



Nordic Walking: A Promising Exercise Option for Improving Functional Fitness for the Elderly

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ABSTRACT

This study looked at how Nordic walking affected older individual's functional fitness levels in Hsinchu City, Taiwan. Seven separate fitness evaluations were performed on the study's thirteen subjects.

These fitnesses are:

1. 30 Second Single Leg Stand,
2. 30 Second Chair Stand,
3. Bicep Curl,
4. Stationary Knee Lifts,
5. Chair Sit and Reach,
6. Back Scratch, and
7. 8 Foot Up and Go.

We designed a 6 week program for this study, with each class lasting an hour. Our exercise program included functional fitness, aerobic exercise, and Nordic walking. We had three parts for our teaching process: warm-up activities, main activities, and cool-down activities. Our warm-up activities consisted of gathering the team and doing warm-up exercises for ten minutes. The main activity involved Nordic walking for 40 minutes, while the cool-down activities included relaxing stretching exercises, sharing experiences, feedback, and comments for ten minutes. The results of the study showed that older person's lower body flexibility, dexterity, and cardiovascular endurance were all significantly improved by Nordic walking. The research, however, found no appreciable increase in the upper body movement. Based on its findings, the study suggests that Nordic walking should be marketed as a safe, simple to learn, and readily included type of physical activity among the elderly, since it can enhance quality of life.

Keywords: Nordic walking; Aging population; Physical education; Health promotion; Elderly care

INTRODUCTION

Background

Taiwan's advancements in healthcare and technology have led to a continuous increase in average life expectancy. As of 2021,

Taiwanese women have an average life expectancy of 84.7 years, while men have an average of 78.1 years (Ministry of the Interior). According to the World Health Organization (WHO), a society with over 7% of its population aged over 65 is considered aging, while over 14% is aged, and over 20% is super-aged. Taiwan's population transitioned to an aging society in 1993,

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aged society in 2018, and is estimated to become super-aged by 2025 (National Development Council, Executive Yuan, 2020). While population aging is a symbol of societal progress, it also introduces new challenges. To alleviate the burden on young adults and national medical expenses, the government must implement policies and strategies that promote and maintain the health of the elderly, facilitating Taiwan's transition towards an elderly friendly society.

A 12 week multimodal exercise training program for older persons was suggested. This program demonstrated substantial improvement in outcomes such the bicep curl, sit to stand, 8 foot up and go, and two minute walk test. Both muscular strength and flexibility were improved by the training, which is essential for reducing falls in the elderly. These results show that exercise benefits older person's physical health, and there is a definite desire for exercise among this group. The creation of suitable and successful exercise programs and courses, as well as the promotion and cultivation of a regular exercise habit among the aged, are crucial issues that our aging society must address today.

The benefits of physical exercise for the elderly population are undeniable, and the Nordic walking training is one form of exercise that has shown promising results. In a similar vein to Fang et al's research, Nordic walking has been proven to be an effective and safe method of physical training, with minimal equipment costs and the flexibility to be practiced almost anywhere. Its accessibility and versatility make it an excellent option for promoting physical activity among the elderly. Moreover, a study conducted by Parkatti et al. on individuals aged 65 and older demonstrated the superior functional fitness results of those who underwent nine weeks of Nordic walking training, twice a week for 60 minutes per session, compared to a control group. These findings underscore the positive impact of Nordic walking on the functional activity ability of older adults. Considering that Nordic walking is already a popular sport with millions of participants worldwide, promoting its practice could prove valuable in enhancing the functional fitness of our aging population. Thus, as we face the challenge of developing effective and appropriate exercise programs for the elderly, Nordic walking may provide a feasible and practical option for improving the physical health of this population. With its low cost, flexibility, and positive impact on functional fitness, promoting the practice of Nordic walking could help guide our society towards a more elderly-friendly future.

This study aims to create a program that incorporates Nordic walking exercise and involves both youth and elderly in a mutual learning approach. University students majored in physical education will lead the elderly in exercising, with the goal of assessing the impact of Nordic walking exercise on the functional physical fitness of the elderly through testing and interviews. The results of this study will be useful for future development and implementation of exercise programs for the elderly.

Research Objectives

This study aims to explore the impact of a 6 week Nordic Walking exercise program on the functional fitness of older adults. The program will be facilitated by physical education university students, who will serve as instructors and guide the elderly

participants through the exercises. The study employs an inter-generational learning approach, where both the youth and the elderly will learn from each other. The findings of this study will provide evidence-based recommendations for future exercise programs that cater to the needs of the elderly population.

Research Questions

The following research questions examine the effect of Nordic walking exercise on the performance of various tests for older adults:

1. Is there a difference in the performance of the 30 second single-arm curl test before and after the intervention?
2. Is there a difference in the performance of the 30 second stand-up test before and after the intervention?
3. Is there a difference in the performance of the back scratch test before and after the intervention?
4. Is there a difference in the performance of the chair sit and reach test before and after the intervention?
5. Is there a difference in the performance of the 2 minute stationary step test before and after the intervention?
6. Is there a difference in the performance of the 8 Foot Up and Go test before and after the intervention?
7. Is there a difference in the performance of the maximum seconds of open-eyed, one legged stand test before and after the intervention?

MATERIALS AND METHODS

Research Design

In this study, a single-group experimental design will be utilized, with the Nordic walking exercise intervention serving as the independent variable and "functional fitness" serving as the dependent variable. The aspects of functional fitness that will be assessed include muscle endurance, endurance, flexibility, balance, cardiorespiratory fitness, and reaction speed. The study subjects were elderly university students from a national university in Hsinchu City, with a total of 11 participants who voluntarily participated in the experiment, including 0 male and 11 female participants. The functional fitness elements designed by Rikli and Jones (1999) were used as the test items for the elderly participants. The test items include the 30 Second Chair Stand (muscle endurance test), Bicep Curl (muscle strength test), Back Scratch test (hand flexibility test), Chair Sit and Reach (trunk flexibility test), 30 Second Single Leg Stand (balance test), 8 Foot Up and Go (reaction test), and Stationary Knee Lifts test (cardiorespiratory endurance test).

Experiment Schedule

This study used purposive sampling to select a total of 11 elderly participants from a national university in Hsinchu City as the experimental subjects. The experiment period was from December 9, 2021 to January 5, 2022, a total of six weeks, with exercise twice a week for a total of 12 times, and each exercise lasted for 60 minutes. Before the first week of the intervention, the experimental participants were asked to fill out a health self-assessment form and undergo a pre-test of functional fit-

ness. After the sixth week of exercise, the post-test of functional fitness was immediately conducted.

Experimental Procedure

This study consisted of a 6 week program, with each class lasting for 60 minutes. The exercise program included elements of functional fitness, aerobic exercise, and Nordic walking. The teaching process (outlined below) included three parts: warm-up activities, main activities, and cool-down activities. Warm-up activities (10 minutes): Gathering the team and warming up exercises. Main activities (40 minutes): Nordic walking activities. Cool-down activities (10 minutes): Relaxing stretching exercises, sharing experiences, feedback and comments.

Course Design

The 6 week course design for this study includes the following:

- **Week 1:** (1) Pre-test, "London Bridge is Falling Down"; (2) Indoor walking, upper and lower limb strength training.
- **Week 2:** (1) Campus tour, upper limb strength and balance training; (2) "123 wooden men", lower limb strength and reaction training.
- **Week 3:** (1) "I Guess, I Guess, I Guess", lower limb strength, cardiovascular endurance, and flexibility training; (2) "Traffic Lights", upper and lower limb strength training.

- **Week 4:** (1) "Nine Palaces", upper and lower limb strength training; (2) Indoor walking, upper and lower limb strength training.
- **Week 5:** (1) "Passing through the Five Obstacles", lower limb strength and balance training; (2) "Balance Beam", upper and lower limb training.
- **Week 6:** (1) "Chase and Run", upper limb strength and balance training; (2) Post-test, "Climbing Up and Down".

Research Analysis

This study utilizes both quantitative and qualitative data analysis. Quantitative data will be analyzed using descriptive and inferential statistics, specifically by calculating the average and standard deviation of the functional fitness test scores before and after the intervention, and using dependent sample t-tests to understand changes in each variable. Qualitative data will be collected through focus group interviews with the elderly participants and will be analyzed using coding techniques.

RESULTS AND DISCUSSION

Descriptive statistics of functional fitness test results The descriptive statistics of the functional fitness tests before and after the 6 week Nordic walking training for the participants are presented in [Table 1](#).

Table 1: Summary of Descriptive Statistics for Functional Fitness Pre and Post-Tests.

Fitness Assessments	N	Pre-Test M ± SD	Post-Test M ± SD
30 Second Single Leg Stand	11	31.17 ± 26.77	63.28 ± 34.24
30 Second Chair Stand	11	18.73 ± 3.17	23.00 ± 4.07
Bicep Curl	11	17.09 ± 3.86	21.27 ± 4.82
Stationary Knee Lifts	11	96.64 ± 12.52	110.09 ± 11.53
Chair Sit and Reach	11	4.09 ± 5.07	8.55 ± 6.19
Back Scratch	11	1.36 ± 5.85	1.73 ± 5.02
8 Foot Up and Go	11	5.65 ± 0.65	5.05 ± 0.38

Table 1 presents the results of the functional fitness tests conducted on the study subjects. The pre-test results for the "30 Second Single Leg Stand" had an average score of 31.17 seconds with a standard deviation of 26.77 seconds, while the post-test results showed an average score of 63.28 seconds with a standard deviation of 34.24 seconds. The "30 Second Chair Stand" had an average score of 18.73 seconds with a standard deviation of 3.17 seconds in the pre-test, and an average score of 23.00 seconds with a standard deviation of 4.07 seconds in the post-test. The Bicep Curl had an average score of 17.09 times with a standard deviation of 3.86 times in the pre-test, and an average score of 21.27 times with a standard deviation of 4.82 times in the post-test. The Stationary Knee Lifts had an average score of 96.64 times with a standard deviation of 12.52 times in the pre-test, and an average score of 110.09 times with a standard

deviation of 11.53 times in the post-test. The Chair Sit and Reach had an average score of 4.09 cm with a standard deviation of 5.07 cm in the pre-test, and an average score of 8.55 cm with a standard deviation of 6.19 cm in the post-test. The Back Scratch had an average score of 1.36 cm with a standard deviation of 5.85 cm in the pre-test, and an average score of 1.73 cm with a standard deviation of 5.02 cm in the post-test. The 8 Foot Up and Go had an average score of 5.65 seconds with a standard deviation of 0.65 seconds in the pre-test, and an average score of 5.05 seconds with a standard deviation of 0.38 seconds in the post-test. Paired-sample t-tests were conducted to analyze the data and the results are presented in [Table 2](#) to further understand the effectiveness of the changes in the subject's functional fitness before and after the test.

Table 2: Summary of Dependent T-Test for Pre-Test and Post-Test of Different Fitness.

Fitness Assessments	Mean Difference	Standard Deviation	t-value	p-value
30 Second Single Leg Stand	-32.11	31.47	-3.38	0.00*
30 Second Chair Stand	-4.27	2.83	-5	0.00*

Bicep Curl	-4.18	3.12	-4.44	0.00*
Stationary Knee Lifts	-13.45	11.92	-3.74	0.00*
Chair Sit and Reach	-4.45	5.61	-2.63	0.03*
Back Scratch	-0.36	2.5	-0.48	0.64
8 Foot Up and Go	0.6	0.43	4.62	0.00*

N=11; p<.05*; Unit: Seconds

The Nordic walking training has shown significant improvements in the functional fitness of older adults, and the data shows that there is significant progress in the 30 Second Single Leg Stand test before and after the training ($p<.05$). This test mainly measures the static balance ability of older adults. This result is similar to the findings of Wu et al. which showed that improvements in static balance ability can prevent falls and unstable center of gravity in older adults. This study confirms that Nordic walking training with the use of walking poles can effectively improve the static balance ability of older adults, thus improving their balance and preventing falls. Interviews with older adults also support this argument:

- "There has been significant improvement in one leg standing scores and overall physical fitness" (Respondent #01).
- "I now feel more powerful when walking" (Respondent #02).

The 30 Second Chair Stand test showed significant improvement ($p<.05$) before and after the Nordic walking training, which is similar to the results found in. This test primarily measures lower limb muscle strength, which is important for improving the ability of older adults to climb stairs and walk. This finding is also supported by the interviews with older adults:

- "After completing the course, many movements that could not be performed before can now be done, such as sitting in a chair, which has become easier" (Respondent #01).
- "Climbing stairs at home is less tiring" (Respondent #02).
- "There is a significant improvement in muscle strength" (Respondent #03).

There was a significant improvement in the Bicep Curl test ($p<.05$) before and after the Nordic walking training for older adults. This result is similar to previous studies. The purpose of this test was to measure upper limb strength in older adults, which is helpful for lifting and carrying heavy objects in daily life. This point was also supported by the older adults interviewed:

- "After the course, I can lift things more easily than before." (Respondent #04)
- "I feel my arms are stronger than before." (Respondent #05)

There was a significant improvement in the Stationary Knee Lifts test before and after ($p<.05$), which aimed to test the cardiorespiratory fitness of the elderly. This result is similar to previous studies by. Thus, it is beneficial for the elderly who live in apartments without elevators to climb stairs and walk outdoors and mountains, which can prevent them from becoming housebound. This viewpoint is supported by the interviews with the

elderly participants:

- "I feel much better than before" (Respondent #06).
- "I am stronger when climbing stairs and not as tired as before" (Respondent #07).
- "I am much better at activities after training" (Respondent #08).

There was a significant improvement in the Chair Sit and Reach test ($p<.05$), which aimed to test the flexibility of the lower limbs of the elderly. This result is similar to previous studies. Sitting on a chair to pick up things from the ground is relatively safer than standing and bending over, and improving lower limb flexibility can prevent the embarrassment of not being able to pick up things from the ground. This viewpoint is supported by the interviews with the elderly participants:

- "I feel more flexible than before" (Respondent #08).
- "I am safer with increased flexibility" (Respondent #04).

There was no significant difference in the Back Scratch test ($p>.05$), which aimed to test the flexibility of the upper limbs of the elderly. This result is similar to previous studies. This suggests the improvement of the upper limb flexibility of the elderly is beneficial for daily activities such as reaching for items and combing hair. According to Wang, it takes at least 20 to 24 weeks to improve upper limb flexibility significantly. This study only lasted for six weeks, and the Nordic walking cane design used in this study did not involve much upper limb flexibility, which may explain why there was no significant improvement in the Back Scratch test.

The 8 Foot Up and Go assessment showed significant improvement ($p<.05$) in agility and dynamic balance. This test was conducted to evaluate agility and dynamic balance, and the results were similar to previous studies conducted. When older adults improve their agility and dynamic balance, they are less troubled when suddenly getting up and walking and can move around freely without assistance. This argument is supported by interviews with older adults:

- "Previously, I always had back pain and sore waist when I got up. Now it's much better" (Respondent #05).
- "I feel much younger after completing the course" (Respondent #06).

Comparing the pre and post-training test data, the elderly showed significant improvement in six areas: 30 Second Single Leg Stand, 30 Second Chair Stand, Bicep Curl, Stationary Knee Lifts, Chair Sit and Reach, and 8 Foot Up and Go assessments. This result was similar to previous studies except for the Back Scratch test, which did not show significant improvement. Overall, after six weeks of Nordic walking training, most functional fitness of the elderly showed significant improvement, except

for the Back Scratch test. The reason for this may be that the Nordic walking training did not specifically strengthen upper limb flexibility or the training period was not long enough, both of which could affect the test results. This study suggests that future researchers could extend the training period and strengthen upper limb flexibility training to improve the upper limb flexibility of the elderly and prevent its degeneration [1-16].

CONCLUSION

The 6 week, twice a week, 60 minute Nordic walking intervention program with moderate intensity significantly improved the upper and lower extremity muscle strength, lower limb flexibility, agility/static dynamic balance, and cardiorespiratory fitness. The results confirmed that Nordic walking training can help improve most functional fitness in middle-aged and elderly people. Nordic walking is simple to learn, suitable for all age groups, and has high safety, making it very suitable for promoting physical activity and health in older people.

Research Results

After the Nordic walking intervention, the following improvements were observed in the elderly participants:

- Significant improvement in 30 second one arm curls performance (upper limb strength).
- Significant improvement in 30 second stand-up test performance (lower limb strength).
- No significant improvement in the back grip test performance (upper limb flexibility).
- Significant improvement in the chair sit and reach test performance (lower limb flexibility).
- Significant improvement in the 2 minute stationary step test performance (cardiorespiratory fitness).
- Significant improvement in the 8 foot up and go test performance (agility/static dynamic balance).
- Significant improvement in the maximum duration of single leg standing with eyes opens (static balance).

Recommendations

This study found that the 6 week Nordic walking intervention was not effective in improving upper body flexibility in older adults. Therefore, future research should focus on strategies to improve upper body flexibility, in order to provide a more comprehensive exercise prescription for improving functional fitness in older adults and promoting successful aging.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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