

What Happens in Vagus: Effects of Yogic Breathing on Autonomic Regulation of Heart Rate Explored with Pharmacological Blockades

Anna Sanova, Richard D. Lane, and John J.B. Allen
Department of Psychology – University of Arizona – Tucson, Arizona

Introduction

- Heart Rate Variability (HRV) reflects dynamic variation in sympathetic and parasympathetic nervous system (SNS and PNS) activity.¹
- The parasympathetic vagus nerve is responsible for HRV between 0.12 and 0.4 Hz.²
- Vagally-mediated HRV is thought to index the capacity for effective coping, and is linked to physical and emotional well-being.⁴
- Yogic breathing to increase vagal activity is often paced below 0.12 Hz,⁵ where the impact on HRV can be due to both sympathetic and parasympathetic mechanisms.^{2,3}

Question

At breathing rates < 0.12 Hz, or 7.2 breaths per minute (BrPM), is HRV vagally mediated?

Hypothesis

- If the effect of breathing slower than 0.12 Hz is mediated vagally, HRV will be lowest when vagal activity is blocked with the drug Glycopyrrolate (a PNS blocker).
- If the effect of breathing slower than 0.12 Hz is mediated sympathetically, HRV will be lowest when sympathetic activity is blocked with the drug Esmolol (an SNS blocker).

Methods

Participants. Participants were 5 healthy volunteers between the ages of 18 and 35. Data are a subset of a larger study examining autonomic effects of yogic breathing.

Procedure. Each participant completed three sessions (placebo, Esmolol, and Glycopyrrolate) in a counterbalanced order about 48 hours apart. During each session:

- Participants provided informed consent and were prepared for physiological recording.
- Recording began with a 5-minute resting period to establish baseline vital signs.
- Drug or placebo was administered through an IV for 5 minutes prior to the start of breathing trials.
- Participants completed paced breathing trials in counterbalanced order at 11 breathing rates from 4.0 to 9.0 BrPM (0.067-0.15 Hz).

EKG Recording and Processing.

- EKG was recorded with Biopac, using an EKG lead on each forearm and a ground on the right ankle.
- EKG was sampled at 500 Hz.
- EKG was processed offline using QRSTool software to identify the timing of each beat.
- HRV was derived using a version of CMeX,¹ implemented in Matlab. Variability across all frequency bands and at specific bands related to breathing frequencies was extracted, and natural log transformed since such values are positively skewed.

Results

Figure 1: Effect of Drug Condition on Total HRV During Yogic Breathing

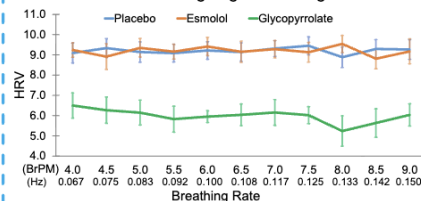


Figure 1. There was a significant effect of drug condition on HRV ($p < 0.001$). Lowered HRV under Glycopyrrolate indicates vagal influence on heart rate at all breathing rates. Sympathetic blockade with Esmolol yielded no significant difference from placebo, suggesting that the SNS is not the mechanism by which paced breathing increases HRV. HRV presented in $\ln(\text{ms}^2)$.

Figure 2: HRV Frequency Power by Breathing Rate

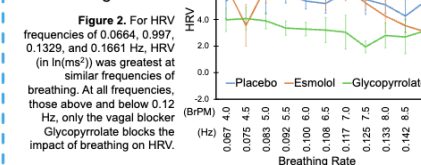


Figure 2. For HRV frequencies of 0.0664, 0.0997, 0.1329, and 0.1661 Hz, HRV (in $\ln(\text{ms}^2)$) was greatest at similar frequencies of breathing. At all frequencies, those above and below 0.12 Hz, only the vagal blocker Glycopyrrolate blocks the impact of breathing on HRV.

Discussion

- Vagal blockade with Glycopyrrolate led to significantly lowered HRV during paced breathing at a rate of 4 to 9 breaths per minute (0.067-0.15 Hz).
- There was no significant difference between placebo and sympathetic blockade with Esmolol.
- Other than when PNS influence was blocked, all frequencies of paced breathing enhanced HRV, indicating that slow paced breathing impacts HRV via vagal mechanisms.
- These findings suggest that slow paced breathing may be an effective method of increasing cardiac vagal control and the capacity for emotion regulation.

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Culture and Happiness: Collectivism and Affective Well-Being Among Low-Income Women

Colette Brown, B.A., Remy Cockerill, B.A., Guido Urizar Ph.D.
California State University, Long Beach



INTRODUCTION

- Sense of community can be defined as feeling that one belongs and matters to the group, and a belief that one's needs will be met by their community (McMillan, 1976).
- Interestingly, in affluent regions, individualism has been associated with increased happiness; whereas in less affluent regions, collectivism is associated with increased happiness (Veenhoven, 1998; Ahuvia, 2000).
- Especially in areas with large income inequalities, such as Los Angeles, this relationship becomes very complex (Edsel & Beja, 2013).
- Additionally, research lacks in assessing the relationship between collectivism and emotional well-being specifically.

PURPOSE

The current study aimed to determine if a greater sense of collectivism is associated with more positive affect and less negative affect among low-income women living in Los Angeles County.

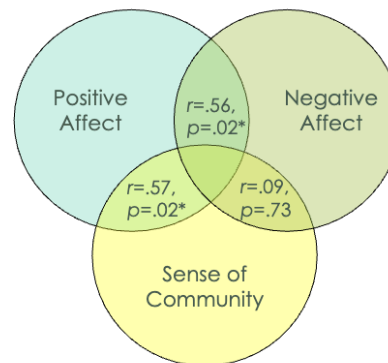
METHODS

Participants completed self-report questionnaires on their sense of community and their mood. Pearson's correlation analyses were conducted to investigate for associations between these variables at one time-point.

AREA OF INTEREST	HOW IT WAS MEASURED	MEASUREMENT DESCRIPTION
Collectivism	Sense of Community Index II (SCI-2)	24-item questionnaire. Higher scores indicate a stronger sense of community. e.g. "I am with other community members a lot and enjoy being with them."
Positive Affect	Positive and negative Affect Scale (PANAS)	5-item subscale of PANAS measures mood at present moment. Higher scores indicate high energy, full concentration, and pleasurable engagement. e.g. "Indicate to what extent you feel this way right now: Enthusiastic..."
Negative Affect	Positive and Negative Affect Scale (PANAS)	5-item subscale of PANAS measures mood at present moment. Higher scores indicate a general dimension of subjective distress and displeasurable engagement. e.g. "Indicate to what extent you feel this way right now: Upset..."

RESULTS

- Women who had a greater sense of collectivism reported more positive affect ($r = .57, p = .02$).
- Collectivism was not found to be significantly associated with negative affect.
- Positive and Negative Affect were positively correlated.



CONCLUSIONS

- These findings suggest that there is a relationship between positive affect and sense of community among low-income women living in an affluent country such as the United States.
- The positive correlation between positive and negative affect should be explored further with similar populations as these constructs are typically uncorrelated (Watson et al., 1988).
- More research needs to be done in order to further examine these findings.



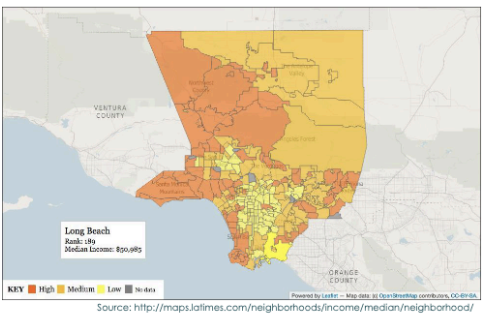
DEMOGRAPHICS

SAMPLE

- Number:** N=20
- Ethnicity:** 65% Latina
- Age range:** 26 – 46, M = 32.55 years, SD = 5.53
- Employment status:** 74% unemployed
- Annual Income:** 60% earned less than \$25,000
- Marital status:** 75% Married or Living Together

LOS ANGELES

- Neighborhoods:** 272
- Highest median income:** \$207,938
- Lowest median income:** \$15,003



Contact Information:
Colette Brown
Remy Cockerill

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