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Cardiorespiratory Responses of Qi-training: A Pilot Study

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SUMMARY

Six volunteers (mean age=25.7 ± 1.7, height=173 ± 1.9 and weight=63.4 ± 2.3 kg) participated in a graded exercise test and one hour of basic form of *ChunDoSunBup* (*CDSB*) Qi-training to investigate the cardiorespiratory responses and exercise intensity of Qi-training, a Korean traditional psychosomatic training. In the maximal exercise, the trainee showed 96.2 ± 8.89 l/min in ventilation ($\dot{V}E$), 46.0 ± 4.4 in breath frequency (BF), 1.31 ± 0.05 in respiratory exchange ratio (RER), 180.7±3.0 in heart rate (HR), and 2.6±1.1 l/min or 40.7 ± 2.3 ml/kg/ml in oxygen consumption ($\dot{V}O_2$). Qi-training induced significant changes in BF, RER, HR, and $\dot{V}O_2$. The exercise intensity of Qi-training were 42.3%, 46.9% and 38.7% of HR_{max} during the sound exercise, slow motion (haeng-gong) and meditation respectively and the average was 46.2% of HR_{max}. We conclude that Qi-training is an aerobic exercise of a light (mild) intensity exercise, and it leads to decrease the metabolic rate in the trainee by breathing efficiently and relaxing them. In addition, Qi-training may affect cardiorespiratory function of BF, RER, HR and $\dot{V}O_{2max}$ in trainees.

Key words: Qigong; Qi-training; Cardiorespiratory responses

INTRODUCTION

Traditional approaches to exercise have focused mainly on physical fitness enhancement. However, there has been some physiological limit, psychological methods(imagery practice and meditation) have been used as a complementary part in exercise to overcome it (Singer, 1988; Solberg *et al*., 1996). As a combined form of physical and psychological aspect of exercise, eastern traditional methods, Qi-gong (Qi-training) and Tai Chi, deserved more attention for their potential benefits for health maintaining (Jin, 1992; Lee *et al*., 2000a; 2000b; Ryu *et al*., 1995; Tang, 1994).

Qi-training is one of a popular Korean traditional psychosomatic training. Recent studies have demonstrated that Qi-training could reduce anxiety, mood disturbance and symptoms of stress (Lee *et al*., 1997, 2000a). In addition, Qi-training is beneficial to the cardiovascular system, neurohormonal system (Lee *et al*., 2000b; Ryu *et al*., 2000). Although the systemic mechanisms responsible for Qi-training-induced psychoneuroimmunological changes in men have not fully and clearly been explored, the previously mentioned studies have directed that Qi-training induces mental stabilization through the functional change of the brain and subsequently manifests the immunity via neurohormonal cascade (Ryu *et al*. 1995; 2000).

However, the cardiorespiratory responses of Qi-training are unknown. In addition, the exercise intensity of Qi-training remains to be measured. The purpose of this pilot study is to investigate the cardiorespiratory responses in young Qi-trainees.

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MATERIALS AND METHODS

Subjects

Six Qi-trainees, aged between 20 and 30 yrs (mean = 25.7 yrs), who were experienced in *CDSB* Qi-training participated in the study (mean training periods=2.6 ± 0.7 yrs). The mean and standard deviations of the subjectís weight, height, and body surface area were 63.4 ± 5.5 kg, 173.2 ± 4.7 cm, 1.76 ± 0.04 m^2, respectively. None of them were smokers or drinkers.

Each individual arrived at the laboratory and was informed the experimental procedures. Following the instruction, the subjects were required to undergo two experimental tests consisting of Qi-training and grade exercise test. At least 24hrs separated the administration of the two tests. The subjects signed consent forms before participating in the experiment, and they abstained from drinking liquids with caffeine for at least 6 hr prior to testing.

Maximal exercise test

Bicycle exercise testing was conducted no sooner than 3hr after lunch. Each subject performed a progressive exercise protocol on an electrically braked bicycle ergometer in the upright position. The load was increased by 25 W/min until the subject could no longer maintain the pedaling frequency (50-60 rpm). Expired gas was analyzed by an automated system (CardiO_2 gas analyzer, Medgraphic, USA). The exercise test was conducted in an air-conditioned laboratory with atmosphere temperature of 19~23°C and relative humidity of 54~60%. During exercise, continuous electrocardiographic monitoring performed.

The oxygen consumption ($\dot{V}O_2$/kg), ventilation ($\dot{V}E$/*l*), heart rate (HR/beats/min), breath frequency (BF/min), and respiratory exchange ratio (RER) were measured every 30 seconds.

Qi-training

ChunDoSunBup Qi-training - programmed exercise, a Korean traditional Qi-training which has previously been reported by Ryu *et al.* (1995) was performed by subjects for one hour directed by a master at every stage of training. The basic step of i-training consisted of three stages, i.e., sound exercise (T1: reciting Chunmoon - 8 lines of 51 meaningless words) for 25 min, motion (T2) for 15 min, and meditation (T3) for 20 min (*CDSB* Inst. 1992a). Details exercise protocol was described in previous reports.

Statistical analysis

The results are presented as mean ± SD. The values were averaged according to each stage of Qi-training. One way analysis of variances (ANOVAs) with repeated measures was used to evaluate the statistical differences among each stages, pre-training, sound exercise (T1), slow motions (T2), meditation (T3) and post-training of the Qi-training. If this analysis showed a significant main effect ($P<0.05$), subsequent comparisons of stages were done with a post-hoc Scheffe's test.

RESULTS

Mean values of cardiorespiratory measurements at graded exercise test and baseline values are presented in Table 1.

During Qi-training, the values of BF, RER, HR, $\dot{V}O_2$/kg were significantly changed by Qi-training, but $\dot{V}E$ was not. By Scheffeís comparison, there were significant differences across the time. The value of BF during T1 (sound exercise) lower than pre-training, T3(meditation) and post-training (T1<pre, T1<t3 :$p<0.05$; T1<post: $p<0.01$). In RER, T2(motion) <T1 ($p< 0.01$), T3<T1 ($p<0.05$); in HR pre<T2, T1<T2, T3<T2, post<T2 ($p<0.01$), T3<T1, post<T1 ($p<0.05$); $\dot{V}O_{2max}$/kg, pre<T2, T1<T2, T3<T3, post<T2 ($p<0.01$).

Cadiorespiratory responses during the motions in Qi-training and cycle ergometry at the same

Table 1. Cardiorespiratory variables at rest and maximal exercise

Variables	Time	
	Resting	Maximal exercise
$\dot{V}E$ (*l*/min)	8.1 ± 0.9	0.996.2 ± 8.9
BF (breath/min)	12.5 ± 1.7	46.0 ± 4.4
RER	0.95 ± 0.04	1.31 ± 0.05
HR (beat/min)	78.2 ± 3.1	180.7 ± 3.0
$\dot{V}O_2$ (ml/kg/min)	3.9 ± 0.3	40.7 ± 2.3

Values are expressed as mean ± SD. $\dot{V}E$: minute ventilation; HR: heart rate; BF: breathing frequency; RER: respiratory exchange ratio; $\dot{V}O_2$: oxygen uptake

Table 2. Cardiorespiratory responses during the basic motions of Qi-training

Subscale	Pre-training (pre)	Mid-training			Post-training (post)	F	P
		Sound exercise (T1)	Motion (T2)	Meditation (T3)			
$\dot{V}E$ (l/min)	9.06 ± 0.43	10.92 ± 1.49	10.50 ± 0.7	8.22 ± 0.46	8.22 ± 0.46	1.58	0.22
BF (breath/min)	13.9 ± 1.3	6.6 ± 1.2	14.4 ± 1.9	13.6 ± 1.5	16.0 ± 1.9	8.53	0.0003
RER	0.94 ± 0.03	1.08 ± 0.07	1.28 ± 0.46	0.86 ± 0.02	0.96 ± 0.02	6.29	0.002
HR (beat/min)	73.3 ± 4.2	76.5 ± 3.8	84.5 ± 3.6	70.2 ± 3.1	71.1 ± 3.0	28.62	<0.0001
VO_2(ml/kg/min)	4.61 ± 0.22	5.02 ± 0.25	6.17 ± 0.16	4.67 ± 0.18	4.43 ± 0.27	39.24	<0.0001

Values are expressed as mean±SD. VE: minute ventilation; HR: heart rate; BF: breathing frequency; RER: respiratory exchange ratio; VO_2: oxygen uptake

oxygen consumption were different in BF (Qi-training: 14.4 ± 1.9; cycle: 16.9 ± 1.2) and $\dot{V}E$ (Qi-training: 10.5 ± 0.7; cycle: 11.2 ± 1.1) but not significant.

The exercise intensity were 42.3%, 46.9% and 38.7% of HR_{max} in sound exercise, motion and meditation, respectively. The mean exercise intensity of Qi-training was 42.6% of HR_{max}.

DISCUSSION

Qi-training is a Korean traditional psychosomatic training and unique for its composition-sound exercise, haeng-gong (slow movements gathering Qi) and meditation. Like other oriental traditional training, Qi-training is safe even for patients with rheumatoid arthritis and may serve as an alternative for exercise therapy. Many patients have got their health back by Qi-training. However, the benefits of Qi-training on the cardiorespiratory responses have not been studied, and its exercise intensity remains unknown.

In the present study, Qi-trainee (40.73 ml/kg/min) showed similar $\dot{V}O_{2max}$/kg in comparison with Shim *et al.* (39.6 ml/kg/min), but lower than Park *et al.* (58 ml/kg/min) in the same aged Korean subjects. In HR_{max}, Qi-trainees (181 beat/min) show lower than Park *et al.* (189 beat/min, 1993) and Shim *et al.* (198 beat/min, 1986). Further studies are needed to conclude the effects of Qi-training on cardiovascular capacity of normal state.

Respiratory exchange rate showed lower value in the motion and meditation with no significance. Decrease of RER in meditation maybe come from decrease of CO_2 metabolism and PCO_2 in blood (Wolkove *et al.* 1984; Kesterson and Clinch 1989).

At the same oxygen uptake, cardiorespiratory responses (BF and $\dot{V}E$) to Qi-training were lower than those of cycle ergometry. These responses may indicate a more efficient use of ventilation volume, similar to that which has been a relaxation response and Tai-Chi but the values are very lower than those of Tai Chi (Brown *et al.*, 1989).

During the meditations of the Qi-training decrease in minute ventilation and oxygen consumption were found, confirming the findings of previous researchers. The results further indicate that the pattern of more relaxed functioning may generalize outside of meditation, as evidenced by relatively lower baseline levels in the trainees. These findings are significance for prevention medicine, indicating the ability of the Qi-training to produce a metabolic state opposite to that of stress.

The exercise intensity of Qi-training was estimated by HR_{max} while they perform the Qi-training. The exercise intensity of Qi-training were 42.3%, 46.9%, and 38.7% of their HR_{max} during sound exercise, motion and meditation, respectively and the average intensity was 42.6% of HR_{max}. It is very low compared to other intervention, Tai Chi. The results demonstrated that the exercise intensity of the basic step of Qi-training is light for young trainee. Therefore, we believe that exercise intensity of Qi-training is suitable for all ages as aerobic and light exercise.

In summary, the results of the basic motion in Qi-training may indicate more efficient use of ventilation volume, relaxation of the mind and body. In addition, Qi-training is aerobic exercise of light (mild) intensity, and it may be prescribed as a suitable conditioning exercise for all ages. But, the reliability for application of Qi-training as exercise

prescription on elderly or patients with disturbed cardiorespiratory regulation remains to be studied.

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