Sleep Habits and Recovery Quality of Ultra-Endurance Runners During a Multi-Stage Ultra-Marathon Competition in the Heat

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Introduction

- Sleep deprivation (SDEP) has previously been reported to promote decrements in running performance1 and prolonged recovery from exercise stress2.
- SDEP has also been linked to reduced mood state and motivation to perform exercise3.
- The increase in somnogenic cytokines (namely IL-1β, TNFα, and IL-6)4,4, also known as pyrogenic or pro-inflammatory cytokines, seen during SDEP have been associated with exacerbated thermoregulatory strain during exercise-heat stress; possibly contributing towards the pathophysiology of exertional heat illnesses5,5.
- Somnogenic cytokines have also been linked to appetite suppression, potentially contributing towards compromising nutritional and hydration status during consecutive days of prolonged strenuous exercise6,7.
- Subsequently, the combination of these factors may directly and indirectly depress immune responses, reducing optimal repair and healing of exercise-induced tissue damage, and/or increasing the risk of illness and infection during consecutive days of exercise-heat stress8,9,10.
- Insufficient sleep and poor sleep quality is commonly reported amongst ultra-endurance runners (UER) during multi-stage ultra-marathon (MSUM) competitions.

AIMS: To assess sleep habits and qualitative recovery of UER during a MSUM conducted in a hot ambient environment.

Methods

Sleep habits of UER (n = 54; age 41 ± 8 y, height 1.69 ± 0.14 m, BM 70.2 ± 11.4 kg, body fat mass (BFM) 17 ± 5%) competing in a MSUM, conducted over five consecutive days (five stages) in hot ambient conditions (Figure 1), were determined through the Pittsburg Sleep Diary11 (with tri-axial accelerometer validation12,13).

A standardised general recovery questionnaire was also administered by trained researchers (n = 8), through interview technique, during the evening recovery period (20:00-22:00 h). To avoid inter-observer error, individual researchers conducted the interview on the same UER throughout the MSUM.

Sleeping arrangements from Stages 1 to 5 included a combination of tent and village sports hall accommodation. All UER reported sleeping on inflatable foam mats. 12 matched individuals who accompanied the UER along the MSUM course, but did not compete (absence of exercise stress), volunteered to participate in the study as part of the control group [CON, n = 12; age 35 ± 13 y, height 1.67 ± 0.09 m, BM 69.9 ± 16.2 kg, BFM 21 ± 6%]. CON reported sleeping on inflatable foam mats or air mattresses.

Kruskal-Wallis and one-way ANOVA with post-hoc Tukey’s HSD test (with verification through Friedman where violations of normality were observed) were use to analyse data. Spearman’s correlation coefficient was used to determine associations. Significance was accepted at p < 0.05.

Results

Average evening bedtime and morning awakening was 22:30 h and 06:30 h, respectively.

- No difference in morning awakening mood state or alertness was observed between stages in UER and CON, nor between UER and CON.
- Greater frequency of awakening during nocturnal sleep was observed on Stages 2 to 4 (mean: x4) in UER (p < 0.05 vs. Stage 1 (mean: x2)).
- Lower frequency of daytime napping was reported on Stages 2 to 4 (6 to 8% of UER) in UER (p < 0.05 vs. Stage 1 (17% of UER)).
- No correlations between caffeine and alcohol ingestion with sleep quantity and quality were observed.
- A weak correlation was observed between energy intake (r = +0.354, n = 54, p = 0.001), motivation (r = +0.350, n = 54, p = 0.05), and sleep quantity; similarly between motivation (r = +0.352, n = 54, p = 0.009), recovery quality (r = +0.352, n = 54, p = 0.002), general fatigue (r = +0.301, n = 54, p = 0.009), and sleep quality.

Discussion and Conclusion

Even though sleep quantity is not affected throughout MSUM, sleep quality appears to degrade as competition progresses, potentially affecting overall quality of recovery and exercise performance on consecutive days of competition.

Reasons for nocturnal awakening in UER (in order of response frequency):
- Body pain, need for toilet, just woke, ambient noise, dermatological injuries (e.g. foot blisters), laying discomfort, and restlessness.

Recommendations for improving sleep quality in UER during MSUM include: 1. Invest in a thick comfortable and trialled inflatable foam mat and pillow; 2. Use ear plugs to reduce effects of ambient noise; 3. Avoid excessive consumption of foods/drinks/supplements which contain stimulants during the day; 4. Avoid large meals or fluid boluses prior to sleep. Have the evening meal ~3 h before sleep-time. A carbohydrate-rich meal and its associated insulin response may induce sleepiness. 5. There exists no convincing evidence that specific foods, dietary supplements, or botanical remedies improve sleep quality; therefore supplementation is not recommended. 6. Consult the MSUM medical crew for appropriate treatment and bandaging of dermatological injuries before sleep; 7. Discuss with GP regarding suitable sleep and/or pain management medication that may be required.

References


Figure 1. Schematic illustration of the research design.

Figure 2. Sleep quantity of ultra-endurance runners (UER) participating in a 225 km multi-stage ultra-marathon (MSUM) competition conducted in a hot ambient environment. Mean ± SD (UER n = 54; CON n = 12). No significant different between stages, nor between CON.

Figure 3. Sleep quality of ultra-endurance runners (UER) participating in a 225 km multi-stage ultra-marathon (MSUM) competition conducted in a hot ambient environment. Mean ± SD (UER n = 54; CON n = 12). * p < 0.01 vs. CON.