# Normative Values of enhanced HRV (eHRV) tests at Rest

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## INTRODUCTION

- Time Domain and spectral domain HRV analysis have been used to assess ANS activity for decades.
- The normative values of the time domain HRV numbers are well established in literature.
- We have developed an enhanced HRV (eHRV) analysis method which uses respiration to isolate both branches of ANS.
- Wavelet spectral analysis used.
- Parasympathetic region in IHR spectrum is defined around the respiration frequency and called RFa
- Sympathetic region in IHR spectrum is adjusted depending on the parasympathetics and called LFa.
- There is a need to establish normative values of RFa and LFa for clinical applications.
- In this study, normative values for LFa (sympathetic modulation), RFa (parasympathetic modulation), LFa/RFa variables of eHRV were determined.
- Their relation with age and gender were also evaluated. eHRV analysis uses time-varying spectral analysis of HRV and respiratory signals for better isolation of sympathetic and parasympathetic branches of Autonomic Nervous System (ANS).

## METHOD

- ECG and respiratory data of 100 healthy subjects (age: 36 ± 14; 54 Female; Body Mass Index: 24.52 ± 4.12; Systolic blood pressure (BP): 118.24 ± 14.18; Diastolic BP: 70.44 ± 10.57) were collected.
- Spectral analysis is performed on normal RR intervals and respiration data using continuous wavelet transform.
- The frequency at highest peak in respiratory spectrum is defined as Fundamental Respiration Frequency (FRF).
- FRF determined the interval of RFa in RR spectrum. RFa is the energy over the interval FRF*0.65 – FRF*1.35 Hz in RR spectrum.
- LFa is the energy over the frequency interval 0.04 - 0.1 Hz but adjusted for low FRF values.
- Logarithm of LFa, RFa and LFa/RFa are taken to obtain normal distribution.
- Normative values are determined as the values of the variables at 5 and 95 percentiles.

## RESULTS

- RangeHR, LFa, RFa were inversely correlated with age ($p < .005$). Normative value ranges for LFa, RFa, LFa/RFa, MeanHR, RangeHR are given in Table 1. None of the variables were significantly different between males and females ($p > .05$).

## CONCLUSION

There have been numerous studies providing normative values for tHRV analysis methods. In this study, for the first time we have presented resting normative values for a new HRV analysis method called eHRV analysis to properly assess ANS activity.

**Table 1**. Normative Values for the entire population

| | Unit | N | 90% Normative Value Ranges | Value (mean ±std) |
|---|---|---|---|---|
| LFa | $Bpm^2$ | 100 | .55 - 10.35 | 3.40 ± 3.05 |
| RFa | $Bpm^2$ | 100 | .51 - 10.30 | 3.19 ± 3.01 |
| LFa/RFa | | 100 | .24 - 4.21 | 1.51 ± 1.32 |
| MeanHR | Bpm* | 100 | 56 - 94 | 74.89 ± 11.67 |
| RangeHR | Bpm | 100 | 12 - 36 | 22.22 ± 7.15 |

* Bpm: Beat per minute