



Research Paper

Effects of repetitive sit-to-stand exercise for participants with severe intellectual disabilities

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ABSTRACTS

The effect of physical function of sit-to-stand exercises for participants with severe intellectual disability is not clear. In this study, we examined whether the exercise for a limited time in workplace affects physical function and physical activity levels of participants at workplace. All 28 participants diagnosed with intellectual disability were divided into two groups (that is, study group and control group). The subjects' intervention period was 13 weeks and 3 days (91 days). The study group performed sit-to-stand exercises 100 times per day as a target value. The control group performed sit-to-stand exercises 20 times per day as an upper limit. Evaluation items were activity of daily living, body composition, physical activity levels, and adverse events. Although the lower limb skeletal muscle mass of the study group showed no significant changes, a significant decrease was observed following the intervention for the control group. As for physical activity level, there was a significant improvement for the study group. The present study indicated that repetitive sit-to-stand exercises may prevent muscle loss in participants with intellectual disabilities when this exercise is performed as a target of 100 times per day and with the aim of improving physical function.

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INTRODUCTION

Physical inactivity is already the fourth leading risk factor for global mortality (Kohl et al., 2012). But, in many countries, the levels of physical inactivity continue to rise. This is predicted to have major effects on the prevalence of noncommunicable diseases and the general health of the population worldwide (World Health Organization, 2010).

Intellectual disability (ID) involves problems with general mental abilities that affect both intellectual functioning (such as learning and reasoning) and adaptive functioning (activities of daily living (ADL) such as communication and independent living). According to the American Association on Intellectual and Developmental Disabilities, ID is characterized by significant limitations in intellectual functioning (reasoning, learning, problem solving) and adaptive behavior (conceptual, social, and practical skills) that originates before the age of 18 years (Vasudevan and

Suri, 2017; American Association on Intellectual and Developmental Disabilities, 2017).

Most adults with ID do not participate in sufficient amounts of physical activity (PA) (Brooker et al., 2015). It is concerning that adults with ID (active or non-active) are spending more time in sedentary time (ST) and less time in light physical activity (PA) than adults without ID (Oviedo et al, 2019). However, the sit-to-stand exercise is a safe, simple, and effective exercise for after stroke rehabilitation and is reported to strengthen the trunk, lower extremities and improve standing balance and walking ability (Rimmer and Wang, 2005; Temple et al., 2006; Draheim et al., 2002).

We reported previously that the sit-to-stand exercise was a safe, practicable exercise for participants with severe ID (Matsuda et al., 2019). However, the effect of physical function of sit-to-stand exercises for people with severe ID

was not clear.

In this study, we examined whether exercise for a limited time in the workplace affected physical function and physical activity levels in participants at their workplace.

PARTICIPANTS AND METHODS

Participants

Among 57 people who worked at the DAINI SATSUKI Workshop For Disabilities, 28 people who could walk independently were elected as participants for this study. The mean age \pm standard deviation (SD) at the time of study was 40.0 (\pm 8.95) years. There were 24 male and 4 female participants. DAINI SATSUKI Workshop For Disabilities is run by the Satsuki Welfare Association.

The exclusion criteria were measurement difficulties due to hyperactivity and absence from the workplace on the measuring day. All participants had been diagnosed with ID. The severity of the ID of the participants was quantified using the method prescribed by the Ministry of Health, Labor, and Welfare of Japan. For reasons such as an Intelligence Quotient (Wechsler, 1967) of 35 or less, 25 people were identified at the severe level, and 3 were "other."

This study was approved by the Research Ethics Review Committee of Kansai University of Welfare Science (No. 18-52).

Procedure

The participants of this study conducted exercise programs at the workshop. All 28 participants were divided into two groups (that is, study group and control group). The basic characteristics of both groups are shown in Table 1.

The subjects' intervention period was 13 weeks and 3 days (91 days). The exercise programs involved repetitive sit-to-stand exercises for 5 days per week as a target value. The study group performed sit-to-stand exercises 100 times per day as a target value. The control group performed sit-to-stand exercises 20 times per day as an upper limit. A chair with backrest and front sitting height of 41 cm was used. Although participants performed the sit-to-stand exercise unassisted, they were monitored closely by care workers in case of emergency.

The evaluation items were ADL, body composition, physical activity levels, and adverse events.

Outcome measures

ADL

The Functional Independence Measure (FIM) (Date

management service of the uniform date system for medical rehabilitation and the center for functional assessment research, 1990) was used to evaluate ADL.

Body composition

Body composition was measured as skeletal muscle mass index (SMI), body fat mass, body fat percentage, and total body water (ECW/TBW) using a body composition analyzer, InBody S10 (InBody Co., Ltd.), immediately before and after the intervention.

Baumgartner reported SMI as a parameter of muscle mass. SMI was calculated by dividing the muscle mass of limbs by the square of height (Baumgartner, 1998). In this study, limb SMI, upper limb SMI, and lower limb SMI were used. Upper limb SMI was calculated by dividing the muscle mass of left and right upper limbs by the square of height. Lower limb SMI was calculated by dividing the muscle mass of left and right lower limbs by the square of height.

Physical activity level

Physical activity level was determined using the short Japanese version of the International Physical Activity Questionnaire Short Form (IPAQ-SF) (Baumgartner, 1998; Lee, 2011).

IPAQ-SF was used to assess the habitual physical activity of the participants for 7 days before the intervention. The IPAQ-SF is a reliable and valid instrument for measuring physical activity in older adults (Baumgartner, 1998; Craig, 2003).

Before and after the intervention, measurements were taken by care workers of the workshop who were well known by the participants. Limb SMI mass and physical activity levels were evaluated before and after the intervention.

Adverse events

Adverse events were the occurrence of joint pain or a fall during the intervention.

Statistical analysis

Statistical analysis of changes in the control group and study group in limb SMI, upper limb SMI, lower limb SMI, and physical activity level were performed using paired t-tests and Wilcoxon signed-rank tests. Comparisons of exercise program implementation rates between the control group and study group were done using the Mann-Whitney U test. SPSS software version 22.0 (IBM, Tokyo, Japan) was used to analyze the collected data, and

Table 1: Basic information for the study group and control group.

	Study group (n = 14)	Control group (n = 14)
Sex (male/female)	11/3	13/1
Age (years) *	39.0	42.2
Height (cm) *	164.5	165.5
Weight (kg) *	65.0	70.9
Body mass index (kg/m ²)*	24.0	25.9
FIM (mean \pm SD)	103.2 \pm 4.8	101.6 \pm 11.6

*.Mean value for each group.
SD, standard deviation.

differences were considered significant at p-value < 0.05.

RESULTS

The average duration of exercise program implementation was 40.6 (13–48) days. The score of FIM showed no change before and after the intervention.

Table 2 shows the results of limb SMI, upper limb SMI, and lower limb SMI, body fat percentage, body fat mass, ECW/TBW, and IPAQ of both groups before and after the intervention. For limb SMI, there was no significant difference for either group. Although the lower limb SMI of the study group showed no significant changes, a significant decrease was observed following the intervention for the control group.

As for physical activity level, there was a significant improvement in IPAQ-SF results for the study group.

DISCUSSION

In this study, we conducted a repetitive sit-to-stand exercise program for participants with severe ID and investigated the effects on physical function and physical activity levels.

Several studies on stroke subjects have shown that 15 min of sit-to-stand exercises five times per week for 6 weeks can improve balance function and strength (Jung, 2017) and 30 min of sit-to-stand exercises five times per week for 4 weeks can improve balance function (Liu et al., 2016).

We have reported previously that following sit-to-stand exercises 20 times per day, 5 days per week for 8.5 weeks (on average), and limb skeletal muscle mass showed no significant improvement for participants. In particular, for the supervision and assist group, a significant decrease was observed following the intervention (Matsuda et al., 2019).

In this study, the control group performed 20 sit-to-stand exercises per day for about 13 weeks and showed significant loss of lower leg muscle mass following the intervention. This may indicate that the exercise load was too low for the subjects with ADL to maintain walking independence. In contrast, the study group showed no

significant decrease in limb skeletal muscle mass or lower limb skeletal muscle mass following the intervention.

The mean BMI of the participants was relatively high. Previous studies have reported that adults with mild and moderate ID were 4 times more likely to be obese than adults without ID (Rimmer and Wang, 2005) and had low physical activity levels (Temple et al., 2006; Draheim et al., 2002). The reason why BMI and body fat percentage did not change following the intervention was thought to be because this exercise was not an aerobic exercise. This exercise intervention was aimed only at physical functions and was considered insufficient to improve BMI and reduce body fat percentage.

For physical activity level, there was no significant change in IPAQ-SF results following the intervention for the control group, but there was a significant improvement for the study group. Oviedo et al. (2019) suggested that the integration of well-designed PA programs into the ID population workday can lead to increased PA levels. The results of the present study may demonstrate that 100 practice-oriented sit-to-stand exercises per day for the study group became a habit, and this exercise was directly reflected in the increase in physical activity level.

To improve the limb skeletal muscle mass, it was considered necessary to secure additional exercise opportunities in leisure time. However, this was difficult in practice. The intervention in this study was exercise on working days, excluding holidays. The hours available for exercise on working days are limited in terms of time and support. In addition, it is necessary to prepare conditions for related factors in the social environment, such as their families, administrative services, and social resources. Therefore, adults with ID have few physical activity environmental resources and opportunities available to them, especially participants living independently or with family rather than in group homes (Howie, 2012). Thus, it is necessary to examine interventions that take into account the actual state of physical activity participation of people with ID.

There were three limitations in this study. First, the number of subjects was too small for a comparative study between the study group and the control group. Second, the upper limb muscle mass improved for the control group

Table 2: Comparison of body composition and physical activity before and after intervention in the study group and control group.

Variable	Study group			Control group		
	Before	After	p-value*	Before	After	p-value**
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Limbs SMI	7.36 (0.70)	7.52 (0.95)	0.346	7.47 (0.85)	7.45 (0.83)	0.669
Upper SMI	1.80 (0.22)	1.94 (0.32)	0.056	1.87 (0.29)	1.94 (0.27)	0.029
Lower SMI	5.56 (0.52)	5.58 (0.68)	0.889	5.59 (0.61)	5.51 (0.61)	0.032
Body fat mass	16.51 (4.75)	17.82 (5.94)	0.242	21.97 (12.3)	21.39 (11.82)	0.330
Body fat percentage	25.27 (5.56)	27.11 (7.34)	0.266	29.39 (9.81)	28.64 (9.07)	0.309
ECW/TBW (Swelling ratio)	0.37 (0.01)	0.37 (0.01)	0.613	0.38 (0.01)	0.38 (0.00)	0.523
Physical activity	114.80(81.28)	342.32(295.65)	0.008	170.39 (191.77)	177.95 (214.13)	0.196

p-value*: Comparison of body composition and physical activity before and after intervention for the study group.

p-value**: Comparison of body composition and physical activity before and after intervention for the control group.

SMI, skeletal muscle mass index.

SD, standard deviation.

following the intervention but could not be clearly examined in this study. Third, physical activity was evaluated using IPAQ-SF based on a questionnaire, but a pedometer may have given more detailed results. Further research is needed in this regard.

Conclusion

The present study indicated that repetitive sit-to-stand exercises may prevent muscle loss in participants with intellectual disabilities when this exercise is performed as a target of 100 times per day and with the aim of improving physical function. Exercise intervention during leisure time as well as time in the workplace is presumed to be important for improving skeletal muscle mass and life expectancy.

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