

Maruyama T³, Sato S¹, Matsumura M³, Duguid J², Hester J², Nishino S³

¹Department of Psychiatry, Akita University School of Medicine, Japan

²IMG sports academy, USA

³Stanford Sleep and Circadian Neurobiology Laboratory, Stanford University School of Medicine, USA

Introduction

We have reported at the last APSS meetings that use of airweave™ (a high rebound [HR] mattress with a breathable structure that facilitates breathability) induces effective heat loss (i.e., a larger decline in core body temperature) and enhances deep sleep (compared to low rebound [LR], pressure-absorbing mattresses) during the initial phase of nocturnal sleep in young and elderly healthy males (Fig.1).

Sufficient and restorative sleep is essential to maximize good athletic performance of advanced athletes, and this was experimentally demonstrated by a recent study (Mah et al., 2005); sleeping longer strikingly improved physical performance of a University-level male basketball team members. We therefore examined if sleeping on HR mattresses will improve sleep and athletic performance of young athletes at IMG sport academy (Bradenton, Florida).

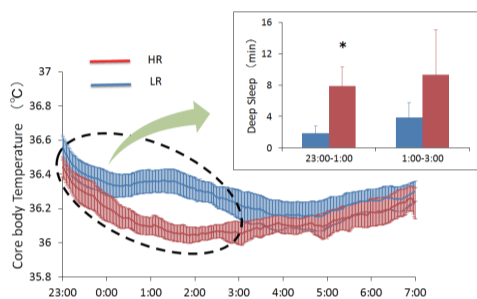


Fig. 1. Changes in core body temperature during sleep with HR and LR topper.

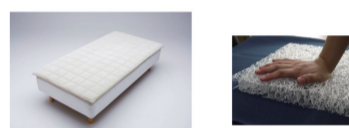


Fig. 2. HR (High Rebound) mattress topper structure. HR-topper has a breathable structure and it can lead the larger and longer lasting decrease in core body temperature in the initial half of the sleep period than LR topper. During this period, large amounts of deep sleep was seen in HR topper.

Materials & Methods

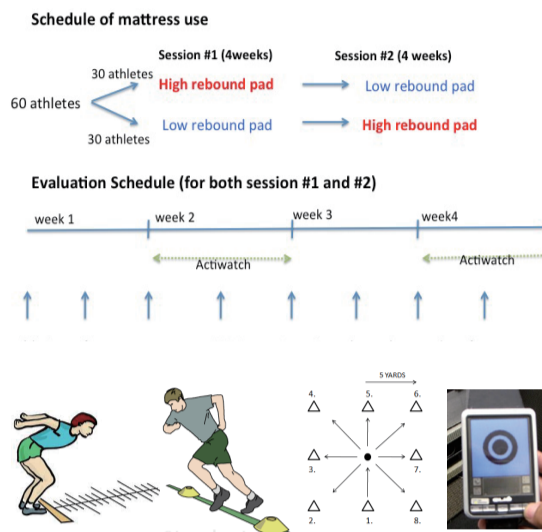


Fig.3. Experimental design and evaluation measures. The experiment had a 2groups cross over design for 4weeks. Evaluation were performed in each topper session 8 times each. Long jump, 40m sprint and star drill were used for athletic evaluation. PVT was used for objective vigilance evaluation.

The study was conducted in 51 healthy male athletes (who provided signed informed consent) from various sport programs at IMG Academy, with a randomized eight week crossover design with HR or a low rebound [LR] mattress toppers. The athletic performance and subjective sleep quality were evaluated twice a week during the last two weeks of each mattress sessions throughout the study. The quantitative measures of athletic performance include 40-meter sprint [SP], long jump [LJ], and star drill [SD]). Subjective self-rating (1 to 10) at practice (SSRP) and games (SSRG) were evaluated. Subjective sleep evaluations using the Epworth sleepiness scale (ESS), visual analogue scales (sleep [VAS-S] and performance [VAS-P]) were also used as well as profile of mood states (POMS). Objective measures of sleep habits and psychomotor vigilance was evaluated with Actigraph and a standardized psychomotor vigilance test (PVT). Wilcoxon rank-sum test was applied for statistical analysis by using JMP ver11 for MAC. The study was approved by the IRB of Stanford University, and all subjects provided informed consent.

Results

- ▶ Among the 51 participants, 47 subjects participated in the both sessions and paired data were obtained from 31 to 47 subjects, depending on the measures. There were no significant differences in objective (PVT and Actigraph) and subjective (ESS and VAS-S) sleep and mood (POMS) measures between HR and LR sessions. There were no significant differences in subjective ratings (SSRP and SSRG) between HR and LR sessions.
- ▶ We however, observed tendencies of improved performance in all 3 objective athletic measures ([HR vs. LR] SP (n=32): 6.96±0.18 vs. 7.28±0.13 sec, LJ (n=39): 182±5 vs. 180±5 cm, SD (n=31): 31.86±0.58 vs. 32.01 ±0.75 sec) with HR use. In particular, a 0.3 sec improvement was seen in 40-meter sprint with HR.

	HR-topper		LR-topper		p-value
	mean	SEM	mean	SEM	
Subjective Evaluation					
ESS	8.41 ±	0.86	9.02 ±	0.80	0.6571
VAS-S	2.18 ±	0.25	1.90 ±	0.24	0.2119
VAS-P	2.17 ±	0.27	1.90 ±	0.23	0.1130
POMS	7.76 ±	1.57	8.45 ±	1.53	0.6841
SSRP	7.50 ±	0.21	7.86 ±	0.22	0.0659
SSRG	7.64 ±	0.24	7.83 ±	0.24	0.1101
PVT					
MeanRT	362.99 ±	25.17	344.42 ±	19.52	0.6642
MajorLapses	0.33 ±	0.15	0.28 ±	0.09	0.5863
MinorLapses	8.17 ±	1.29	7.96 ±	1.30	0.8294
Actigraph					
Total Minutes in Bed	511.505 ±	42.892	529.11 ±	43.306	0.3163
Latency	9.38917 ±	1.9011	9.6317 ±	1.5555	0.7020
Total Sleep Time (min)	440.423 ±	45.727	457.71 ±	45.597	0.4304
Athletic performance					
Long Jump (cm)	1.82 ±	0.05	1.80 ±	0.05	0.5079
40M sprint (sec)	6.96 ±	0.18	7.28 ±	0.13	0.1556
Star Drill (sec)	31.86 ±	0.58	32.01 ±	0.75	0.5783

Table.1. Comparison of each evaluation parameter between HR-topper and LR-topper(2013). Between HR-topper and LR-topper, there were no significant differences in each evaluation parameters. Wilcoxon rank-sum test was applied for statistical analysis.

Abbreviation in Table.1

ESS: epworth sleepiness scale
VAS-S: Visual analog scale of sleep
VAS-P: Visual analog scale of performance
POMS: profile of mood states
SSRP: subjective self rating, practice
SSRG: subjective self rating, game

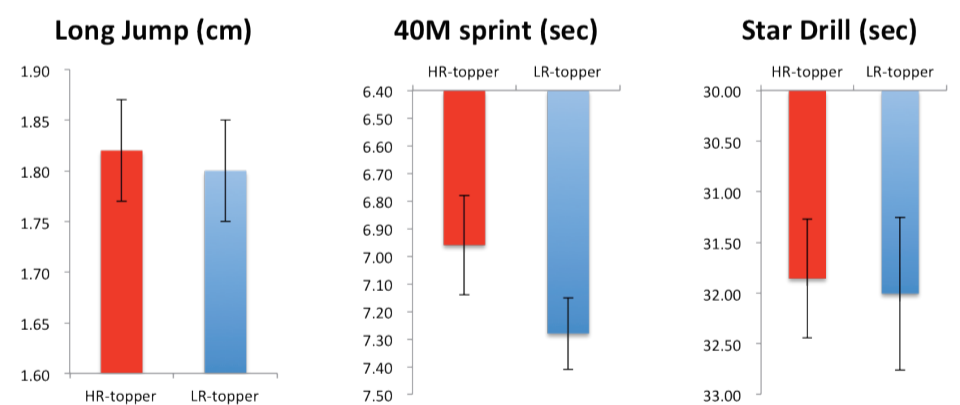
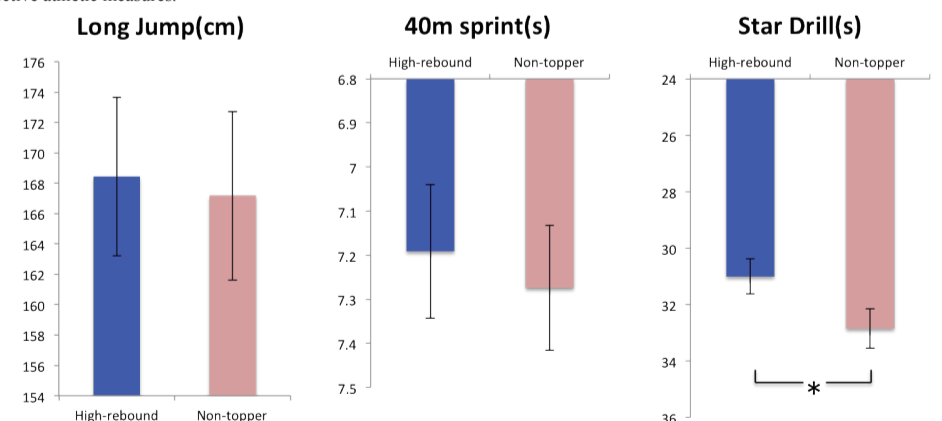


Fig. 4. Athletic performance after sleeping with HR-toppers or LR-toppers (2013). There was no significant difference in athletic performance. However, tendencies of improved performance was observed in all 3 objective athletic measures.



Supplemental Fig. Athletic performance after sleeping with HR-toppers or Non-toppers in 2014-2015, in progress.

Further studies are in progress at IMG academy in 2014-2015. The experiment has a 2 groups crossed over design for 6 weeks (HR-topper vs. Non-topper). Evaluation were performed 4 times in the last 2 weeks in each topper session. Same measurement (Long jump, 40m sprint and star drill) were used for athletic evaluation. There was a significant difference in Star Drill measures ([HR-topper vs. No-topper](n=23): 31.01± 0.62 vs. 32.85 ± 0.70 sec, p-value= 0.0386) Wilcoxon rank-sum test is applied for statistical analysis. *p<0.05

Conclusions

There is a possibility that sleeping with HR improves athletic performance in youth at a sport academy. Further studies are in progress and the results indicate statistical differences in Star Drill performance.