utilizing push-ups, curl-ups, one-repetition maximum chest press, and one-repetition maximum leg press.

Purpose and Hypothesis

The purpose of this intervention is to determine if and to what extent eight weekly sessions of exercise training can improve physical health in sedentary individuals with

intellectual disabilities. The investigators hypothesized that the participants would improve fitness levels in the 20-meter PACER, push-ups, curl-ups, one-repetition maximum chest press, and one-repetition maximum leg press tests.

METHODS

Participants

Fourteen participants (8 females, 6 males, ages 20-23 years old) were recruited from Mental Health Mental Retardation of Tarrant County and the Crowley Independent School District. Approximately 40% of participants had DS, 10% had CP, and 50% had ASD. During the first visit to the lab, participants completed paperwork (exercise readiness questionnaires, informed consents, assents, supplemental health questionnaires). Height, weight, and BMI then were collected using a standard stadiometer.

Procedures

Each participant came to the Adapted Physical Activity Lab in the TCU Kinesiology Department, where they completed the IRB approved consent form and the Consent/Assent form. Anthropometric information was gathered, including weight, height, and BMI, on a standard stadiometer. After preliminary information was collected, each participant completed the pre-test, consisting of five exercises from the BPFT: 20m PACER, push-ups, curl-ups, one-repetition maximum chest press, and one repetition maximum leg press. For the next eight weeks, participants attended a once-weekly 60-minute exercise session, consisting of 30 minutes of aerobic exercise and 30 minutes of strength training. At the end of the eight-week intervention, participants completed a post-test of the same five BPFT exercises used in the pre-test.

RESULTS

Participants' demographic information can be found in Table 1 of Appendix A. A dependent samples t-test was used to examine the changes between pre- and post-test data for each exercise. No significant differences were found, most likely due to the limited sample size. A Cohen's d-test was then run to examine changes between pre- and post-test data for each exercise. Although not significantly different, Cohen's d effect size demonstrated small to moderate effects as a result of the training protocol; these are illustrated in Appendix B. Minimal to no improvements were found in the PACER (d=0, effect size = 0.03, 0%), push-ups (d=0, effect size = -0.03, 0%), & sit-ups (d=0.13, effect size = 0.10, 7%). Participants improved in the chest press (d=0.34, effect size = -0.33, -14%) and leg press (d=0.44, effect size = -0.37, -17%).

DISCUSSION

The purpose of this intervention was to determine if and to what extent eight weekly sessions of exercise training can improve physical health in sedentary individuals with intellectual disabilities. This intervention yielded no improvements in the PACER, push-ups, or sit-ups, and no significant improvements in the chest press and leg press lifts. However, the small improvements seen in the chest press and leg press lifts do have some practical significance for compromised populations, like the participants in this intervention. Resistance training is correlated with better physical and functional health, potentially improving quality of life and functional capacities, which include certain activities of daily living and occupational skills (Gennuso et. al, 2013). As some of these individuals phase out of the education system and choose to find jobs, many will work in the blue-collar sector, which typically requires more manual skills, such as walking, lift-

ing, and carrying. Participating in regular physical activity can help these individuals perform more functional activities and occupational skills more easily, increasing independence and quality of life over their lifetimes.

Limitations

Improvements seen in this intervention were specific to the training protocol. Participants trained on similar weight machines as the chest press and leg press each week, which may have been the cause for some of the improvements in these areas. Conversely, these participants did not perform the PACER, push-ups, or sit-ups on a regular basis, which may have resulted in no improvements in these areas. Furthermore, the improvements in chest press and leg press may have been due to increased muscular strength as a result of neuromuscular adaptations, meaning that these participants improved their ability to recruit muscle groups to perform the lifting motions.

Since many of these participants relied upon others for transportation to weekly exercise sessions, attendance was a limiting factor in this intervention. The MHMR group had a 50-60% compliance rate, due to family scheduling conflicts and other extracurricular commitments. However, since the Crowley group received transportation to the exercise facility through their school, these participants had a compliance rate of about 80% throughout the eight-week intervention.

Future Directions

Reasons for lack of improvement in PACER, push-ups, & sit-ups need to be examined in more depth. More research is needed to determine whether improvements in the chest press and leg press were due to increased muscular strength or neuromuscular adaptations. Further interventions should also address attendance issues. Even with this

limited sample size, small improvements were made in the chest-press and leg-press lifts. Two or more sessions per week may result in more dramatic strength increases, as well as improvements in the PACER, push-ups, and sit-ups. Furthermore, follow-up study should examine the dose-response relationships for each of these exercises to more accurately determine appropriate training protocols for adults with intellectual disabilities.

APPENDIX A:

Table 1 - Group demographic data

	Minimum	Maximum	Mean
Age (years)	20.00	23.00	21.67
Height (inches)	57.60	71.10	64.09
Weight (pounds)	101.20	293.80	186.20
Body Mass Index (BMI)	21.44	46.01	31.47

APPENDIX B:

Figure 1 - Pre- & Post-Data (Brockport activities)

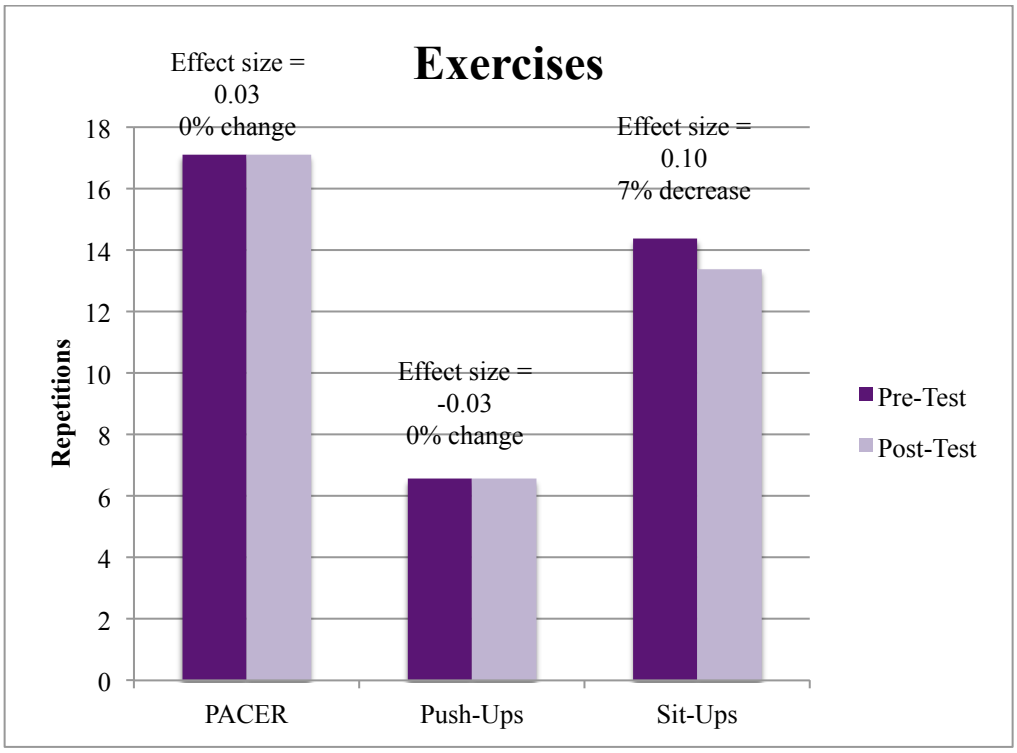
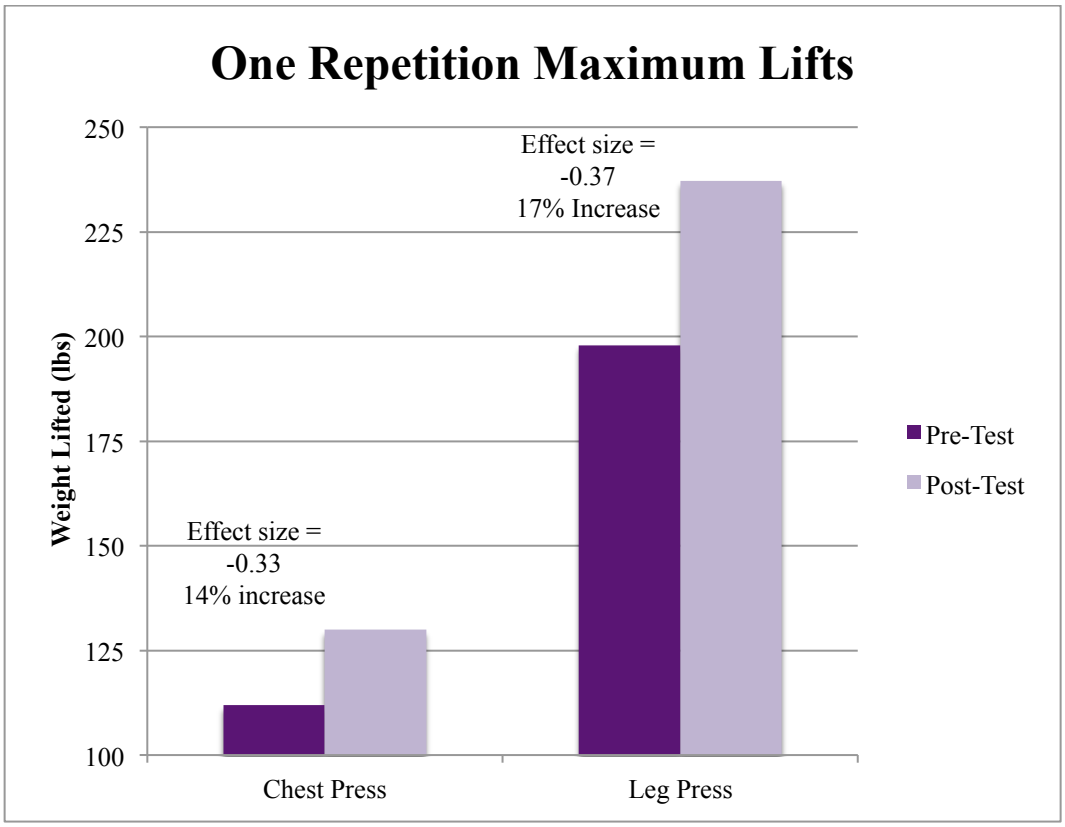


Figure 2 - Pre- & Post-Data (one repetition maximums)



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