Cerebral oxygenation and cognitive performance under acute normobaric hypoxia

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01 INTRODUCTION

► **Altitude hypoxia** can **degrade executive functions and associated behavioral responses** in fighter pilots and so be at the origin of accidents in flight.

► **Working Memory (WM)** is impaired during exposure to hypoxia beyond 3000m *(Malle et al., 2013)*

► **Cerebral oxygenation responses** are correlated to cognitive performance during hypoxia *(Williams et al., 2019)*

Purpose

Identify the effects of acute exposure in normobaric hypoxia on cerebral oxygenation and cognitive performance during a working memory task

02 METHODS

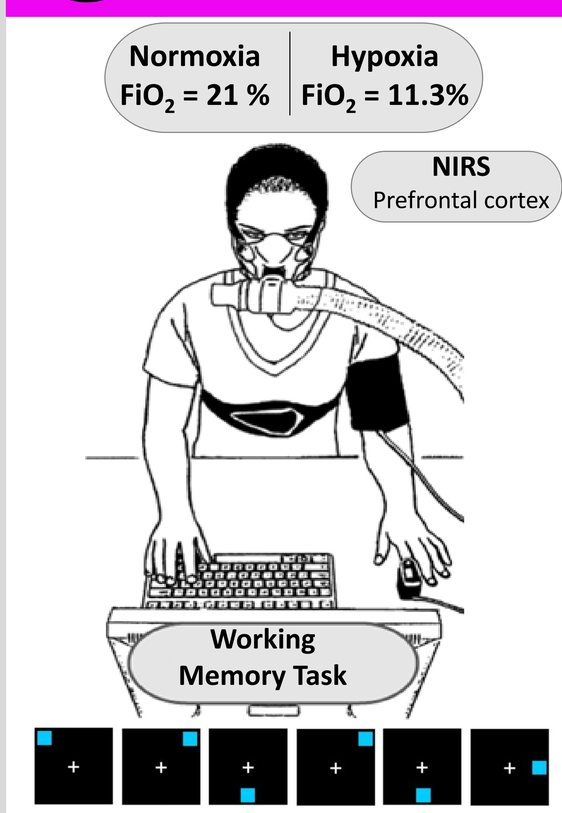

Fig.1: Experimental set-up

Participants:

10 healthy adults attended 2 randomized sessions:
- 1 normoxia (N)
- 1 hypoxia (H)

Design (Fig.1):

9 blocks of 49 stimuli of a WM task (2-back)
- N session: 9 blocks under N
- H session: 2 blocks N (T1) → 3 blocks up to H (T2) → 4 blocks H (T3)

Variables:

Cerebral oxygenation (PortaLite, Artinis; 10Hz): oxygenated (**O_2Hb**) and desoxygenated (**HHb**) blood

Working memory performance and reaction time (RT)

Nasa-TLX (subjective questionnaire)

03 RESULTS

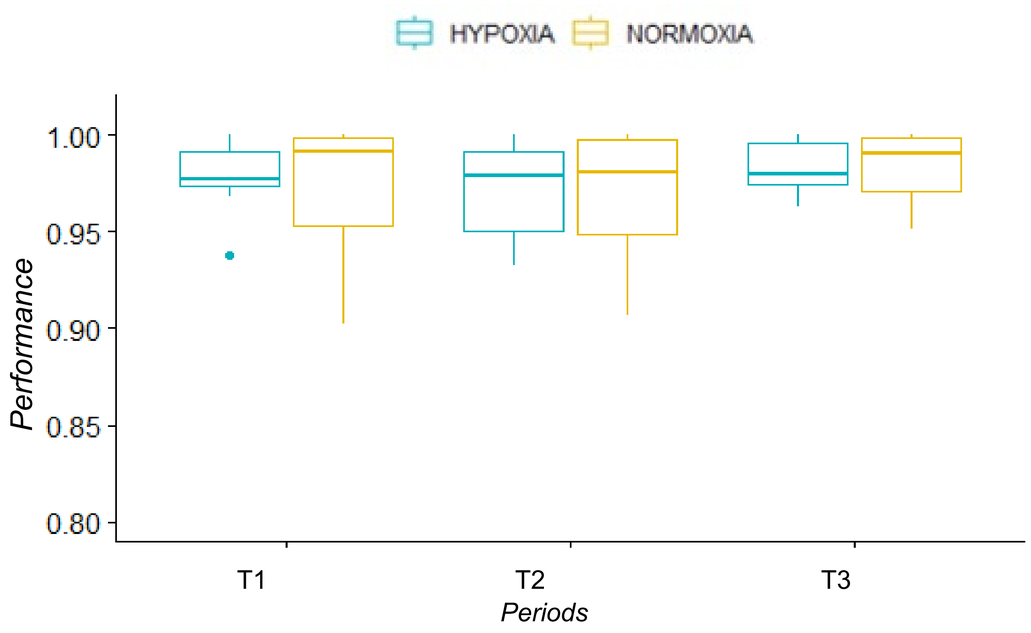

Fig.2: Performance of Working Memory task depending on condition (H vs N) and time periods

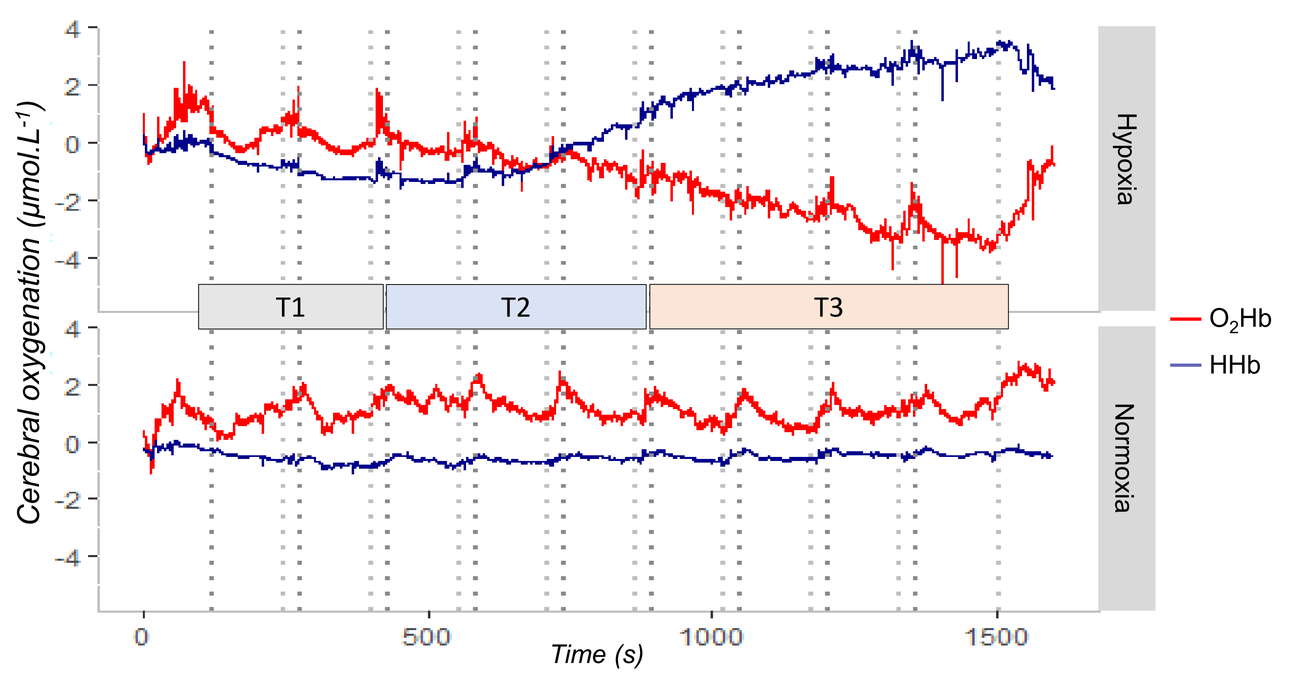

Fig.3: Cerebral oxygenation under N and H during the cognitive task

IN BRIEF

Working Memory (Fig.2)
- No difference of condition (H / N) on performance and RT
- No difference of time on performance and RT

Cerebral oxygenation (Fig.3)
- Difference between N and H on O_2Hb and HHb
- ↘ O_2Hb and ↗ HHb with time in H

NASA-TLX
- Hypoxia ↗ perceptive workload ($p < .05$)

04 CONCLUSION

► **Hypoxia (~5000m) induced reduction in cerebral oxygenation but not with cognitive performance.**

The difficulty of WM might be too low in altering the cognitive performance.

► **Other executive functions must be taken in consideration (e.g., inhibition and selective attention with the Stroop task)**

Notes
[1] EuroMov Digital Health in Motion, Univ Montpellier, IMT Mines Ales, Montpellier, France
[2] Semaxone, Rochefort du Gard (30650), France

References
- Malle C, *et al.* (2013). Aviat Space Environ Med. DOI: 10.3357/ASEM.3482.2013
- Williams TB, *et al.* (2019). Exp Physio. DOI: 10.1113/EP087647

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