



Exercise is associated with changes in sleep architecture during stress

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Conclusion

High exercise activity is related to shorter sleep without shorter time in bed during stress.

Introduction

Exercise have historically and popularly been associated with good sleep, however the objective evidence of this relationship is conflicting. The most common observations of positive effects of acute exercise on sleep are increased amount of subsequent slow wave sleep (SWS), increased total sleep time (TST) and reduced REM sleep. However, individual responses to exercise have been found to vary with poorer positive changes in fitness in those who report higher levels of baseline mental stress. This study aims to investigate the stress-sleep-exercise connection further.

Methods

Sleep was recorded with polysomnography (PSG) at their own home in 28 teachers during one high stress and one low stress condition (and a habituation night). Probable upcoming stress levels were estimated through weekly ratings on a web questionnaire. Participants also kept sleep- and wake diaries and wore actigraphs. Exercise was reported in minutes of duration and defined as a continuous activity of intensity equivalent to a brisk walk or higher. Participants also kept sleep diaries and wore actigraphs.

Results

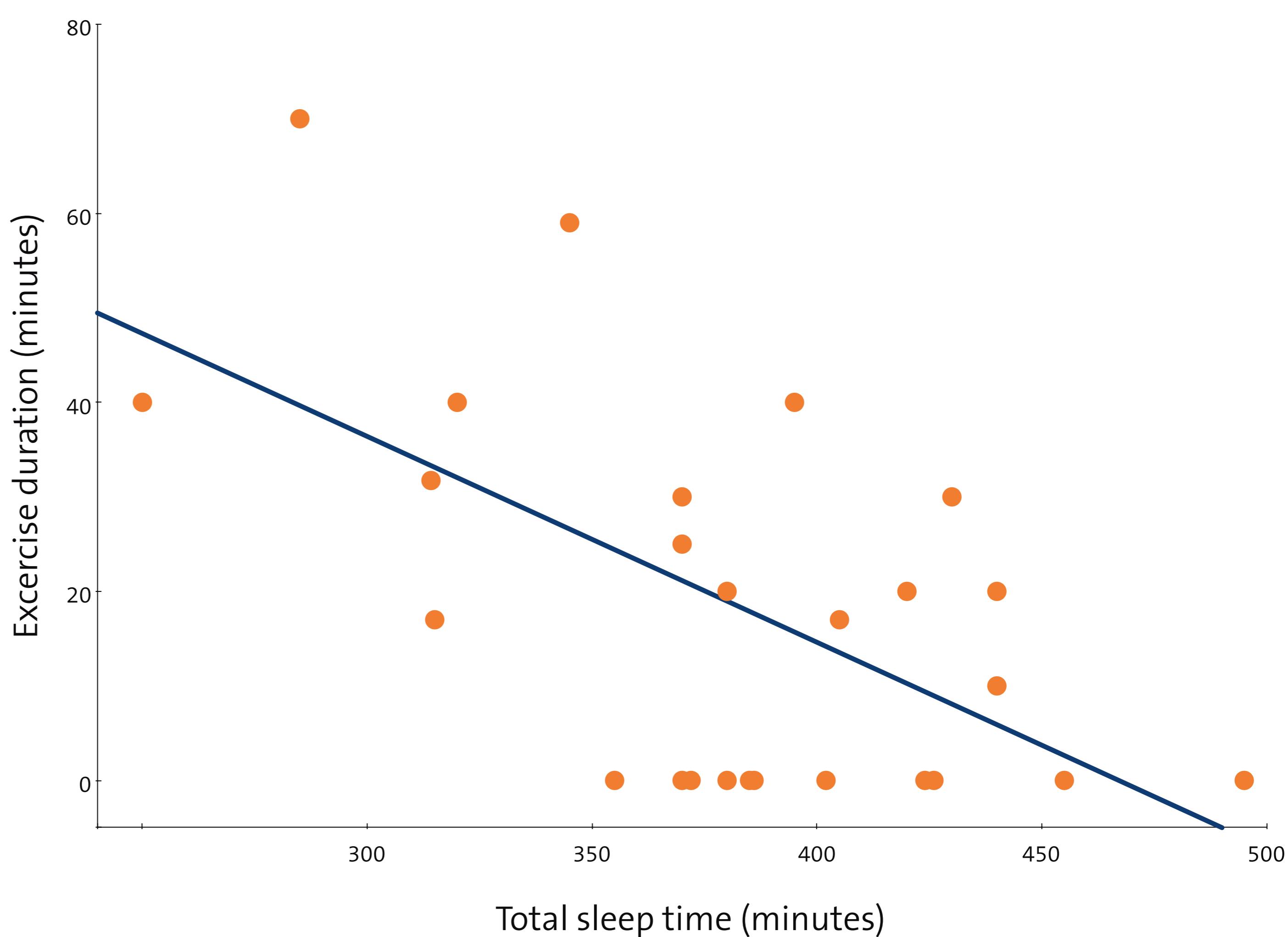
On the day of the high stress PSG recording the participants exercised for $17,7 \pm 3,7$ minutes (median 15 min, range 0-60 min), 43 % did not exercise at all that day and in the low stress condition for $23,4 \pm 3,8$ min (median 30 min, range 0-60 min), 21 % reported 0 minutes of exercise. 60 % exercised for 30 min or longer during low stress and 32 % during high stress condition. None of the PSG variables, including bedtime and time of rising, during the low stress condition was related to exercise.

	Mean \pm se	r	p
Sleep start	23.2 \pm 0.2	0,285	0,149
Sleep end	6.1 \pm 0.1	-0,098	0,628
Total sleep time	382.1 \pm 10.7	-,600**	0,001
Wake time	41.74 \pm 7.4	0,112	0,57
Sleep efficiency	90.55 \pm 1.5	-0,184	0,349
REM (min)	95.4 \pm 4.3	-,511**	0,005
Stage 1 (min)	12.5 \pm 1.6	-0,035	0,859
Stage 2 (min)	243.0 \pm 8.8	-,516**	0,005
Stage 3 (min)	31.3 \pm 3.8	0,106	0,591

Means, standard error of the means and R-value for PSG variables during high stress sleep.

During high stress exercise duration was negatively related to TST ($r = -0,600$, $p < 0.01$), REM ($r = -0,511$, $p < 0.01$) and stage 2 ($r = -0,516$, $p < 0.01$). The latter variables plus age, sex, body mass index (BMI), bedtime and wakeup time were entered in a multiple stepwise regression. Only TST remained significant (adjusted $R^2 = 0.37$; $F(1/25) = 16, 44$; $= -, 221$; $p < 0.001$).

Change in the PSG variables between the low and the high stress sleeps related to change in exercise yielded a significant change in SWS (adjusted $R^2 = 0.24$; $F(1/24) = 8, 67$; $= 1,835$; $p < 0.01$).



Discussion

Exercise seems associated with less TST, REM and Stage 2 under stress, without a change in bedtime or time of rising. A reduction of exercise duration from low to stress high sleep appears to be related to a reduction in SWS. Since bedtime and time of rising was adjusted for, it appears that high exercise activity is related to shorter sleep without shorter time in bed. TST between the two conditions did not differ. It is suggested that exercise is associated with shorter sleep during stress.

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CONTACT