The effects of the Spironess conditioning method on cardiorespiratory function compared to stepwise-paced breathing in sedentary adults

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ABSTRACT

Noninvasive approaches that effectively improve health include breathing techniques that act on the coupling relationship between cardiovascular and respiratory function. **Purpose**: The aim of this pilot study was to compare the differences between stepwise-paced breathing (SPB) and conditioned breathing exercises (Spironess) in sedentary adults on cardiovascular and respiratory function. **Method**: A total of 8 individuals participated in the breathing study (3 males and 5 females; average age 41.38 years). Participants met virtually twice a week over 5 weeks for a total of 10, 30-minute personalized breathing sessions. Results: Paired t-tests showed a statistically significant difference between before and after resting respiratory rates of (M = 6.51, SD = 2.20), t(3) = 5.93, p<.01 and systolic pressure (M = 4.83, SD = 2.42), t(3) = 4.97, p<.016 of the Spironess group. The repeated measures ANOVA determined that mean resting respiratory rates, F(1.00, 11.274) = 15.542, p = 0.010 and systolic pressure F(1.00, 35.00) = 24.686, p = 0.016 differed statistically significantly between time domains. **Conclusions**: In sedentary populations, resting respiratory rates, and systolic pressure, improved following five weeks of Spironess conditioning. These results suggest that five weeks of Spironess training twice a week improve some key cardiovascular and respiratory parameters without aerobic exercise.

INTRODUCTION

Aerobic exercise is the standardized prescription to improve cardiorespiratory function [4]. Although the benefits of aerobic exercise have been established, sedentary behavior is emerging as a risk factor for cardiovascular health [2]. Sedentary behavior is defined as any waking behavior with an energy expenditure of 1.0 to 1.5 metabolic expenditure units (METs) [3]. Activities with an energy expenditure of 1.0 – 1.5 METs include activities of prolonged sitting/reclining/lying down. The sedentary population include those immobile due to disabilities and physical/mental illness, but also include the growing population of busy students and adults commuting (driving) and sitting at school or work with little to no time for physical activities.

Existing literature has shown that the respiratory and cardiovascular systems are considered coupled oscillators [5]. Due to their close non-linear relationship, the respiratory system (respiration rate) has the ability to manipulate or modify, heart rate, systolic blood pressure, heart rate variability, and cardio-vagal baroreflex sensitivity (BRS), which can increase vagal activity and oxygen saturation [1]. Since the respiratory and cardiovascular systems are coupled oscillators, the purpose of this paper is to determine the extent that breathing exercises improve cardiovascular and respiratory parameters without exercise.

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METHOD

Eight healthy, but sedentary subjects were recruited in this pilot study (Females = 5, Males = 3). The mean age of the Spironess group was 45.8 yo. and the SPB group 37 yo. Participants met for five consecutive weeks on a virtual platform for 30-min. coached breathing sessions twice weekly. Korr CardioCoach and Infiniti ProComp by Thought Technology were used to assess subjects.

Participants were divided into random groups. One group would be led through a stepwise-paced breathing session (SPB) and the other group would be led through a respiratory conditioning program called Spironess. The SPB sessions were divided into three sets of 9-minute rounds. Participants followed a pacer displayed on their screen. The pacer was decreased by .5 breaths per minute at each level. The Spironess breath conditioning sessions were divided into three sets of 10-minute rounds. Each set is composed of two, 5-minute paced breathing exercises, called Diaforce and Suprapnée. The first 5- minutes of each set (Diaforce) involved participants following a pace of forced exhalations after each paced inhalation. The second 5 minutes of each round (Suprapnée) follows a paced breathing ratio that was timed to music. Respiration cycles during this phase of the conditioning is between 1.5 – 3 breaths per minute.

Table 2. Spironess

	Before Spironess	After Spironess	*P* value
Resting HR (bpm)	72.3 ± 7.3	66.25 ± 3.6	0.072
Recovery HR (%)	22.25 ± 7.8	36.0 ± 9.1	0.065
Systolic BP (mmHg)	125.3 ± 11.4	113.3 ± 12.3	0.016
Diastolic BP (mmHg)	81.0 ± 13.4	70.3 ± 9.2	0.052
Resting Respiratory rate (cpm)	14.1 ± 3.8	7.6 ± 2.0	0.010
Resonance Frequency (cpm)	5.9 ± 0.8	5.4 ± 0.6	0.092
VO2Max (ml/kg/min)	27.5 ± 3.4	32.5 ± 4.5	0.067
Aerobic Threshold (ml/kg/min)	14.6 ± 3.5	16.7 ± 2.4	0.187
Anaerobic Threshold (ml/kg/min)	18.0 ± 3.5	18.9 ± 3.2	0.673
RER	0.8 ± 0.1	0.9 ± 0.0	0.808
VE/VO2 (ml/min)	24.8 ± 3.1	25.1 ± 2.1	0.880
VE/VCO2 (ml/min)	30.0 ± 4.2	29.0± 2.8	0.523

Table 3. SPB

	Before SPB	After SPB	*P* value
Resting HR (bpm)	84.3 ± 9.1	83 ± 2.6	0.849
Recovery HR (%)	23.7 ± 2.5	30.0 ± 3.6	0.195
Systolic BP (mmHg)	140.3 ± 19.5	130.3 ± 7.6	0.572
Diastolic BP (mmHg)	88.3 ± 9.1	79.7 ± 6.1	0.355
Resting Respiratory rate (cpm)	11.0 ± 0.9	10.9 ± 1.4	0.931
Resonance Frequency (cpm)	5.5 ± 0.5	5.7 ± 0.4	0.067
VO2Max (ml/kg/min)	33.0 ± 4.5	31.0 ± 5.7	0.153
Aerobic Threshold (ml/kg/min)	20.8 ± 8.9	16.4 ± 6.4	0.358
Anaerobic Threshold (ml/kg/min)	27.9 ± 8.6	26.4 ± 8.3	0.111
RER	0.8 ± 0.1	0.8 ± 0.0	0.921
VE/VO2 (ml/min)	22.1 ± 1.2	21.1 ± 2.1	0.410
VE/VCO2 (ml/min)	27.6 ± 1.7	25.2 ± 2.8	0.333

All data are expressed as mean ± SD values.
SPB: Stepwise-Paced Breathing, HR: heart rate, RER: respiratory exchange ratio

RESULTS

The paired t-test showed a statistically significant difference between before and after systolic pressure (M = 4.83, SD = 2.42), t(3) = 4.97, p<.016 (Table 4) of the Spironess group with the repeated measures ANOVA of systolic pressure F(1.00, 35.00) = 24.686, p = 0.016 (Table 2). The paired t-test also showed a statistically significant difference between before and after resting respiratory rates of (M = 6.51, SD = 2.20), t(3) = 5.93, p<.01 (Table 4) and the repeated measures ANOVA determined that mean resting respiratory rates, F(1.00, 11.274) = 15.542, p = 0.010 (Table 2).

Table 4. Paired *t* test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	B_SYS – A_SYS	12.000	4.830	2.415	4.314	19.686	4.968	3	.016
Pair 2	B_DIA – A_DIA	10.750	6.850	3.425	-.149	21.649	3.139	3	.052
Pair 3	B_RHR – A_RHR	6.000	4.397	2.198	-.997	12.997	2.729	3	.072
Pair 4	B_HRR – A_HRR	-13.750	9.639	4.820	-29.088	1.588	-2.853	3	.065
a. Group = Spironess									
Pair 2	B_RRR – A_RRR	6.5075	2.1967	1.0984	3.0120	10.0030	5.925	3	.010
Pair 3	B_VO2 – A_VO2	-5.07500	3.60867	1.80434	-10.81720	.66720	-2.813	3	.067

CONCLUSION

The results presented in this work indicate that the Spironess method leads to significant improvements in systolic blood pressure and resting respiratory rates apart from exercise. It potentially could also improve diastolic blood pressure, resting heart rate and recovery heart rate. The Spironess protocol may be used to improve cardiorespiratory systems in sedentary populations which would potentially remove barriers to starting exercise regimes. Although the Spironess method is not designed to replace aerobic exercise, it does offer some benefits found through aerobic exercise that would benefit populations that are immobilized or precluded from partaking in aerobic exercise. The findings in this study also provides a methodology to globally improve the musculature needed to execute all breathing techniques which could directly correlate to the amount of time needed to benefit from the various breathing techniques used across disciplines.

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