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Analysis of sleep EEG during rebound sleep after three days REM deprivation

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Background
Effects of selective rapid eye movement sleep (REMS) deprivation are usually studied with the single platform-on-water method (flower pot). In this protocol, animals are placed on a small platform (SP) surrounded by water, and as muscle atony is typical for REMS, they fall into the water and awaken immediately as they switch to REMS. A large platform (LP) is also used, in order to separate the effects of REMS deprivation from other stress factors caused by the procedure, because animals can curl and can reach REMS on LP. Our aim was to study quantitative-electroencephalography (Q-EEG) in different vigilance stages measured in the rebound period after three-day-long sleep deprivation.

Methods
In our study, male Wistar rats were equipped with EEG and electromyographic electrodes. After the recovery period rats were kept on SP or LP for 72 hours, and then animals were placed into the recording cages. Frontoparietal electroencephalogram, electromyogram and motility were recorded during the first hour of the rebound period beginning at the passive phase. Home cage (HC) recordings were also taken in the same one hour period. The EEG power spectra (1–60 Hz) were analyzed of the following sleep stages: active and passive wake (AW, PW), light and deep slow wave sleep (SWS-1, SWS-2) and REMS, and the results of SP, LP and HC groups were compared to each other.

Results
Our main results show that in sleep stages SWS-1 and SWS-2, both LP and SP enhanced the EEG power in a wide frequency range (5–25 Hz), but only the LP group decreased the delta frequency power compared to HC. A shift in theta frequency power in PW and REM was also caused by both LP and SP.

Conclusions
Using the same setup and time interval, a marked REM rebound in SP compared to both LP and HC groups was described by us. In spite of that we found here that Q-EEG analysis provided evidence for differences between LP and HC groups, while the SP group data resembled those of LP or HC using different measures. These findings suggest that the effects of stress and REM deprivation could be differentiated using sleep and Q-EEG analysis. Decrease in REM latency in depressed patients and the general REM-reducing effects of antidepressants underline the significance of these results.

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