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The Effect of Balance between General Walking Exercise and Power Walking Exercise

This study aims to compared effect of balance between general walking exercise and power walking exercise. Twenty subjects were classified into two groups, general walking exercise(n=10) and power walking exercise(n=10). As a result, two group showed difference within the group and there is significant difference between two groups. 1) In compared static balance of sway area at pre-post test to exercise group, general walking exercise group did not change significantly. however, power walking exercise group did change significantly. and At sway distance, two group showed significant changes. 2) In compared Static balance between the groups sway area and sway path at pre-post test, two group showed significant changes. 3) In compared dynamic balance of center distance at pre-post test to exercise group, general walking exercise group was no significant difference in all directions. power walking exercise group was significant difference in all directions. 4) In compared dynamic balance between the groups sway area and sway path at pre-post test, there was no significant difference in leftward, rightward, forward directions and was significant difference in backward, overall direction. Therefore, power walking exercise can be recommended promote balance.

Key words: *General Walking; Power Walking; Static Balance; Dynamic Balance*

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INTRODUCTION

In modern society, automated life following the advancement of scientific technologies not only extremely limits people's physical activities but also adversely affects people's living habits eventually leading to lack of exercise and insufficiency of posture control functions and entailing diabetes, obesity, hypertension, and heart diseases thereby being magnified as a cause of people's loss of their physical balance(1). The decreases in physical activities including walking following the universalization of sedentary life eventually lead to muscle mass decreases, declines in cardiopulmonary functions and physical strength and muscular atrophy and even act as a cause of chronic diseases such as pulmonary function insufficiency and obesity(2, 3).

Recently, as interest in wellbeing has picked up, populations that perform exercise for health, obesity prevention, and physical balance have been increasing every year. Among representative aerobic exercise, walking is well known as an efficient exercise that can improve cardiopulmonary functions and physical motor ability and can be done by anybody(1). Walking is complex motions that make movements through coordination of muscles and many upper limb and lower limb joints(4). Therefore, walking can affect the improvement of balance ability because nerves and muscles are generally used and many muscles and joints are used in combination for walking. Walking is also a useful method for improvement of aerobic capacity(3), body composition(5), blood pressure(6), and bone density(7, 8).

Power walking exercise that has been recently attracting attention from those who perform walking exercise which is known as power walking is a kind of walking that provides larger exercise effects than jogging or running, is easy, and can be performed for long. It is more dynamic compared to general walking, enables using many muscles that are not usually

used such as those of the lumbar, the buttocks, the thighs, and the calves(9), and uses large lower limb joint angles. Therefore, it can help in improving the stability of the chest and the pelvis. In addition, it improves body composition and mass density, reduces cholesterol and triglyceride levels, and improves not only blood pressure and depression but also mental health(10). Power walking exercise is universally performed by walking at speeds of 6~8km/h while maintaining the back straightened, looking straight ahead, and forcibly swinging the arms back and forth(11). It can effectively reduce body fat, make the heart and the lung healthy to reduce the feeling of fatigue, and strengthen the bones. In addition, it improves endurance, strengthens, muscles, and enhances the level of immunity. It is also involved in the improvement of balance ability by providing important elements for the ability for balance between the pelvis and the trunk during one leg support in the process of walking(12). Therefore, as an exercise that can be done by anybody, power walking exercise can be said to an optimum physical activity which is more effective than other exercises(11).

Balance which is maintaining the body in equilibrium and maintaining or controlling postures on the basal plane is a basic element of posture maintenance and motor skills and is complicated motor control work that include sensory information integration, nervous system processing, and biomechanical factors(13). Balance control requires programming and movement strategies for execution and the musculoskeletal system's contribution to balance control includes musculoskeletal flexibility such as ranges of joint motion and joint stability, postural alignment, muscle implementation(muscle strength, power, and endurance), and sensation(14, 15, 16, 17, 18, 19).

As walking exercise has been frequently used as an exercise that can be performed without being much restricted by time and space following rapid increases in people's attention to health and their recognition of the importance of exercise, many studies have been conducted that examined the effects of walking exercise on cardiopulmonary capacity, obesity, and changes in physical ability. However, few studies examined changes in balance ability.

Therefore, the purpose of this study is to examine the effects of general walking and power walking on balance which is motor skills.

METHODS

Subjects

The subjects of this study were a total of 20 K University students(males 10, females 10) selected between October 22 and November 30. 2012. The subjects were randomly assigned to a general walking exercise group of 10 subjects and a power walking exercise group of 10 subjects. Those who had musculoskeletal system pain, those who experienced any injury within the last six months, and those who had any neurological problem were excluded from the selection of study subjects.

Exercise Methods

General walking exercise group

This group performed warming up exercises for five minutes and general walking exercise for 30 minutes. General walking exercise was performed by conducting continuous and repetitive motions of moving the body forward using one leg while the other led was maintaining a stable state of the stance phase.

Power walking exercise group

This group performed warming up exercises for five minutes and general walking exercise for 30 minutes. Power walking exercise refers to walking fast at speeds of 6~8km/h which are approximately three times of the speed of general walking while maintaining the back straightened, and forcibly swinging the arms.

Measuring Method

A BioRescue(BioRescue AP 153. RM INGENIERIE, France) was used to evaluate balance ability. Each subject was instructed to stand spreading his/her legs tomake an angle of approximately 30° and look straight ahead. Then, the experimental method was explained through a video and demonstrated by the researcher. There after, the subject was instructed to maintain balance for one minute with open eyes and for another one minute with closed eyes. Then, the distance and area of sway of the center of the gravity were measured to examine static balance and the stability limit was measured to evaluate dynamic balance.

Data Analysis

To establish differences between the study subjects' general walking exercise and power walking exercise, SPSS Window 18.0 was used for statistical processing of the data. Paired sample t-tests were conducted for comparison of values between before and after the exercise within each group and independent sample t-tests were conducted for comparison of exercise effects between the groups. Statistical significance level α was set to .05.

RESULTS

General Characteristics of the Subjects

General characteristics of the subjects are shown in Table 1. The general walking exercise group consisted of 11 young adults and the power walking exercise group consisted of 10 young adults. Sex, age, height, and weight homogeneity tests did not show any statistically significant difference($p>.05$)(Table 1).

Changes in Static Balance Ability

Comparison of sway areas between the general walking exercise group and the power walking exercise group

Changes in sway areas between before and after the training in individual groups are as shown in Table 2. Whereas the general walking exercise group did not show any significant change between before and after the training, the power walking exercise group showed significant changes between before and after the training(Table 2). In a comparison between the two groups, the power walking exercise group showed better changes($p<.05$)(Table 3).

Comparison of sway path between the general walking exercise group and the power walking exercise group.

Changes in sway training between before and after the treatment in individual groups are as shown in Table 3. The general walking exercise group and the power walking exercise group showed significant changes between before and after the training(Table 2). In a comparison between the two groups, the power walking exercise group showed better changes($p<.05$)(Table 3).

Table 1. General characteristics of subjects

	Walking	Power walking	p
Gender	Male: 5 Female: 5	Male: 4 Female: 6	.673
Age(years)	20.30±0.94	20.20±0.63	.785
Height(cm)	166.70±10.59	166.00±9.49	.878
Weight(kg)	60.30±12.55	60.10±11.92	.971

Table 2. The result of sway path and sway area on each group at pre-post test.

(unit: ㎟)

		General walking	Power walking
Sway area	Pre	80.5±23.30	80.1±10.50
	Post	66.40±20.05	48.00±16.28*
	t	1.76	6.39
Sway path	Pre	26.13±3.56	27.93±6.77
	Post	23.27±3.18*	18.44±6.39*
	t	2.67	7.61

Table 3. Comparison of sway path and sway area between group at pre-post intervention.

(unit: ㎟)

		General walking		Power walking
Sway area	M±SE	-14.10±7.98		-32.10±5.02*
	t		2.25	
Sway path	M±SE	-2.86±1.07		-9.49±1.24*
	t		2.14	

Changes in Dynamic Balance Ability

Comparison of leftward weight shift distances between the general walking exercise group and the power walking exercise group.

Changes in leftward weight shift distances between before and after the training in individual groups are as shown in Table 4. Whereas the general walking exercise group did not show any significant change between before and after the training, the power walking exercise group showed significant changes between before and after the training(Table 4). A comparison between the two groups did not show any significant difference($p<.05$)(Table 5).

Comparison of rightward weight shift distances between the general walking exercise group and the power walking exercise group.

Changes in rightward weight shift distances between before and after the training in individual groups are as shown in Table 4. Whereas the general walking exercise group did not show any significant change between before and after the training, the power walking exercise group showed significant changes between before and after the training(Table 4). A comparison between the two groups did not show any significant difference ($p<.05$)(Table 5).

Comparison of forward weight shift distances between the general walking exercise group and the power walking exercise group.

Changes in forward weight shift distances between before and after the training in individual groups are as shown in Table 4. Whereas the general walking exercise group did not show any significant change between before and after the training, the power walking exercise group showed significant changes between before and after the training(Table 4). A comparison between the two groups did not show any significant difference($p<.05$)(Table 5).

Comparison of backward weight shift distances between the general walking exercise group and the power walking exercise group.

Changes in backward weight shift distances between before and after the training in individual groups are as shown in Table 4. Whereas the general walking exercise group did not show any significant change between before and after the training, the power walking exercise group showed significant changes between before and after the training(Table 4). In a comparison between the two groups, the power walking exercise group showed better changes($p<.05$)(Table 5).

Comparison of entire weight shift distances between the general walking exercise group and the power walking exercise group.

Changes in entire weight shift distances between before and after the training in individual groups are as shown in Table 4. Whereas the general walking exercise group did not show any significant change between before and after the training, the power walking exercise group showed significant changes between before and after the training(Table 4). In a comparison between the two groups, the power walking exercise group showed better changes($p<.05$)(Table 5).

Table 4. The result of center of leftward, rightward, forward, backward and entire weight shift distances on each group at pre-post test. (unit: ㎟)

		General walking	Power walking
Center of left length	Pre	4518.40±502.51	4112.80±333.17
	Post	4701.20±372.70	5809.30±602.17*
	t	-.33	-4.89
Center of right length	Pre	4741.30±464.99	4092.30±318.02
	Post	4741.30±464.99	5585.20±582.77*
	t	-1.73	-3.14
Center of forward length	Pre	5119.50±529.51	4997.30±228.96
	Post	5728.50±529.51	6003.60±311.11*
	t	-1.15	-2.95
Center of backward length	Pre	3317.70±430.56	3067.80±298.07
	Post	3047.80±375.15	4518.70±916.16*
	t	.66	-5.88
Center of total length	Pre	8337.30±1146.37	8105.10±916.16
	Post	9038.10±692.17	11185.90±738.71*
	t	-0.71	-7.41

Table 5. Comparison of center of leftward, rightward, forward, backward and entire weight shift distances between group at pre-post intervention. (unit: ㎟)

		General walking		Power walking
Center of left length	M±SE	182.8±546.03		1696.50±346.79
	t		.67	
Center of right length	M±SE	622.50±358.81		1492.90±474.79
	t		-1.13	
Center of forward length	M±SE	609.00±529.42		1006.30±341.55
	t		-.41	
Center of back ward length	M±SE	269.90±411.50		1450.90±246.57*
	t		-2.31	
Center of total length	M±SE	700.80±984.50		3080.80±415.72*
	t		-2.12	

DISCUSSION

In this study, to examine the effects of general walking exercise and power walking exercise on balance, a total of 20 adult males and females were assigned to either a group that performed general walking exercise or a group that performed power walking exercise three times per week for six weeks.

Lee(9) reported that power walking exercise is more dynamic compared to general walking and strengthens many muscles that are not usually used such as those of the lumbar, the buttocks, the thighs, and the calves. These muscles mainly act to improve static balance(20, 21, 22). In the results of studies of changes in static balance ability, whereas the general walking exercise group showed significant increases

in stability areas but no change in stability lengths, the power walking exercise group showed significant changes in both stability areas and stability lengths. When the two groups were compared with each other, the power walking exercise group showed significantly larger changes than the general walking exercise group. Given these results, power walking exercise can be said to improve lower limb and trunk muscle strength and affect improvement of static balance ability.

In the results of examination of dynamic balance ability, whereas the general walking exercise group did not show any significant change in any items, the power walking exercise group showed significant changes in all items. In the results of comparisons between the two groups, the power walking exercise group showed more significant changes than the general walking exercise group in backward weight shift distances and entire weight shift distances. Won(23) indicated that the activity of the musculus rectus abdominis, the longissimus muscle, the external oblique abdominal muscle, the multifidus muscle, the vastus medialis muscle, the biceps femoris muscle, the tibialis anterior muscle, and the medial gastrocnemius muscle affect changes in dynamic balance ability and this is considered to be the reason for the better changes in dynamic balance ability in the power walking exercise group shown by the results of this study. These results indicate that power walking exercise improves the muscle strength of those muscles more that the general walking exercise does and that power walking exercise induces coordinated contraction which in turn affects dynamic balance.

Given the above mentioned results, power walking exercise is considered to have better effects on static, dynamic balance and improvement of the strength and endurance of muscles related to balance ability than general walking exercise. However, because this study was conducted with a small number of healthy subjects and did not examine changes in the muscle activity of specific muscles, better results may be obtained if experiments are conducted with subjects with physical limitations and those with specific diseases.

CONCLUSION

When general walking exercise and power walking exercise were performed the following changes occurred in static and dynamic balance.

1. Sway areas and sway path before and after training were compared with each other within each group to examine changes in static balance ability. In the results, whereas the general walking exercise group did not show any significant change in sway areas, the power walking exercise group showed significant changes and both the general walking exercise group and the power walking exercise group showed significant changes in sway path.

2. Sway areas and sway path before and after training were compared between the two groups to examine changes in static balance ability and the power walking exercise group showed more statistically significant changes than the general walking exercise group.

3. Weight shift distances before and after training were compared with each other within each group to examine changes in dynamic balance ability. In the results, whereas the general walking exercise group did not show any significant change in any item, the power walking exercise group showed significant improvement in leftward, rightward, forward, backward and entire weight shift distances.

4. When weight shift distances before and after training were compared between the two groups to examine changes in dynamic balance ability, no significant differences were shown in leftward weight shift distances, rightward weight shift distances, and forward weight shift distances but significant differences were shown in backward weight shift distances and entire weight shift distances.

As such, the reinforcement of trunk muscles and lower limb muscles through power walking exercise not only improves muscle strength but also induces coordinated contraction to contribute to improvement of static balance and dynamic balance. Therefore, power walking exercise can be actively utilized in clinics as a method of improving the balance ability of patients with poor balance ability.

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