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Original Article

Post-intense exercise sleep concerns in weightlifters: A pilot study

Narendra Yadav ^a, Anuj Kumar ^b, Uma Mahajan ^c, Karuna Datta ^{d,*}^a Resident, Department of Sports Medicine, Armed Forces Medical College, Pune, 411040, India^b Officer in Charge, Sports Science Faculty, Army Sports Institute, Pune, 411040, India^c Bio-Statistician, Sports Science Faculty, Army Sports Institute, Pune, 411040, India^d Professor, Department of Sports Medicine, Armed Forces Medical College, Pune, 411040, India

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ABSTRACT

Background: Weightlifting is a power and dynamic strength game. Performance of weightlifters during competition depends on absolute and relative power output achieved by them. To enhance power and strength in weightlifters, training programmes have frequent high-intensity exercise sessions. On an informal interaction with the sports-persons, they often complain of problems after intense training. There was a felt need to analyse the problems they perceive after intense training.

Method: A feedback form was developed after brainstorming with coaches and sports medicine physicians of a sports institute. Thirty-six male weightlifters aged 19.78 ± 4.71 yrs (mean $\pm$ standard deviation) of an institute participated after obtaining informed consent. The feedback form was collected and analysed.

Result: After an intense exercise, participants reported complaints such as increased fatigue ($n = 27$), sleep problems ($n = 26$), restlessness ($n = 18$) and decreased appetite ($n = 12$). Of the sleep problems, 69.4% ($n = 25$ out of 36) noticed worsening of sleep, 50% ($n = 18$) noticed sleep was light after intense training, 58.3% ($n = 21$) felt difficulty in falling asleep, 47.2% ($n = 7$) complained of frequent waking up during sleep at night and 77.8% ($n = 28$) felt sleepy after waking up.

Conclusion: Intense training encounters certain problems such as fatigue, sleep disturbances, restlessness and decreased appetite.

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Introduction

Intense training in elite weightlifters is highly recommended for enhancement of power and strength.¹ Intensity is the qualitative component of exercise² and describes the amount

of weight lifted during resistance training. Intensity ranges from low to high and is measured as percentage of repetition maximum (RM) in resistance training. RM is defined as the maximum weight an individual can lift with one single effort.³ High intensity (>80%–85% of 1RM) is required to develop maximal strength and is often used in training.⁴ The

* Corresponding author.

E-mail address: karunadatta@gmail.com (K. Datta).<https://doi.org/10.1016/j.mjafi.2018.09.005>

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improvement after such training occurs as a result of distinct neural pattern developments.^{4,5} This causes a change in the recruited number of motor units, frequency of motor nerve firing rates and synchronisation of motor units. It also increases muscle cross-sectional area by increasing size and numbers of muscle fibres.³ All these factors cause improvement in both rate of force development and maximal force production. Although intense training is recommended to enhance performance, an informal interaction with the sportspersons often reveals complaints of short-term problems. Sleep-onset problems are documented, but information on how often it is seen and what other problems may occur is not much available. Because intense training is essential for enhancement of performance, problems occurring, if any, after such training may be important to understand so that possible solutions may be provided to enhance recovery after such training. There was a felt need to study problems of weightlifters after intense training.

Aim and objective

The aim and objective of this study was to study various problems, if any, encountered by weightlifters after intense training.

Materials and methods

Thirty-six male weightlifters of a sports institute volunteered to participate in the study. The informed consent was obtained from volunteers. In participants aged below 18 years, informed consent was obtained from the guardian, and informed assent was obtained from the weightlifter himself. Ethical clearance was obtained from the institutional ethics committee through letter no 7/IEC/Aug/2017.

Study design

A pilot study was planned to explore if any problem related to sleep and physical complaints exist among weightlifters after intense training. All the weightlifters who were undergoing intense training in the last one month were included in the study. Training and recovery of these weightlifters was individualised, standardised and supervised. The study was conducted among weightlifters during August–September 2017 in a national-level sports training institute.

Inclusion and exclusion criteria of participants

Those weightlifters involved in at least six months of regular training, underwent intense training in the previous one month and who were following normal sleep-wake and training schedule, were taking recommended diet and supplements were included in the study. Weightlifters with acute illness/injury during the previous one month, who did not undergo intense training in the last one month, those who were on international travel, who were in the precompetition and competition phase of training or who had changed their diet or supplements were excluded from the study analysis.

Development of feedback form

Brainstorming with coaches was conducted, and a feedback form was developed in consultation with the sports medicine physician of a sports institute. As this was a pilot study, open-ended questions were planned to elucidate different types of problems which may be encountered in weightlifters while doing intense training. Because sleep problem is known after such training sessions, details of the problem to understand the type of problem were enquired. Opinion of weightlifters about their recovery after such training subjectively was also enquired in the form (Appendix 'A'). All the weightlifters undergoing intense training for at least one month were asked to report on this feedback form which was collected and tabulated in MS Excel.

Data analysis

Data were collected on type and duration of the training, physical complaints (fatigue, sleep problems, restlessness, injury and change in appetite) and sleep problems (changes in pattern and quality of sleep, feeling sleepy/fresh after waking up, difficulty in falling asleep or sleep initiation, frequently waking during sleep and decreased duration of sleep) experienced after the training.

Furthermore, the number of physical complaints (minimum = 0, maximum = 5) and sleep problems (minimum = 0, maximum = 6) experienced was calculated as follows.

Physical complaints = Fatigue (yes) + sleep problems (yes) + restlessness (yes) + injury (yes) + change in appetite (increased/decreased).

Sleep problems = Change in sleep (yes) + quality of sleep (worsen) + feel sleepy after waking up (yes) + difficulty in falling asleep or sleep initiation (yes) + frequent waking during sleep (yes) + decreased duration of sleep (yes).

Respondents were asked to rate their sleep before and after the training on a scale of 0–10, in which 0 indicates very bad sleep and 10 indicates very good sleep. Self-rated sleep scores before and after the intense training were further reverse coded as 10 raw sleep scores, in which 0 indicates very good sleep and 10 indicates very bad sleep to make it unidirectional with the number of physical complaints and sleep problems.

Mean and standard deviations (SDs) were calculated for continuous variables. Frequencies and percentages were calculated for categorical variables. Normality of continuous variables was tested using Kolmogorov–Smirnov test. Paired t-test was used to test the difference between sleep scores before and after the training. Pearson's correlation was used to test the correlation between the respondent's age (years), training age (years), number of physical complaints, number of sleep problems and subjective sleep score before and after the training. Chi-square and Fisher's exact tests were used to test the association of categorical variables. Fisher's exact test was used when expected cell frequencies were less than 5. Statistical significance was set at $p \leq 0.05$, and the analyses was done using SPSS, version 20.0, for Windows (SPSS Inc., Chicago, IL).

Results

Subject characteristics

Overall, 36 weightlifters aged 12–30 years participated in the study. Mean age of the weightlifters was 19.8 ± 4.7 years (mean $\pm$ SD); 41.7% respondents were <18 years old, and 58.3% were ≥ 18 years old. Mean training age of the respondents was 5.9 ± 3.9 years (mean $\pm$ SD). This group of weightlifters was undergoing at least one month of intense training; training schedule and recovery were individualised, standardised and supervised for all weightlifters. The data obtained using the feedback form from participants showed problems encountered by weightlifters after intense training.

Problems after intense training

Out of the 36 participants, 75% ($n = 27$) complained of increased fatigue, 72.22% ($n = 26$) complained of having sleep-related problems, 50% ($n = 18$) complained of having restlessness, 33.3% ($n = 12$) noticed decreased appetite after intense training, whereas 22.2% ($n = 8$) did not find any change in appetite and 44.4% ($n = 16$) noticed increased appetite after intense training. Significantly higher proportion of respondents aged ≥ 18 years (76.2%) reported restlessness as compared with the respondents aged <18 years (13.3%) ($p < 0.0001$) (Table 1) (Fig. 1). There was a statistically significant association of the physical complaint restlessness with worsening of sleep (94.4% $p = 0.001$), decreased quality of sleep (light sleep) (72.2%, $p = 0.008$), difficulty in falling asleep (74.8%, $p = 0.018$) and decreased duration of sleep (94.4%, $p < 0.0001$) (Table 2).

Age wise total number of physical complaints and sleep problems in weight lifters after intense training

Fig. 1 – Scatter plot showing physical complaints and sleep problems age group wise.

Sleep problem and sleepiness after intense training

All participants showed a change in their sleep pattern in one or the other form.

Change in sleep quality

Out of 36 participants, 69.4% ($n = 25$) noticed worsening of sleep, whereas 30.5% ($n = 11$) noticed improvement in sleep

Table 1 – Age-wise physical complaints and sleep problems in weightlifters after intense training.

After training	Total respondents	Age		p-value
		<18 years	≥ 18 years	
	(N = 36)	(N = 15)	(N = 21)	
	n (%)	n (%)	n (%)	
Physical complaints				
Fatigue ^a	27 (75.0)	10 (66.7)	17 (81.0)	0.443
Sleep problems ^a	26 (72.2)	8 (53.3)	18 (85.7)	0.058
Restlessness ^b	18 (50.0)	2 (13.3)	16 (76.2)	<0.0001
Injury ^a	9 (25.0)	3 (20.0)	6 (28.6)	0.705
Change in appetite ^a				0.134
Decreased	12 (33.3)	1 (6.7)	11 (52.4)	
No change	8 (22.2)	7 (46.7)	1 (4.8)	
Increased	16 (44.4)	7 (46.7)	9 (42.9)	
Sleep problems				
Worsen sleep ^a	25 (69.4)	7 (46.7)	18 (85.7)	0.025
Light sleep ^b	18 (50.0)	4 (26.7)	14 (66.7)	0.018
Feel sleepy after waking up ^a	28 (77.8)	13 (86.7)	15 (71.4)	0.424
Difficulty in falling asleep ^a	21 (58.3)	6 (40.0)	15 (71.4)	0.059
Frequent waking during sleep ^b	17 (47.2)	4 (26.7)	13 (61.9)	0.037
Decreased duration of sleep ^b	22 (61.1)	6 (40.0)	16 (76.2)	0.028

N = total number of respondents; n = the number of respondents in the respective category; % = percentage of respondents calculated as $n/N \times 100$.

^a Applied Fisher's exact test to test the association of age with physical complaints and sleep problems when expected cell frequency <5.

^b Applied Chi-square test to test the association of age with physical complaints and sleep problems.

Table 2 – Physical complaint–related associated sleep problems in weightlifters after intense training.

Sleep problems after training	Total respondents (N = 36)	Fatigue ^a (N = 27)		Restlessness ^b (N = 18)		Injury ^a (N = 9)		Change in appetite ^b		
		n (%)	p-value	n (%)	p-value	n (%)	p-value	Decreased (N = 12)	Increased (N = 16)	p-value
Worsen sleep ^a	25 (69.4)	21 (77.8)	0.096	17 (94.4)	0.001	6 (66.7)	>0.995	12 (100)	9 (56.3)	0.001
Light sleep ^a	18 (50.0)	14 (51.9)	>0.995	13 (72.2)	0.008	5 (55.6)	>0.995	8 (66.7)	6 (37.5)	0.031
Feel sleepy after waking up ^a	28 (77.8)	23 (85.2)	0.086	14 (77.8)	>0.995	7 (77.8)	>0.995	9 (75.0)	11 (68.8)	0.721
Difficulty in falling asleep ^a	21 (58.3)	18 (66.7)	0.122	14 (77.8)	0.018	3 (33.3)	0.122	8 (66.7)	9 (56.3)	0.094
Frequent waking during sleep ^b	17 (47.2)	14 (51.9)	0.451	11 (61.1)	0.095	4 (44.4)	>0.995	7 (58.3)	6 (37.5)	0.142
Decreased duration of sleep ^b	22 (61.1)	18 (66.7)	0.267	17 (94.4)	<0.0001	6 (66.7)	>0.995	11 (91.7)	7 (43.8)	0.008

N = total number of respondents; n = the number of respondents in the respective category; % = percentage of respondents calculated as n/N*100.

^a Applied Fisher's exact test to test the association of age with physical complaints and sleep problems when expected cell frequency <5.

^b Applied Chi-square test to test the association of age with physical complaints and sleep problems.

after intense training. A significantly higher number of respondents aged >18 years experienced worsening of sleep (85.7%, $p = 0.025$) than those aged less than 18 years (Table 1) (Fig. 1).

Quality of sleep

All 36 respondents reported change in subjective sleep depth, in which 50% ($n = 18$) reported it to be light, and the other 50% reported it to be deep sleep after intense training. A significantly higher number of respondents aged >18 years experienced light sleep (66.7%, $p = 0.018$) than those aged less than 18 years (Table 1) (Fig. 1).

Residual sleepiness

Out of 36 participants, 77.8% ($n = 28$) felt sleepy after waking up, whereas 22.8% ($n = 8$) felt fresh after waking up the next morning after intense training (Table 1) (Fig. 1).

Sleep-onset and maintenance problem

58.3% ($n = 21$) felt difficulty in falling asleep, and 47.2% ($n = 17$) complained of frequent waking up during sleep at night. Eleven participants had both an onset and maintenance of sleep problem at night. Maintenance of sleep problem was more in respondents aged ≥ 18 years (61.9%, $p = 0.037$) than the respondents aged <18 years after intense training (Table 1) (Fig. 1).

Total sleep duration

61.1% ($n = 22$) complained of decreased total duration of sleep after intense training session. Decreased total duration of sleep was more in respondents aged ≥ 18 years (76.2%, $p = 0.018$) than in the respondents aged <18 years after intense training (Table 1) (Fig. 1).

Sleep score

Mean coded sleep scores were 2.8 ± 1.53 (mean $\pm$ SD) and 4.2 ± 2.36 (mean $\pm$ SD), respectively, before and after the intense training. The coded sleep score after the intense training was significantly higher than the sleep score before the intense training ($t_{35} = 3.669$, $p = 0.001$).

Recovery after intense training

Out of 36 participants, 30.6% ($n = 11$) complained of not recovering from these problems; 38.89% ($n = 14$) needed extra sleep or daytime rest/sleep. These elite weightlifters also reported the use of steam bath ($n = 21$), ice bath ($n = 9$) or sauna bath ($n = 5$) to recover from these problems.

Discussion

In our study, we found that the participants after high intensity exercise felt subjective improvement in performance, but all of them reported some or the other problem after intense training. Although sleep-onset problems are mentioned in the literature, we found many problems other than sleep-onset such as sleep maintenance and change in the quality of sleep and duration of sleep. In strength athletes, sleep problems are documented. Sleep was found to be deteriorated after six and nine days of intense session in well-trained athletes.^{6,7} In a practical setting, however, intense training is carried out only twice or thrice a week by elite sportsmen including the weightlifters who were doing this intense phase for a minimum of one month. A daily intense training may be biased with findings of overtraining also, and hence, in our design, we did not induce intense training everyday, rather kept it as per the training protocols. In our study, fatigue and sleep problems were most common apart from appetite and restlessness. Some of the participants felt

difficulty in recovering, and some also used different measures such as extra sleep, sauna bath, steam bath, etc. to help them feel better. Some also reported improvement in sleep after intense training.

Because this study used a feedback form to bring out problems primarily after intense exercise, we did not study any physiological parameters in this field study. The exact mechanism of these problems is not known, but enhanced autonomic arousal after intense exercise is known⁸ and may be proposed to worsen sleep and cause sleep-onset problems. Increased fatigue after autonomic arousal may also occur directly or indirectly.

Our participants complained of incomplete recovery after intense exercise which not only affects the performance of weightlifters but also makes them prone to injuries and other illnesses.^{9,10} Presleep arousal also plays an important factor in sleep quality, onset and maintenance. Problems such as reduced appetite, restlessness and decreased quality of sleep can further add on to delay recovery of weightlifters, implying that although the performance enhancement does occur with increased intense training, there is a need to reduce these complaints to improve recovery.

Intense exercise is known to enhance autonomic arousal that increases both at daytime and presleep arousal. It is documented that interventions such as yoga performed in daytime cause parasympathetic dominance at night time during sleep¹¹ which improves sleep. Intervention to improve presleep arousal can be tried such as progressive muscle relaxation and cognitive therapy and may be a future direction to solve these problems. In our study, we found a group of participants who showed improvement in sleep and appetite. Several factors may be responsible for this difference such as time of exercise,¹² phase of training at which it was carried out, preintense exercise autonomic status, fatigue and sleep status assessment. Age of the sportsperson and individual susceptibility also play an important role and hence are needed to be studied in detail.

This field study highlights not only different types of complaints but also differences in the type of complaints. Our study uses retrospective stating of problems only using a form; however, exact problems faced on the day of training and their nature are not addressed in this report. A need to study these problems in a structured way may be required to bring out treatment/relief strategies for recovery of these sportspersons. A scientifically planned interventional study using non-pharmacological approach may be planned to find possible solutions to alleviate these problems. Some problems may not be related to sleep, and hence, a multipronged approach may be required once the exact nature of problems is identified.

Conclusion

After intense training, weightlifters encountered subjective problems such as increased fatigue and sleep disturbances which may hamper their recovery.

Conflicts of interest

The authors have none to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.mjafi.2018.09.005>.

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