Singing Acutely Improves Vascular Function

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INTRODUCTION

- Singing is a physical activity with little reliance on skeletal muscle strength.
- The cardiovascular effects of singing have not been well-studied.
- To our knowledge, no studies have evaluated the impact of singing on endothelial function.

OBJECTIVES

The primary objective of this study was to assess the acute effects of singing on peripheral vascular endothelial function. The secondary objective was to assess heart rate variability before, during, and after a 10-minute period of singing.

METHODS

- Adults without unstable chest pain or heart failure symptoms were recruited from cardiology clinics for a single study visit
- Subjects with atrial fibrillation, permanent pacemaker or implantable cardioverter defibrillator, Parkinson’s disease or tremors, and those requiring supplemental oxygen were excluded from this study
- Vascular function was measured at the fingertips with pneumatic probes and a peripheral arterial tonometry (PAT) device
- Heart rate variability (HRV) was measured with a Bluetooth-compatible chest wrap sensor
- Subjects watched and sang to a 10-minute coaching video led by a voice expert
- PAT measurements were obtained before and after singing and expressed as reactive hyperemia index (RHI) and Framingham reactive hyperemia index (fRHI)
- Linear regression modeling was performed to evaluate the effect of covariates on baseline vascular function
- Paired t-tests and repeated measures of variance were used to compare serial measures of vascular function and heart rate variability, respectively
- Linear mixed models were adjusted for repeated measures

RESULTS

| TABLE 1: COHORT DEMOGRAPHICS, n=60 |
|-----------------|------------------|
| Age (years)     | 60.65 ± 13.1     |
| % Female        | 41 (68%)         |
| Past Smoker     | 18 (30%)         |
| Coronary Artery Disease | 26 (43%) |
| Congestive Heart Failure | 10 (17%) |
| Hypertension    | 36 (60%)         |
| Diabetic        | 14 (25%)         |
| Using Statins   | 33 (55%)         |
| Chronic Respiratory Disease | 17 (28%) |

**Figure 1:** Effects of Singing on Reactive Hyperemia Index

![Figure 1: Effects of Singing on Reactive Hyperemia Index](image)

**Figure 2:** Effects of Singing on Heart Rate Variability

![Figure 2: Effects of Singing on Heart Rate Variability](image)

**Figure 3:** Effect of ASCVD Risk on Endothelial Function

![Figure 3: Effect of ASCVD Risk on Endothelial Function](image)

**Figure 4:** Effect of Baseline Endothelial Function on Reactive Hyperemia

![Figure 4: Effect of Baseline Endothelial Function on Reactive Hyperemia](image)

REFERENCES


CONCLUSIONS

- Sixty subjects completed the study with demographics that can be found in Table 1
- Statin use and diabetes were associated with lower baseline fRHI (-0.62 ± 0.3, p=0.03 and -0.63±0.3, p=0.05, respectively).
- There was a significant increase in fRHI before and after singing (1.88 ±0.14 to 2.10 ±0.14, p=0.02) with no significant change in the RHI (1.99±0.10 to 2.12±0.09, p=0.17), Figure 1
- There was a significant decrease in HRV during singing, Figure 2
- Subjects at higher ASCVD risk (established ASCVD or >2 risk factors) had significant improvement (1.82±0.14 to 2.08±0.13, p=0.015) in fRHI compared to subjects at lower ASCVD risk (2.35±0.73 to 2.28±0.70, p=0.78), Figure 3
- Subjects with abnormal baseline endothelial function, defined as RHI<1.67, demonstrated significant improvement in the RHI after singing (1.40±0.05 to 1.80±0.13, p=0.01), when compared to subjects with normal baseline RHI (2.32±0.12 to 2.30±0.11, p=0.82) Figure 4

FINANCIAL DISCLOSURE

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