

1. HRV is measured in milliseconds (ms).
2. Measuring HR is relatively simply to do.
3. Measuring HRV is not (will discuss this later).
4. On average, healthy adults **mean HRV** is 42 ms & athletes may get as high as 120 ms (Tiwari et al., 2021).

What is HRV Cont'd

During the 1960's, the monitoring of fetal distress used HRV Souza et al., 2021).

From this, HRV expanded in the 1970's to correlate w/pathophysiological events like cardiovascular diseases (Souza et al., 2021).

The 1980's afforded a significant breakthrough. Lower HRV increases the change of mortality.

History

The Role of Heart Rate Variability (HRV) in the Medical Fitness Space

Age: 18-25	HRV: 62-85 ms
Age: 26-35	HRV: 55-75 ms
Age: 36-45	HRV: 50-70 ms
Age 46-55	HRV: 45-65 ms
Age: 55-65	HRV: 42-62 ms
Age: 66+	HRV: 40-60 ms

Some Standard HRV scores



HRV, huh, what is that?

1. What is HRV?
2. Its Relationship to Overall Health.
3. Its Relationship to VO2max & HRR.
4. HRV & Wearables.
5. How to Improve HRV.
6. Some Misconceptions about HRV.
7. The future of HRV.

Items to Consider

An electrocardiogram (ECG or EKG) is the accurate way (Wong & Figueroa, 2019).

It allows precise measuring of HRV by quantifying the variations in R-R intervals.

HRV is typically measured with either time or frequency domain (Wong & Figueroa, 2019).

Gold Standard in Measuring HRV

- Heart rate is the # of beats in a minute.
- It does not consider any variations each beat may have.
- This is where HRV helps.
- HRV is the difference between heartbeats in a single period (Shafer & Ginsberg, 2017; Tiwari et al., 2021).

What is HRV?

"Our heart rate is not constant or static, there is a dynamic component." Dr. Aditya Bhonsale

"A healthy heart is not a metronome" (Shaffer & Ginsberg, 2017, p.1).

One in three deaths result from cardiovascular disease (CDC).

Introduction

- One of the foremost ways to evaluate how the environment, emotions, thoughts, and feelings affects the nervous systems and its response (Tiwari et al., 2021).

- It is also a well grounded & non imposing measure for assessing cardiac function.

If one knows HRV, then they know...



I am still confused! Tell me more...

Wearables (Polar, Garmin, etc.) are more practical, but not as accurate.

Wearables either use photoplethysmography or heart rate sensors.

It is most accurate when a healthy person is at rest (Addleman et al., 2024).

Alternatives in Measuring HRV



Some of the latest research on HRV

HRV is controlled by the Autonomic Nervous System (ANS) (Addleman et al., 2024).

The ANS regulates all physiology of the human body (Tiwari et al., 2021).

So, a low HRV may indicate distress to the ANS where as a high HRV may indicate "eustress" to the ANS.

Low HRV could equate to C-V diseases, whereas high HRV=cardiac fitness.

The "Weeds" of HRV

- Physical or mental stress causes differences when comparing the gold standard to alternative methods (Addleman et al., 2024).

- Wearables b/c less reliable at HR's > than 160 bpm & with a lot of wrist motion.

- Skin tone is a factor too.

Issues with Measuring HRV



Recent Research

1.

Tekin et al. (2025) suggests HRV could be a KPI for monitoring soccer players physiological readiness & training adaptations.

2.

Addleman et al (2024) suggest HRV guided programming maybe more useful than normal predefined programming for strength and conditioning.

3.

Peabody et al. (2022) suggest HRV is an effective way to monitor stress of medical professionals during high fidelity situations. In turn, this allows them to be properly trained to reduce chances of chronic stress.

4.

Souza et al. (2022) prove those with chronic degenerative diseases (Alzheimer's, Parkinson's, etc.) can increase their HRV through aerobic exercise.



I think I am starting to understand HRV now!

HRV is can be measured at different times throughout the day.

It can taken from different body positions.

Most wearables measure HRV during slow-wave (deep) sleep.

Other Factors to Consider w/Measuring HRV

HRV is only applicable to fitness.
All wearables are equal in reliability.
HRV is the same as RHR.
Developing universal norms for HRV measures.

Some Misconceptions of HRV

1. HRV & VO2max (maximal oxygen consumption) have a moderate positive correlation (Tekin et al., 2025)
2. Those with higher HRV & VO2max adapt better to training loads & have less weekly HRV fluctuations (Tekin et al., 2025).

HRV & VO2max

Closing Thoughts:

HRV is useful to assess the stress placed on the ANS

HRV is useful in assessing one's risk for metabolic diseases.

HRV is useful to assist with fitness programming.

Regular Exercise

General Stress Management

Drink plenty of water

How to

Quality Sleep

Healthy Eating

Progression Muscle Relaxation (Gro & Kohlmann, 2021)

Improve HRV

Thank you!

Maurice D. Williams, MS, CSCS

240.200.4003

movewellfitness@hotmail.com

- HRV is not a fitness fad.
- Future considerations include studying HRV w/medicine, psychology, sports, & the ability to measure HRV remotely.

The future of HRV

References

- Addleman, J. S., Lackey, N. S., DeBlauw, J. A., & Hajduczuk, A. G. (2024). Heart rate variability applications in strength and conditioning: A narrative review. *Journal of Functional Morphology and Kinesiology*, 9(2), 93. <https://doi.org/10.3390/jfmk9020093>
- Groß, D., & Kohlmann, C. W. (2021). Increasing heart rate variability through progressive muscle relaxation and breathing: A 77-day pilot study with daily ambulatory assessment. *International Journal of Environmental Research and Public Health*, 18(21), 11357. <https://doi.org/10.3390/ijerph182111357>
- Laborde, S., Mosley, E., Bellenger, C., & Thayer, J. (2022). Editorial: Horizon 2030: Innovative applications of heart rate variability. *Frontiers in Neuroscience*, 16, 937086. <https://doi.org/10.3389/fnins.2022.937086>
- Medfit Network Team (2025, May 12). *Heart rate variability, why it matters, and how you can improve it*. All MFN Blog. <https://medfitnetwork.org/public/all-mfn/heart-rate-variability-why-it-matters-and-how-can-you-improve-it/>
- Peabody, J. E., Ryznar, R., Ziesmann, M. T., & Gillman, L. (2023). A Systematic review of heart rate variability as a measure of stress in medical professionals. *Cureus*, 15(1), e34345. <https://doi.org/10.7759/cureus.34345>
- Shaffer, F., & Ginsberg, J. P. (2017). An overview of heart rate variability metrics and norms. *Frontiers in Public Health*, 5, 258. <https://doi.org/10.3389/fpubh.2017.00258>
- Souza, H. C. D., Philbois, S. V., Veiga, A. C., & Aguilar, B. A. (2021). Heart rate variability and cardiovascular fitness: What we know so far. *Vascular Health and Risk Management*, 17, 701–711. <https://doi.org/10.2147/VHRM.S279322>
- Tekin, R. T., Kudas, S., Buran, M. M., Cabuk, S., Akbasli, O., Uludag, V., & Yosmaoglu, H. B. (2025). The relationship between resting heart rate variability and sportive performance, sleep and body awareness in soccer players. *BMC Sports Science, Medicine & Rehabilitation*, 17(1), 58. <https://doi.org/10.1186/s13102-025-01093-7>
- Tiwari, R., Kumar, R., Malik, S., Raj, T., & Kumar, P. (2021). Analysis of heart rate variability and implication of different factors on heart rate variability. *Current Cardiology Reviews*, 17(5), e160721189770. <https://doi.org/10.2174/1573403X16999201231203854>
- Wong, A., & Figueroa, A. (2021). Effects of acute stretching exercise and training on heart rate variability: A review. *Journal of Strength and Conditioning Research*, 35(5), 1459–1466. <https://doi.org/10.1519/JSC.0000000000003084>