Effects of Resistance Training on Heat Release, Nighttime Sleep, and δ-Power in Young Adult Women

Fushimi.M[1)], Iijima.R[1)], Kiyama.M[2)], Kubokawa.H[2)], Sugawara.K[2)], Takakura.M[2)], Noguchi.S[3)], Konno.M[1)], Aritake-Okada.S[1)2)]

1)Graduate School of Health Sciences and Social Work, Saitama Prefectural University, Saitama, Japan, 2) Department of Health Sciences, Laboratory Sciences, Saitama Prefectural University, Saitama, Japan, 3)Graduate School of Sport Sciences, Waseda University, Tokyo, Japan

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INTRODUCTION

- The temperature rhythm associated with a woman's menstrual cycle is closely related to sleep.
- It has been reported that progesterone suppresses heat dissipation during the luteal phase, resulting in increased sleepiness, but also decreased sleep quality, including increased mid-onset awakenings and decreased REM and deep sleep[1)].
- Recently, it has been reported that exercise promotes heat dissipation and deep sleep[2)], and that exercise promotes heat dissipation during luteal phase arousal in women, suggesting that exercise promotes a smooth decrease in body temperature in women, increasing deep sleep and improving sleep quality in the luteal phase[3)].
- In this study, we focused on the enhancement of heat dissipation by exercise and examined the effects of exercise on body temperature, heat dissipation, nighttime sleep, δ-power, and subjective evaluation during the follicular phase (FP) and luteal phase (LP) in women, as well as the physiological characteristics of heat dissipation and sleep structure.
- Twelve young adult female subjects participated in the experiment for a total of 4 days: 1) FP non-exercise condition(FP-NEC), 2) FP exercise condition(FP-EC), 3) LP non-exercise condition(LP-NEC), and 4) LP exercise condition(LP-EC). Exercise consisted of 40 minutes of resistance training (RT) at 70% 1RM during the day. EEG, skin temperature, and tympanic temperature were measured simultaneously at the subject's home at night, and distal-proximal-skin-temperature-gradient (DPG) was calculated.

RESULTS

- In both FP and LP, the percentage of stageN3 was increased at night; in the LP exercise condition (Figure1 and Figure2).

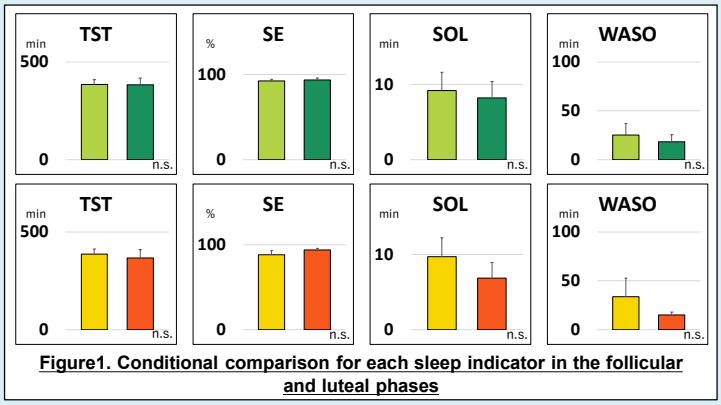

Figure1. Conditional comparison for each sleep indicator in the follicular and luteal phases

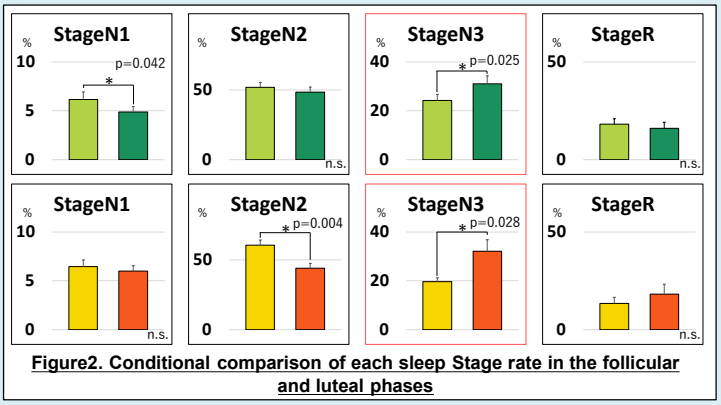

Figure2. Conditional comparison of each sleep Stage rate in the follicular and luteal phases

- **The amount of stageN3 sleep was higher from mid to end of sleep, DPG (heat release response) was increased during the same period, and δ-power was also increased compared to the LP non-exercise condition (Figure3).**

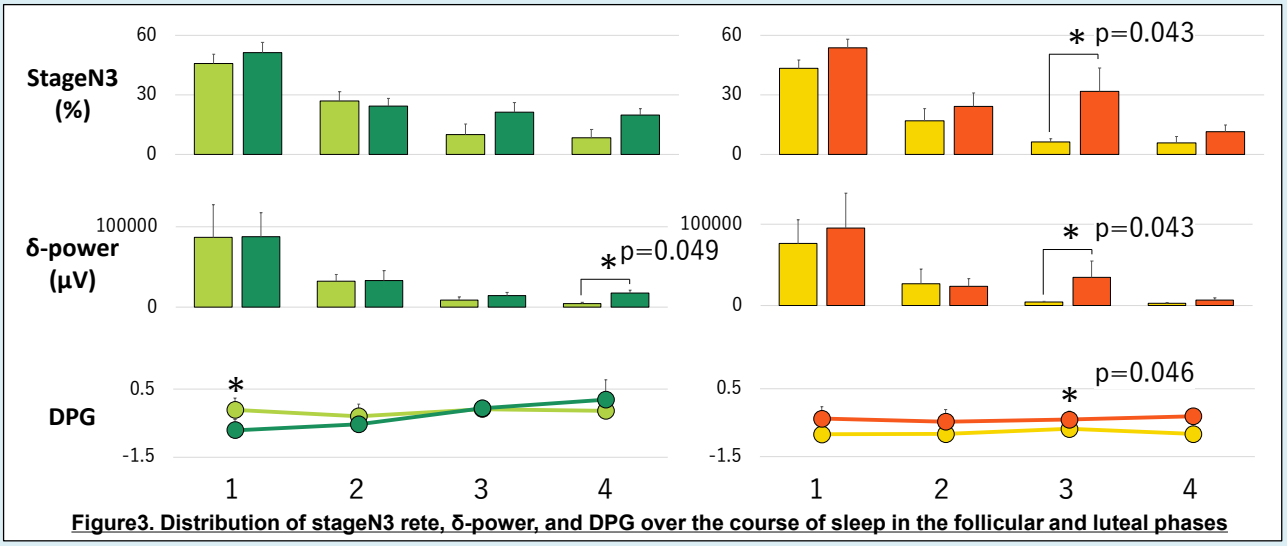

Figure3. Distribution of stageN3 rete, δ-power, and DPG over the course of sleep in the follicular and luteal phases

*p＜0.05 FP non-exercise condition (FP-NEC) and FP exercise condition (FP-EC), LP non-exercise condition (LP-NEC) and LP exercise condition (LP-EC).
Total sleep time(TST) and Sleep efficiency(SE), Sleep onset latency(SOL) and Wake time after sleep onset(WASO).

CONCLUSION

- RT increased deep sleep during the FP in women, and promoted heat dissipation, deep sleep, and δ-power during nocturnal sleep in the LP, when body temperature is higher and body temperature rhythms are disrupted. Encouraging RT during the LP may help women to overcome sleep disturbance associated with this phase of the menstrual cycle.

REFERENCES

1. Shibui K, Uchiyama M, Okawa M, et al. : Diurnal fluctuation of sleep propensity and hormonal secretion across the menstrual cycle. Biol. Psychiatry 48 : 1062–1068, 2000
2. Aritake-Okada S, Tanabe K, Mochizuki Y, et al. : Diurnal repeated exercise promotes slow-wave activity and fast-sigma power during sleep with increase in body temperature: a human crossover trial. J. Appl. Physiol. 127 : 168–177, 2019
3. Kuwahara T, Inoue Y, Taniguchi M, et al. : Effects of physical training on heat loss responses of young women to passive heating in relation to menstrual cycle. Eur. J. Appl. Physiol. 94 : 376–385, 2005

CONTACT

Momo Fushimi Mail:2491008c@spu.ac.jp

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