Effects of an abdominal muscle exercise program in people with intellectual disabilities residing in a residential care facility

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Abstract. [Purpose] The purpose of this study was to provide basic information as reference and guidelines for the implementation of abdominal muscle exercise programs for people with intellectual disabilities residing in residential care facilities. [Subjects and Methods] The study period was 12 weeks, from July 1, 2015, to September 30, 2015. The study participants comprised of 10 people with intellectual disabilities who were residing in a residential care facility. An occupational therapist measured each subject’s weight and physical fitness (muscle strength and flexibility). Collected data were encoded by using items and analyzed using SPSS ver.18.0. [Results] Weight decreased significantly, and physical fitness (muscle strength and flexibility) increased significantly. [Conclusion] To actively improve abdominal muscle strength and health management in people with intellectual disabilities residing in residential care facilities, consistent implementation of abdominal muscle exercise programs and improvements are indispensable, as these could lead to the development of systematic programs for rehabilitation physical activities. Key words: Abdominal muscle exercise, People with intellectual disability, Residential care facility

INTRODUCTION

For various reasons, people with intellectual disabilities do not achieve a normal level of physical function during development. Especially, they have a delay in balanced growth and do not reach the physical development appropriately for their age quantitatively and qualitatively. These factors make it more difficult for them to perform movements skillfully, including basic motor functions to maintain physical balance, as well as connecting and separating different types of movements. In comparison with able-bodied, disabilities have substantially worse functional motor skills, including speed, accuracy, response time, and muscle strength1).

Physical exercise leads to promote their physical function improvement and health management. Particularly abdominal-muscle exercise has been a recommendation program for people with intellectual disabilities residing in a care facility, because of the few limitations of time, place, and cost, and having a low risk for injury. Especially, in terms of the physical function, abdominal muscles’ strength has a positive impact on stabilization of lumbar vertebra2). Also, abdominal muscles, such as rectus abdominis, transverses abdominal, provide stability to each segment when performing a functional motion and supporting the body weight. According to theses effects, this exercise helps people develop flexibility, stability, and motor control. Because of its benefits and impact, it may be appropriate program for people with intellectual disabilities to participate in their residing environment3). In addition, it would allow them to achieve their rehabilitation targets, including physical, mental, and social development. Thus, they are highly effective, becoming increasingly useful, and can be imple-
mented in people with intellectual disabilities residing in residential care facilities.

Overall, 80,846 people live in a total of 1,457 disability residential care facilities across the country\(^5\). Too often however, people with intellectual disabilities residing in these facilities spend their pastime being inactive, with little movement such as watching TV\(^6\). Therefore, implementing abdominal muscle exercises is needed to make up for the lack of physical activity and manage their health more actively. There have been various studies evaluating the management of physical fitness and health for people with intellectual disabilities. In most cases, however, the studies included students, exercise programs with tools such as elastic band exercises in children\(^6\), circuit exercises in students\(^7\), and slings exercises in children\(^8\). To our knowledge, there are only a few studies evaluating the implementation of abdominal muscle exercises in people with intellectual disabilities residing in residential care facilities.

Implementing an abdominal muscle exercise program for people with intellectual disabilities residing in residential care facilities and evaluating its impact on weight and basic physical strength is needed. Thus, the purpose of this study was to serve as basic information of reference and guidelines for the implementation of muscle exercise programs for people with intellectual disabilities residing in residential care facilities.

**SUBJECTS AND METHODS**

The study included 10 people with intellectual disabilities residing in a residential care facility in Yongin City, Gyeonggi Province in Korea. They were not administered psychotropic drugs, had no visual or auditory problems, and no neurological or orthopedic problems interfering with walking. Based on the Declaration of Helsinki, the study’s purpose and method were fully explained to the potential subjects. And then, through this procedure, study subjects only were recruited to consent to participate in it. Also, because of the limitation on communication and social interaction skills of intellectual disabilities, participation of this exercise program was restricted to receive consent from their care givers\(^9\). The study lasted 12 weeks from July 1, 2015, to September 30, 2015, and an experienced occupational therapist measured weight and basic physical fitness (muscle strength and flexibility).

To strengthen abdominal muscles, an abdominal muscle exercise program was applied to participants in this study. Dynamic stretching exercises were performed during warm-up and cool-down for approximately 10 minutes. This program was done on a regular basis twice a week in accordance with the World Health Organization Global Recommendations on Physical Activity for Health for adults between 18 and 64 years\(^10\). To add more health benefits, we made sure that the program lasted more than 10 minutes and were performed for a total of more than 150 minutes a week with the help of one daily-life rehabilitation trainer. Abdominal muscle exercises consisted of 3 types of exercise methods such as Crunch, Sit-up and Leg raise including 3 sets of 12 repetitions (Table 1).

To measure the weight changes according to the exercise program application, a body composition analyzer, Inbody 230 (Biospace, Seoul, Korea), was used to measure subjects’ weight before the beginning of the exercise program on the basis of the weighing guidelines of Son SM, Jeon BJ, and Kim HJ\(^11\). To minimize measurement errors and accurately measure their weight, the subjects’ weight was measured once a month on the same day of the week at the same time in the morning. Also, to reduce the effects of the food intake, the subjects measured their weight on an empty stomach.

To measure the basic physical fitness changes according to the exercise program application, muscular strength and flexibility were measured before the beginning of the exercise on the basis of the basic physical fitness measurement and evaluation guidelines from the 2014 Guideline of the Ministry of Health and Welfare in Korea\(^12\). To observe changes according to the exercise program application, the subjects’ changes of the weight and the basic physical fitness were measured once every 4 weeks during the 12 weeks study period. Sit-up and sit-and-reach were used to improve muscular strength and flexibility, and performed after the exercises were fully explained to the subjects with visual cues\(^13\).

For sit-up, the subjects were instructed to lie on the mat in an occupational therapy room, bend their knees, raise their torso until their elbows touched their knees, and return to a lying position. The number of sit-ups was recorded once for a minute. And, for sit-and-reach, the subjects took their shoes off and stretched both of their feet against a test box. We gently pressed down their knees and bent their torsos forward. After keeping this posture for more than 2 seconds, we recorded the mark where the tip of their fingers reached; we used the best distance reached out of two repetitions.

The collected data were encoded by items and analyzed with SPSS ver.18.0. Descriptive statistics were used for the general characteristics of the subjects. The non-parametric test (the Friedman test) was used to compare changes in weight and basic physical fitness (muscular strength and flexibility). Statistical significance was accepted outside the 95% confidence interval.

**RESULTS**

A descriptive statistical analysis was conducted to analyze the general characteristics of the 10 study participants who were residing in a residential care facility. Their average age was 22.9 years and average height 160.7 cm. Concerning disability ratings, 3 subjects had a level 1 disability, 6 subjects had a level 2 disability and 1 subject had a level 3 disability (Table 2).

The results of the analysis indicate that the subjects’ average weight steadily decreased over period, from 60.8 kg to 59.0 kg. Statistical verification yielded χ\(^2\), 30.000 and a 99.9% confidence level, indicating that the decrease was statistically significant (Table 3). Therefore, application of the program had a positive effect on the subjects’ weight decrease.
The results of the basic fitness indicate that the subjects’ average muscles strength steadily increased over period, from 29.6 times to 34.8 times. Statistical verification yielded $\chi^2 = 28.958$ and a 99.9% confidence level, indicating that the increase was statistically significant (Table 3). The results of the analysis indicate that the subjects’ average flexibility steadily increased over period, from 4.3 cm to 5.6 cm. Statistical verification yielded $\chi^2 = 29.250$ and a 99.9% confidence level, indicating that the increase was statistically significant (Table 3). Therefore, application of the program had a positive effect on the subjects’ basic fitness increase.

**DISCUSSION**

Abdominal muscles comprise muscles in the antero-lateral and posterior abdominal wall. The antero-lateral abdominal wall consists of the external and internal oblique abdominal muscles, and the transversus and rectus abdominis muscles. The posterior abdominal wall consists of the quadratus lumborum muscle. This structure provides stability to the trunk during physical movements, controls movements, supports the spine, and plays an important role in breathing. Kinematically the posterior abdominal wall adjusts during bending and turning of the torso, and supports the pelvic bone and the sacroiliac joint against excessive load. In addition, abdominal muscle size and strength have an influence on perform the physical tasks of daily living such as dressing and the ability to performance and the difficulty of performing daily tasks.

Thus, abdominal muscles perform an important role in physical function and movement.

In general, as individuals get older, weakening in torso muscles is more pronounced than in other segmental muscles, and muscle volume significantly decreases. Compared with people without disabilities, people with intellectual disabilities show more muscle weakening and decreasing muscle volume. This decrease in muscle and basic physical strength raises their risk for back pain and structural spinal deformities.

To address these concerns, it has become increasingly important to implement interventions, such as motor control training programs, to restore the ability of people’s abdominal muscles to control motion. Muscle strengthening exercise programs, including physical rehabilitation, have been recommended for people with intellectual disabilities to increase muscular strength and maintain the neutral positions for maintenance of the spine during external loading. In that context, our study evaluated the impact of the abdominal muscle exercise program on the change of weight and basic physical fitness (muscle strength and flexibility) for people with intellectual disabilities residing in a residential care facility.

A variety of studies has reported that muscle exercise is effective in controlling weight. It has also been reported to have an impact on maintaining muscle strength and decreasing body fat. Abdominal muscle exercises have a positive effect on increase abdominal muscle fibers and protein metabolism and decrease blood lipids. As a result, these effects to reduce abdominal fat. This study was evaluated to the subjects’ physical changes and purposed to see the effects of the exercise program application. Specifically the average weight decreased by an average of 1.8 kg from 60.8 kg to 59.0 kg. Increase the physical movement through abdominal muscle exercise has an influence to raise energy consumption and burn the body fat cells. As a result, the weight showed the decrease as much as consumed body fat cells.

Our results are supported by studies from Lee BJ, Lim KI, Lee WH and Nam HC; and Park et al. We found that...
there was a statistically significant decrease in the weight of our subjects after the implementation of the muscle exercises, demonstrating the impact of the exercise. Therefore, we believe that abdominal muscle exercises could be consistently implemented in people with intellectual disabilities, as one of the safest and most effective weight-loss programs\(^\text{15}\). In addition, we believe it should be actively recommended in people with intellectual disabilities residing in residential care facilities.

Muscle exercises have a wide range of benefits including improving muscular strength, widening cross-sectional muscle area, increasing basal metabolic rate, enhancing bone mineral density, and preventing bone mineral density loss. It also plays an important role in preventing the loss of muscle volume and strength associated with aging. Furthermore, it has gained support as an appropriate exercise method to promote muscle strength in men and women of all ages, including children\(^\text{15}\). The average muscle strength of the subjects in our study rose by 5.2 times, from 29.6 times to 34.8 times. In a previous study, researchers suggested that continuous abdominal muscle exercises led to better isometric muscle contractions of the abdominal muscles, stronger upper body stability, and greater muscle strength\(^\text{15}\). In our study, we also observed a positive effect on average flexibility, which continued to increase by 1.3 cm, from 4.3 cm. to 5.6 cm. It has been shown that contraction and relaxation from abdominal muscle exercises improve flexibility\(^\text{11}\).

If they do not engage in physical activities for a long period time, people with intellectual disabilities experience a more rapid decrease in muscle volume and strength, than those without such disabilities. In addition, people with intellectual disabilities residing in residential care facilities have fewer activities and lead a daily routine in a limited space, and are at risk for obesity. It is often becoming the case that these health problems develop into secondary diseases.

Various studies are under way to resolve these concerns and help manage the health of people with intellectual disabilities. In 2014, Beak SH\(^\text{19}\) evaluated physical activities in 40 people with intellectual disabilities, and found that the lack of physical movements in this population could be offset by engaging in physical activities and improving their basic physical strength, including muscle strength, endurance, agility, and flexibility. In 2006, Lee HY\(^\text{20}\) also evaluated rehabilitation in a nursing program study where elastic band exercises were implemented in 22 people with intellectual disabilities and reported a statistically significant increase in muscle strength and flexibility. Implementing these types of physical activities would allow people with intellectual disabilities to lead a healthier lifestyle by improving physical and psychological function. It would also facilitate social participation through their involvement in group-based activities. Furthermore, achieving targets for rehabilitation physical activities may reduce healthcare costs by preventing and managing disease and injuries associated with disabilities\(^\text{21}\). For these reasons, implementing muscle exercise as a rehabilitation physical activity in people with intellectual disabilities is indispensable. Abdominal muscle exercises should be consistently implemented to prevent obesity and promote health management.

The limitations of this study include that we did not control meals and snacks the subjects ate at the residential care facility before and after the exercise program, they were permitted their usual food intake. We believe that along with muscle exercise, a diet with an appropriately high level of protein and nutrients for stronger muscle strength and improved basic physical strength would help increase the effect of muscle exercise.

In conclusion, we sought to evaluate the impact of a 12-week abdominal muscle exercise program on weight and basic physical strength in people with intellectual disabilities residing in a disability residential care facility. We found a statistically significant decrease in subjects’ weight and concurrent statistically significant increase in basic physical strength (muscle strength and flexibility). To actively improve abdominal muscle strength and health management in people with intellectual disabilities residing in residential care facilities, it is indispensable to consistently implement abdominal muscle exercise programs and achieve improvements that could lead to the development of systematic programs for rehabilitation physical activities.

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