**A PRIMER ON HEART RATE VARIABILITY (HRV)**

Hello this is Doc Z. Today, I want to talk to you about Heart Rate Variability or more commonly called HRV  
  
Whether you are a serious competitive athlete, or someone that is simply a fitness enthusiast you have probably heard of the term “Heart Rate Variability”.  Some of you may have in fact used it in your training but perhaps for others -not so much. As part of our educational effort in promoting Cognitive Fitness for Blayze members, I would like to  provide you with a bit of history about HRV followed by a description of its basic physiology without boring you, and lastly how monitoring and training HRV will contribute to making you a healthier more fit individual.   
  
In recent years, Heart rate variability (HRV) has emerged as a practical, noninvasive tool to quantitatively measure cardiac activity and the balance of one’s autonomic nervous system.  This is not unlike how we have used blood pressure to measure the health of one’s heart and blood vessels.   
  
First of all I want to emphasize that HRV is NOT heart rate, although for sure is related to it. Heart Rate Variability is simply a measure of the variation in time between each heartbeat or what cardiologists refer to as R-R peaks. While it is “normal” to assume that if your resting heart rate is  say 60 beats per minute, that there is a constant 1-second spacing between beats, but- this is not the case.  Sometimes the spacing between beats may be .8 sec and on other beats it might be 1.3 sec.   
  
This small variation is controlled by the autonomic nervous system or ANS. The ANS is subdivided into two large components, the sympathetic branch also known as the stressful, fight-or-flight component, and then there is the parasympathetic branch, that is associated with the slowing down activities of the body or what I like to call the “relaxation response”. You may recall that I mentioned the Autonomic Nervous system on an earlier episode where I discussed “resonance breathing” in the audio entitled, “The Power of Your Breath”. In summary, HRV allows us to objectively measure how physical, mental, and emotional stress is impacting your body.  
  
**So Why monitor heart rate variability?**  
Monitoring your HRV first thing each morning while at rest will give you insight into the balance or imbalance of your autonomic nervous system.  
  
If your body is in a stressed, fatigued, or in a fight-or-flight mode, the variation between subsequent heartbeats will be low. If you are in a more relaxed or “recovered” state, the variation between beats will be high. In other words, the healthier your ANS the faster you are able to switch gears, showing more resilience and flexibility in your decision-making. Over the past few decades, research has shown a relationship between low HRV, worry and anxiety. On the other hand, Individuals who consistently show a high HRV generally have greater cardiovascular fitness and are more resilient to stress. However, like with measuring blood pressure, it is important to know that a single low or single high HRV value should not be interpreted as good or bad.  It depends on many factors (e.g. sleep, diet, hydration), factors you will better understand as you engage in HRV monitoring.   
  
**How do you monitor your heart rate variability?**  
Historically, the gold standard for measuring HRV is to analyze a long strip of an electrocardiogram (EKG), a test usually done in a medical office or laboratory where sensors are attached to the chest. But in recent  years, several companies have launched apps and heart rate monitors that capture HRV nearly as accurately as an electrocardiogram which is amazing. The easiest and least expensive way to check and monitor HRV is to buy a heart monitor chest strap from a company like Polar or First Beat and download a free app to analyze the data.  Elite HRV is a wonderful app as is Kubios (spell out). Elite HRV also sells a finger sensor called (CorSense) that works on photoelectric plethysmography or PPG. Photo plethysmography (PPG), is a simple, non-invasive and low-cost optical technique that can be utilized to detect blood volume changes in the bed of tissue usually the forefinger.   
  
Recently a company called HRV4 Training has developed an App that uses your cell phone camera as a PPG sensor and it is amazingly accurate. All you have to do is put your finger under the camera light and you are good to go.  
  
**So How is HRV reported to you the user?**  
For sure most of you understand the metrics of blood pressure where you might see a value of 120/80, reflecting systolic and diastolic blood pressure, also in heart rate where you see 65 beats per minute, and respiration at say 15 respirations per minute. But how is HRV reported?  First, the boring scientific measurement part:  
  
Since the beginning of HRV research there has been a constant debate about the “best” way to report the scientific measurement.  Two procedures occur today: 1. Frequency domain measurements and  2. Time domain measurements. Both are complex and difficult to explain in a session like this. For now let me say that the excellent apps available today use a Time Domain measurement called RMSSD or Root Mean Square of Successive RR Interval Differences.   
  
To make interpretation more meaningful App developers like HRV4 Biofeedback have converted these complex HRV scores to something that makes sense to a typical user.  For instance Elite HRV provides you with a “Readiness” score 1-10, plus an HRV score (e.g. 35) over the 2 minute measurement.  But for the users interested in using the original “raw” Time Domain and Frequency Domain numbers, the Elite HRV has this readily available, along with minimum and maximum Heart Rate, and quality of the PPG signal.  So you can get it all.  The HRV apps also provide you with normative values for HRV by age, and gender.  
  
**Training HRV Using Biofeedback**  
Simple Tracking of HRV may be a great tool to motivate behavioral change for some of you, because it can help create more awareness of your life style, exercise strain, sleep, diet, your emotions, and generally how you handle stress over time.  The good news about HRV, is that it can also be trained using HRV Biofeedback.  I have been doing this with athletes for years but in the past it required expensive technology.  Today, Consumer products like HRV4Biofeedback simply require a cell phone with a good camera and a downloadable App. The App will guide you through skills of relaxing physically and emotionally, reduce your anxious thoughts and negative emotions, and engage you in smooth diaphragmatic breathing at your resonance rate of about 6 respirations per minute.   
  
  
**In Conclusion Here are Some Suggested Best Practices and Tips**  
First, How/when to take the measurement: I recommend measuring HRV first thing in the morning right after waking up, as you are in a relaxed physiological state. Take your measurement while lying down if possible, otherwise sit for the 2 minute measurement and try not to move.  What matters the most is that you always measure in the same position and following the same morning routine. ​Try to take your HRV every morning.  The Apps do a wonderful job or saving and reporting your data over time.  
  
**Now on HRV Biofeedback Training:**  
I recommend using the App, HRV4Biofeedback to train parasympathetic activity.  For a low cost you can enhance the balance in your autonomic nervous system.  Practice for at least 10 minutes preferably daily, but at least 3 times per week.  
  
Some of you may be interested in reading more about the technical aspects of HRV, so please take a look at the links on this page.  
  
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