

Updated Heart Rate Variability Norms for Healthy Undergraduates



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Gratitude

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Introduction

Zerr et al. (2014) reported heart rate variability (HRV), respiration, and accessory surface EMG norms for 29 variables in healthy undergraduates.

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Introduction

The present study replicated and expanded the Zerr et al. (2014) study by including autonomic, respiratory, and normalized HRV measurements.

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Method

Participants

Eighty-five undergraduates (59 women and 26 men), 18 to 28 years of age, participated in this study.

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Method

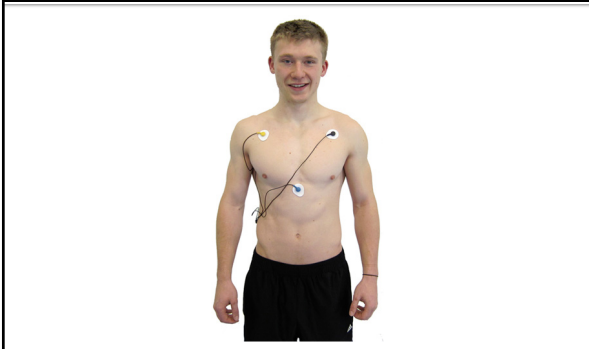
Apparatus

A Thought Technology ProComp Infiniti™ system monitored ECG, HRV, respiration, skin conductance, and skin temperature.

Active ECG electrodes were located on the upper torso. A respirometer was positioned over the navel to measure excursion and respiration rate.

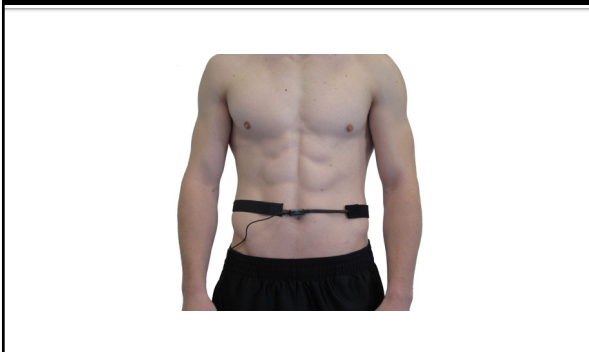
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Method



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Method



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Method

Skin conductance sensors were placed on the palmar aspect of the second phalange of the index and ring fingers. A thermistor was taped to the web dorsum of the nondominant hand.



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Method

Procedure

Subjects were stabilized for 5 min and then monitored for 5 min sitting upright, with eyes open, no feedback, and instructions to breathe normally.

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Method

Data were artifacted within CardioPro and then detrended in Kubios 3.1 using a smoothness priors procedure. Frequency domain analysis utilized Welch's periodogram (FFT) procedure.

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Results

Autonomic	N	Mean (SD)	95% CI
Diastolic blood pressure	74	77.01 (10.67)	74.54-79.48
Systolic blood pressure	74	114.22 (11.34)	111.59-116.84
Heart rate	85	78.25 (14.67)	75.09-81.41
Skin conductance (μ S)	85	4.29 (2.47)	3.76-4.82
Skin temperature ($^{\circ}$ F)	85	88.63 (3.83)	87.80-89.45

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Results

Respiratory	N	Mean (SD)	95% CI
End-tidal CO ₂ (torr)	85	34.72 (3.34)	34.00-35.45
Heart rate-respiration phase	85	22.23 (29.95)	15.77-28.69
Respiration amplitude	85	1.73 (1.52)	1.40-2.05
Respiration rate (bpm)	85	13.02 (4.00)	12.16-13.88

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Results

Time-Domain	N	Mean (SD)	95% CI
HR Max-HR Min (bpm)	85	12.85 (9.14)	10.88-14.82
NN ₅₀	84	91.31 (65.09)	76.12-104.35
pNN ₅₀ (%)	84	25.64 (20.14)	20.98-29.69
RMSSD (ms)	84	53.60 (33.71)	45.64-60.31
SDNN (ms)	85	57.90 (28.30)	51.80-64.00
TINN	85	297.00 (161.91)	262.08-331.92
Triangular Index	85	13.54 (5.05)	12.45-14.63

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Results

Frequency-Domain	N	Mean (SD)	95% CI
VLF power (ms ²)	85	96.62 (134.50)	67.61-125.63
LF power (ms ²)	85	442.74 (627.51)	307.39-578.09
LFnu	85	48.68 (25.38)	43.20-54.15
HF power (ms ²)	85	369.76 (704.97)	217.70-521.82
HFnu	85	51.25 (25.37)	45.78-56.72
LnHF	85	5.12 (1.19)	4.87-5.38
LF/HF	85	2.40 (4.06)	1.53-3.28

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Results

Nonlinear	N	Mean (SD)	95% CI
Approximate Entropy	85	1.01 (0.13)	0.98-1.04
Correlation Dimension	85	2.78 (1.19)	2.52-3.04
Determinism	85	97.68 (1.20)	97.42-97.94
DFA α_1	85	1.09 (0.31)	1.02-1.16
DFA α_2	85	0.24 (0.10)	0.22-0.27
Sample Entropy	85	1.32 (0.34)	3.04-3.19
SD1	85	37.61 (23.94)	32.45-42.77
SD2	85	71.57 (34.40)	64.15-78.99
ShanEn	85	3.11 (0.36)	3.04-3.19

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Discussion

The present study extended norms reported by Zerr et al. (2014) by increasing sample size and expanding autonomic, cardiovascular, and respiratory measurements.

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Discussion

The mean heart rate of 78 bpm fell within a normal 60-80 bpm range.*

Our undergraduates were normotensive (77/114). Their respiration rate of 13 bpm and end-tidal CO₂ of 35 torr fell within the normal, 12-14 bpm and 35-45 torr, ranges, respectively.*

* Khazan (in press)

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Discussion

A mean skin conductance of $4 \mu\text{S}$ fell within the $\leq 5 \mu\text{S}$ range.*

Mean finger temperature of 89°F also fell within the normal $88\text{-}95^\circ\text{F}$ range.*

* Khazan (in press)

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Discussion

Both the RMSSD and SDNN time-domain values were comparable to the Nunan et al. (2010) norms for 21,438 healthy adults.

Time-Domain Measures	Urban et al.	Nunan et al. (2010)
RMSSD (ms)	54 (34)	42 (15)
SDNN (ms)	58 (28)	50 (16)

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Discussion

While LF and HF power were lower than the Nunan et al. (2010) norms, LFnu and HFnu, and LF/HF were comparable.

Frequency-Domain Measures	Urban et al.	Nunan et al. (2010)
LF (ms^2)	443 (628)	519 (291)
LF nu	49 (25)	52 (10)
HF (ms^2)	370 (705)	657 (777)
HF nu	49 (25)	40 (10)
LF/HF	2.4 (4.1)	2.8 (2.6)

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Discussion

The authors encourage further research to establish female and male norms in larger samples of healthy undergraduates.

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Discussion



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References

Nunan, D., Sandercock, G. R. H., & Brodie, D. A. (2010). A quantitative systematic review of normal values for short-term heart rate variability in healthy adults. *Pacing and Clinical Electrophysiology*, 33, 1407–1417.

Zerr, C., Kane, A., Vodopest, T., Allen, J., Fluty, E., . . . Shaffer, F. (2014). Heart rate variability norms for healthy undergraduates. *Applied Psychophysiology and Biofeedback*, 39, 300.

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