

## 室内スポーツによる体内時計の強化

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### Control of Circadian Pacemaker by Indoor Exercise

by

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#### ABSTRACT

The purpose of the present study is to examine the effects of indoor exercise to circadian pacemaker in humans. In the first study, 24 young healthy subjects were equally divided into 3 groups. They spent 15 days alone in a temporal isolation room where the light intensity was less than 50 lx during the waking period. Sleep-wake cycle and rectal temperature was continuously recorded and plasma melatonin was measured on days 1, 8 and 14. In the first group, subjects had no instructions to sleep and wake (F group). In the second, subjects were directed to sleep and were awakened from outside through interphone to follow 23.67-hr forced sleep-wake schedule (FS group). In the third, subjects

followed the 23.67-hr forced sleep-wake schedule and did 2-hr exercise at 2 and 7 hr after wake-up during every waking period ( FSE group ). The free-run period of plasma melatonin rhythm was 24.37 hr in F group, 24.06 hr in FS group, and 23.88 hr in FSE group. The free-run periods in FS and FSE groups were significantly shorter than in F group, and the melatonin rhythm in FSE group was significantly shorter than in FS group and almost entrained to the forced sleep-wake schedule. In the second study, 24 subjects were equally divided into 3 groups and spent 3 days alone in the isolation room. Each group did 2-hr exercise in the morning ( 9:00-11:00 ), afternoon ( 15:00-17:00 ), or night ( 0:00-2:00 ). The plasma melatonin rhythm was significantly phase-delayed in the afternoon and night exercise groups but was not changed in the morning exercise group. The present study demonstrated that non-photoc zeitgeber such as forced sleep-wake schedule and repeated indoor exercise phase-shifts circadian pacemaker but single morning exercise did not in humans. These results indicate that habitual indoor exercise controls the circadian pacemaker and is beneficial for stabilizing circadian rhythms.

## 要 旨

継続的な運動が体内時計の調節に関わるか否かを調べる目的で、24名の成人被験者を、時間的制限なしのフリーラン群（F群）、23.67時間周期の強制睡眠スケジュールを加えた群（FS群）、強制睡眠スケジュールに連日4時間の運動を加えた群（FSE群）に分け、15日間低照度下の時間隔離実験室に隔離し、睡眠覚醒リズム、血中メラトニンリズム、深部体温リズムの変化を調べた。メラトニンリズムの周期は、F群で24.37時間であるのに対し、FS群では24.06時間、FSE群では23.88時間であり、3群間にはそれぞれ統計学的な有意差が認められ、FSE群では強制睡眠スケジュールにほぼ同調した。午前、午後、夜間に2時間1回のみ運動負荷した実験では、午前の運動ではメラトニンリズムに変化は認められず、午後と夜間の運動で位相が後退した。ヒトでは非光因子である運動も体内時計に作用し同調を促進させることが示唆された。