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Initial Effects of Different Recovery Methods of Vital Sign After

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Abstract

Hypertension is recognized as a risk factor that will continue in the future, and a study was undertaken to find out how to quickly and safely recover elevated blood pressure after exercise to reduce blood pressure stably. HR, BP, and SpO2 were measured using the target heart rate (THR) 60% and RPE. Statistical analysis was carried out by SPSS 20.0 version program. One-way ANOVA was performed to compare the homogeneity between groups and the difference of dependent variables according to the recovery method after exercise. Experimental results showed that SBP, DBP, and HR were significantly different after exercise, 2 minutes, 5 minutes, and 10 minutes, respectively. There was no significant difference in saturation. As a result of post hoc analysis, SBP and DBP showed significant results between groups and most of them showed significant values. HR showed significant results immediately after exercise, after 2 minutes, after 5 minutes) and after 10 minutes. After exercise, low-intensity exercise and diaphragmatic breathing showed greater and faster recovery than normal in SBP, DBP, and HR.

Keywords: Blood Pressure, exercise, recovery, vital sign, heart rate

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Introduction

Blood pressure increases with physical activity, and hypertension is an ongoing risk factor for the future (Miyai N et al., 2013). The WHO calls high blood pressure a silent killer and explains that it can cause many diseases, premature death and disability. One in three adults says they have high blood pressure, and they don't recognize high blood pressure because symptoms don't

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always occur. As a result, nine million people die each year, with about half of all deaths from heart disease and stroke. The risk of hypertension is emphasized, and consequently, studies on hypertension are increasing, and many studies recommend moderate intensity exercise control as one of the initial treatments for reducing blood pressue in mild hypertension (Campbell NR et al., 1999). Previous studies did not reveal the definitive mechanism underlying post-exercise hypotension (PEH), but mainly showed reduced vascular resistance. Previous studies have shown that aerobic exercise reduces blood pressure and ambulatory blood pressure (ABP), treating hypertensive patients and risking cardiovascular risk. Aerobic exercise reduces blood pressure rise in response to muscle contraction, which is partly due to the metabolism of trained muscles (Fisher JP and White MJ., 2004). The mechanisms that contributed to the onset of exercise and changes in heart rate during exercise were also studied. There is less interest in the things that cause the heart rate to drop when you stop exercising. In recent years, however, clinicians have recognized the prognostic value of post-exercise heart rate reduction as an indicator of mortality in patients at risk for cardiovascular disease (Coote JH., 2010). Heart rate recovery (HRR) is a preliminary indicator of cardiovascular disease. HRR of post exercise is also controlled by the interaction between sympathetic and parasympathetic nerves, and post-exercise, parasympathetic reactivation and sympathetic relaxation both lower the heart rate to pre-exercise levels (Kohli U et al., 2015). Previous studies have shown that post-exercise reduction in heart rate is almost exclusively controlled by parasympathetic reactivation, as opposed to sympathetic relaxation, and post-exercise exercise reduction affects fitness and overall cardiovascular health (McDonald KG et al., 2014). Low intensity exercise in heart rate recovery after exercise is said to lower blood pressure and not increase plasma catecholamine's, and low intensity exercise programs may be desirable for hypertensive patients. In other words, low-intensity exercise may help the BP recover (Hua LP et al., 2009). There are also studies on HRR after exercise that can be done not only by low-intensity exercise but also by breathing. Previous studies have shown that the decrease in resting blood pressure, compared to that obtained with whole body exercise, is also seen in the practice of yoga and meditation, and the general feature of this technique is slow and regular breathing (Jones CU et al., 2015). Many randomized controlled studies have also shown that slow breathing is effective in lowering blood pressure (Sharma M et al., 2012). As research on breathing progresses, there are studies

Table 1. Characteristics of participants

variable	General group(a)	Low intensity exercise(b)	Diaphragmatic breathing(c)	F
Age	32.53 ±14.17	31.86 ±13.95	29.60±9.17	.222
Height	164.26±6.45	167.23±10.41	174.06±5.71	6.222*
Weight	63.22±10.33	70.11±15.65	78.34±14.24	4.644
BMI	23.40±3.49	24.78±3.22	25.78±12.24	1.633

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Body fat percentage	27.43±4.85	26.95±9.25	22.62±4.72	2.404
PP	41.93±7.67	46.46±5.98	48.33±6.44	3.577*
MBP	94.97±11.92	95.22±9.96	100.11±6.42	1.335
MHR	187.46±14.17	188.13±13.95	190.40±9.17	.222
HRR	112.60±18.99	112.13±15.44	113.53±16.47	.026
THR	142.42±8.58	143.28±10.06	144.98±4.74	.387

*$p<0.05$

on the diaphragm that are intuitively related to breathing. In particular, there are many studies related to diaphragmatic breathing. Previous studies have defined that diaphragmatic respiration is diaphragmatic breathing, and diaphragmatic breathing has been used in part, with an emphasis on yoga, Pilates, and core stability, and in areas of alternative medicine (Fayh A et al., 2018). Respiratory movements and respiratory control are said to be viable treatment options for hypertension, and a decrease in respiratory rate lowers the BP by more control of the cardiovascular (Ferreira JB et al., 2013). Therefore, the aims of this study were to recover the elevated BP quickly and safely after exercise, and to study whether to do nothing and to find the stability of breathing and low intensity exercise faster.

Materials and Methods

Subject

The subjects of this study were members of I-health center in U city and P-health center in S city. Forty-five subjects were selected from 20s to 50s regardless of male and female. Patients with medical history, pain or discomfort due to running movements, those with orthopedic problems including ankles or knees recently, and those with abnormal blood pressure ranges were excluded from the experiment. Forty-five subjects were randomly assigned to three groups: 15 normal rests, 15 diaphragmatic breaths, and 15 low-intensity exercise (light walking) in Table 1. Normal rest, diaphragm breathing, and low intensity exercise (light walking) were performed as a single intervention after baseline measurements. The evaluation items were heart rate, blood pressure, and oxygen saturation. Blood pressure monitor (Rossmax internation al Ltd. Taiwan) was used to measure BP and HR, and pulse oximeter (B. choice Electronic co., Ltd, China OEM) was used to measure oxygen saturation and heart rate in Figure 1. In addition, the pre-inspector evaluator received one hour of safety training to prepare for safety incidents

Table 2. Changes in vital signs after activity

Variable		General group(a)	Low intensity exercise(b)	Diaphragmatic breathing(c)	F	Post hoc tests
SBP	Stable	122.93±14.43	126.20±12.40	132.33±9.22	2.291	-
	Right after	138.00±19.74	175.13±33.11	148.60±13.00	9.944*	*a<c<b*
	2 minutes later	133.26±15.71	176.13±30.09	140.60±6.18	19.866*	*a<c<b*

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	5 minutes later	128.60±15.80	160.66±27.59	132.00±9.95	12.573*	*a<c<b*
	10 minutes later	126.00±15.17	126.46±12.71	128.60±7.64	.192	-
DBP	Stable	81.00±11.34	79.73±9.16	84.00±5.75	.879	-
	Right after	86.80±11.47	127.73±28.47	94.73±13.75	18.742*	*a<c<b*
	2 minutes later	84.66±10.11	125.13±27.31	88.73±10.01	23.554*	*a<c<b*
	5 minutes later	81.66±13.71	113.53±25.25	80.80±7.20	17.730*	*c<a<b*
	10 minutes later	79.66±11.28	79.06±9.47	82.73±7.66	.631	-
HR	Stable	74.86±9.96	76.00±10.21	76.86±9.63	.153	-
	Right after	137.93±12.61	146.80±15.80	136.06±13.82	2.466*	*b>c*
	2 minutes later	97.20±13.05	106.93±10.21	91.13±12.21	6.744*	*c<a<b*
	5 minutes later	92.86±10.70	93.46±9.31	85.40±9.93	3.027*	*c<a<b*
	10 minutes later	88.33±9.82	79.13±8.00	78.73±8.35	5.760*	*c<b<a*
Saturation	Stable	96.73±1.16	96.00±2.07	96.80±1.32	1.201	-
	Right after	96.66±1.04	96.20±1.65	96.66±1.67	.491	-
	2 minutes later	96.86±1.18	96.00±1.60	96.60±1.63	1.330	-
	5 minutes later	96.60±2.02	96.06±1.27	96.53±1.59	.458	-
	10 minutes later	96.60±1.18	96.06±1.38	96.60±1.40	.806	-

$*P<0.05$

that may occur during the intervention and evaluation. Using a blood pressure monitor, an oxygen saturation meter, and a cycle, the investigator explained the purpose, method, and precautions of the cardiopulmonary function test to the subject before conducting the cardiopulmonary function test. gave. After sufficient explanation, subjects measured heart rate, blood pressure, and oxygen saturation at bicycle in Figure 2 while maintaining their exercise intensity at THR (60%) and RPE 13 levels of `` a little hard ''.

General group

In order to set the default value, a sufficient rest was given for 5 minutes before the cycle. To set the default value, a 5-minute cycle was performed with a target heart rate (THR) of 60%. At this time, the intensity of the test was continuously monitored using Rated Perceived Exertion (RPE) Scale developed by Gunner Borg to maintain the RPE level of 'Slightly Hard'. The items to measure are heart rate, blood pressure and oxygen saturation. After measuring the basic value, the patient was allowed to rest without any intervention in order to obtain the mediation value, HR, BP, SPO2 were measured after exercise 0minute, 2minute, 5 minute, and 10 minute in Figure 3.

Low intensity exercise group

In order to set the default value, a sufficient rest was given for 5 minutes before the cycle. To set the default value, a 5-minute cycle was performed with a target heart rate (THR) of 60%. At this time, the intensity of the test was continuously monitored using Rated Perceived Exertion (RPE) Scale developed by Gunner Borg to maintain the RPE level of 'Slightly Hard'. The items to measure are heart rate, blood pressure and oxygen saturation. After measuring the basic value, the patient was allowed to rest without any intervention in order to obtain the mediation

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value, HR, BP, SPO2 were measured after exercise 0minute, 2minute, 5 minute, and 10 minute in Figure 4.

Diaphragmatic breathing group

In order to set the default value, a sufficient rest was given for 5 minutes before the cycle. To set the default value, a 5-minute cycle was performed with a target heart rate (THR) of 60%. At this time, the intensity of the test was continuously monitored using rated perceived exertion (RPE) Scale developed by Gunner Borg to maintain the RPE level of 'Slightly Hard'. The items to measure are heart rate, blood pressure and oxygen saturation. After measuring the basic value, the patient was allowed to rest without any intervention in order to obtain the mediation value, HR, BP, SPO2 were measured after exercise 0minute, 2minute, 5 minute, and 10 minute in Figure 5.

Analysis

All statistical analyzes were performed using the SPSS 20.0 version program. One-way ANOVA was performed to compare the dictionary homogeneity between groups and the difference of dependent variables according to the recovery method after exercise. LSD was performed as a post-hoc. All statistical significance levels were below 0.05

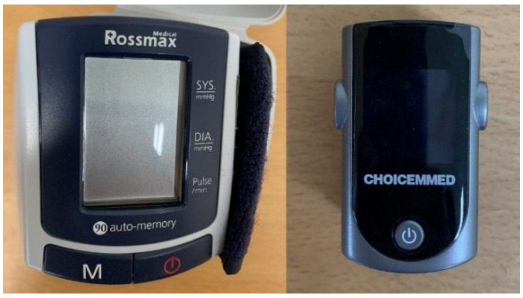

Figure 1. Blood Pressure Monitor and pulse oximeter

Figure 2. bicycle

Figure 3. General group

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Figure 4. Low intensity exercise

Figure 5. Diaphragmatic breathing

Results and Discussion

Our study was conducted to investigate the immediate effects of various recovery methods on vital signs after exercise in Table 2. There was a significant difference among groups in SBP immediately after exercise (p <0.00). In the post hoc analysis, the SBP group showed a significant difference from the low intensity exercise (p <0.00), and the low intensity exercise showed a significant difference from the general group (p <0.00) and the diaphragmatic breathing (p <0.00). Diaphragmatic breathing was significantly different from low intensity exercise (p <0.00). Overall, the general group was the lowest, followed by the lower diaphragmatic breathing and the lowest intensity exercise (a <c <b). After 2 minutes, there was a significant difference between the groups in the SBP (p <0.00), and in the post hoc analysis, the general group showed a significant difference from the low intensity exercise (p <0.00). 0.00), and diaphragmatic breathing were significantly different (p <0.00), and diaphragmatic breathing was significantly different from low intensity exercise (p <0.00). Overall, the general group was the lowest, followed by the lower diaphragmatic breathing and the lowest intensity exercise (a <c <b). After 5 minutes, there was a significant difference between the groups in the SBP (p <0.00). 0.00), and diaphragmatic breathing were significantly different (p <0.00), and diaphragmatic breathing was significantly different from low intensity exercise (p <0.00). Overall, the general group was the lowest, followed by the lower diaphragmatic breathing and the lowest intensity exercise (a <c <b). After 10 minutes there was no significant difference in SBP. Immediately after exercise, DBP showed significant differences between groups (p <0.00).

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Post hoc analysis showed that the general group showed a significant difference from the low intensity exercise (p <0.00), and the low intensity exercise showed a significant difference from the general group (p <0.000) and the diaphragmatic breathing (p <0.00). Was significantly different from low intensity exercise (p <0.00). Overall, the general group was the lowest, followed by the lower diaphragm breathing and the lowest intensity exercise (a <c <b). After 2 minutes, DBP showed a significant difference between groups (p <0.00), and after the analysis, the general group showed a significant difference from low intensity exercise (p <0.00). 0.00), and diaphragmatic breathing were significantly different (p <0.00), and diaphragmatic breathing was significantly different from low intensity exercise (p <0.00). Overall, the general group was the lowest, followed by the lower diaphragm breathing and the lowest intensity exercise (a <c <b). After 5 minutes, DBP showed significant differences between the groups (p <0.00), and after the analysis, the general group showed a significant difference from the low intensity exercise (p <0.00). 0.00), and diaphragmatic breathing were significantly different (p <0.00), and diaphragmatic breathing was significantly different from low intensity exercise (p <0.00). Overall, diaphragmatic respiration was the lowest, followed by the lower general group and the highest intensity exercise (c <a <b). After 10 minutes, DBP showed no significant difference. There was no significant difference between groups in HR immediately after exercise (p <0.09). In post hoc analysis, low intensity exercise was significantly different from diaphragmatic breathing (p <0.04), and diaphragmatic breathing was significantly different from low intensity exercise (p <0.04). Overall, diaphragmatic breathing was the lowest, followed by the lower general group and the highest intensity exercise (c <a <b). After 2 minutes, HR showed significant differences among the groups (p <0.00), and after the analysis, the general group showed a significant difference from the low intensity exercise (p <0.03). 0.03), diaphragmatic breathing was significantly different (p <0.00), and diaphragmatic breathing was significantly different from low intensity exercise (p <0.00). Overall, diaphragmatic breathing was the lowest, followed by the lower general group and the highest intensity exercise (c <a <b). After 5 minutes, there was no significant difference among groups in HR (p <0.05). Post hoc analysis showed that the general group showed a significant difference from diaphragmatic breathing (p <0.04), and the low intensity exercise showed a significant difference from the diaphragmatic breathing (p <0.03). There was a significant difference from the intensity exercise (p <0.03). Overall, diaphragmatic breathing was the lowest, followed by the lower general group and the highest intensity exercise (c <a <b). After 10 minutes, HR showed significant differences between the groups (p <0.00), and post hoc analysis showed that the general group showed a significant difference between low intensity exercise (p <0.00) and diaphragmatic breathing (p <0.00). Low intensity exercise was significantly different from general group (p <0.00), and

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diaphragm breathing was significantly different from low intensity exercise (p <0.00). Overall, diaphragmatic respiration was the lowest, followed by the low intensity exercise and the highest in the general group (c <b <a). There was no significant difference among groups in 0,2,5,and 10 minutes. The aim of our research was to investigate the effect of recovery after exercise on vital signs. Forty-five subjects set the exercise method to borg scale and THR 60% during exercise, and measured vital signs by dividing into normal, low intensity exercise and diaphragmatic breathing after exercise. All the subjects studied in a safe state. The experimental results showed significant results in SBP, DBP and HR according to the recovery method after exercise, but not in saturation. Previous studies have shown that this BP response was greater after higher intensity, short duration (INT) competition compared to LMOD despite other cardiovascular adjustments including cardiac output (CO) and total peripheral resistance (TPR). As a result of our study, exercise could be prescribed at lower intensity for longer periods of time, leading to a beneficial effect of lowering blood pressure immediately after exercise. It supports the theory. In addition, a decrease in TPR occurred after all exercise competitions in this study, indicating that the amount of exercise in all trials in this study is sufficient to induce immediate neurological and vascular components associated with sympathetic vascular control and the 'dose' of exercise. It is said to be clinically similar when (strength, duration) is the same as for normal blood pressure individuals (Jones H et al., 2007). Also, exercise training has been shown to induce a systematic adaptation of arterial walls in healthy individuals, which can be interpreted as better arterial vascular adaptation that can promote a decrease in peripheral resistance after an exercise session. The study also interprets this as being caused by low intensity, and supports the study that individuals with more physical activity achieve higher BP reductions after exercise sessions. The higher the initial blood pressure, the greater the change in blood pressure after exercise as determined by outpatient measurements. This study found that jogging was a mode of exercise that led to greater magnitudes of SBP and DBP changes, and demonstrated that the longer the exercise time, the greater the SBP decrease. The change is supporting large things. These results also appear to be consistent with previous reports that relate to overall exercise workload, not PEH and exercise performance intensity, and that exercise leads to systematic adaptation of the arterial wall to healthy individuals and is more likely to promote decreased peripheral resistance after exercise. It is interpreted as better arterial duct adaptation and reports higher BP reduction after exercise (Carpio-Rivera E et al., 2016). Previous studies suggest that low-intensity exercise may be beneficial (Lemaitre RN et al., 1999). In the early stages of exercise, a gradual increase in sympathetic activation was observed as the parasympathetic effect on HR immediately decreased and exercise intensity increased (Lemaitre RN et al., 1999). Significant differences in low-intensity exercise in this study

supported the reactivation of parasympathetic nerves and retraction of sympathetic nerves as exercise progressed, supporting that heart autonomic tone and heart rate were affected by breathing patterns (Boussuges A et al., 2018). And HRR have been reported to rely on parasympathetic reactivation and progressive sympathetic blockade at the same time, and found that moderate aerobic exercise can improve HRR due to glycemic control, resting heart rate and physical fitness, thus improving exercise intensity (Molina GE et al., 2016). It is thought that in the early post-exercise period, the parasympathetic nerve regulates the sino-atrial node and the heart rate decreases. Interactions have traditionally been viewed from an interactive point of view, but there is evidence that these interactions are synchronous and synergistic (Georgiopoulou VV et al., 2012). Increased slope or response of the heart rate from rest to anaerobic thresholds suggests an improvement in the balance between the sympathetic and parasympathetic nervous system because the interaction between the sympathetic and parasympathetic nervous system exists throughout the movement (Pierpont GL and Voth EJ., 2004). It has been shown to favorably alter chest dynamics (reduce chest pressure) and improve sympathetic hyperactivity (Macefield VG., 1998). Previous studies have shown that low-intensity exercise and diaphragmatic breathing in the post-exercise recovery phase lower BP and HR more than usual, and the exact pathophysiological mechanism of the rapid recovery effect of BP and HR is unclear (Englund E et al., 2018). In addition, it is because the blood supply to the blood vessels of the whole body by simple body movement or abdominal pressure. However, the limitation of this study was that it was difficult to accurately measure BP and HR during low-intensity exercise during post-exercise recovery phase. Therefore, it is predicted that if the individual is highly skilled in the recovery method, different results will be produced.

Conclusion

The conclusion of this study was that recovery exercise was effective for heart rate recovery. Also, during the initial 5 minutes after exercise, abdominal breathing exercise was more effective in recovering heart rate than low intensity aerobic exercise. After 5 minutes, low intensity aerobic exercise is more effective than abdominal breathing. Therefore, based on the results of this study, it is recommended to perform abdominal breathing for the first 5 minutes and low intensity aerobic exercise after 5 minutes to recover the heart rate after exercise. It is hoped that this study will be used as an intervention method for heart rate recovery after exercise.

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