Effects of Core Strengthening Exercise on Balance and Quality of Life in an Elderly Population

Rachel Geiger and Hayden Sutton, and Dr. Dan Halvorsen, PhD.

Department of Human Kinetics and Applied Health Science
The Biokinetics Program

Abstract

Purpose: As the human body ages, it is prone to natural physiological changes which can be influenced by genetics, environment, and activity levels. A major change is sarcopenia, or the loss of muscle mass and strength caused by aging. A low activity level in combination with sarcopenia can cause a decrease in the ability to balance, and also a decrease in quality of life. The aim of this study is to determine if a five-week core strengthening exercise program could improve balance and quality of life in an elderly population. Research has shown an increase in the elderly population's balance due to lower extremity exercise programs however, little research has been conducted on whether a core focused exercise program has a positive effect on the balance of the elderly population.

Methods: Participants included six volunteers (4F, 2M) 85.4 + 4.4 SD years old, height=165.8cm+8.8cm, weight=133.4 lbs+15.3 lbs, and BMI=22+1.5, all from an independent senior living community, eligible based on health history and ability to stand comfortably. Subjects attended a five-week core focused exercise program two times/week for 30-minute sessions consisting of a warm up, resistance and balance training, and cool down for 5, 20, 5 minutes respectively. The Biodex Biosway Balance System (BBBS) and the Perceived Quality of Life Assessment (PQLA) was conducted before and after completion of 5-weeks of exercise.

Results: Paired sample t-tests displayed no significant training with BBBS under any of the testing conditions, (eyes open-firm surface (p=0.53), eyes open-foam surface (p=0.38), eyes closed-foam surface (p=0.40)). The eyes closed-firm surface testing condition showed a trend in sway index with pre-test =1.45+0.55 and post test =1.65 +0.59 (p=0.19). No significance was determined for PQLA for physical state (p=0.76), mental/emotional state (p=0.78), or overall quality of life (p=0.99).

Conclusion: The data indicated that no statistical significant scores were achieved for BBBS or (PQLA). Our results are likely due to small sample size, the short time frame of the exercise program and possibly the older age of the subjects. A longer program using younger seniors and a larger sample size could yield more meaningful results, but significant experience and relationships were gained working with elderly seniors.

Introduction

The aim of this study was to gain a greater understanding of how age-related decline in function affects daily life. Natural physiological changes occur over time as an individual ages. Such changes are influenced by genetics, the environment, and the degree of activity the person maintains throughout life. One of those physiological changes is sarcopenia. Sarcopenia is a loss of muscle mass, strength and contractile speed (Ehrman, Gordon, Visich, & Keteyian, 2009). The combined effects of sarcopenia and lack of physical activity leads to declining balance in the elderly population. Lack of balance is a major contributor to falls, which is a leading cause of injury, disability, and death (Ehrman et al., 2009). As the body's muscles continue to weaken, more effort is needed to perform daily tasks, bringing about increased discomfort and difficulty in daily activity (Roubenoff, 2000). This can lead to a decreased quality of life. The aging population has the ability to adapt and respond to both endurance and strength training (Mazzeo & Tanaka, 2001). Older adults are able to increase muscle mass, strength, power, and endurance especially if they were sedentary before beginning exercise (Faulkner, Larkin, Claflin, & Brooks, 2007). A major goal in prescribing exercise for the elderly is to combat the frailty that is easily developed due to a sedentary lifestyle and the natural occurrence of sarcopenia (Faulkner et al., 2007). In order to improve balance and reduce the risk of falls, we worked with the Regional Wellness Director of Presbyterian Homes to implement an exercise program for our subjects.

Figure 1: Comparison of Pre and Post Intervention BioSway Index Score (Eyes Open/Firm Surface)

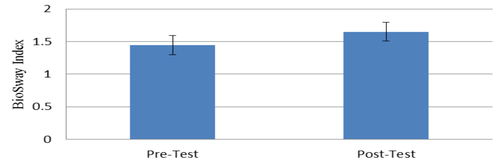


Figure 2: Comparison of Pre and Post Intervention Biosway Index Score (Eyes Closed/Firm Surface)

Figure 3: Comparison of Pre and Post Intervention BioSway Index Score (Eyes Open/Foam Surface)

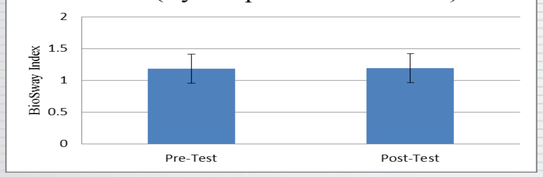
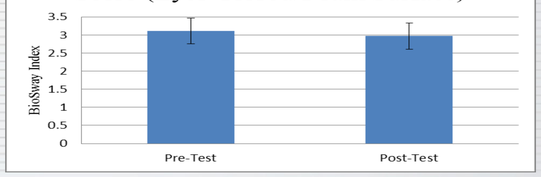


Figure 4: Comparison of Pre and Post Intervention BioSway Index Score (Eyes Closed/Foam Surface)



Results

The analysis was carried out using a Paired Sample t-test with an accepted statistical significance of $p \leq 0.05$. When measuring significance of BBBS and PQLA, 5 of the 6 participants results were utilized. Results of the BBBS resulted in no significance with (eyes open-firm surface (p=0.53), figure 1, eyes open-foam surface (p=0.38), figure 3, eyes closed-foam surface (p=0.40) figure 4). The eyes closed-firm surface testing condition showed a trend in sway index with pre-test =1.45+0.55 and post test =1.65 +0.59 (p=0.19) (figure 2). No significance was determined for PQLA for physical state (p=0.76), mental/emotional state (p=0.78), or overall quality of life (p=0.99).

Acknowledgment

A special thank you to Johanna Shores Presbyterian Homes and all the subjects who were involved in the study. We also want to thank the Regional Wellness Director, Lynn Truninger for partnering with us to find participants and times for the therapeutic interventions.

Methods

All participants were assessed according to the BBBS, which utilizes four different balance tests to obtain a sway index, eyes open-hard surface, eyes closed-hard surface, eyes open-soft surface, and eyes closed-soft surface. Pretesting also included a PQLA. The five week core exercise program was conducted two days a week, thirty minutes each session, with optional make-up sessions to ensure adequate attendance. Participants were encouraged to maintain an upright posture and to engage their core muscles during exercises and activities. The exercise protocol consisted of a Warm Up, Seated exercises with balls, Standing Exercises with chair assistance and a Cool-Down. Warm-Up consisted of a 1. Neck Stretch held for 5 seconds on the left and right and a 10 second 2. Ear Tip to left and to right shoulder, a 3. Shoulder Shrug with alternating anterior and posterior rotation, and 4. Seated Marches for 30 seconds followed by 5. lateral and medial ankle rotations of each ankle. The exercises following the warm up consisted of 6. Seated Crunches, 7. Side bend to both right and left sides, 8. Elbow to Knee seated crunches, 9. Knee Extensions, 10. Weight Shifts, 11. Arm Raises with ball resistance, 12. Inner Thigh Ball Squeezes, 13. Sit to Stands, 14. Standing Marches, 15. Squats, 16. Calf Raises, 17. Butt Kickers, 18. Dynamic Lunges, a 19. ball bounce, and 20. Lateral Leg Lifts. The Cool-Down mirrored the Warm-Up with the addition of subjects placing a ball between their back and the back of the chair giving themselves a seated back massage. At completion of the exercise program, the post testing included participants testing on the BBBS and completing a PQLA survey, each performed by the same evaluator as the pre-test to ensure consistency.

Conclusion

Our results did not show statistical significance for the Biodex Biowsay Balance System. However, out of the 6 subjects, 4 showed an increase of balance under the first and fourth testing conditions, determined by their post-test BBBS results. Our results did not show statistical significance for the Quality of Life assessments under physical state, mental/emotional state, or overall quality of life. Though significance was not found in balance during the 5 week intervention (as seen in figures 1-4), we hypothesize that a longer core exercise intervention with younger seniors and a larger sample size may show an increase in balance and an increase in quality of life, bringing a reduction in the progression of sarcopenia.

References

Ehrman, J. K., Gordon, P. M., Visich, S. J., & Keteyian, S. J. (2009). Chapter 7: The elderly. In Clinical exercise physiology (Second ed., pp. 135). Champaign, IL:Human Kinetics.

Faulkner, J. A., Larkin, L. M., Claflin, D. R., & Brooks, S. V. (2007). Age-related changes in the structure and function of skeletal muscles. Clinical & Experimental Pharmacology & Physiology, 34(11), 1091-1096. doi:10.1111/j.14401681.2007.04752.x

Mazzeo, R. S., & Tanaka, H. (2001). Exercise prescription for the elderly: Current recommendations. Sports Medicine, 31(11), 809-818.

Nelson, M. E., Rejeski W J., Blair S N., Duncan P W., Judge J O., King A C., . . . Castaneda-Sceppa C. (2007). Physical activity and public health in older adults: Recommendations from the American College of Sports Medicine and the American Heart Association,39(8), 1435-45.

Roubenoff, R. R. (2000). Sarcopenia and its implications for the elderly. *European Journal Of Clinical Nutrition*, *54*(6), S40.

Rachel Geiger: reg45249@bethel.edu ▪ Hayden Sutton: hayden-sutton@bethel.edu ▪ Dr. Dan Halvorsen: d-halvorsen@bethel.edu