

# Heart Rate Variability in Individuals with Tinnitus following Acoustic Therapy

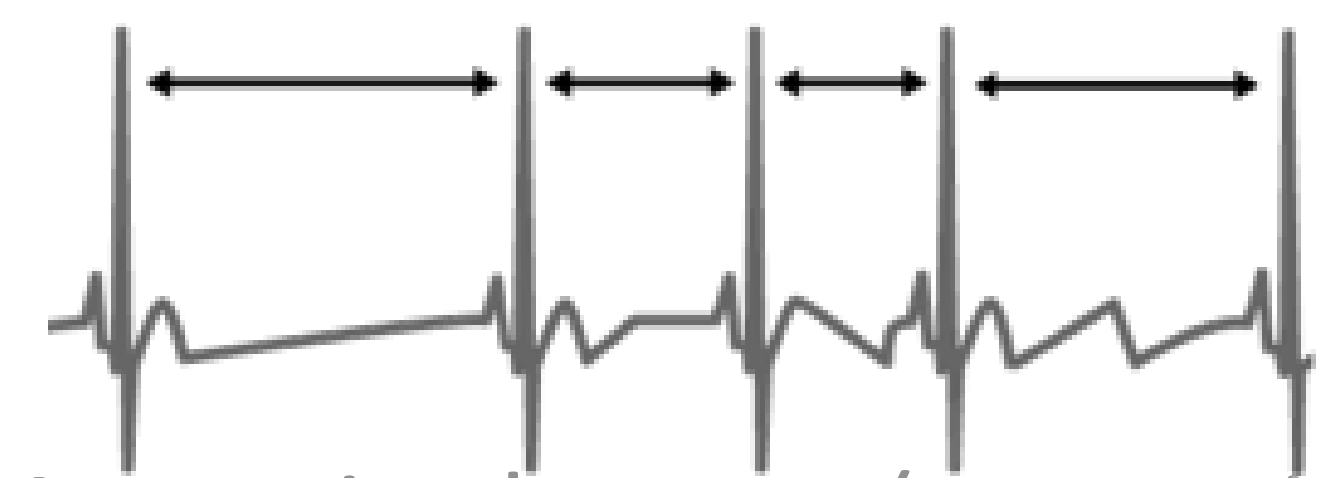
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## INTRODUCTION

- Individuals with tinnitus exhibit decreased autonomic function indicative of being in a constant elevated stress state<sup>1</sup>.
- Heart rate variability (HRV) is a common, non-invasive measure reflecting autonomic nervous system function, with *higher HRV associated with lower stress*<sup>2</sup>.



higher HRV = lower stress  
lower HRV = higher stress

- Acoustic therapy (e.g., using a “tinnitus masker” via hearing aids) is commonly used to provide tinnitus relief<sup>3</sup>.

### Research Purpose:

To examine whether acoustic therapy causes an increase in HRV (consistent with a decrease in stress) in individuals with tinnitus.

## METHODS

26 participants (mean age = 62.8 years) with varying hearing impairment (Fig 1) and tinnitus handicap (Fig 2), as measured by Tinnitus Handicap Inventory (THI)<sup>4</sup>.

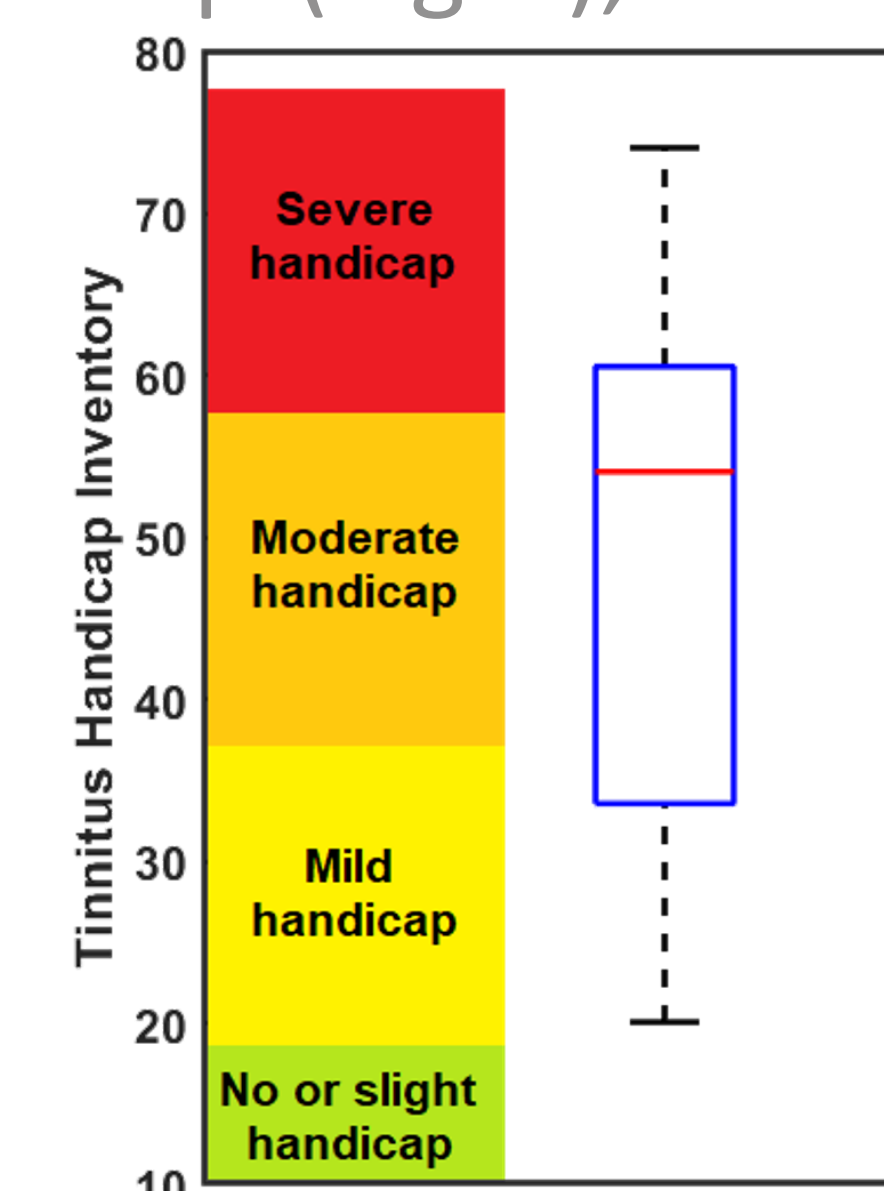
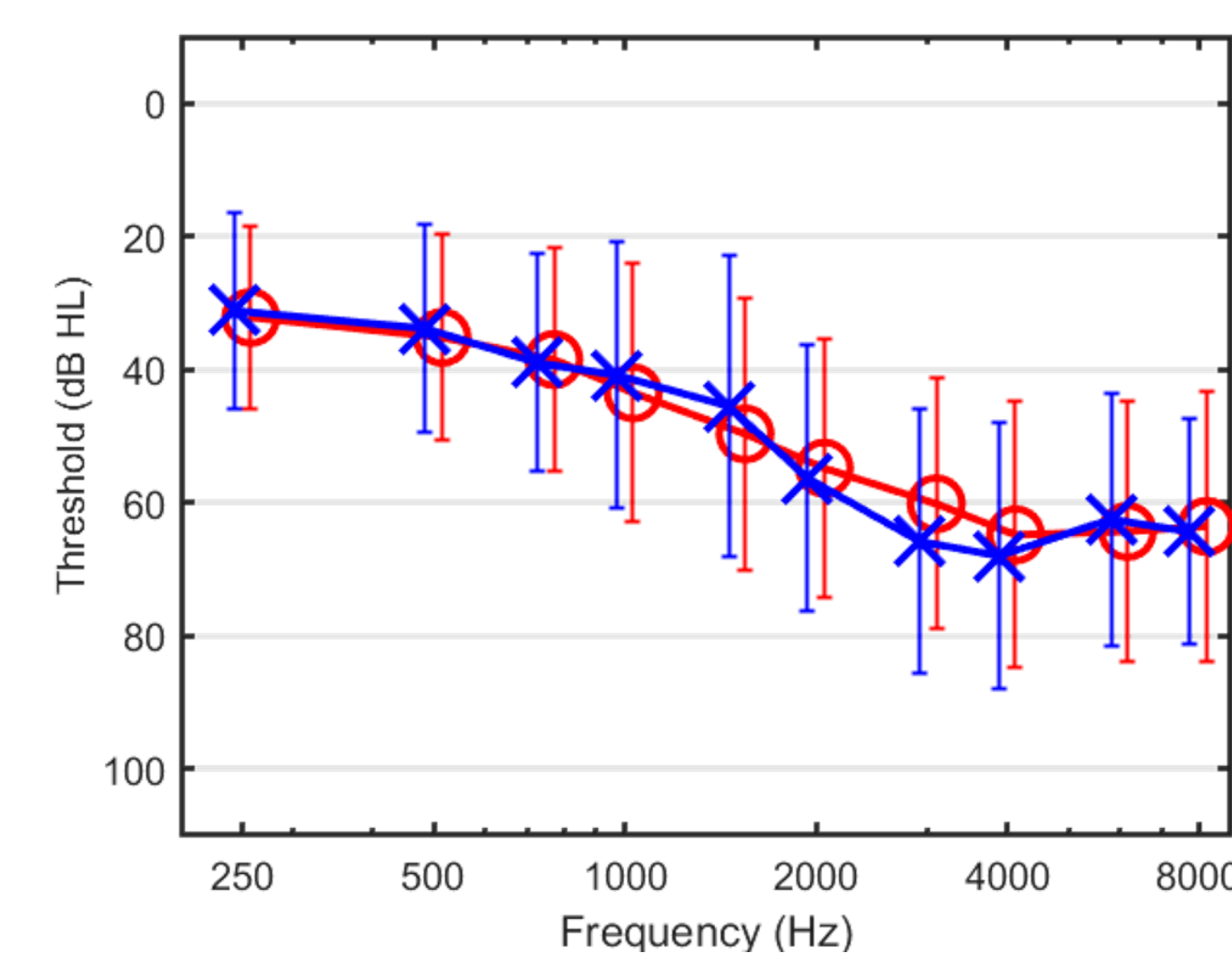


Figure 1: Mean participant audiogram Fit with Starkey hearing aids and provided 3 tinnitus maskers using Starkey’s Multiflex Tinnitus Pro technology:

1. White Noise
2. Audiogram-shaped Noise
3. Custom Noise

Completed 8-week trial during which they could use the maskers.

HRV measured using electrocardiography at start and end of study.

## RESULTS

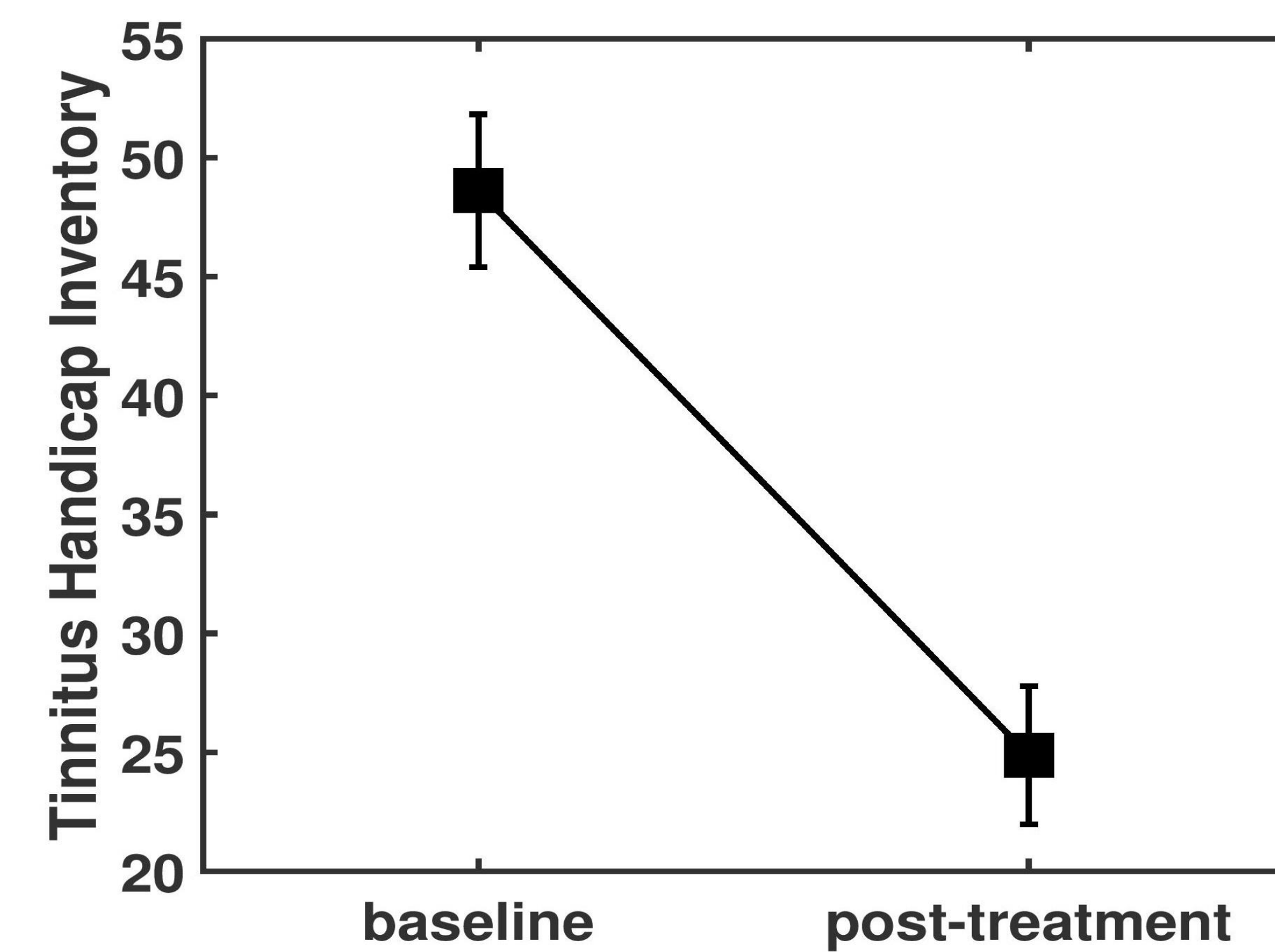


Figure 3: Results of Tinnitus Handicap Inventory showing a significant reduction ( $p < .0001$ ) in tinnitus handicap post-treatment (end of 8-week trial) compared to baseline (beginning of study). Error bars represent  $\pm 1$  standard error.

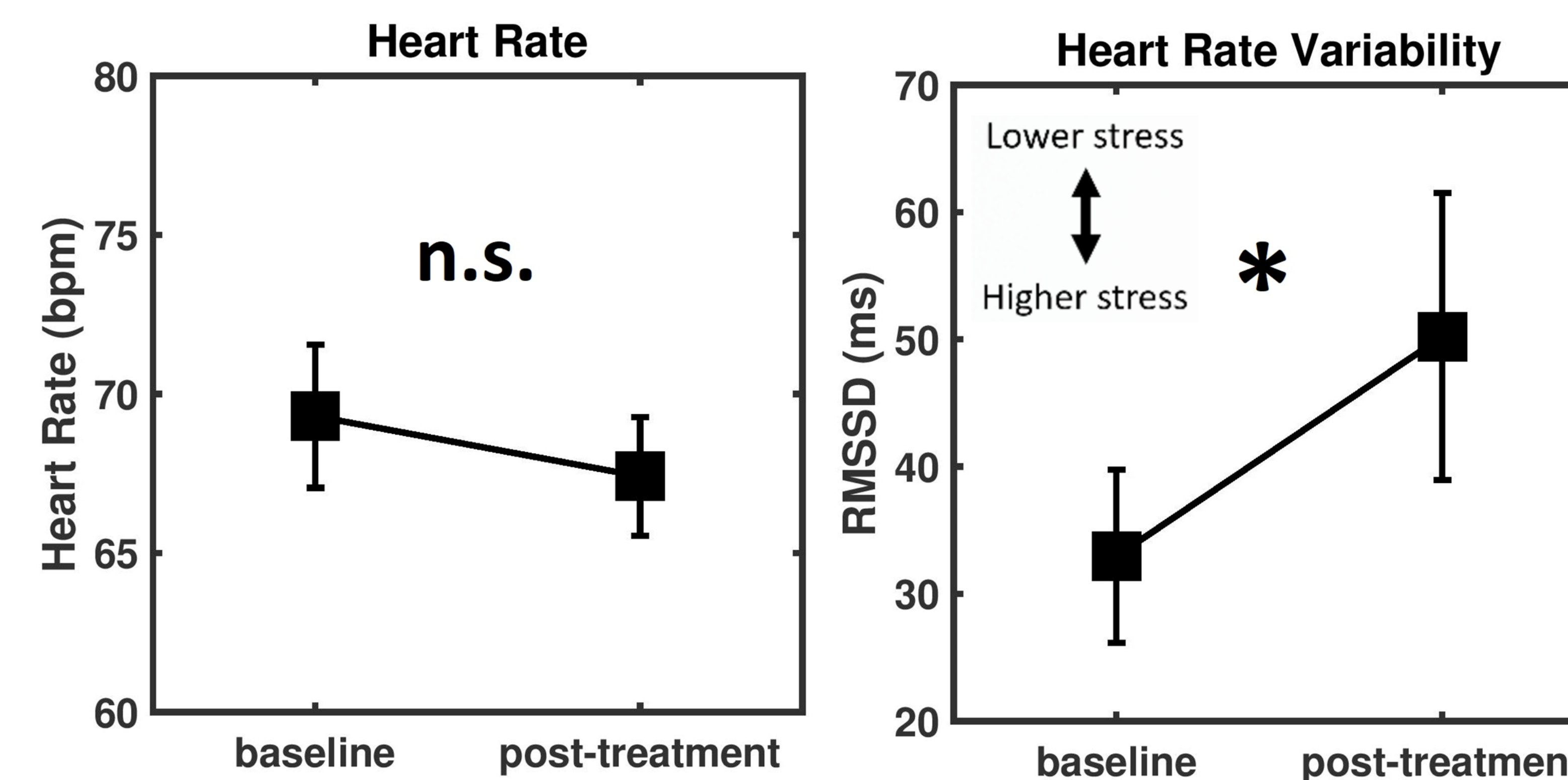


Figure 4: Results of electrocardiography recordings measured at baseline (beginning of study) and post-treatment (end of 8-week trial). Left panel shows heart rate in beats per minute (bpm), and right panel shows rate variability in root mean square of successive differences (RMSSD). Error bars represent  $\pm 1$  standard error. n.s. =  $p > .05$ ; \* =  $p < .05$ .

## RESULTS (Continued)

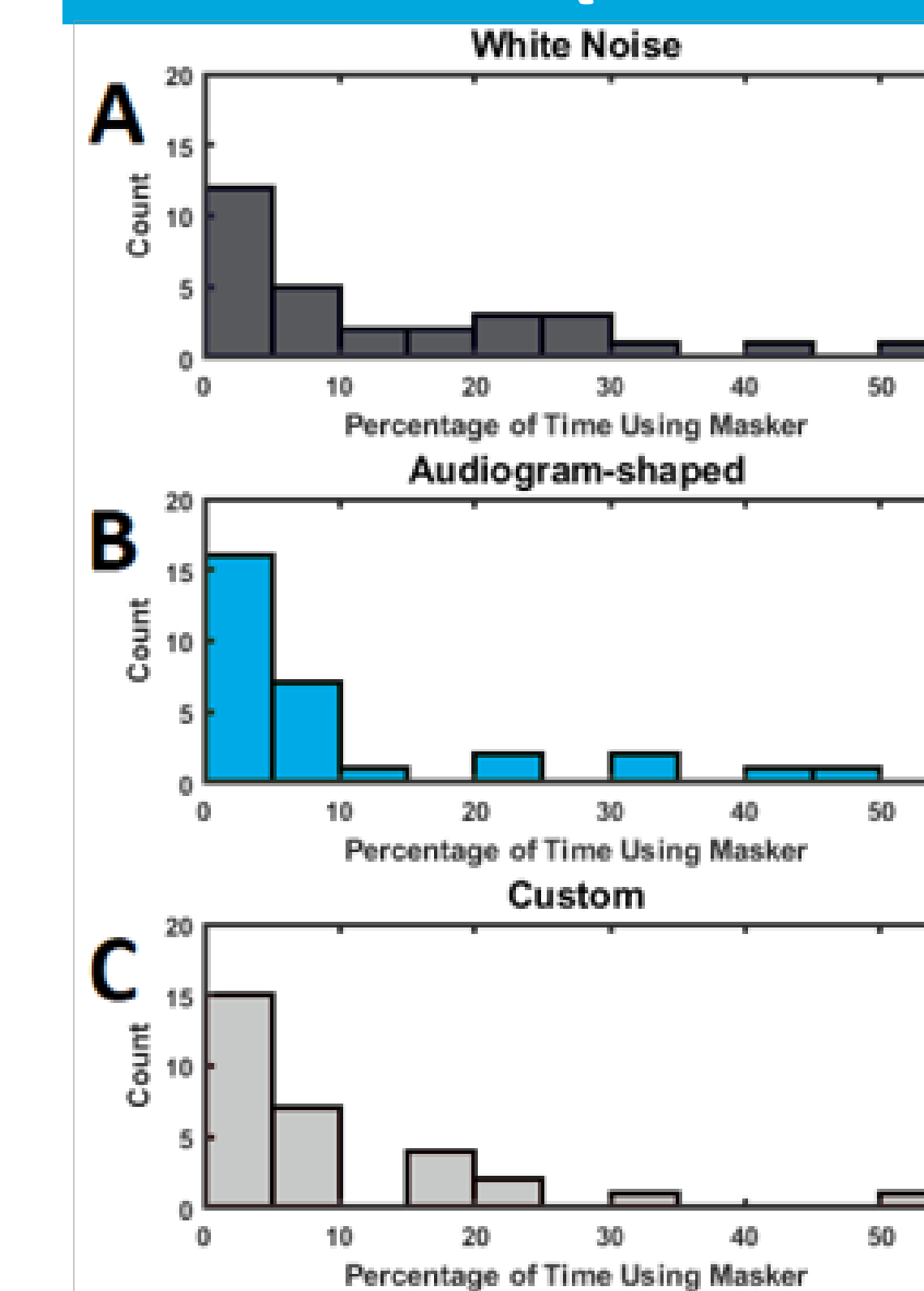


Figure 5: Datalogging results showing distribution of percentage time participants used different maskers.

Median percentages are:

- 68.8% amplification alone (no masker)
- 8% White Noise
- 4% Audiogram-shaped Noise
- 5.3% Custom Noise

## CONCLUSIONS

- Participants reported a significant reduction in tinnitus handicap following an 8-week trial utilizing acoustic therapy via tinnitus maskers presented via hearing aids.
- Participants exhibited a concurrent increase in heart rate variability following the trial, which is indicative of a decrease in overall stress levels.
- Findings suggest heart rate variability may be used as an objective biomarker for tracking effectiveness of tinnitus interventions.

## REFERENCES

<sup>1</sup>Datzov, E., Danve, S., Haralanov, H., Naidenova, V., Sachanska, T., & Savov, A. (1999). Tinnitus, heart rate variability, and some biochemical indicators. *International Tinnitus Journal*, 5(1), 2023.

<sup>2</sup>O'Brien, I. A., O'Hare, P., & Corral, R. J. (1986). Heart rate variability in healthy subjects: effect of age and the derivation of normal ranges for tests of autonomic function. *Heart*, 55(4), 348-354.

<sup>3</sup>Jastreboff, P. J., & Jastreboff, M. M. (2000). Tinnitus retraining therapy (TRT) as a method for treatment of tinnitus and hyperacusis patients. *Journal of the American Academy of Audiology*, 11(3), 162-177.

<sup>4</sup>Newman, C. W., Sandridge, S. A., & Jacobson, G. P. (1998). Psychometric adequacy of the Tinnitus Handicap Inventory (THI) for evaluating treatment outcome. *Journal American Academy of Audiology*, 9, 153-160.

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