Effects of Reflexive Performance Reset on Heart Rate and Blood Lactate Response to Repeated Sprints

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Abstract

Reflexive Performance Reset (RPR) is a sequence of neural activation techniques that may improve neural feedback during exercise and recovery. The purpose of this study was to investigate the immediate effects of one week of RPR on wrestling athletes' heartrate (HR) and associated anaerobic metabolites during repeated sprints. Eleven male high school wrestlers (age 15.5 ± 1.6 years) participated in this quasi-experimental study. Subjects performed ten, 60-meter sprints with one-minute rest intervals between sprints. Subjects then performed RPR for six consecutive days and then re-performed the sprinting test. Mean HR recovery showed a significant reduction in the post-test (127.4 ± 5.71 vs 122.8 ± 6.86 bpm, $P=0.04$). Blood lactate levels also showed a significant decrease (11.1 ± 1.51 vs 8.8 ± 1.47 mmol/liter, $P \leq 0.01$). RPR may help athletes recover faster with reduced metabolic stress thus, should be integrated in warm-up procedures prior to practices requiring repeated bouts of effort.

Methods

Eleven male high school wrestlers, average age 15.5 years, participated in this study at the end of their regular season for wrestling in 2021. Subjects were excluded from the study if they presented any conditioning or were on any medication that could preclude their HR, breathing, or ability to run. During the course of the study, subjects were asked to maintain their normal daily routines but avoid drinking alcohol, caffeine, and avoid intense physical activity 24 hours prior to testing.

Pre-testing Procedures

Subject Preparation.

In accordance with the Declaration of Helsinki, this study was approved by the Institutional Review Board, and subjects provided informed consent prior to participation. The purpose and procedures of the study were given to all the subjects prior to testing. Subjects then attached a HR monitor to oneself and completed their practice warm-up procedures used during normal wrestling practices.

Day of Repeated Sprinting Test.

Subjects showed up to the gymnasium individually at specific times. First, body mass, height, body composition, and a health history survey were recorded; body compositions were recorded for each participant using a bioelectric impedance. After all basic data were collected by a researcher, subjects were instructed to go to the track.

All testing was performed one participant at a time on an indoor Mondo surface track including a curve and straight away segment. After warm-ups, subjects completed ten, 60-meter sprints including one-minute rest periods between each sprint in which they slowly walked approximately 35 meters across the interior of the indoor track back to the starting area. Subjects were instructed to complete all sprints at 100% maximal effort. HRs were continually monitored and recorded at one-second intervals during sprints and recovery periods with a Polar V800 watch. HR data were downloaded from the watch using Polar software. Each sprint was timed with laser timing gates.

Blood lactate testing.

After the last one-minute rest period following all ten sprints, blood was drawn for a blood lactate test from each participant. Briefly, a trained researcher using a single-use retractable lancet obtained approximately 50 µL sample of blood via fingerstick. All lactate samples were measured in duplicate using a hand-held dry chemistry analyzer. If the two readings were not within one mmol of each other, a third reading was taken and was ensured to be within one mmol of one of the first two readings.

Reflexive Performance Reset Procedures

Approximately ten minutes after completing the sprinting test, when subjects felt ready, subjects went to a separate room with a researcher. During that time, subjects were taught the RPR *wake up drills*. RPR *wake up drills* consisted of subjects using their thumbs to rub specific reflexive points on specific areas of their body. The specific reflex points, along with instructions on how to perform the *wake up drills*™ are shown in *Figure 1*.

Figure 1: Reflexive Performance Reset Wake Up Drills

Subjects were then asked to join a zoom meeting the day after the pre-test to perform the first RPR® intervention. Subjects chose a time in the morning to meet via zoom and were walked through RPR by a researcher using a video, the researcher ensured that cameras were on and all subjects were participating. After that day, for the next five consecutive days, subjects performed RPR prior to warm-ups for any practices or competitions. A researcher was present during all RPR interventions to ensure RPR was being done properly.

Post-test Procedures

After the six consecutive days of performing RPR, subjects returned to the gymnasium for the post-test. Subjects were scheduled at the same time of day as the pre-test. Procedures for the post-test were the same as the pre-test procedures with RPR added to the warm-up routine.

Results

Stress on the cardiovascular system was similar in the pre-test and post-test, which may be related to peak HR. Peak HR was the highest HR recorded during each of the ten individual sprints. Peak HR over all ten sprints for the 11 subjects showed similar results in the pre-test (148.1 ± 1.3 bpm) to their post-test (148.7 ± 0.4 bpm). Thus, there was no significant difference following a one-week RPR® intervention for peak HR (P=0.15) in pre-test and post-test data (*Figure 2*).

Figure 2: Mean Peak HR found over all 10 sprints for all subjects pre-test and post-test.

Similarly, peak HR was related to sprinting times. Mean sprint times over all ten sprints for the 11 subjects showed similar times for both pre-test and post-tests (8.08 ± 0.3 seconds & 8.04 ± 0.3 seconds, respectively). No differences were found in sprinting times (P=0.20) from pre-test to post-test (*Figure 3*).

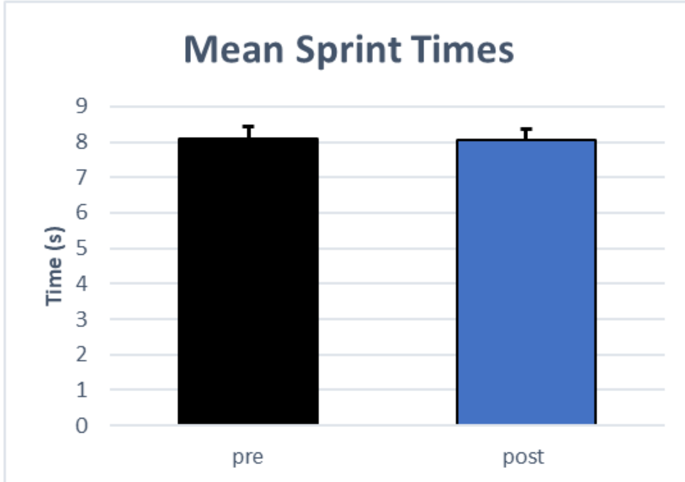

Figure 3: Mean Sprint Times recorded for all 10 sprints for all subjects pre-test and post-test.

Although stress on the cardiovascular system was similar in both tests, subjects showed a reduction in recovery HR in the post-test compared to that of the pre-test. Recovery HR was the lowest HR recorded in all ten of the rest periods, which were the minute intervals following each individual sprint. Pre-test recovery HR was significantly greater than that of the post-test (127.4 ± 5.71 bpm and 122.6 ± 6.86 bpm, respectively; P=0.04). Reduction in recovery HR is shown in *Figure 4*.

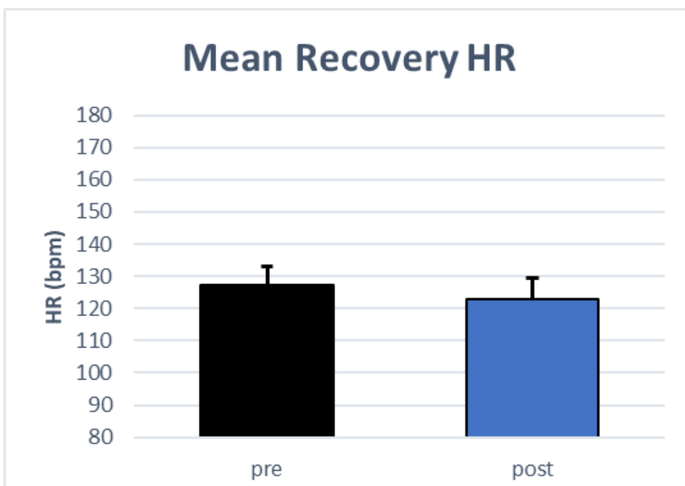

Figure 4: Mean Recovery HR recorded during all 10 recovery periods after all 10 sprints for every subject pre-test and post-test.

When analyzing associated anaerobic metabolites between both tests, blood lactate concentrations were lower in the post-test (8.8 ± 1.47 mmol/liter) than in the pre-test (11.1 ± 1.51 mmol/liter). Thus, subjects showed a significant decrease in blood lactate concentrations from pre-test to post-test (11.1 ± 1.51 mmol/liter and 8.8 ± 1.47 mmol/liter, respectively; P≤0.01). Reduction in blood lactate concentration is shown in *Figure 5*.

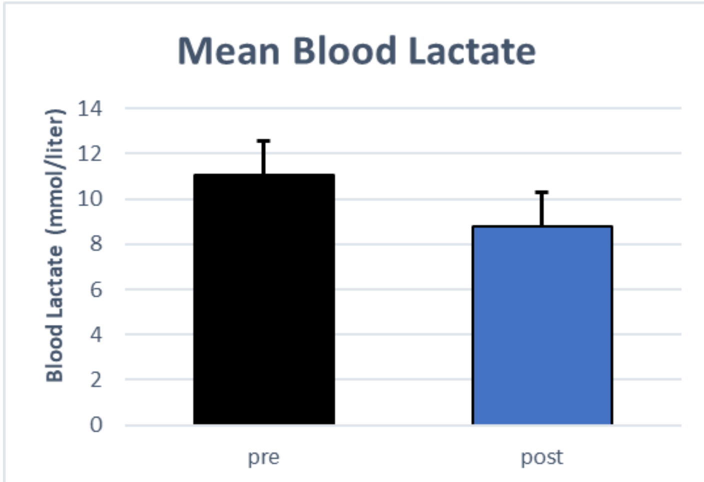

Figure 5: Mean Blood Lactate Concentrations recorded after the last recovery period for all ten subjects, pre-test and post-test.

Thus, HR was continually monitored throughout the entire sprinting tests. There was no difference found in peak HR but a significant decrease found in recovery HR after one week of RPR® interventions. The representative subject's data is shown in *Figure 6*, pre-test, and *Figure 7*, post-test.

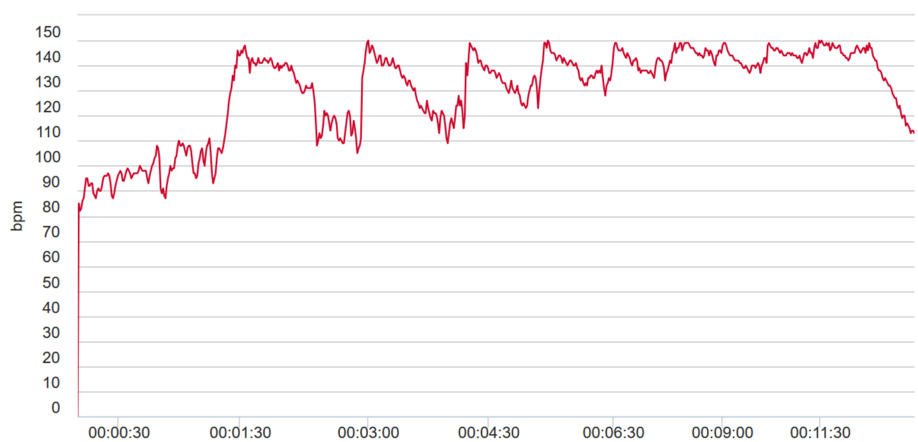

Figure 6: Representative subject's raw data for HR over all 10 sprints in pre-test.

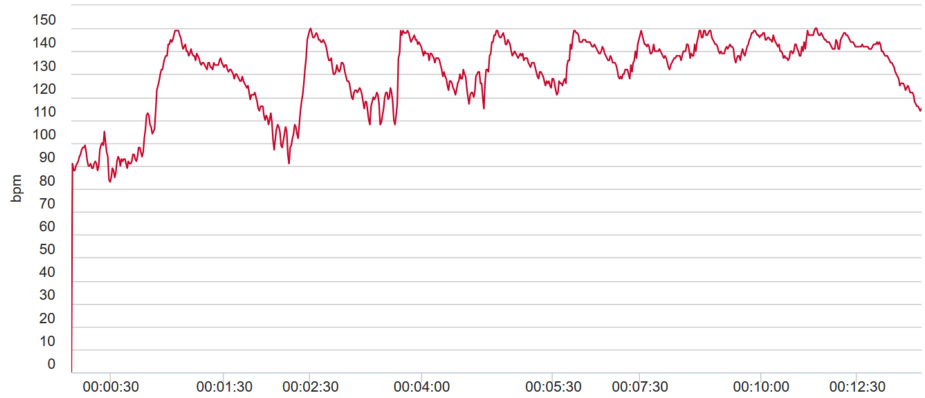

Figure 7: Representative subject's raw data for HR over all 10 sprints in post-test.

As you can see in *Figure 6* and *Figure 7* HR were recorded and plotted on a table with bpm on the Y-axis and time on the X-axis. The red line indicated the HR recorded every second during the sprints. In *Figure 6*, the subject ran ten, 60-meter sprints prior to performing RPR. The sprints can be noticed where the HR peaks and recovery periods can be seen once HR starts to drop. Once the subject reached their sixth sprint, it is hard to distinguish recovery periods leading up to the tenth sprint. One week later, after RPR interventions, the subject showed more distinguishing rest periods near the end of their ten sprints (shown in *Figure 7*) opposed to their pretest. This specific subject was able to get their HR up to 150 bpm during their pretest as well as during their post-test. Although, the subject's lowest recovery HR during the pretest was recorded at 114 bpm compared to 94 bpm after one week of RPR.

Conclusion

A main focus when training athletes is to increase overall athletic performance. If an athlete is able to train at higher intensities and recover faster during short periods of time, whether in a game, match, or during practice. The athlete will be able to perform to their greatest potential. This study provides evidence that RPR, when used as a warm-up procedure, helps individuals recover faster between sprints. This may have been due to shifting sympathetic outflow during recovery to a more parasympathetic state which helped lower HR faster. RPR® also decreased blood lactate concentrations which may have been due to shifting neuromuscular compensation patterns thus, decreasing the stress put on the body during all ten sprints. Thus, RPR® may be used as a component of warm-up before any practices that require repeated bouts of effort.