Decoding Bidirectional Interactions Between Alcohol and Pain

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Funding Support
NIAAA R01AA025337
NIAAA R21AA026805
Overview

1. Introduction

2. Pain as an antecedent for alcohol use

3. Acute analgesic effects of alcohol

4. Discussion and future directions
Introduction
Pain Prevalence and Costs

- 20.4% of US adults have chronic pain (Dahlhamer et al., 2018)
- 8.0% have high-impact chronic pain, limiting activities on most days
- Prevalence elevated among older adults, women, veterans, and those living in poverty
- Overall costs to US economy > $600B USD/year (Institute of Medicine, 2011)
- Front line treatments have poor efficacy and significant side effects (e.g., Reinecke et al., 2015)
Pain Self-Management with Alcohol

- Riley and King (2009) surveyed 4321 individuals with tooth, jaw, or arthritis pain.
- Across conditions, ~25% of individuals endorsed the use of alcohol to manage pain.
- Risk factors:
  - Male
  - Young adults
  - Greater pain severity
  - Higher SES
  - White racial identity
  - Depression
  - Longer pain duration
  - Use of prescription analgesics (e.g., opioids)

Risks of Pain Self-management with Alcohol

1. Interactions between alcohol and pain medications may have severe health consequences
   - Approximately 77% of the 100 most prescribed drugs in the US have potentially harmful interactions with alcohol
   - Includes drugs used for pain treatment:
     - All opioid analgesics
     - Antidepressants, including SSRIs and SNRIs (e.g., fluoxetine, duloxetine)
     - Non-steroidal anti-inflammatory drugs (e.g., ibuprofen, aspirin, naproxen)
     - Acetaminophen
     - Gabapentin
   - **Note: 36.8% of US adults over 65 take more than 5 medications**
     - Pain medications, benzodiazepines, muscle relaxants among most common

Risks of Pain Self-management with Alcohol

2. Self-medication of pain with alcohol likely results in hazardous drinking
   • Risk of developing painful alcohol-related neuropathy (25-60% of people with AUD)
   • Relief of pain provides additional negative reinforcement for alcohol use, increasing risk of developing AUD or return to use for those in recovery

3. Alcohol withdrawal increases pain severity and sensitivity

4. Alcohol use/misuse itself results in costs > $200B USD/year
Effects of substance use on pain
Acute analgesia
Abstinence-induced hyperalgesia
Risk for developing chronic pain

SUBSTANCE USE

Maintenance and progression of both chronic pain and addiction

Effects of pain on substance use
Pain as a motivator of substance use
Use of substances to cope with pain
Pain as a barrier to cessation
Risk for developing substance-related disorders

PAIN
CANUE Model

Pain as an Antecedent for Alcohol Use
Background

• Substantial evidence that pain is a potent predisposing factor for heavy drinking and alcohol-related consequences (e.g., Bush et al., 2022)

• Greater pain severity has been associated with greater odds of return to drinking both during and after treatment (Witkiewitz et al., 2015)

• Reductions in pain severity of the course of residential treatment predicted increased abstinence self-efficacy and quality of life, and reduced craving (Ferguson et al., 2022)

• Experimentally-induced pain increases urge and intention to drink in healthy young adults (Moskal et al., 2018)
Effect of Musculoskeletal Pain on Reinforcing Efficacy of Alcohol

• Strength Training and Alcohol Consumption (STAC) Study

• N=53 (30 women) randomized to vigorous eccentric (DOMS) or low-intensity concentric bicep exercise (Sham DOMS)

• Demand assessed using Alcohol Purchase Task before and 48 hours after exercise
  • Intensity, breakpoint, Omax, Pmax, essential value

Effect of Pain on Drinking Topography

- Pain and Alcohol in Virtual Reality (PAVR) Study
- N=20 (11 women) completed two alcohol self-administration sessions in VR
  - Heat pain (44°C)
  - Non-noxious warmth (38°C)
- Drinking topography compared between sessions using multilevel modeling

Acute Analgesic Effects of Alcohol
Background

• Anecdotal and clinical reports of alcohol’s analgesic effects date back as far as 1513 (Dundee et al., 1969)

• Consistent laboratory evidence that alcohol increases pain threshold and decreases pain intensity in healthy individuals (Thompson et al., 2017)

• However, studies often limited to men and people without chronic pain
Analgesic Effects of Alcohol in Chronic Jaw Pain

- NIAAA-funded R21
- N=48 (36 women; 19 chronic pain) completed two double-blind testing sessions
  - Alcohol (.08 g/dL target BrAC)
  - Placebo (0 g/dL target BrAC)
- Pressure algometry performed at masseter insertion
- Pain threshold, pain intensity, and perceived pain relief assessed using VASs


Acute Tolerance and Functional Neural Correlates of Alcohol Analgesia

- NIAAA-funded R01
- N=110 (63 women; 45 family history positive) without chronic pain completed two double blind testing sessions
  - Alcohol (.08 g/dL target BrAC)
  - Placebo (0 g/dL target BrAC)
- Heat-based quantitative sensory used to characterize effects of alcohol on pain threshold, pain intensity, and perceived pain relief
- Resting state and task-based fMRI data collected at peak BrAC


**RSV: Regional Signal Variability**

- Standard deviation of signal intensity over time

- Greater RSV is associated with improved cognitive performance and pain modulation.

- Higher RSV reflects greater functional capacity of a brain region
Discussion and Future Directions
Overall Summary

• Results provide further evidence that pain increases the motivation to use alcohol, the reinforcing efficacy of alcohol, and alters drinking topography
• These effects appear to be especially strong among men and individuals with higher negative urgency
• Alcohol acutely increases pain threshold and perceived pain relief, and decreases pain intensity, but...
  • Effects on pain relief ratings are greater than pain threshold or intensity
  • Changes in pain relief ratings do not appear to be correlated with QST measures
  • Pain relief ratings are greater on the ascending than descending limb
Future Directions

- Need to more fully characterize:
  - Pain as an antecedent for alcohol use and/or return to use as a function of putative risk factors
    - Systematic inclusion of individuals at higher risk for alcohol-related consequences, including older adults, historically excluded and marginalized groups, individuals with chronic pain, people in AUD recovery
    - Adequately powered sample to test predictions of CANUE model
  - Impact of sex and family history on analgesic effects of alcohol and functional neural correlates
  - Mechanisms underlying negative reinforcing effects of alcohol intake in the context of pain
    - I.e., how do individuals determine that alcohol has produced pain relief?
  - Interventions to reduce risk of alcohol-related consequences in people with pain, and vice versa
Questions?

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