

# EFFICACY OF CONTROLLED BREATHING AND HEART RATE VARIABILITY (HRV) BIOFEEDBACK ON CRAVING AMONG PEOPLE USING ALCOHOL AND OTHER DRUGS: A META-ANALYSIS

## INTRODUCTION

Craving is a core feature of substance use disorders (SUDs) and a predictor of relapse. There is growing interest in somatic techniques such as controlled breathing to reduce craving and support recovery. Breathing-based interventions—including resonant, yogic, slow, deep, or heart-rate variability biofeedback (HRVB)—are simple, zero-cost strategies that can modulate physiological and emotional states. However, their effectiveness in reducing craving among people who use alcohol and other drugs is yet to be systematically evaluated

## OBJECTIVE

To systematically review and synthesize the literature on breathing interventions for craving in people who use alcohol and other drugs.

## METHODOLOGY

This pre-registered (CRD42024524235) meta-analysis synthesised data from trials investigating the effect of breathing interventions on craving in individuals who use alcohol or drugs. Studies were identified through systematic searches of Web of Science, PsycINFO, MEDLINE, CINAHL, EMBASE, PubMed, Scopus, and Cochrane Central Register of Controlled Trials. Eligible studies included randomized controlled trials (RCTs) and quasi-experimental designs that reported pre-post craving outcomes. Standardized mean differences (Hedges'  $g$ ) were calculated, and random-effects models were used to estimate pooled effects. Risk of bias and study heterogeneity were assessed

## RESULTS

A total of 12 studies (7 RCTs and 5 quasi-experimental; 8 treatment and 5 non-treatment samples;  $n = 591$  participants) met inclusion criteria. Breathing interventions significantly reduced craving compared to control conditions (Hedges'  $g = -0.44$ , 95% CI:  $-0.58$  to  $-0.29$ ,  $p < .001$ ), with low heterogeneity ( $I^2 = 24.6\%$ ). Subgroup analyses showed consistent effects across 6 HRVB compared to 6 non-biofeedback breathing interventions. Funnel plot (publication bias), Trim and Fill analyses, and Fail-safe N test suggest the results are consistent across studies and there is no evidence of publication bias.

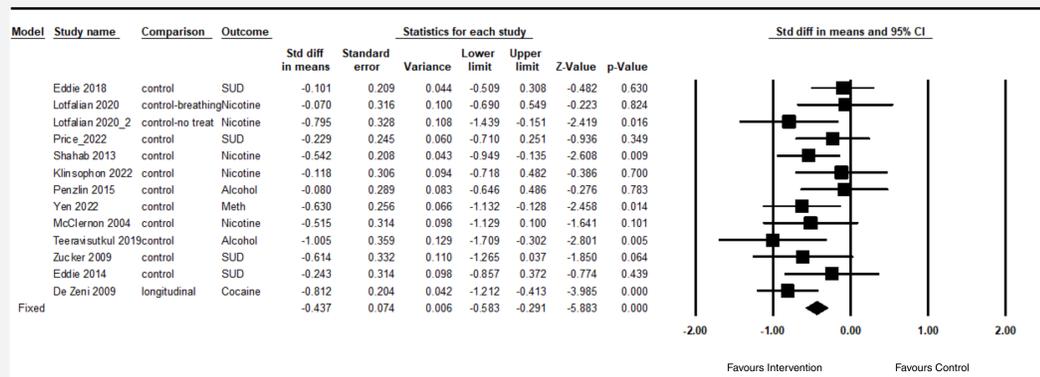


## DETAILS OF INCLUDED STUDIES

Study	Substance	Sample size	Study design	Comparator	RoB
Eddie et al. (2018)	AOD	46	Quasi-experimental	Waitlist	Medium
Lotfalian et al. (2020)	Nicotine	60	RCT	a) cognitive strategy, b) no treatment	Low
Price et al. (2022)	AOD	77	RCT	Sham breathing 14BPM	Low
Shahab et al. (2013)	Nicotine	96	RCT	Breathing video	Medium
Klinsophon et al. (2022)	Nicotine	43	RCT - cluster	Counselling	Low
Penzlin et al. (2015)	Alcohol	48	RCT	TAU	Low
Yen et al. (2022)	Stimulant	64	RCT	TAU	Low
McClernon et al. (2004)	Nicotine	21	Quasi-experimental	Sitting quietly	Low
Teeravisutkul et al. (2019)	Alcohol	35	RCT	TAU	Low
Zucker et al. (2009)	AOD	38	RCT	TAU	Low
Eddie et al. (2014)	AOD	48	Quasi-experimental	TAU	Low
deZeni et al. (2009)	Cocaine	32	Uncontrolled	None	High

Note: AOD indicates non-specific alcohol and/or other drug use or diagnosis of substance use disorder.

## META ANALYSIS



## CONCLUSION

The meta-analysis revealed a significant reduction in craving following breathing interventions compared to control conditions, showing consistent effects across diverse populations (people who use nicotine, alcohol, and other drugs) and settings (community, in-patient). Importantly, subgroup analyses showed consistent effects across HRVB and non-biofeedback breathing techniques, suggesting that the mechanism of action may be shared across modalities—likely involving autonomic regulation and attentional control. The robustness of these findings is supported by the low risk of bias in the majority of included studies (75% of meta-analysed studies), and by publication bias tests (funnel plot, Trim and Fill, Fail-safe N), which indicated no significant bias. These results position breathing interventions as a viable, and zero-cost, tool for craving management.

## RELATED LITERATURE

de Zeni, T. C., & Araujo, R. B. (2009). Deep breathing in the management of craving and anxiety... *Revista de Psiquiatria do Rio Grande do Sul*, 31, 116-119.

Eddie, D., et al. (2018). Assessing heart rate variability biofeedback as an adjunct to college... *Journal of Substance Abuse Treatment*, 92, 70-76.

Eddie, D., et al. (2014). A Pilot Study of Brief Heart Rate Variability Biofeedback to Reduce... *Applied Psychophysiology and Biofeedback*, 39(3), 181-192.

Lotfalian, S., et al. (2020). The effects of mindfulness-based yogic breathing on craving, affect, and... *Psychology of Addictive Behaviors*, 34(2), 351-359.

Klinsophon, T., et al. (2022). The effect of three-part breathing exercise on smoking cessation... *Journal of Bodywork and Movement Therapies*, 32, 156.

McClernon, F. J., et al. (2004). The effects of controlled deep breathing on smoking withdrawal symptoms in... *Addictive Behaviors*, 29(4), 765-772.

Penzlin, A. I., et al. (2015). Heart rate variability biofeedback in patients with alcohol dependence: a... *Neuropsychiatric Disease and Treatment*, 11, 2619.

Price, J. L., et al. (2022). Effects of arousal modulation via resonance breathing on craving and affect in women... *Addictive Behaviors*, 127, 107207.

Shahab, L., et al. (2013). The acute effects of yogic breathing exercises on craving and withdrawal symptoms in... *Psychopharmacology*, 225(4), 875.

Teeravisutkul, P., et al. (2019). Stress and craving reduction under treatment with... *Psychology Research and Behavior Management*, 12(null), 619-627.

Yen, C.-F., et al. (2022). A Pilot Randomized Control Study on Effect Brief... *International Journal of Environmental Research and Public Health*, 19(9), 5230.

Zucker, T. L., et al. (2009). The effects of respiratory sinus arrhythmia biofeedback on heart rate... *Applied Psychophysiology Biofeedback*, 34(2), 135-143.

## AUTHORS

Roxburgh, A., Manning, V., Lubman, D.I., Rowland, B., Sukhjit K. B., Pek, M., Tso, B., & Arunogiri, A.

## AFFILIATIONS

1. Monash Addiction Research Centre, Eastern Health Clinical School, Monash University, Melbourne, Australia.  
2. Turning Point, Eastern Health, Melbourne, Australia.



MONASH University