Transcutaneous vagus nerve stimulation facilitates invigoration of effort

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Introduction

• Activation of the vagus nerve is associated with dopamine release in the substantia nigra¹
• Reward processing and homeostatic regulation modulated by signaling of vagus nerve afferents to the nucleus tractus solitarii (NTS) and the forebrain²
• Weight loss as a side effect of vagus nerve stimulation in depressed patients³

Transcutaneous Vagus Nerve Stimulation (tVNS):

• Non-invasive approach to manipulate signaling of the auricular branch of the vagus nerve
• Application in the treatment of major depression⁴

Research question: Does tVNS modulate reward-related behavior and metabolism? How are these domains related?

Methods

Sample: N = 41 healthy participants (26 female; M_age = 25.3 years ± 3.8; M_BMI = 23.0 ± 2.9; 17.93 - 30.9 kg/m²)

Procedure:

• 2 morning sessions after overnight fasting
• Application of tVNS/sham stimulation during tasks
• State ratings (VAS: hunger, satiety, and mood) before/after tasks

Session protocol: 2 sessions single-blind randomized cross-over

The Effort Allocation task (EAT):

Physiology sessions (N=19)

• Resting Energy Expenditure (REE) and Electrogastrogram (EGG) under tVNS vs. sham on two consecutive days with returning participants

Discussion

• tVNS increases invigoration, but not maintenance of work specifically for food rewards
• tVNS induces gastric slowing
• No association of task and physiological effects

Conclusion:

• Invigoration for food might be shaped by vagal inputs modulating the dopaminergic NTS circuits
• Potential increase of homeostatically induced reward signals by tVNS
• Gastric slowing is related to feelings of fullness
• Weight loss effects of VNS might be mediated by lower gastric motility

Results

Analysis: 2-level hierarchical models for task / tVNS effects

No effect of tVNS on REE

Negative effect of tVNS on EGG

Physiology & behavior are not correlated

References


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