

Cortical Hemodynamic Responses Measured by fNIRS During and After Exergaming in Older Adults



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A scoping review mapping neurophysiological evidence on cortical activation during, pre-, and post-exergaming training in adults aged 60 years or above.

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Background

Exergaming is increasingly recognized as a strategy to improve both motor and cognitive outcomes in older adults, yet the neurophysiological mechanisms behind these benefits remain underexplored.

Functional near-infrared spectroscopy (fNIRS) enables noninvasive assessment of cortical hemodynamic responses during task performance and is well suited for ecologically valid exergaming research.

Why this review?

- To map evidence on cortical activation measured by fNIRS during and pre-and post-exergaming training among older adults

Eligibility

- Empirical fNIRS studies
- Exergaming-related assessment
- Participants aged 60 years or above

Search Sources

- PubMed
- Scopus
- MEDLINE
- CINAHL Ultimate
- Cochrane Library

Included Studies

- Eggenberger et al. (2016)
 - Intervention study; 50-minute dance-step exergame, 10 weeks, twice weekly
- Knols et al. (2017)
 - Acute study; 21-minute bedside exergaming session
- Liao et al. (2021)
 - Intervention study; 60-minute stepping/reaching game, 12 weeks, thrice weekly
- All included studies examined the prefrontal cortex

Key Synthesis

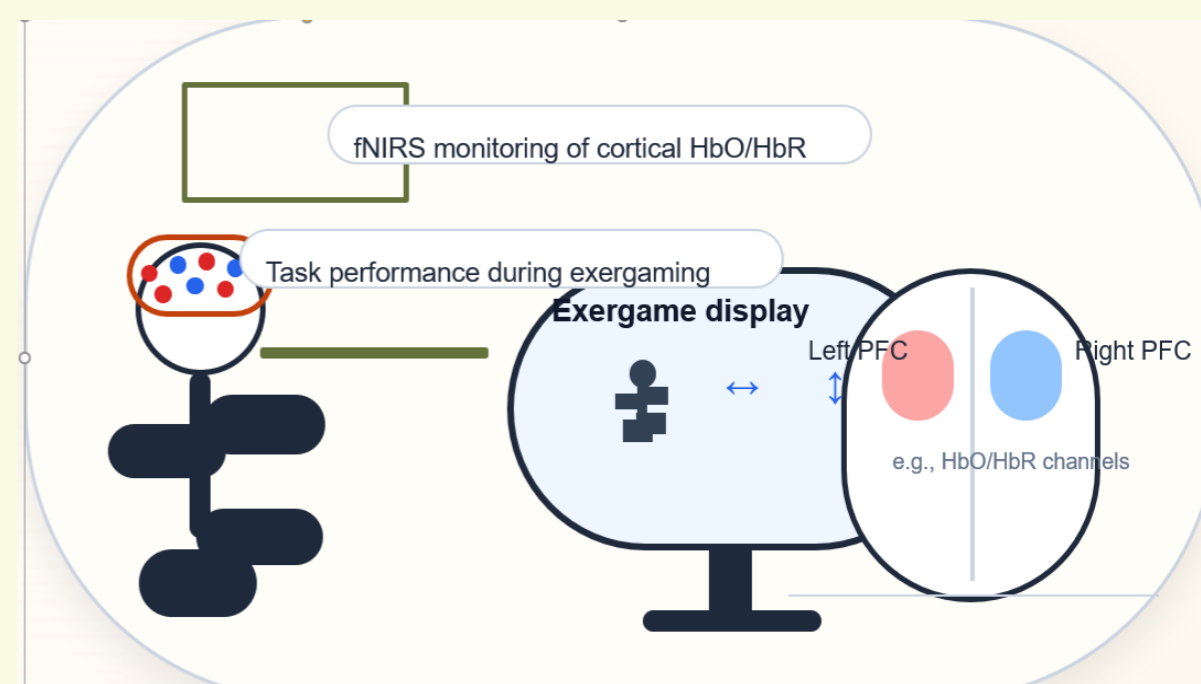
- ❑ All three included studies examined the prefrontal cortex (PFC)
- ❑ Mean age range: 63.7 to 83.8 years
- ❑ Two intervention studies reported reduced post-training PFC activation
- ❑ One acute bedside study reported transient decreases in PFC oxygenation

Poster snapshot

Status: manuscript under review

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Interpretation

- ❑ Findings support neural efficiency as a possible mechanism for exergaming-related motor-cognitive benefits

Methodological Gaps

- ❑ All three studies used sampling rates of 1-10 Hz, considered suboptimal for stronger fNIRS methodological rigor
- ❑ Only one study reported motion artifact correction
- ❑ None analyzed total hemoglobin
- ❑ None reported physiological noise analysis

Conclusion and Future Directions

- ❑ fNIRS appears feasible and safe for exergaming research in older adults
- ❑ Neural efficiency is a plausible mechanism for dual motor-cognitive benefits
- ❑ Future randomised controlled trials should use standardized protocols and stronger artifact correction procedures
- ❑ Broader hemodynamic analysis is needed to clarify cortical adaptation in gerontechnology-mediated cognitive aging

Take-home Message

- ❑ The evidence base is promising but still very limited.



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