



Original Article

Effects of a walking exercise program for obese individuals with intellectual disability staying in a residential care facility

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Abstract. [Purpose] The purpose of this study was to confirm the critical importance of active obesity management through a fitness program, and to provide foundational data required for effective obesity management of disabled persons residing in residential care facilities. [Subjects and Methods] The study period lasted 16 weeks, from August 1 to November 30, 2014. The study participants comprised 9 individuals and they participated in a walking exercise program. An occupational therapist assessed each participant's body weight, body composition (body mass index [BMI], body fat, and abdominal fat), basic fitness (muscle strength and flexibility), and waist circumference. Collected data were encoded by items and analyzed with SPSS ver.18.0. [Results] It was found that the body weight, body composition (BMI, body fat, and abdominal fat), and waist circumference decreased significantly, while baseline fitness (muscle strength and flexibility) improved significantly. [Conclusion] Obesity management is critically important for intellectually disabled persons residing in residential care facilities. Active care through continuous program implementation is needed. Accordingly, walking exercise programs should be offered to obese intellectually disabled persons residing in residential care facilities.

Key words: Residential care facility, Obesity, Intellectual disability

(This article was submitted Oct. 16, 2015, and was accepted Nov. 25, 2015)

INTRODUCTION

Currently, 1,457 residential care facilities across South Korea provide rehabilitation counseling, treatment, and training to disabled individuals as they prepare to reenter society (Disability Act, Section 48). The number of individuals enrolled in these long-term care facilities is estimated to be 80,846¹⁾. Those with a developmental disability, for whom the impairment is not apparent or is delayed, such as individuals with intellectual disability and autism spectrum disorder (Development Disability Act, Section 2), have steadily increased in number over the years to reach a total of 418,543 in 2014¹⁾. Many developmentally disabled individuals reside in long-term care facilities to achieve independence through treatment and rehabilitation.

In addressing these figures, the Ministry of Health and Welfare²⁾ has made a tremendous effort to provide quality services under the stated vision of “from destination to the residence of choice”. Its major policy goals include a shift to small-scale care facilities, establishment of quality standards, and promotion of both suppliers' and users' right to choose. Reflecting these changes, many care facilities are developing and implementing various programs designed to incorporate individual resident needs and desires with the aim of improving their quality of life. These programs and services are offered through local communities and facilities in various formats³⁾.

Unfortunately, services related to residents' recreational activities are scarce, and due to an insufficient supply of profes-

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sional staff and funding, as well as information on disabled individuals as it pertains to these programs, advancing these programs in a systematic manner has been challenging. More specifically, it is difficult for disabled individuals to participate in everyday sports and fitness activities, because of the insufficient number of fitness facilities available to them, and the limited options in terms of the type of fitness activities they can engage in. Consequently, without someone's active encouragement and support, a mere attempt at participation can be challenging for intellectually disabled individuals. Due to these issues, many individuals with an intellectual disability residing in long-term care facilities tend to spend countless hours without being able to engage in physical activity, despite the relative abundance of time at their disposal^{4, 5}). This results in an increased risk of obesity as well as other health problems among these individuals. Compromised health status can lead to a secondary dysfunction. Obesity, in particular, can lead to other highly prevalent chronic conditions such as diabetes and hypertension, which have become a serious threat to those residing in long-term care facilities⁶).

Previously conducted Korean studies on obesity and individuals with intellectual disability analysed individuals residing in occupational rehabilitation facilities, a long-term care facility, and welfare facilities and employed in an occupational rehabilitation facility. However, research on the health of intellectually disabled individuals residing in care facilities is lacking⁷).

This study investigated the effects of a walking exercise program on the obesity rate among intellectually disabled individuals residing in a residential care facility. The ultimate aim of this study was to confirm the critical importance of active obesity management through a fitness program that promotes regular physical activity and to provide the basic data required for effective obesity management of the disabled residing in residential care facilities.

SUBJECTS AND METHODS

The study subjects were 9 individuals with intellectual disability residing in a residential care facility located in Chungju city, Chungcheongbukdo Province. The participants were deemed overweight or obese based on an Inbody assessment conducted prior to the intervention. None of the participants was receiving antipsychotics, and none had visual, auditory, neurological or orthopedic impairments that impeded normal walking. A thorough explanation of the study purpose was provided, after which consent was obtained from each participating individual. This study was approved after a stringent review by the KNU IRB.

The study period lasted 16 weeks, from August 1 to November 30, 2014. An occupational therapist assessed each participant's body weight, body composition (body mass index [BMI], body fat, and abdominal fat), basic fitness (muscle strength and flexibility), and waist circumference.

The walking exercise used in this study is one of the most widely known cardiovascular exercises. Walking is the most fundamental physical activity of humans. It is the easiest and the most familiar form of exercise, both physically and mentally. Most people enjoy walking as a type of exercise regardless of age, fitness level, or technique, and it is associated with very little risk of injury. It is therefore well-suited for individuals with intellectual disability⁸).

For these reasons, a walking exercise program was chosen for this study. Each session included approximately 10 minutes of warm-up and cool-down, during which participants focused on range of motion and active stretching. The main portion of the walking exercise program, which consisted of 3 walking sessions per week, was designed following the World Health Organization (WHO) physical activity guidelines for adults between the ages of 18–64 years⁹). In order to reap greater health benefits from the exercise program, a minimum of 300 minutes per week/ 100 minutes per session was ensured with the help of 2 rehabilitation specialists.

Individuals with intellectual disability tend to have difficulty with feeding. Additionally, they are at an increased risk of malnutrition due to food-drug interaction, metabolic dysfunction, and other developmental dysfunctions. These individuals also tend to exhibit unhealthy eating habits such as fussy eating, preference for high-calorie food, binge eating, and obsessing over food, all of which predispose them to increased body weight due to excess fat accumulation.

This study used an Inbody 230 (Biospace, Korea), a body composition measurement device, to assess the changes in the participants' body weights according to the dietary intake during participation in social rehabilitation programs, dining-out, outdoor activities, and camps, as well as to track the effects of the walking exercise program. Measurements were taken in the morning and post-exercise, on the same day of each month. Because body weight measurement can vary significantly depending on the time of day and the amount of food intake, the participants' body weight were measured on an empty stomach to ensure accuracy and minimize deviation.

Inbody 230 (Biospace, Korea) was used to track the changes in participants' body compositions during participation in the walking exercise program. BMI, body fat, and abdominal fat, which are used to assess obesity, were measured and recorded.

Participants were instructed to remove any personal adornments such as wristwatches and similar items. Sufficient information on the measurement method and correct body posture required for accurate measurement as well as visual cues were provided. Age, gender, and height were entered into the measurement device. Participants were instructed to take off their socks followed by cleansing of the palms and soles with wet wipes, after which they were assisted in standing correctly on the spot marked on the device for accurate measurement.

Participants were instructed to hold the device handles with both hands, with their arms slightly parted for measurement of body weight, which was followed by impedance analysis of each body segment. A total of 10 measurements were taken for the impedance analysis, which consisted of measurements at 2 different frequencies (20 kHz and 100 kHz) of 5 different body

segments (right arm, left arm, torso, right leg, left leg). The 4-electrode 8-point impedance method and a direct segmental multi-frequency bioimpedance method (DSM-BIA) were used.

Baseline fitness refers to the physical ability required by an individual for a normal daily life. It can be distinguished into health fitness and sports fitness. In consideration of the 2014 fitness assessment and evaluation guidelines issued by the Ministry of Health and Welfare's community integration health promotion project, this study measured participants' muscle strength and flexibility (components of health fitness) prior to starting the exercise program. In order to examine the changes, these measurements were performed once a month. Sit-up counts and trunk flexibility were measured after providing a thorough explanation and visual cues to the participants.

Sit-ups, used traditionally as a method for measuring strength, are easily administered, as they require only a mat and a timer¹⁰. In this study, participants were instructed to lie supine on the mat with knees bent and fingertips behind their ears; they were asked to raise the upper body until their elbows touched the knees and then roll back down to the starting position. The number of sit-ups performed in a single minute was recorded.

The flexibility test used in this study, which required the participants to bend their torso at the hips, is a widely known and standardized test. Participants were instructed to remove their shoes and stand on the device with the backs of both heels touching the stand. They were instructed to gently press the knees and bend the torso. At the point where participants could hold the position for at least 2 seconds, measurement was taken where their fingertips reached. The test was performed twice for each participant, and the better result of the two was accepted.

Waist circumference is closely associated with diabetes, cardiovascular diseases, and risk of hypertension. It is thought to be a predictor of abdominal fat and insulin resistance¹¹.

This study followed the body weight management guidelines recommended by the type 2 diabetes clinical research center designated by the Ministry of Health and Welfare. Additionally, to track the changes before and after the exercise program, measurements were taken once a month. Measurements were taken after providing a thorough explanation of the procedure as well as visual cues to the participants. Participants were instructed to stand with their feet approximately 25–30 cm apart, and measurements were taken with a tape measure between the lowest ribs and hip bone ridge.

Collected data were encoded by item and analyzed with SPSS ver.18.0. Descriptive statistics were used for the participants' general characteristics. To compare changes in body weight, baseline fitness (strength and flexibility), the waist circumference, a non-parametric test (the Friedman test) was used. For the analysis of the changes in BMI, body fat, and abdominal fat, a non-parametric test (the Wilcoxon signed rank test) was performed. Statistical significance was accepted outside the 95% confidence interval.

RESULTS

A descriptive statistical analysis was conducted to analyze the general characteristics of the 9 study participants who were residing in a residential care facility. Their average age was 42.33 years and their average height was 160.69 cm. Concerning disability ratings, 6 participants had a level 1 disability, 1 participant had a level 2 disability, and 2 participants had a level 3 disability (Table 1).

Wilcoxon's signed-rank test, a non-parametric testing method, was used to compare changes in the participants' body composition before and after the exercise program. The results of the analysis show that average BMI decreased from 26.8 pre-exercise to 25.9 post-exercise; average body fat decreased from 35.4% pre-exercise to 31.0% post-exercise; and average abdominal fat decreased from 1.0% pre-exercise to 0.9% post-exercise. The analysis results for all 3 indexes indicate that the changes were statistically significant, suggesting that the walking exercise program had a positive effect on the participants' body composition (Table 2).

The Friedman test, a non-parametric test, was used to analyze the monthly changes in participants as they participated in the walking exercise program. The results of the analysis indicate that the participants' average body weight steadily decreased over 4 months, from 69.6 kg to 67.3 kg. Statistical verification yielded $\chi^2=35.289$ and a 99.9% confidence level, indicating that the decrease was statistically significant (Table 3). Therefore, participants' average body weight steadily decreased over the course of the exercise program.

The Friedman test was also used to examine the changes in the monthly baseline fitness levels (strength and flexibility) during participation in the walking exercise program. The results of the analysis show that the average strength steadily increased from 16.3 to 24.8 over 4 months. Statistical verification yielded $\chi^2=30.341$ and a 99.9% confidence level, indicating that the increase in strength was statistically significant (Table 3).

The average flexibility, which was -3.3 cm pre-exercise, also steadily increased over the 4 months to 1.2 cm. Statistical verification yielded $\chi^2=29.3972$ and a 99.9% confidence level, indicating that the increase was statistically significant (Table 3). Therefore, the exercise regimen had a positive effect on the participants' average strength and flexibility.

The Friedman test was also used to analyze the monthly changes in the average waist circumferences of the participants during participation in the walking exercise program. The results of the analysis show that the participants' average waist circumference steadily decreased over 4 months, from 37.3 cm pre-exercise to 35.1 cm post-exercise. Statistical verification yielded $\chi^2=34.583$ and a 99.9% confidence level, indicating that the decrease was statistically significant (Table 3). Therefore, the exercise program had a positive effect on the participants' waist circumference.

Table 1. General characteristics

Number (n)	Age (yrs)	Length (cm)	Disability rating		
			1st grade (n)	2nd grade (n)	3rd grade (n)
9	42.3±10.5	160.7±9.8	6	1	2

Table 2. Body composition analysis (N=9)

Item	Pre-treat		Post-treat	
	Mean	SD	Mean	SD
BMI **	26.8	3.6	25.9	3.4
Body fat (%) **	35.4	7.8	31.0	8.7
Abdominal obesity (%) **	0.98	0.05	0.93	0.05

** p< 0.01

Table 3. Comparison of participants' physical characteristics before and after the exercise regimen (N=9)

	Base		1 month		2 months		3 months		4 months	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Weight (kg) ***	69.6	11.0	69.3	11.0	68.5	10.9	67.9	10.7	67.3	10.6
Strength (kg) ***	16.3	4.9	19.7	6.0	21.3	5.6	22.6	6.0	24.8	7.5
Flexibility (cm) ***	-3.33	9.63	-3.22	9.76	-2.11	8.92	-0.94	8.84	1.17	8.11
Waist size (cm) ***	37.3	4.5	36.6	4.5	36.2	4.6	35.8	4.6	35.1	4.2

*** p< 0.001

DISCUSSION

Obesity is a serious health problem that reduces life expectancy and threatens the quality of life of individuals with disability¹², and threatens their health, as it is often a precursor to highly prevalent chronic conditions such as diabetes and hypertension. Although the cause of obesity among disabled individuals is unclear, changes in body composition due to inactivity and muscle atrophy as well as physiological changes are implicated¹³. The most relevant studies have reported higher obesity prevalence among individuals with disability than among healthy individuals, and an even higher prevalence rate of morbid obesity¹⁴⁻¹⁶. For individuals residing in a long-term care facility, in particular, a low level of physical activity and limited living sphere can easily lead to obesity.

Increased abdominal fat, among the various criteria used to evaluate obesity, is known to result in decreased balance as it negatively affects flexibility while shifting the musculoskeletal structure¹⁷. Obesity tends to cause arching of the affected individual's back, and increased stress on the muscles surrounding the spine can result in back pain¹⁸. Subsequent postural instability can also lead to low back pain and diminished flexibility, and the resulting limited range of motion can lead to secondary inactivity and obesity¹⁹. The main goal of obesity management is to decrease the size of the fat tissues while minimizing the effects on Fat Free Mass (FFM). Cardiovascular exercise is known to be the very effective at decreasing the amount of accumulated fat by utilizing fat as fuel to produce energy. Walking exercise, like many other cardio exercises, improves cardio-respiratory endurance and increases secretion of growth hormones (epinephrine and nor-epinephrine), which are known to promote loss of accumulated fat. Furthermore, increased hormone secretion promotes protein synthesis, which has a positive effect on muscle growth and increased FFM. Walking exercise is actively promoted for fat loss, as it is a very effective low-impact exercise that carries a low risk of injury. Therefore, this study implemented a walking exercise program for overweight individuals with intellectual disability residing in a residential care facility. The program followed the WHO physical activity guidelines for adults⁹ and was designed to incorporate 3 exercise sessions per week for 16 weeks, during which the participants' body weight, body composition (body fat and abdominal fat), baseline fitness level (strength and flexibility), and waist circumference were continually monitored.

The most important component of obesity management is continuous weight management, which requires a great deal of effort. Overweight individuals with disability residing in residential care facilities must make it a daily habit to exercise for weight management using life redesigning programs. In this study, the participants' body weight steadily dropped over the 16 weeks of the obesity management program from an average of 69.6 kg to 67.3 kg, a 2.3 kg decrease. Previous studies have reported that increased physical activity leads to increased calorie burn and activation of enzymes that extract energy from fat

cells, which results in an active supply of energy, fat loss, and decreased body weight. Additionally, the participants' average BMI decreased by 0.9, from 26.8 to 25.9; average body fat decreased by 4.4%, from 35.4 to 31.0; and the average abdominal fat decreased by 0.1%, from 1.0 to 0.9. The average waist circumference decreased from 37.3 cm to 35.1 cm, a 2.2 cm decrease. These results are attributable to energy expenditure during walking and consequent decrease in body weight and fat.

According to a study²⁰, walking utilizes 90% of all muscles (including lower and upper extremity muscles), strengthens the muscles and increases the stability of the upper segment of the spine. The results of this study support these findings as well, as evidenced by the fact that the participants' average muscle strength increased by 8.5 more sit-ups, from 16.3 to 24.8. Average flexibility also increased from -3.3 to 1.2, which is a 4.5 cm increase.

Walking exercise appears to be an effective exercise, and an active walking program had positive effect on the level of obesity, and significantly reduced body weight, body fat and waist circumference²¹. Also, walking exercise contributed to reductions in body weight and body fat by increasing muscle tissue, maintaining muscular strength and increasing flexibility²². These reports support our present findings, which suggest that walking serves as an effective exercise for overweight and obese individuals with intellectual disability. Therefore, continuous and systematic implementation of such an exercise program is needed.

The limitations of the present study are as follows. As this study involved only 9 obese individuals with intellectual disability residing in a single residential care facility, the findings cannot be generalized. Additionally, the participants' dietary intake including meals and snacks served at the facility, as well as other dietary intake occurring while participating in various activities, was not controlled. For these reasons, verifying the pure effects of the exercise program was difficult. It would be beneficial for future studies to address controlling of the various factors that may influence the study results.

This study investigated the effects of a 16-week walking exercise program in overweight and obese individuals with intellectual disability residing in a residential care facility. It was found that the participants' body weight, body composition (BMI, body fat, and abdominal fat), and waist circumference decreased significantly, while baseline fitness (muscle strength and flexibility) improved significantly. Obesity management is critically important for individuals with intellectual disability residing in residential care facilities. Active care through continuous program implementation is therefore needed. Accordingly, walking exercise programs should be offered to obese individuals with intellectual disability residing in residential care facilities.

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