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Effect of age on the macro- and microstructure of sleep in women

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Background

Changes in sleep across age are well documented, but most large-scale studies focus on either healthy individuals and/or use only measures of sleep macrostructure. whereas sleep microstructure has been primarily assessed in small and selected samples. Moreover it is unclear, whether age-related changes in sleep are primarily related to co-occurring changes in health status and mood, as recently shown regarding subjective sleep complaints (*Grandner et al., 2012*).

Objectives

- Investigate the effect of age on sleep macrostructure, spectral composition of sleep, intra state elements and sleep continuity
- Investigate whether changes in physiological sleep across age are related to the co-occurrence of depressed mood, subjective health and sleep-disordered breathing

Methods

Sample

- 233 women (age: 48.9 + 11.2, range 22- 72 years) from a randomly selected representative sample of 400 women (oversampling of snorers)
- Exclusion criteria: severe somatic disease, being on drugs that might interfere with sleep architecture & insufficient PSG quality

Procedures

- One night of ambulant PSG recording & questionnaires

Measures

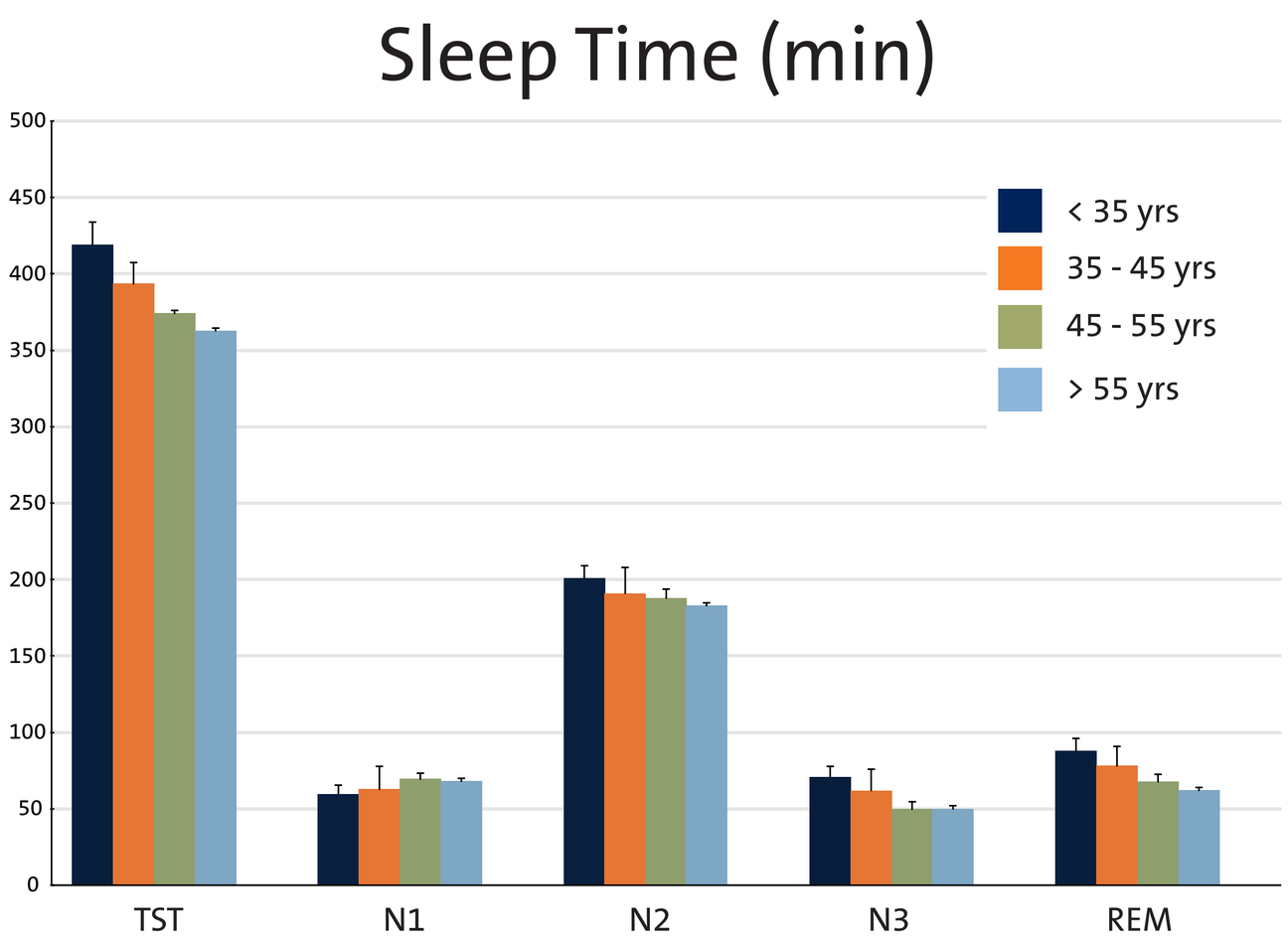
- Sleep scoring, spectral analysis and microstructure analysis (C3-A2) were conducted using automatic analysis and verified manually by a sleep scoring expert
- Depressed mood was assessed using the Hospital Anxiety and Depression Scale, subjective health was measured using one question from the SF36

Statistical analysis

- Linear regression analyses (non-weighted)
- Significance level p <.05 for all analyses

Results

Age was associated with a significant reduction in Total Sleep Time, time in N3 and REM sleep (see figure), as well as a reduction in number of sleep cycles.



Changes across age in power density as well as spindle, K-complex and REM density are displayed in table 1.

Table 1 **Mean (SEM) for power density (log) in different bands during NREM sleep, spindle, K-complex and REM density**

	< 35yrs	35-45yrs	45-55yrs	> 55yrs	R^2
Delta power	55.9 (1.5)	52.2 (0.9)a	50.2 (0.6)a	51.1(0.7)a	0.084
Theta Power	32.1 (1.1)	29.5 (0.9)	30.2 (0.7)	30.9 (0.7)	0.017
Sigma Power	9.8 (1.0)	6.7 (0.97)a	6.3 (0.78)a	6.0 (0.8)a	0.033
Beta 1 Power	-38.3 (1.7)	-37.0 (1.7)	-36.5 (1.3)	-34.2 (1.4)	0.015
Beta 2 Power	-71.1 (1.8)	-67.6 (1.9)	-67.2 (1.5)	-64.2 (1.5) a	0.030
Spindle density	4.4 (0.4)	3.1 (0.31)ad	2.7 (0.2)a	2.2 (0.2)a	0.1158
K complex density	1.2 (.1)	1.01 (0.07) cd	0.73 (0.06)a	0.65 (0.05)a	0.1487
REM density	0.17 (.0)	0.16 (0.01)	.16 (0.01)	.16 (0.01)	0.0009

** a = significant difference to age group < 35yrs; b = significant difference to age-group 35-45yrs; c = significant difference to age-group 45-55yrs; d = significant difference to age-group > 55 yrs*

The number of microarousals was not significantly affected by age. The percentage of segments shorter than 5 min for NREM sleep (N2, N3), SWS sleep and REM sleep is displayed in table 2.

Table 2 **Mean (SEM) percentage of segments of consolidated sleep shorter than 5 min**

	< 35yrs	35-45yrs	45-55yrs	> 55yrs	R^2
NREM sleep (N2 + N3)	76 (2)	78 (2)	81 (1)a	81 (1)a	0.029
N3 sleep	67 (3)	69 (3)	76 (2)a	75 (2)a	0.035
REM sleep	24 (3)	29 (4)	32 (3)	31 (3)	0.012

** a = significant difference to age group < 35yrs*

Effect of covariates

- Higher AHI was associated to an increase in N1 sleep
- Worse subjective health was associated to a decrease of the number of sleep cycles, higher beta 2 power density during NREM sleep, and to an increase in fragmentation of SWS sleep
- Higher depression scores were related to a decrease in delta and theta power density during NREM sleep, and a decrease of K-complex density
- The effect of age was largely not altered by including the covariates

Conclusions

Increasing age was as expected associated to a reduction of the number of sleep cycles, decreased sleep time and decreased N3 and REM sleep. The decrease in sleep spindles and K-complexes during N2 sleep presumably indicates a decrement of sleep protective mechanisms with increasing age. Sleep fragmentation was slightly increased in particular in women in the perimenopause age-range (45-55yrs). Including covariates did against expectations by and large not affect the effect of age on the sleep parameters.

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