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Comparison of Shoulder Ranges of Motion During Nordic Pole Walking and General Walking in the Elderly

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Abstract: This study purpose was to find the effect of Nordic pole walking on range of upper extremity in the old person compared to those of general walking exercise. The subject who were 65 years of age or older and 27 were randomized into 2 groups with Nordic walking group (N = 13) and general walking group (N = 14). Testing was done pre and after 6 weeks walking exercise intervention to determine Range of Motion (ROM) at the shoulder joint. Active ROM at shoulder joint was measured using goniometer. Paired t-test compared the variables change between baseline and after 6 weeks in Nordic and general walking group. We compared the changes pre and post-test the Nordic walking and the general walking. There were significant differences in all the actions (flexion, extension, abduction, external and internal rotation) pre and post-test the exercise in the Nordic pole walking group ($p<0.05$). However, statistically significant differences were not found in actions in the general walking group ($p>0.05$). The results suggest that, the pole walking had positive effects on the upper limb muscles to subsequently increase the joint working ranges of the upper limbs. Range of motion at shoulder joint improved 6 weeks of Nordic walking exercise elderly.

Key words: Nordic pole walking, general walking, elderly, gait, shoulder range of motion, Korea

INTRODUCTION

As interest in personal well ageing has increased, Korean communities are now providing programs for preventing chronic disorders and promoting the health of the elderly. Such health programs for the elderly include walking exercise to reduce risk factors of metabolic syndrome (Jun, 2014; Nam, 2010; Kim *et al*., 2015) and fall prevention programs for preventing falling and improving the muscular strength of the elderly using balance and resistance exercise (Choi *et al*., 2012). Walking exercise is an appropriate type of aerobic exercise for elderly because it involves less risk of musculoskeletal system injury (Colbert *et al*., 2000). Regular walking exercise prevents a decline in the basal metabolic rate (Kungsun, 2012) and is effective in maintaining elderly individual's gait ability (Kawanabe *et al*., 2007).

Nordic pole walking is a type of walking exercise with poles in both hands including rhythmical movements of the upper limbs while the poles touch the front ground and then the arms stretch out posteriorly (Santos and Fernandez, 2013). The walking exercise increases exercise's effects throughout the entire body as well as the lower limbs by raising muscular activity in the upper body and it is effective for backaches and arthritis among the elderly by sharing the load on the spine and lower limb joints (Porcari *et al*., 1997). In addition, it is demonstrated that the exercise intensity of the upper limbs of Nordic pole walking is higher than that of general walking (Sugiyama *et al*., 2013). During general walking, the arms only show natural movements, not large ones, while moving back and forth.

Although, Nordic pole walking leads to increased muscular activity and movements in the upper limbs, there have been few studies specifying the degrees of increase in the joint working range. In this context, this study purpose was to confirm the effects of Nordic pole walking on the range of the upper limbs in the elderly compared to those of general walking exercise.

MATERIALS AND METHODS

Subjects: Among the elderly in Gangwon-do whose were at least 65 years old and who accessed facilities and institutions to the elderly, 27 people served as the subjects after they actively consented to participating in this study. The subjects were able to communicate, understand what the questionnaire said, walk at least

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Table 1: Demographic and clinical characteristics of study participants included in the two difference groups

Variables	Nordic (N = 13)	General (N = 14)
Gender (%)		
Male	5(38.46)	2(14.29)
Female	8(61.54)	12(85.71)
Age (years)	71.31±4.39	74.21±4.59
Height (cm)	157.38±8.10	158.00±7.97
Weight (kg)	59.27±8.80	62.24±9.84

30 m independently and grasp the Nordic poles without difficulty. Meanwhile, those who had disorders in the nervous system or the musculoskeletal system or diseases of at least moderate degrees were excluded from this study. Prior to the start of this study, we get consent from Kangwon National University (KWNUIRB-2015-07-001-002). This study goes after guideline on Helsinki Declaration. And the Nordic pole walking group's average age was 71.31±4.39 years, average height was 157.38±3.10 cm and average weight was 59.27±8.80 kg. The general walking group's average was 74.21±4.59 years, average height was 158.00±7.97 cm and average weight was 62.24±9.84 kg (Table 1).

Instrument and intervention: The Nordic walking and the general walking consisted in a warm-up, major exercise and warm-down. The subjects underwent the 50 min training three times a week for 6 weeks. For the general walking, the warm-up exercise was foot and ankle rolling smoothly in the order of the toes, the soles and the heels while the subjects stood for 10 min. The main exercise was general walking on the track of a playground for 30 min, the subjects underwent the walking exercise while their heart rates maintained 60~80% (Resnick, 2000). The warm-down consisted of a weight-support exercise on both feet for 10 min, a breathing exercise and chest stretching. During the Nordic pole walking, the warm-up and the warm-down were similar to those of the general walking, except the subjects grasped the poles. The main exercise was 30 min walking forward using the Nordic poles (Fig. 1). We measured the joint working range of the shoulder joints in flexion, extension, abduction, internal and external rotation using the method presented by Clarkson (2005) and Foissac *et al*. (2008). We used a goniometer for measurement when the subjects actively performed motion ranges using their muscular strength.

Data analysis: Statistical analysis was performed using SPSS for Windows Version 19.0. We used for means and standard deviation for quantitative data. The paired t-test was used to compare the results pre and post in Nordic pole and general walking group for statistical significance level, α was selected as 0.05 for all results.

Fig. 1: Nordic pole walking

RESULTS AND DISCUSSION

We compared changes pre and post-test in the Nordic and the general walking. There were significant differences in all the motions (flexion, extension, abduction, internal and external rotation) pre and post the exercise in the Nordic pole walking group ($p<0.05$). However, no statistically significant differences were found in the motions in the general walking group ($p>0.05$), except for external rotation in the left shoulder ($p<0.05$) (Table 2).

This study goal was to identify changes in the joint working range of the upper limbs before and after Nordic pole walking and general walking. The incipient angles of flexion, extension and abduction of the shoulder joints in all the subjects were not included in the normal range but their joint working ranges did not restrict their daily movements.The internal and external rotation angles, however were only half of the normal ones. The elderly frequently undergo flexion, extension and abduction of their shoulder joints when they take things from shelves, put their hands on the floor and stuff their hands in the back pockets while they infrequently engage in shoulder joint rotation in their daily lives. This may reduce the angle of the internal and external rotation of the shoulder joints.

However, the Nordic pole walking group showed significant improved in flexion, extension, abduction, internal and external rotation after 6 weeks. The results suggest that the pole walking had positive effects on the upper limb muscles to subsequently increase the joint

Table 2: Results of paired t-test comparing Nordic and general walking groups range of motion of the shoulder joint (flexion, extension, abduction, internal rotation, external rotation)

Motions	Nordic (N = 13)	General (N = 14)
Flextion left		
Pre	160.00±14.31	163.14±17.56
Post	168.00±11.23	167.07±12.83
t-values	-3.95	-1.80
p-values	0.00‡	0.09
Flextion right		
Pre	159.85±10.38	167.43±9.75
Post	167.62±9.95	170.07±9.71
t-values	-4.66	-1.23
p-values	0.00‡	0.24
Extention left		
Pre	39.77±5.39	39.57±9.47
Post	45.15±5.89	42.29±9.35
t-values	-3.80	-2.06
p-values	0.00‡	0.06
Extention right		
Pre	39.23±11.57	40.64±11.41
Post	43.23±8.20	42.93±10.71
t-values	-2.23	-1.82
p-values	0.05†	0.09
Abduction left		
Pre	165.54±8.20	169.71±8.30
Post	171.54±5.61	171.21±7.33
t-values	-4.94	-1.22
p-values	0.00‡	0.24
Abduction right		
Pre	163.92±11.09	168.29±9.58
Post	170.08±6.69	171.64±6.05
t-values	-2.85	-2.15
p-values	0.01‡	0.05
Internal rotation left		
Pre	34.31±6.33	34.21±9.02
Post	38.15±5.60	35.21±9.44
t-values	-4.09	-0.93
p-values	0.00‡	0.37
Internal rotation right		
Pre	29.00±6.24	32.86±11.59
Post	33.31±6.50	33.00±11.75
t-values	-4.57	-0.26
p-values	0.00‡	0.80
External rotation left		
Pre	39.77±6.07	40.50±8.87
Post	42.69±7.69	42.50±9.14
t-values	-2.29	-2.81
p-values	0.04†	0.01†
External rotation right		
Pre	45.85±11.73	43.71±8.77
Post	53.15±10.25	45.36±8.99
t-values	-3.67	-1.46
p-values	0.00‡	0.17

*†p≤0.05, ‡p≤0.01

working ranges of the upper limbs when compared to studies in which pole walking rather than general walking reduced the muscular activity of the lower limbs but increased that of the upper limbs by up to 15% (Foissac *et al*., 2008). As a study of changes in skin temperature after 60 min Nordic pole walking reported that subjects showed an increased skin temperature in the upper limbs, the increased use of the upper limbs may be connected to increases in skin temperature, joint working range and muscular activity.

CONCLUSION

Nordic pole walking may increase the use of the upper limbs, leading to the positive effect of an increase in the joint working range of the upper limbs of the elderly. In add, this study call for something to identify the effects of Nordic pole walking on the overall health and quality of life of elderly individuals.

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