

DELTA-WAVE SLEEP AND THYROID FUNCTION IN HEALTHY YOUNG MEN

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Although the duration of delta-wave sleep is known to be influenced by several factors, its variations in healthy young adults are largely unexplained. We have carried out an experiment to test our hypothesis that variations within the normal limits of thyroid function, in the absence of thyroid disease, are related directly or indirectly to the amount of delta-wave sleep at night.

Six healthy male volunteers (21-24 yrs) each slept at their usual times for 4 consecutive nights in the laboratory. All-night recordings of EEG, EOG and (DC) electrical resistance of palmar skin enabled the stages of sleep and wakefulness to be scored objectively¹. Venous blood samples were collected just before sleep at night and again upon waking up next morning. The Free Thyroxine Index (FTI) was determined for each sample. The FTI (total thyroxine concentration \times percent T₃-resin-uptake) provides an indirect measure of the free thyroxine concentration in serum.

Product-moment correlation coefficients were calculated between the FTI measured at night, the duration of delta-wave sleep, REM sleep and wakefulness during the night, the delay before falling asleep initially, the total duration of sleep and the average length of the first 3 REM-sleep cycles.

The FTI did not show a diurnal rhythm but did vary significantly between the subjects ($P < .001$) and from day to day in 3 of the subjects ($P < .05$). The FTI values ranged from 3.0 to 5.4 (normal range 2.3 to 8.2). The variations in FTI were associated with changes in the total thyroxine concentration (and presumably with thyroxine secretion) rather than changes in the binding capacity of serum proteins.

There was a significant positive correlation between the FTI at night and the amount of delta-wave sleep ($P < .01$). A negative correlation between FTI and REM-sleep cycle length approached, but did not reach, statistical significance ($P < .10; > .05$). Within each subject analysis of covariance, with differences between subjects removed, the FTI varied directly with the duration of delta-wave sleep ($P < .01$), inversely with the duration of REM sleep ($P < .05$) and the total duration of wakefulness during the night.

The causes of the variations, both in thyroid function and in delta-wave sleep, are uncertain. Exercise during the day was not measured, but the subjects' own reports suggested that this was likely to be a major factor. However, delta-wave sleep is reported to be increased in thyrotoxicosis². The present results indicate that a similar relationship between sleep and thyroid function exists in the absence of thyroid disease. The relationship between thyroid function and sleep is probably indirect, mediated perhaps by an effect of general metabolic rate on the concentration of biogenic amines in the brain.

Johns, M.W., Cornell, B.A. & Masterton, J.P. An analog sleep analyzer based on EEG, EOG and skin resistance. *Psychophysiology*, 1971, 9: 147.

Dunleavy, D.L.F., Oswald, I., Brown, P. & Strong, J.A. Hyperthyroidism, sleep and growth hormone. *EEG Clin. Neurophysiol.* 1974, 36: 259-263.