

OBJECTIVE SLEEP CHARACTERISTICS OF YOUNG ELITE FEMALE GYMNASTS: A CASE SERIES REPORT

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Abstract

Purpose: Sleep is considered one of the most important recuperation techniques for elite athletes, with its specific features implicating different aspects of learning skills and physical recuperation. The aims of this study were (1) to assess objectively the sleep characteristics of elite gymnasts and (2) to correlate these findings with their age.

Methods: Twelve elite female gymnasts (15.1 ± 1.5 years old; VO₂MAX: 53.18 ± 5.1 ml·min⁻¹·kg⁻¹; 30.7 ± 1.7 training hours/week) underwent a nocturnal polysomnography (PSG) after a regular training day (6 - 6.5 h of training). The PSG was scored according to the guidelines of the American Academy of Sleep Medicine (AASM). Time in bed (min), Total Sleep Time (TST, min), Sleep Efficiency (SE, %), Non Rapid Eye Movement 1 (NREM1, %), NREM2 (%), Slow Wave Sleep (SWS, %), REM (%), Wake After Sleep Onset (WASO, min), Sleep Onset Latency (SOL, min), Awakening Index (/h) and Apnea-Hypopnea-Index (/h) were measured and analyzed. Furthermore, the gymnasts completed the Epworth Sleepiness Scale (ESS) and Pittsburgh Sleep Quality Index (PSQI). Sleep parameters were correlated with age using a Pearson Correlation.

Results: The following objective values were attained: time in bed 487 ± 13 min, TST 437 ± 27 min, SE 89.5 ± 4.1 %, NREM1 4.9 ± 3.6 %, NREM2 38.7 ± 10.2 %, SWS 36.9 ± 11.4 %, REM 19.3 ± 3.8 %, WASO 32.4 ± 9.2 min, SOL 18.3 ± 16.5 min, Awakening Index 16.1 ± 6.3 /h, Apnea-Hypopnea-Index 0.9 ± 0.8 /h, Epworth Sleepiness Scale 5.3 ± 2.5 (/24), PSQI 2.6 ± 1.9 (/21). Age-matched correlations for %SWS (r = -0.693, P = 0.013) and arousals from SWS (r = -0.622, P = 0.031) were found. The younger the gymnasts, the higher %SWS was found, with higher amounts of arousals from SWS in the younger gymnasts.

Discussion: Objective sleep assessments through PSG in elite female athletes suggest a higher amount of SWS compared to non-elite athletic peer students (Suppiah et al., Ped. Ex. Sc. 2016; 28: 588-595) as a salient feature in their sleep architecture. This may represent an advantage towards higher performance, as sleep deficits are related with lower performance. Hence, it needs to be explored whether a thorough analysis of elite athletes' sleep should be incorporated in health screenings.

Abbreviations

TST	Total Sleep Time
	Time between sleep onset time and sleep offset time without awakening periods
SE	Sleep Efficiency
	TST/ Time in bed
WASO	Wake After Sleep Onset
	Duration of nocturnal awakenings
SOL	Sleep Onset Latency
	Time between time to bed and sleep onset

References

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Contact

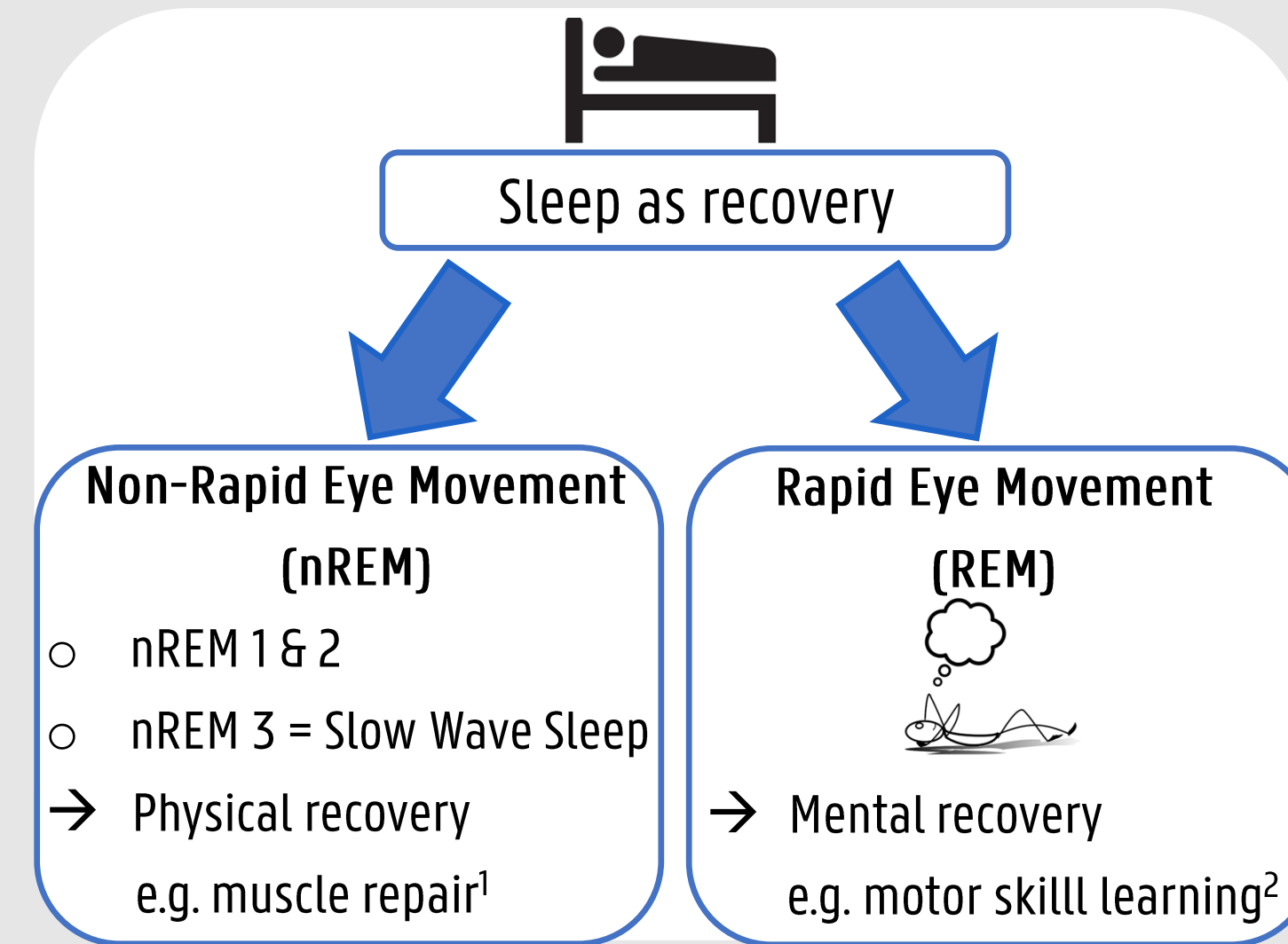
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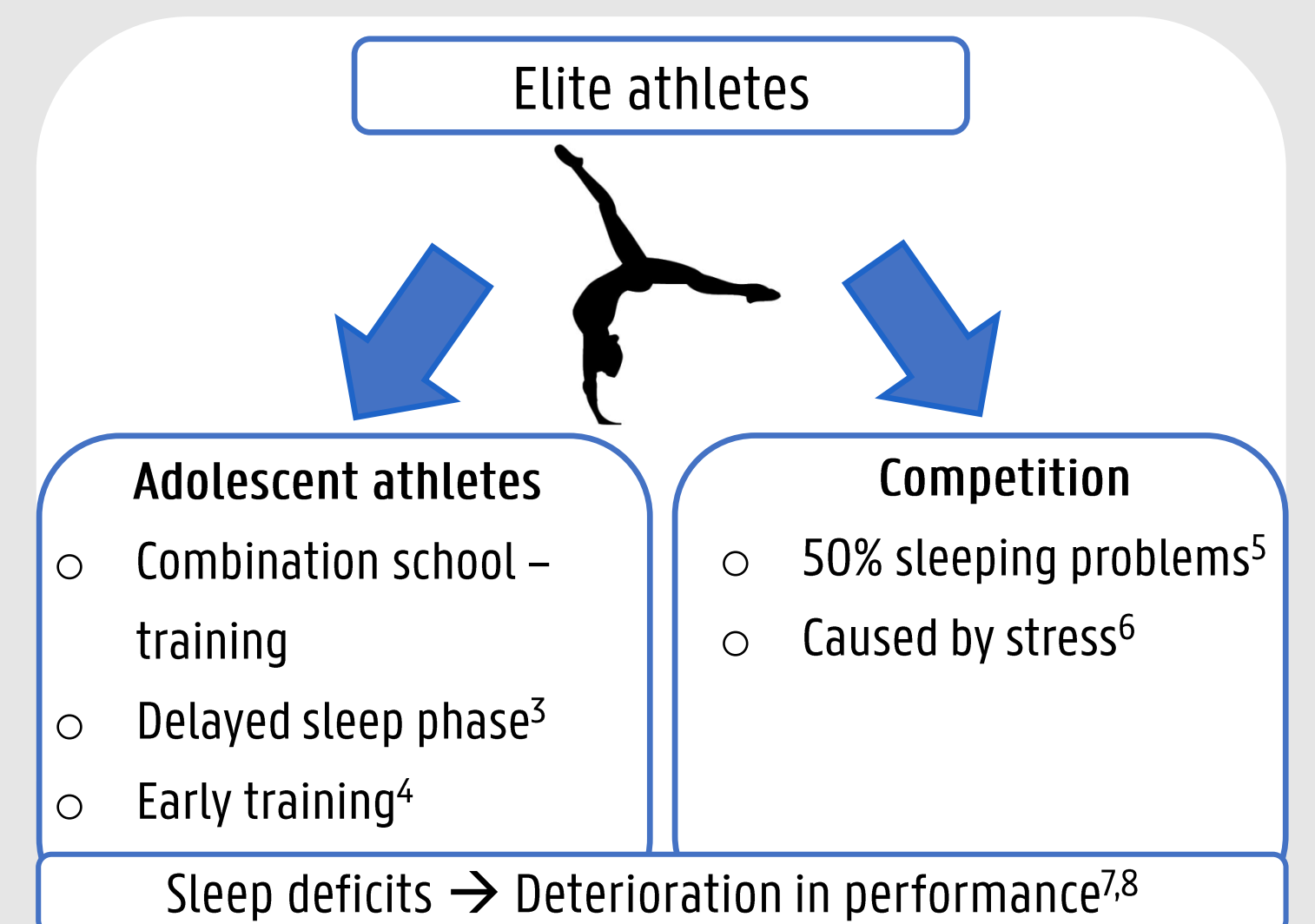
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Introduction



Aim

Objective assessment of young elite female gymnasts' sleep



Methods

Age (years old)	15.1 ± 1.5 (13-17.6)
Height (m)	1.54 ± 0.07 (1.43-1.66)
Body weight (kg)	44.7 ± 6.1 (36-53.5)
BMI (kg·m ⁻²)	18.8 ± 1.5 (17.1-21.3)
VO ₂ max (ml·min ⁻¹ ·kg ⁻¹)	53.18 ± 5.1 (45.64-58.65)
Training volume (hours/week)	30.7 ± 1.7 (28.5-32)

Subjectively

- Epworth Sleepiness Scale (ESS)⁹
- Likelihood of dozing off
 - 0-5 (lower normal daytime sleepiness), 6-10 (higher normal daytime sleepiness), 11-12 (mild excessive daytime sleepiness), 13-15 (moderate excessive daytime sleepiness), 16-24 (severe excessive daytime sleepiness)
- Pittsburgh Sleep Quality Index (PSQI)¹⁰
- ≥5 (/21): indicative of poor sleep
- Subjective sleep questionnaire: sleep quality and quantity

Objectively

Polysomnography (PSG)



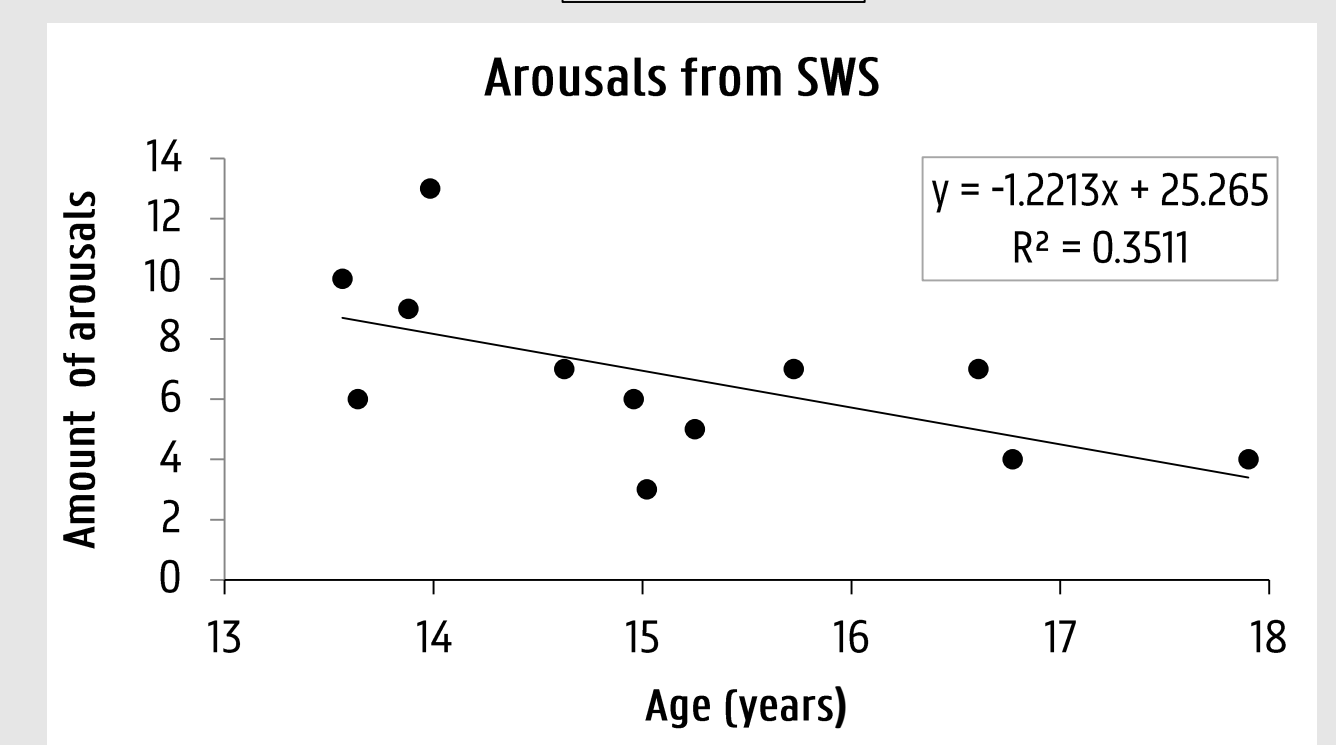
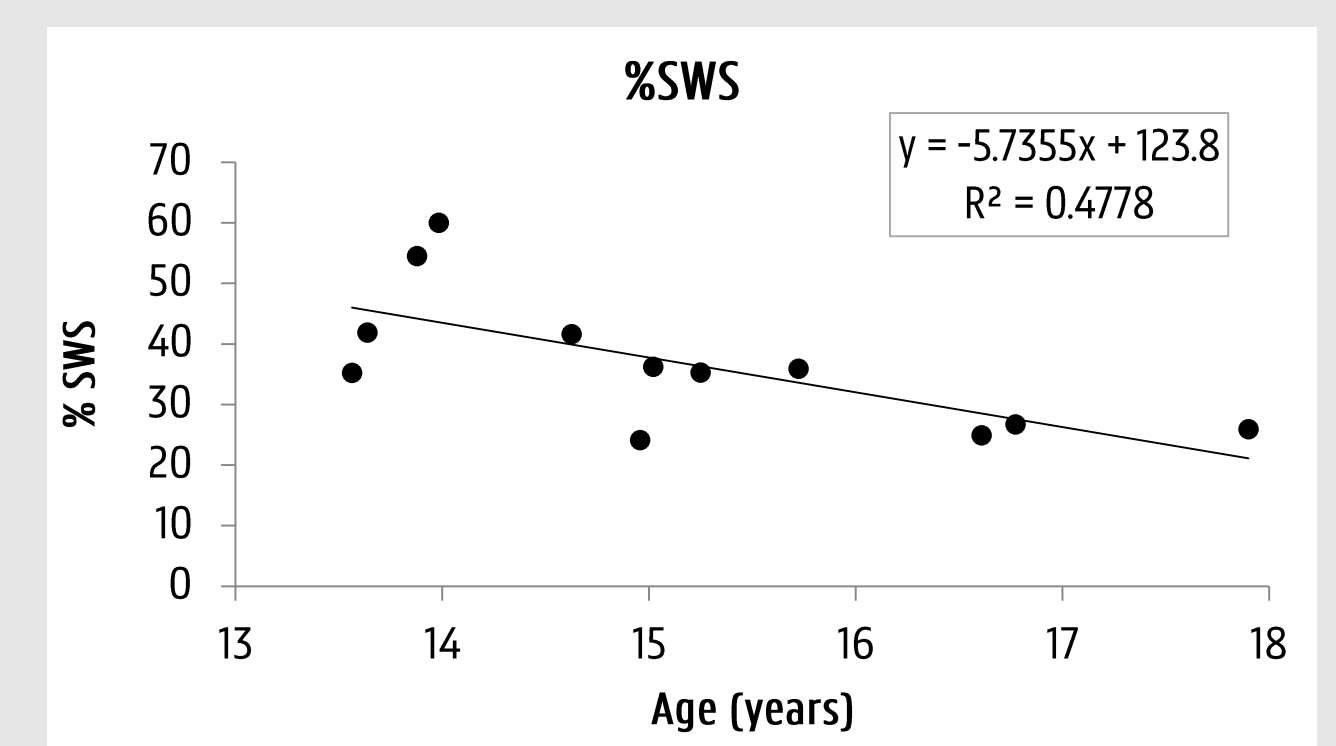
Electroencephalography (EEG), electro-oculography (EOG), electrocardiography (ECG), electromyography (EMG; chin, right leg, left leg), posture detector, pulse oximeter (assessing oxygen saturation), breathing detectors (thorax and abdomen), manometer (measurement of oronasal pressure)

Results

Parameter	Gymnasts (mean ± SD)	Correlation with age (r-value)
Time in bed (min)	487 ± 13	-0.186
TST (min)	437 ± 27	-0.132
SE (%)	89.5 ± 4.1	-0.282
NREM1 (%)	4.9 ± 3.6	0.521
NREM2 (%)	38.7 ± 10.2	0.454
SWS (%)	36.9 ± 11.4	-0.693*
REM (%)	19.3 ± 3.8	0.367
WASO (min)	32.4 ± 9.2	-0.234
SOL (min)	18.3 ± 16.5	-0.217
Arousals from SWS (#)	6.8 ± 2.7	-0.622*
Micro-awakenings (/h)	11.7 ± 6.0	0.064
Macro-awakenings (/h)	4.4 ± 0.9	0.383
Awakening index (/h)	16.1 ± 6.3	0.116
Apnea-Hypopnea-Index (/h)	0.9 ± 0.8	-0.295
Epworth Sleepiness Scale (/24)	5.3 ± 2.5	0.515
PSQI (/21)	2.6 ± 1.9	-0.138

Objectively vs. Subjectively

- Objective SOL < Subjective SOL
- Objective TST = Subjective TST
- ESS: normal
- PSQI: 2 gymnasts with poor sleep quality



Conclusion

Higher SWS in elite female gymnasts compared to young non-elite athletes¹¹

- High training intensity & volume?
- Genetic predestination?
- Combination?