2-O-43 Effect of carbon dioxide-rich water bathing on thermoregulation, EEG and heart rate variability during sleep at nighttime
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Purpose: Carbon dioxide-rich water (CO₂) has been used for rehabilitation for athlete and the treatment for patients with vascular disease. In this study presented here, we examined the effect of CO₂ bathing on core temperature, electrocardiogram (ECG), electroencephalogram (EEG), and sleeping impression during sleep at nighttime, and compared to fresh water (FR) bathing in healthy male.

Methods: Six healthy male subjects participated in our study. After having inserted the thermistor into the rectum, each subject bathed in CO₂ (1000 ppm, pH 4.5-4.6) or FR at 39°C to the level of nipples for 10 min at 10:30PM. After the bathing, each subject moved to the climatic chamber at 24°C and 50% rh, and slept until 11:00PM-6:00AM. Rectal temperature, skin temperature, ECG and EEG was measured continuously.

Results and Discussion: Rectal temperature and forehead skin temperature decreased gradually during sleep after both CO₂ and FR bathing, it was slightly larger after CO₂ bathing. Heart rate was decreased immediately after the start of sleep after both CO₂ and FR bathing. The high frequency component of heart rate variability during sleep was higher after CO₂ bathing compared with after FR bathing. Latency of hypnagogic was significant shorter after CO₂ bathing compared with after FR bathing, and nocturnal awakening was also few after CO₂ bathing. The score of sleeping impression on getting up was higher after CO₂ bathing compared with after FR bathing.

Conclusions: These results suggested that the sleep at nighttime after CO₂ bathing might greatly reduce fatigue.

Key words: CO₂ bathing, thermoregulation, ECG, EEG

2-O-44 Artificial gravity and ergometric exercise as a countermeasure of everyday improve spaceflight deconditioning caused by head-down bed rest for 20 days
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Purpose: We examined the hypothesis that centrifuge-induced artificial gravity and ergometric exercise as a countermeasure improve spaceflight deconditioning caused by simulated weightlessness using head-down bed rest (HDBR) for 20 days. Methods: Twenty healthy male subjects participated in our study. Countermeasure group of subjects performed artificial gravity with ergometric exercise for cumulative 30 min per day using gravity-exercise step-up method in the 20 days HDBR, while control group subjects underwent the same HDBR procedure without countermeasure. Results and Discussion: In countermeasure group, burst rate of MSNA during head-up tilt test were not significant difference at the every head-up position between before and after HDBR, whereas it increased at the resting supine position after HDBR in the control group. Although MSNA activity increased after HDBR in the control group, the blood pressure has decrease. The decrease of anti-G score before and after HDBR was prevented in countermeasure groups, whereas in the control group it decreased significantly (P<0.001). Cross sectional area of the quadriceps significant decrease in control group, but no change in countermeasure group after HDBR. Control group decreased in stroke volume and cardiac output, whereas countermeasure group exhibited no significant changes after HDBR.

Conclusions: Spaceflight deconditioning induced by HDBR was improved by countermeasure of everyday.

Key words: artificial gravity, ergometric exercise, space deconditioning