Exercise Workload of the “Fujisawa +10 Exercise” Program in Older Women

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ABSTRACT

Osawa Y, Saito Y, Tsunekawa N, Manabe T, Oguma Y. Exercise Workload of the “Fujisawa +10 Exercise” Program in Older Women. JEPonline 2015;18(5):79-85. The purpose of this study was to investigate the exercise intensity of the “Fujisawa +10 exercise” program in the elderly. Seven women (aged 65 to 75 yrs old) performed the newly developed exercise program in both standing and sitting conditions. Expired gas and heart rate were measured throughout the program, and participants quantified their effort using the rating of perceived exertion (RPE). The cardiorespiratory exercise responses while standing were 2.7 ± 0.3 METs (metabolic equivalents) and 88.0 ± 15.4 beats·min⁻¹. The responses to the program while sitting were 2.0 ± 0.3 METs and 80.2 ± 13.6 beats·min⁻¹. In addition, oxygen consumption (VO₂ max) was 42.0 ± 9.1% mL·kg⁻¹·min⁻¹ in the standing position and 31.7 ± 8.7% in the sitting position. The subjects’ RPE ranged from “very light” to “fairly light” during the exercise program under both conditions. In conclusion, the findings indicate that the exercises that comprise the “Fujisawa +10 exercise” program are of low intensity. The program should be easily applicable for introducing daily exercise habits in the elderly.

Key Words: Elderly, Breath-by-breath Oxygen consumption, Heart rate, Rating of perceived exertion
INTRODUCTION

Accumulated evidence shows that physical activity and structured exercise improve health and reduce the risk of several lifestyle-related diseases, including type 2 diabetes, lipid metabolism abnormalities, and cancers of the colon and breast (12,16). In addition, moderate to vigorous physical activity improves muscle function, musculoskeletal mobility, and cognitive ability in the elderly (4,6,9). Based on these findings, it is recommended that elderly individuals should perform physical activity of moderate-intensity for approximately 150 min·wk\(^{-1}\) (2).

Several types of structured exercise programs, particularly Tai-chi exercise, which is extremely popular in the East Asian countries, achieve an exercise intensity of 4.0 METs (i.e., metabolic equivalents). This MET level corresponds to moderate-intensity physical activity and, therefore, it is suitable for achieving the weekly recommended levels of activity (1). However, the movements and positions required by these exercise programs are difficult to perform in the untrained elderly and typically require intensive instruction.

Although physical activity is a major factor contributing to health and longevity, the number of inactive people has rapidly increased worldwide (10). For this reason, governments of nearly all countries have implemented policies aimed at promoting physical activity. In Japan, the National Institute of Health and Nutrition of the Ministry of Health, Labour, and Welfare published an “Active Guide” that includes physical activity recommendations such as performing an additional 10 min of physical activity in one’s daily routine (13,19). For the elderly, the Guide also recommends engaging in any intensity of physical activity for 40 min·d\(^{-1}\) (19). To meet these recommendations, local governments and healthcare providers in Japan have developed strategies that include health promotion events and the introduction of urban walking courses.

In Fujisawa City, which is located in the eastern part of Japan, the Fujisawa City Health and Medical Center and Keio University collaboratively developed the “Fujisawa +10 exercise” program. The program is designed for the easy implementation of an additional 10 min of daily physical activity that is performed during daily routines or recreational activities without needing equipment. However, because the workload of the exercise program has not been well characterized in the elderly (i.e., physiologically speaking), the purpose of the study was to evaluate the exercise intensity of the “Fujisawa +10 exercise” program in elderly subjects.

METHODS

Subjects
Seven women (65 to 79 yrs age) were recruited from the Fujisawa City Health and Medical Center. The subjects were required to have a medical checkup at the Center within 1 yr of entering the study. The checkup included a cardiorespiratory fitness test (Table 1). Exclusion criteria included a history of severe orthopedic abnormality, cardiovascular disease, and the use of drugs that could potentially alter outcome measurements. This study was approved by the local ethics committee of Keio University. Written informed consent was obtained from all subjects. All experimental procedures were performed in accordance with the ethical standards outlined in the 1964 Declaration of Helsinki.
Table 1. Characteristics of the Study Participants.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean ± SD (n = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>71.6 ± 3.4</td>
</tr>
<tr>
<td>Body height (cm)</td>
<td>153.6 ± 4.2</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>50.7 ± 4.3</td>
</tr>
<tr>
<td>Estimated VO$_{2}$ max (mL·kg$^{-1}$·min$^{-1}$)</td>
<td>23.0 ± 3.4</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>127.3 ± 15.2</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>77.6 ± 7.9</td>
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</table>

“Fujisawa +10 Exercise” Program
The “Fujisawa +10 exercise” program is a 10-min body weight exercise program that consists of dynamic and static stretching exercises, knee-ups, squatting or knee extensions, arm circle exercises, and body balance exercises in the standing or sitting positions. The subjects performed the exercise program under the supervision of a Health Fitness Programmer in the Fujisawa City Health and Medical Center. Each subject was asked to practice the exercise program at home. For evaluation of the exercise intensity of the program, the subjects visited the laboratory on a separate day to perform the exercise program in the standing and sitting positions while watching a video recording of each exercise being performed to music with verbal instructions for the proper exercise positions.

Measurements
Expired gas was measured throughout the testing period using a Quark CPET pulmonary gas exchange system (COSMED, Rome, Italy). Heart rate (HR) was recorded using a COSMED wireless HR monitor connected to the gas exchange system used for the measurement of oxygen consumption (VO$_{2}$). Before each test, the Quark system turbine flowmeter was calibrated with a 3-L syringe. The Quark gas analyzer was calibrated with ambient air (oxygen, 20.93%; carbon dioxide, 0.03%). Prior to the testing, the subjects were fitted with a mask for breath-by-breath VO$_{2}$ measurements and, then rested quietly in a sitting position for 5 min. After completion of the exercise program, the subjects again rested in a sitting position for 10 min. During the rest period, the subjects were asked to refrain from moving, talking, or sleeping.

Oxygen consumption and HR were measured continuously in the pre-exercise, exercise, and post-exercise periods using the gas exchange system. After the data were averaged for 1-min intervals, then, the data were averaged for each period (pre-exercise, exercise, and post-exercise). In addition to absolute VO$_{2}$, the subjects’ MET level was calculated by dividing relative VO$_{2}$ (mL·kg$^{-1}$·min$^{-1}$) by 3.5 mL·kg$^{-1}$·min$^{-1}$ (8). We also calculated the relative exercise intensity of the cardiorespiratory fitness test that was conducted during the medical check of the subjects. Briefly, the test was performed using a cycle ergometer (STB-2400, COMBI,
Tokyo, Japan). The subjects began cycling at 15 Watts (W). Power output was increased by 15 W every minute until the subjects were unable to maintain a cadence of 50 rev·min⁻¹ (18). Based on the peak power output (W), age, and body weight (BW), VO₂ max was calculated using the following equation (17): 

\[ \text{VO}_2 \text{ max (mL·min}^{-1}\) = 9.39 W × 7.7 BW – 5.88 yrs old + 136.7 mL·min⁻¹ \]

The subjects were asked to rate their subjective perceived exertion during the exercise program using the Borg 6 to 20 scale (3). Rating of perceived exertion (RPE) was recorded at the end of each exercise modality.

**Data Analyses**
All values are presented as the mean ± standard deviation. All analyses were performed using IBM SPSS version 22.0 for Macintosh (SPSS, Inc., Tokyo, Japan).

**RESULTS**

Table 2 shows the results of objective and subjective assessments of the exercise intensity of the “Fujisawa +10 exercise” program. The cardiorespiratory responses to the exercise program in the: (a) standing position were 2.7 ± 0.3 METs and 88.0 ± 15.4 beats·min⁻¹; and (b) sitting position were 2.0 ± 0.3 METs and 80.2 ± 13.6 beats·min⁻¹. The relative exercise workloads in the standing and sitting positions were 42.0 ± 9.1 %VO₂ max and 31.7 ± 8.7 %VO₂ max, respectively. The subjects’ RPE ranged from “very light” to “fairly light” throughout the exercise program in both positions (Table 2).

**Table 2. Cardiorespiratory Responses to the “Fujisawa +10 Exercise” Program.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Standing (Mean ± SD)</th>
<th>Sitting (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO₂ (mL·kg⁻¹·min⁻¹) [rest 5 min]</td>
<td>4.6 ± 0.6</td>
<td>4.4 ± 0.8</td>
</tr>
<tr>
<td>VO₂ (mL·kg⁻¹·min⁻¹) [exercise]</td>
<td>9.4 ± 1.2</td>
<td>7.1 ± 1.2</td>
</tr>
<tr>
<td>VO₂ (mL·kg⁻¹·min⁻¹) [post 10 min]</td>
<td>5.1 ± 0.6</td>
<td>4.6 ± 0.8</td>
</tr>
<tr>
<td>METs (3.5 mL·kg⁻¹·min⁻¹) [rest 5 min]</td>
<td>1.3 ± 0.2</td>
<td>1.2 ± 0.2</td>
</tr>
<tr>
<td>METs (3.5 mL·kg⁻¹·min⁻¹) [exercise]</td>
<td>2.7 ± 0.3</td>
<td>2.0 ± 0.3</td>
</tr>
<tr>
<td>METs (3.5 mL·kg⁻¹·min⁻¹) [post 10 min]</td>
<td>1.5 ± 0.2</td>
<td>1.3 ± 0.2</td>
</tr>
<tr>
<td>HR (beat·min⁻¹) [rest 5 min]</td>
<td>73.8 ± 13.5</td>
<td>72.8 ± 13.5</td>
</tr>
<tr>
<td>HR (beat·min⁻¹) [exercise]</td>
<td>88.0 ± 15.4</td>
<td>80.2 ± 13.6</td>
</tr>
<tr>
<td>HR (beat·min⁻¹) [post 10 min]</td>
<td>75.9 ± 13.2</td>
<td>74.9 ± 15.3</td>
</tr>
<tr>
<td>RPE [after stretching exercises]</td>
<td>10.0 ± 1.7</td>
<td>9.9 ± 1.7</td>
</tr>
<tr>
<td>RPE [after knee-ups]</td>
<td>10.4 ± 1.5</td>
<td>10.0 ± 1.4</td>
</tr>
<tr>
<td>RPE [after squatting/knee extension]</td>
<td>10.6 ± 1.9</td>
<td>10.4 ± 1.7</td>
</tr>
<tr>
<td>RPE [after balance exercises]</td>
<td>10.7 ± 1.4</td>
<td>10.1 ± 1.6</td>
</tr>
</tbody>
</table>
DISCUSSION

Various bodyweight exercise programs have been developed and used worldwide. However, the exercise intensities of only a few of such programs have been objectively and subjectively evaluated (1). The present study investigated the exercise intensity of the “Fujisawa +10 exercise” program, which was designed to increase daily physical activity of elderly female subjects by 10 min through simple exercises. Cardiorespiratory responses and the RPE measurements of the “Fujisawa +10 exercise” program indicated that the exercises were of low-intensity and would be highly suitable as part of an introductory exercise program for elderly individuals (14).

The physical activity position statement of the American College of Sports Medicine for the elderly recommends that if individuals cannot perform physical activity of moderate intensity, they should, at a minimum, engage in regular physical activity and avoid inactivity (2). However, due to physiological deterioration and time constraints, many elderly individuals may be unable to accomplish the recommended physical activity levels (20). In addition, changes in skeletal muscle systems, such as the loss of muscle mass and/or functions, often lead to reduced physical activity (5,7).

Recent studies suggest that light-intensity physical activity may contribute to the maintenance of physical function in the elderly (11,15). Based on these findings and the reported physical activity levels among the elderly, decreasing the amount of physical inactivity may be a more realistic approach for improving health and well-being than achieving the physical activity recommendations (11). However, to our knowledge, few evidence-based low-intensity structured exercise programs have been developed. In this regard, the “Fujisawa +10 exercise” program, which is demonstrated in the present study to be a low-intensity exercise program, may be suitable for increasing physical activity in the elderly.

A few limitations of this study should be considered when interpreting and generalizing the findings. First, because only exercise intensity was investigated, further research is needed to examine the long-term effects of the exercise program on health-related outcomes. Second, because the study subjects had regular exercise habits, further investigations are warranted to examine the exercise intensity of the program in the frail elderly individuals.

CONCLUSIONS

The present study investigated the exercise intensity of the “Fujisawa +10 exercise” program in healthy elderly women. The results suggest that the exercise intensity of the program was equivalent to low-intensity, and that the program would be applicable for the introduction of exercise habits in the elderly.
ACKNOWLEDGMENTS
This research was supported by Comprehensive Research on Aging and Health Science Research Grants for Dementia R&D from the Japan Agency for Medical Research and Development (AMED).

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REFERENCES


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