

DISTINCTIVE SLEEP PHENOTYPES IN FORMER ELITE CONTACT-SPORT ATHLETES ARE ASSOCIATED WITH MEMORY INDEPENDENT OF ALZHEIMER'S PATHOLOGY

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INTRODUCTION

- Sleep disturbances are common in Alzheimer’s disease (AD)¹ and often precede cognitive decline.
- Former contact-sport athletes also report poor sleep² and elevated pTau217³ associated with repetitive head impacts (RHI), yet objective characterisation of sleep in this population remains limited.
- We hypothesised that longitudinal, contactless-monitoring of sleep would identify abnormal sleep profiles in former elite contact-sport athletes (association football and rugby), which would relate to memory performance, potentially via AD-related pathology.

METHODS

- Sleep behaviour was characterised over ~45 days using the Withings Sleep Analyser (WSA) (Fig.1) – a contactless, unobtrusive bed mat⁴

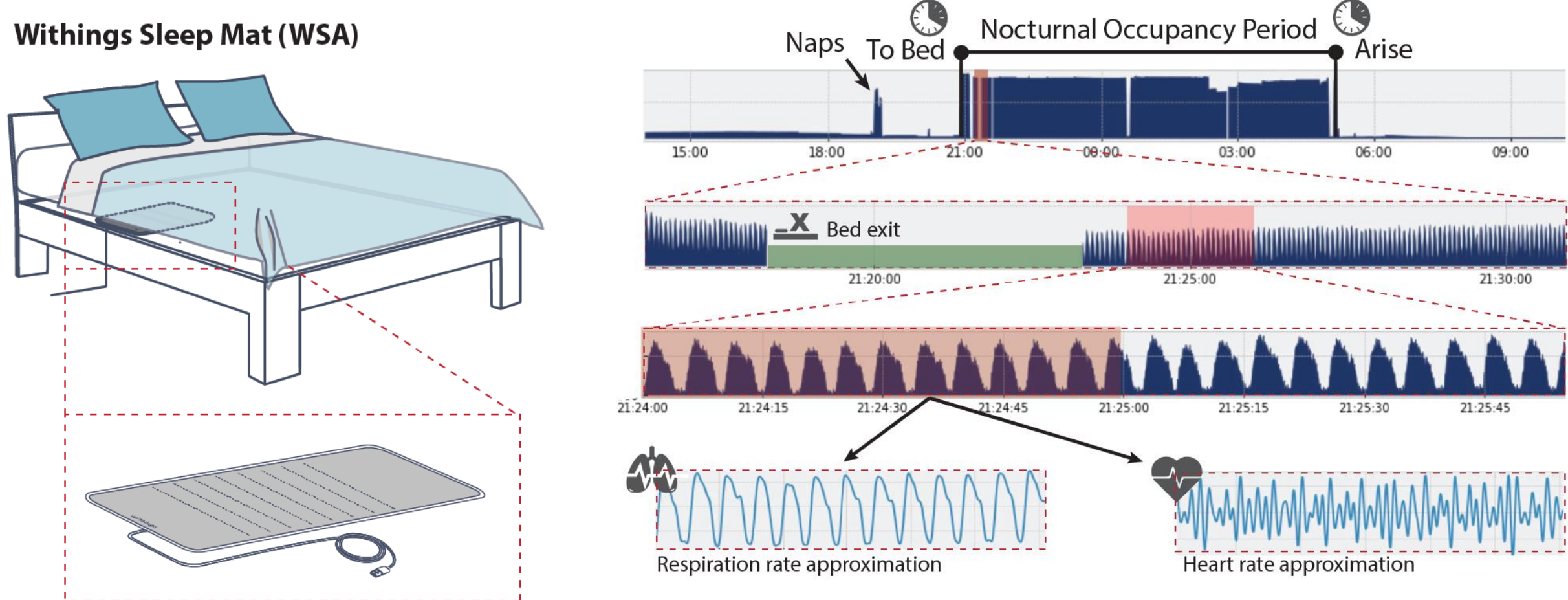


Figure 1. Left: Withings Sleep Analyzer (WSA), an under-mattress bed mat; Right: Raw signals derived from the sleep mat.

- Tau pathology (pTau217) was quantified via Quanterix Simoa, and memory outcomes were assessed using the RBANS delayed memory index –sensitive to early AD⁶ and RHI⁷

	Healthy Controls	Contact-sport	AD	P-value (overall)	P-value (HC-Contact)
n	884	49	77		
Age	47.1 ± 8.0	47.2 ± 8.4	82.9 ± 6.3	<.001	.925
Sex (M%)	93%	92%	52%	<.001	.985

- Main analysis:** ANCOVAS compared sleep profiles across propensity matched controls from Withings, former elite contact-sport athletes recruited from the Advanced Brain Health Clinic, and older adults with AD from the Minder cohort. FDR correction was applied
- Exploratory analysis:** In former athletes, associations between sleep, delayed memory, and pTau217 were examined using regression models adjusted for age, sex, and education.

RESULT: Sleep relates to cognition independently of tau pathology

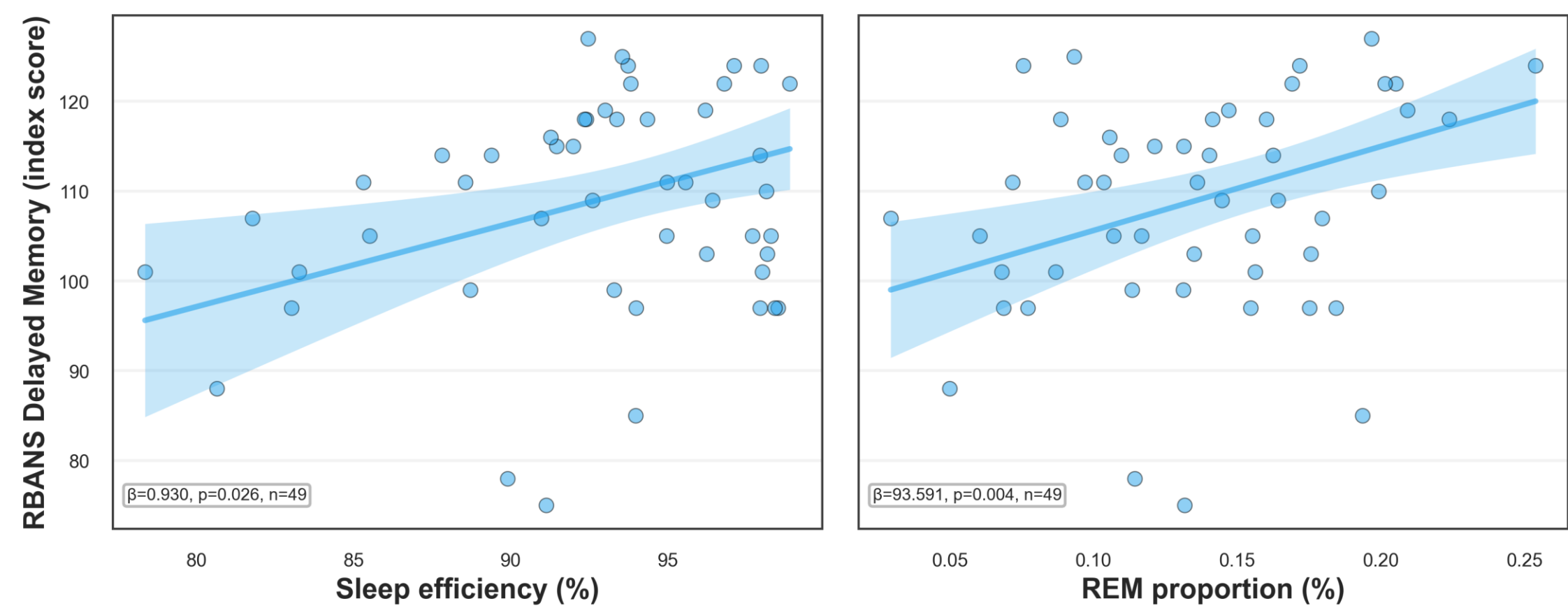


Figure 1. Regression of sleep behaviors with RBANS Delayed Memory in former elite contact-sport athletes, adjusted for age, sex, and education (95% CI).

RESULT: Former athletes display a distinct sleep phenotype

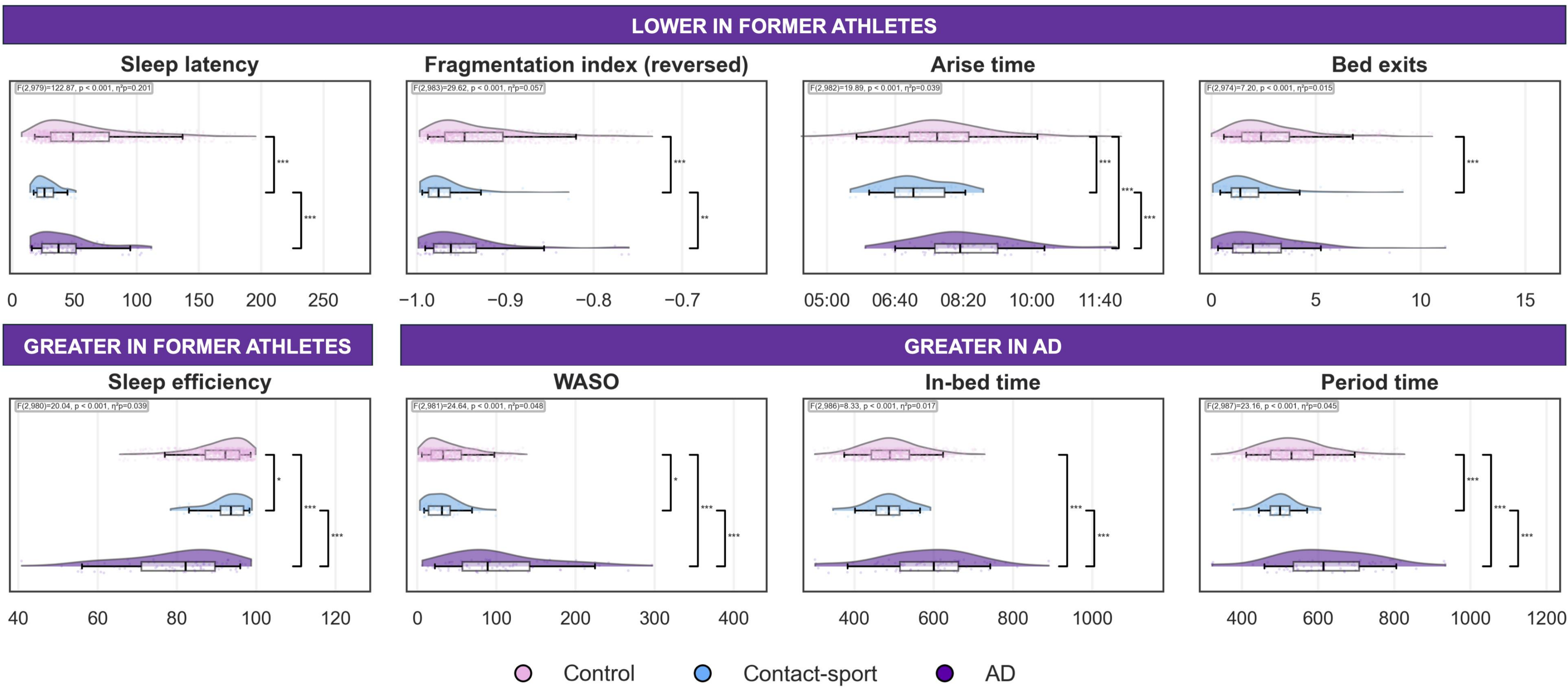


Figure 1. Age- and sex-adjusted sleep outcomes across groups. WASO = wake after sleep onset

SLEEP ARCHTECHTURE

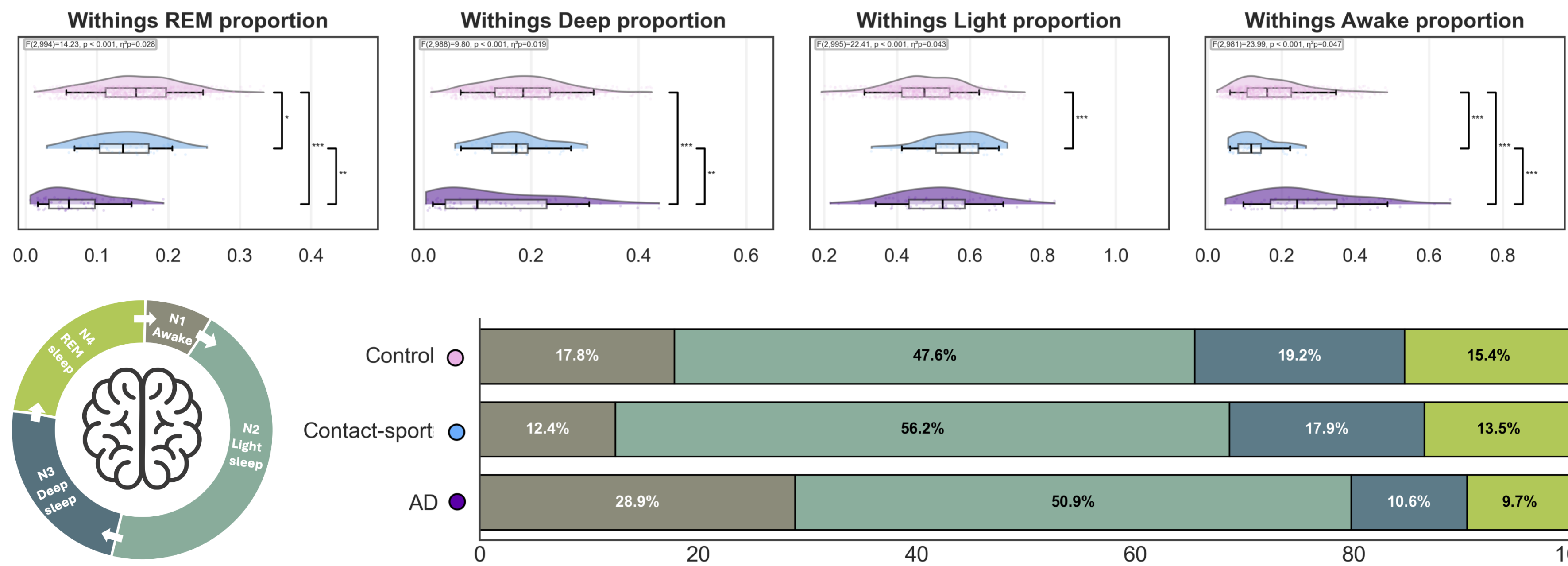


Figure 3. Top: Withings-derived proportions of REM, deep, light, and awake sleep across groups. Bottom: Literature-derived estimations of sleep-stage distributions (left) and group-mean proportions (right).

CONCLUSION

- Distinctive sleep phenotype:** Former contact-sport athletes exhibited a sleep profile distinct from matched controls and AD.
- Sleep-memory links are not biomarker-driven:** pTau217 did not moderate sleep-memory associations, suggesting that functional sleep disruption, rather than underlying tau pathology, best explains cognitive variation in this population.
- Sleep as a modifiable target:** If sleep-memory links are independent of tau burden, they may be amenable to intervention, positioning sleep as an early actionable target in former contact-sport athletes.
- Future directions:** Longitudinal work integrating neuroimaging, fluid biomarkers, and lifestyle factors are needed to establish whether sleep disruption precedes, accelerates or reflects neuropathology in this population.

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