EFFECT OF REGULAR WALKING EXERCISE ON BALANCE ABILITY AMONG THE ELDERLY

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Summary

The study aimed to clarify the difference of balance ability among different ages of elderly people, who had regular walking habit based on the adapting ecological validity. Meanwhile, this study also evaluated the relationship between different comfortable walking patterns and balance ability. In this study, 61 elderly people who had regularly walking exercise for a long term were recruited as subjects, and categorized into pre-senile and mid-senile groups. The amount of walking exercise of participants was obtained from the questionnaires. The foot pressure plate (50 Hz) was used to collect the center of pressure (COP) for 10 seconds. The results indicate that there were no significant differences between different ages of elderly people for the numbers of exercise, average time and total time per week. However, the sway area of pressure center in pre-senile group was significantly smaller than that of the older aging group under both open eyes and closed eyes conditions. There was no significant relationship between the balance ability and walking amount of exercise. In conclusion, the ability of balance was decreased as the age increased. Due to the low-intensity of comfortable walking speed, the benefit of balance ability was not significant for elderly regardless of the amount of walking exercise. The results of the present study were different from previous findings which were set up by limited speed in laboratory.

Keywords: Different age, ecological validity, amount of exercise, center of pressure, benefits of exercise.

INTRODUCTION

Older adults usually engage in walking exercises at different durations and frequencies, which includes the number of weekly exercises, the duration of each exercise, and the total time of weekly exercise. Walking exercises, performed consistently for a minimum of 30 minutes, at least three times a week for 8 to 12 weeks can improve the balance ability and lower limbs muscle strength (Laroche, Millett, & Kralian, 2011；Parkatti, Perttunen, & Wacker, 2012). In older adults, the aforementioned exercise regimens can improve the step rate, step length, coordination, balance ability, and lower limb muscle strength, in addition to reducing the likelihood of falls and halving the rate of a person's deterioration in basic physical fitness (Ansai, Aurichio, & Rebelatto, 2015). However, it is unclear whether the findings are ecologically valid.

Thus to ensure the ecological validity, this study investigated whether regular walking exercise results in substantial improvements in the balance ability of older adults, segmented by age. This study recruited older adults of different ages, who had a similar walking exercise regimen that included walking at a comfortable pace. Differences in balance ability were investigated first, and then the correlation between balance ability and duration and frequency of walking exercises were tested. Our study aimed to uncover the correlation between exercise efficiency and balance ability in older adults across different ages. Ecological validity was ensured by data on the regular exercise regimen of participants where they walked at their most comfortable pace.

RESEARCH METHODS

Sixty-one older adults aged over 65 years were participated in this study. Participants were randomly recruited from various sources, including stadiums, universities, and college sports fields. Participants were requested to answer a questionnaire on their frequency and duration of walking exercises. A force plate was used to measure the participants' standing position on both feet, once with their eyes open and another time with their eyes closed. The

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participants were first categorized into pre-senile and mid-senile groups, and further separated into sub-groups based on their number of weekly exercises, the duration of each exercise, and the total time of weekly exercise. We calculated and plotted the sway trajectory of the pressure center, which served as the reference for assessing the balance ability of a participants. To determine whether the exercise amount and balance ability differed between the age groups, an independent sample t-test was conducted. Subsequently, the Pearson correlation coefficient was used to calculate the correlation between sway area and amount of exercise for the two groups. Crucially, the correlation between exercise efficiency and balance ability was tested under the condition of a regular walking exercise regimen, thus ensuring the ecological validity (Venue layout, figure 1).
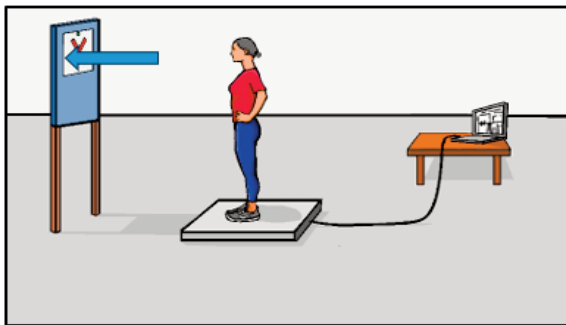

Figure 1. Venue layout

RESULTS AND DISCUSSION

The pre-senile and mid-senile groups displayed no significant difference in terms of the number of weekly exercises, duration of each exercise, and total time of weekly exercise ($p > .05$) (Table 1). While standing with their eyes opened, the sway area of the pressure center of the pre-senile group was significantly lower than that of the mid-senile group ($p < .05$). Similar results were found when the participants stood with their eyes closed ($p < .05$) (Table 2).

No significant difference was observed in the correlation of the sway area of the two groups while standing (eyes opened and eyes closed) with the number of weekly exercise sessions, the duration of each session, and the total time of weekly exercise ($p > .05$) (Table 3).

CONCLUSION

Previous studies that have examined the relationship between balance ability and exercise frequency and duration were lack of ecological validity. Our findings indicate that although motivation-with respect to regular exercise habits does not decrease with age in older adults, balance ability does. Moreover, the balance ability of pre-senile older adults was superior to that of their older counterparts, regardless of whether intervention training was conducted. In addition, older adults who exercised regularly had significantly greater lower limb muscle strength compared with older adults who did not exercise regularly. For older adults walking at their most comfortable speed, the correlation between exercise efficiency and balance ability was relatively slight, even if the frequency and duration of exercise were long. This is likely due to the low exercise intensity from the slow walking speed. Therefore, walking speed is the most crucial factor to improve the balance ability in older adults, in addition to exercising to a certain amount.

Table 1. Comparison of differences in exercise frequency and duration between different age groups (n=61)

	Pre-senile group (n=32)	Mid-senile group (n =29)	t value	p value
Number of weekly exercise sessions (times)	5.97 ± 1.84	5.79 ± 1.55	0.323	0.748
Duration of each exercise session (min)	71.88 ± 23.75	64.64 ± 21.34	1.283	0.205
Total time of weekly exercise (min)	443.75 ± 222.71	373.57 ± 156.93	1.384	0.172

Note: *p < 0.05.

Table 2. Comparison of differences in balance ability between different age groups (n=61)

	Groups	Sway area	t value	p value
Standing with eyes opened	Pre-senile (n =32)	105.21 ± 63.43	2.17	.03*
	Mid-senile (n =29)	184.42 ± 104.04		
Standing with eyes closed	Pre-senile (n =32)	213.62 ± 141.71	2.27	.03*
	Mid-senile (n =29)	334.83 ± 263.46		

*$p < .05$, unit: cm2. Presenile group comprised participants aged 65–74; mid-senile group comprised participants aged 75–84.

Table 3. Correlation between balance ability and exercise frequency and duration (n=61)

		Pearson correlation	Number of weekly exercise sessions	Duration of each exercise session	Total time of weekly exercise
Pre-senile group (n =32)	Sway area of standing with eyes opened	r value	-0.25	-0.01	-0.19
		p value	0.17	0.99	0.29
	Sway area of standing with eyes closed	r value	-0.07	-0.17	-0.16
		p value	0.69	0.35	0.39
Mid-senile group (n =29)	Sway area of standing with eyes opened	r value	0.16	-0.04	0.08
		p value	0.43	0.83	0.7
	Sway area of standing with eyes closed	r value	-0.22	-0.07	-0.18
		p value	0.27	0.71	0.37

Note: *$p < 0.05$.

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