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ORIGINAL ARTICLE

The Effects of a 30-Minute Napping Opportunity after a Night of Partial Sleep Denied on Cognitive and Short-Term High-Intensity Performance and Mood States

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ABSTRACT

Background: It is suggested that there is a relationship between a 30-minute napping opportunity after a night of partial sleep denied on cognitive and short-term high-intensity performance and mood states.
Aim: The purpose of this study was to look at the effects of a 30-minute nap on cognitive and short-term high-intensity performance, as well as mood states, following a night of partial sleep deprivation.
Methods: On a voluntary basis, 15 elite male athletes took part in the study. The study was carried out as a quantitative study using an experimental design with pre-test and post-test groups. After four weeks of training on five days a week, the athletes were given a 30-minute nap (laying down) between 13:00 and 15:00. The Pittsburgh sleep quality index, vertical jump test, and pulmonary function test were administered to the athletes who napped at 17:00. The Shapiro-Wilk Normality Test was used to determine the data's normality distribution. In accordance with the experimental model and research design, the differences between measurement results were determined using the paired samples t-test (paired samples t-test). The threshold for significance was set at p0.05.
Results: Maximum anaerobic power (W), average anaerobic power (W), minimum anaerobic power (W), vertical jump (cm), FVC(L), FEV1(L), FEV1/FVC (%) and FEF25 of the athletes participating in the research. A significant difference was determined between -75(L/s) pre-test values and post-test values ($p<0.05$). Athletes' anaerobic power (W), average anaerobic power (W), minimum anaerobic power (W), vertical jump (cm), FVC(L), FEV1(L), and FEF25-75 (L/s) post-test The athletes' FEV1/FVC (percent) post-test values were higher than the pre-test values and lower than the pre-test values (p0.05).
Conclusion: As a result, short nap sessions have anaerobic power. It has been demonstrated that it improves respiratory functions and vertical jump parameters.
Keywords: Cognitive level, napping, mood, high-intensity performance.

INTRODUCTION

Sport etymologically is derived from the Latin words "desportare and ispotus". These words mean having fun and a good time.[1] Alternative forms of recreation are a feature of the living world. Sleep at rest is commonly regarded as a repair process that influences the homeostatic regulation of the autonomic, neuroendocrine, and immune nervous systems. Adequate sleep is required for optimal muscle performance and human behavior in physically active people.[1] Because of its great importance for human circadian rhythms, disruption of the sleep-wake cycle can have adverse effects on mental and muscle performance in different environments.[2,3] Previous research supports the hypothesis that sleep deprivation negatively affects mood states as well as psychomotor and cognitive performance. reported that a sleep deprivation night (SDN) had a negative impact on cognitive performance (ie, reaction time, attention).[4]

Reduced cognitive performance during a disturbed sleep state may be related to impaired prefrontal cortex activity as a result of both arousal and attentional sensitivity. In addition, previous studies have shown that physical performance is lower during the 30-second Wingate test after SDN compared to a normal night of sleep (NSN). Otherwise, it is important to remember that athletic performance is dependent on the effectiveness of physical, psychomotor, and cognitive components, and that the decline in mood, psychomotor, and cognitive functions occurs faster than the decline in physical abilities.[5] In practice, many situations that can cause sleep disruption are described in the literature (eg, poor sleep conditions, anxiety or stress caused by competition and travel. However, only a few strategies are available to overcome the impact of sleep loss or restlessness on subsequent cognitive and physical performance as well as mood states). Short-term naps after lunch are one of the previously investigated strategies to improve mood states as well as cognitive and physical performance after SDN, and naps can be used to reduce a variety of sleep-related issues, such as impaired cognitive and physical performance and naps' arousal levels.[6] As a result, the previous night's sleep quality and quantity are adequate.[7]

Somnolence is a commonly used way to overcome drowsiness and impaired performance caused by fatigue, sleep loss, or prolonged wakefulness. In this context, it has been reported that afternoon is the best time to take a nap, as it coincides with the peak of daytime sleepiness.[8]

Previous studies have shown that in short nap periods (i.e., 5 to 15 minutes), the benefits are almost immediate (between 1 to 3 hours). Longer periods (ie, ≥30 minutes) may result in sleep inertia for a short time after waking and an improvement in cognitive performance over several hours. Accordingly, it is reported that 20-minute and 90-minute afternoon naps can eliminate the negative effect of SDN on repeated sprint exercises.[9]

For the possible explanation for the beneficial effect of naps on cognitive and physical performance, in a recent review study.[10] Reported that naps for young adults included both non-rapid eye movement and rapid eye movement bouts. It is associated with non-rapid eye movement, low energy expenditure and high neuronal synchrony. When compared to waking, rapid eye movement sleep is associated with increased brain activity and energy expenditure. The researchers came to the conclusion that a midday nap reduces sleepiness, improves executive function, and aids memory consolidation, which is followed by learning and emotional processing. As a result, the purpose of this study was to investigate the cognitive (i.e., alertness and reaction time) and short-term high-intensity impact of a 30-minute nap opportunity following one night of SDN and NSN with repetitive performance and mood states. The hypothesis of this study is that a 30-minute nap opportunity can counteract the negative impact of SDN in physical activity on cognitive and short-term high-intensity repetitive performances, as well as mood states, based on the literature data.

MATERIAL AND METHOD

Totally 15 elite male athletes, who train regularly and each with at least 5 years of sports history, took part in this study on a voluntary basis and according to the determined criteria. The research was carried out in accordance with the experimental design with pretest-posttest group in quantitative research type. In line with the determined purpose; while the male athletes in Turkey constitute the universe of the study, the sample is; A total of 15 elite male athletes between the ages of 18 and 25 who actively do sports and compete in the top league in Diyarbakır province affiliated to the Turkish Athletics Federation. The mean values of the descriptive data of the athletes participating in the study were determined as 20.33±0.82 years for age, 9.60±0.83 years for sportive experience and 171.33±2.35 centimeters for height.

Collection of Data: While the athletes continued their regular training programs for a total of 4 weeks and 5 days a week, a 30-minute nap (reaching) protocol was applied after the training by creating a comfort zone to provide nap (napping) patterns between 13:00 and 15:00. The pittsburgh sleep quality index, which was designed to test the sleep quality of the athletes, was applied to the athletes who were applied nap (napping) at 17:00. In addition to the sleep quality of the athletes, in addition to the physical and physiological performances of the athletes, the vertical jump test using the digital sensor floor and the measurement method of the time of stay in the air and the jump height were used. Thus, the explosive strength and anaerobic capacity evaluations were determined. For the measurement of physiological parameters; SFT (respiratory function test) measurement was made with the Vitalograph Micro digital device, which is a hand-held spirometer, and the lung volume and capacity of the athletes were measured.

Criteria for being included in the study: The inclusion criteria of the participants in this study were as follows:

not using tobacco products; Cigarette etc.

Not having pathological sleep disorders,

Alcohol etc. not using drugs

Doing physical exercise regularly (at least 3 hours per week)

Experimental Design: Participants visited the laboratory twice in the week preceding the study and had the opportunity for a short nap to become acquainted with the material and experimental procedure, as well as to determine height and body mass.

After the four-night familiarization sessions, the participants came to the lab to perform the experimental testing session. Night sleep and nap opportunities were controlled by acti-graph recording and sleep diaries under strict surveillance by experimenters and cameras during all testing sessions. During this study, using a between-subject design, participants performed four testing sessions separated by four days of rest: two sleep conditions (NSN and SDN) and two nap opportunities. The 15 participants were divided into four groups: three groups of four participants and one group of three participants. Test sessions were conducted in a balanced order between 13:00 and 18:00.

Analysis of Data: The research data was analyzed using the SPSS 22.0 statistical package program for Windows. The measurement results' arithmetic mean, standard deviation, minimum and maximum values were computed. The Shapiro-Wilk Normality Test was used to determine the data's normality distribution. In accordance with the experimental model and research design, the differences between measurement results were determined using the paired samples t-test (paired samples t-test). The Significance level was accepted as p<0.05.[11]

RESULTS

In our study, in which the effects of a 30-minute nap opportunity after a night of partial sleep deprivation on cognitive and short-term high-intensity performance and mood states were investigated, all the findings of the study are given in detail in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6.

Table 1: Values of Athletes Descriptive Parameters

Parameter(Unit)	n	Minimum	Maximum	$\bar{X}$-Ss.
Age (year)	15	19,00	22,00	20,33±0,82
Sportive Experience (year)	15	167,00	177,00	171,33±2,35
Stature (centimeter)	15	8,00	11,00	9,60±0,83

Table 2: Sleep Quality Index Values of Athletes

Parameter(Unit)	n	Minimum	Maximum	$\bar{X}$-Ss.
Sleep Quality(points)	15	1,00	4,00	2,73±1,03
Subjective Sleep Quality (points)	15	0,00	1,00	0,47±0,52
Sleep Latency(points)	15	0,00	3,00	1,07±0,70
Sleep Time (points)	15	0,00	0,00	0,00±0,00
Habitual Sleep Activity (points)	15	0,00	0,00	0,00±0,00
Sleep Disorder (points)	15	0,00	1,00	0,93±0,26
Use of Sleeping Pills (points)	15	0,00	1,00	0,13±0,35
Daytime Dysfunction(score)	15	0,00	1,00	0,13±0,35

According to Table 1; The mean values of the descriptive data of the athletes participating in the study were determined as 20.33±0.82 years for age, 9.60±0.83

years for sportive experience and 171.33±2.35 centimeters for height.

According to Table 2; The mean sleep quality index values of the athletes participating in the study were 2.73±1.03 points for sleep quality, 0.47±0.52 points for subjective sleep quality, 1.07±0.70 points for sleep latency, 00 for sleep duration, 0±0.0 points, 00.0±0.0 points for habitual sleep activity, 0.93±0.26 points for sleep disturbance, 0.13±0.35 points for sleep medication use, and 0 for daytime dysfunction It was determined as 13±0.35 points.

Table 3: Pre-Test Values of Athletes' Body Weight, Body Mass Index, Vertical Jump, Anaerobic Performance and Pulmonary Function Tests

Parameter (Unit)	n	Minimum	Maximum	$\bar{X}$-Ss.
Body Weight(kg)	15	60,00	70,00	67,93±2,43
Body Mass Index (kg/m2)	15	21,26	24,22	23,14±0,82
Maximum Anaerobic Power(W)	15	863,00	1070,00	953,20±58,16
Average Anaerobic Power(W)	15	645,00	981,00	849,53±102,05
Minimum Anaerobic Power(W)	15	649,00	914,00	778,27±99,98
Fatigue Index (watts/sec)	15	3,17	11,60	7,18±2,95
Vertical Bounce(cm)	15	49,00	58,00	54,27±2,43
FVC(L)	15	4,13	4,64	4,39±0,17
FEV1(L)	15	4,10	4,60	4,35±0,15
FEV1/FVC(%)	15	83,00	95,00	88,20±3,43
FEF25-75(L/s)	15	3,82	4,07	3,93±0,07

According to Table 3, the mean values of the pre-test data of the athletes participating in the study in body weight, body mass index, vertical jump, anaerobic performance and pulmonary function tests were 67.93±2.43 kg for body weight, 23.14±0 for body mass index. .82 kg/m2, 54.27±2.43 cm for vertical jump, 953.20±58.16 watts for maximum anaerobic power, 849.53±102.05 watts for average anaerobic power, 778 for minimum anaerobic power, 27±99.98 watts, 7.18±2.95 watts/s for fatigue index, 4.39±0.17 L for FVC, 4.35±0.15 L for FEV1, 88% for FEV1/FVC, 20±3.43 and 3.93±0.07 L/s for FEF25-75.

Table 4: Posttest Values of Athletes' Body Weight, Body Mass Index, Vertical Jump, Anaerobic Performance and Pulmonary Function Tests

Parameter (Unit)	n	Minimum	Maximum	$\bar{X}$-Ss.
Body Weight(kg)	15	60,00	70,00	67,60±2,32
Body Mass Index (kg/m2)	15	21,18	24,51	23,03±0,90
Maximum Anaerobic Power(W)	15	881,00	1086,00	992,33±68,12
Average Anaerobic Power(W)	15	710,00	1032,00	906,67±92,14
Minimum Anaerobic Power(W)	15	654,00	986,00	833,47±111,96
Fatigue Index (watts/sec)	15	2,61	11,36	6,34±2,66
Vertical Bounce(cm)	15	53,00	62,00	57,27±2,99
FVC(L)	15	4,56	5,01	4,79±0,12
FEV1(L)	15	4,28	4,67	4,47±0,11
FEV1/FVC(%)	15	80,00	90,00	84,60±2,95
FEF25-75(L/s)	15	3,86	4,10	3,96±0,07

According to Table 4, the mean values of the post-test data of the athletes participating in the study in body weight, body mass index, vertical jump, anaerobic performance and pulmonary function tests were 67.60±2.32 kg for body weight and 23.03±0 for body mass index. .90 kg/m2, 57.27±2.99 cm for vertical jump, 992.33±68.12 watts for maximum anaerobic power, 906.67±92.14 watts for average anaerobic power, 833 for minimum anaerobic power, 47±111.96 watts, 6.34±2.66 watts/sec for fatigue index, 4.79±0.12 L for FVC, 4.47±0.11 L for FEV1, 84% for FEV1/FVC, 60±2.95 and 3.96±0.07 L/s for FEF25-75.

Table 5: Differences in Body Weight (kg) and Body Mass Index (kg/m2) Pre-Test-Post-Test Values of Athletes (Paired Sample T-Test)

Parameter(Unit)	Difference	$\bar{X}$-Ss.	t	Sd.	p
Body Weight(kg)	Pre-Test-Post-Test	0,333±0,817	1,581	14	,136
Body Mass Index (kg/m2)	Pre-Test-Post-Test	0,114±0,957	,462	14	,651

*p<0.05

According to Table 5; There was no significant difference between the body weight (kg) and body mass index (kg/m^2) pre-test and post-test values of the athletes participating in the study (p>0.05).

Table 6: Differences in Pre-Test-Post-Test Values of Athletes' Vertical Jump, Anaerobic Performance and Pulmonary Function Tests (Paired Sample T-Test)

Parameter(Unit)	Fark	$\bar{X}$-Ss.	t	Sd.	p
Maximum Anaerobic Power(W)	Ön Test-Son Test	39,133±29,607	-5,119*	14	,000
Average Anaerobic Power(W)	Ön Test-Son Test	57,133±96,329	-2,297*	14	,038
Minimum Anaerobic Power(W)	Ön Test-Son Test	55,200±42,852	-4,989*	14	,000
Fatigue Index (watts/sec)	Ön Test-Son Test	0,839±1,687	1,925	14	,075
Vertical Bounce(cm)	Ön Test-Son Test	3,000±2,204	-5,272*	14	,000
FVC(L)	Ön Test-Son Test	0,400±0,170	-9,140*	14	,000
FEV1(L)	Ön Test-Son Test	0,121±0,057	-8,145*	14	,000
FEV1/FVC(%)	Ön Test-Son Test	3,600±0,632	22,045*	14	,000
FEF25-75(L/s)	Ön Test-Son Test	0,037±0,010	13,569*	14	,000

*p<0.05

Depending on Table 6; maximum anaerobic power (W), average anaerobic power (W), minimum anaerobic power (W), vertical jump (cm), FVC(L), FEV1(L), FEV1/FVC (%) and FEF25-75 A significant difference was determined between the (L/s) pre-test values and the post-test values (p<0.05). In these determined differences, the athletes' anaerobic power (W), average anaerobic power (W), minimum anaerobic power (W), vertical jump (cm), FVC(L), FEV1(L) and FEF25-75 (L/s) posttest It was determined that the FEV1/FVC (%) post-test values of the athletes were higher than the pre-test values and lower than the pre-test values (p<0.05). There was no significant difference between the fatigue index (watt/sec) pre-test values and post-test values of the athletes ($p>0.05$).

DISCUSSION AND CONCLUSION

The point of the study was to see how a 30-minute nap affected cognitive (alertness and reaction time) and short-term high-intensity repetitive performance.

The main findings of this study were that a 30-minute nap opportunity, as well as psychological (i.e. mood states) and physiological (i.e. blood lactate) parameters that monitor SDN and NSN, have a negative impact on mood states, as well as short-term exercise and cognitive performance. that it has a positive impact and improves performance and mood states Short-term exercise performance and the ability to take a 30-minute nap are noted to help overcome the negative impact of SDN on short-term exercise, cognitive performance, and mood.[12] The variation of cognitive and physical performances after SDN compared to NSN is consistent with several previous studies.[13] For physical performance in this context, Abedelmalek et al. (2013), HajSalem et al. (2013), N. Souissi et al. (2013) and H. Chtourou et al. (2015), peak during the 30-second Wingate test and reported that the average power was significantly lower during SDN compared to NSN.[14]

After a full night of sleep, Baati et al. (2015) reported a significant decrease in peak strength during 10 × 6 seconds of repeated maximum cycling exercise. These studies of physical exercise reported a significant increase in the fatigue index recorded during the 30-second Wingate test after SDN compared to NSN. Also, in agreement with the results of this study, several previous studies have reported a significant decrease in cognitive performance after SDN compared to NSN.[13,4] Jarraya and others. (2012, 2013) reported that vigilance and response time recorded by the number cancellation test were negatively affected after SDN compared to NSN.

The results of this study revealed a change in mood (ie, an increase in anxiety, fatigue, confusion, and depression, as well as a decrease in vitality) after SDN compared to NSN, but no change in blood lactate. Similarly Scott et al. (2006) found a significant increase in negative mood sensations after SDN compared to NSN in their study.[15]

The same findings show a significant increase in negative moods following SDN versus NSN. Although higher blood lactate has been reported during submaximal exercise performed after both late bedtime and early awakening[16], the results of this study revealed no significant difference in blood lactate after SDN compared to NSN.

The current study's findings revealed that a 30-minute nap improved mood states as well as cognitive and physical performance after both SDN and NSN. However, after SDN, there was a greater improvement. This improved performance can assist in overcoming poor performance.

These observations showed that a 30-minute nap resulted in a significant increase in performance during a sprint workout. Also, Tietzel and Lack (2001) showed an improvement in alertness and cognitive performance after a 10-minute nap. After SDN, she found an improvement in alertness after a 30-minute nap. He reported that short naps can counteract performance degradation during short-term maximal exercise caused by a disturbed night of sleep. Electrophysiological events in anatomically different parts of the human brain dynamically facilitated motor memory during sleep.[17] Similarly, he reported an improvement in performance during repeated sprint exercise after napping following SDN.[18]

On the other hand, nap time is important in explaining its beneficial effect on performance. Indeed, less than 20 minutes is considered optimal to avoid slow-wave sleep (deep sleep).[19]

Alternatively, 90 minutes is also considered optimal, as this allows for a full sleep cycle (non-rapid eye movements (non-REM) and rapid eye movements (REM)) to occur and reduces the effects of sleep inertia, which is a temporary reduction in arousal.[12]

When the circadian rhythm slows down after lunch, afternoon naps, a time of attention and alertness, may occur. Milner and Cote (2009) The improvement in cognitive and physical performance following a 30-minute nap opportunity may be explained in part by the fact that this duration is comparable to a night's sleep and includes both non-rapid and rapid eye movement bouts. Following learning and emotional processing, it was concluded that these sleep stages help minimize sleepiness, improve executive function, and facilitate memory consolidation.[20,21]

Finally, the findings of this study revealed that a 30-minute nap improved cognitive and physical performance, as well as the mood states of athletes after a night of sleep deprivation and after a normal night of sleep. However, there were no significant changes in physiological parameters in response to exercise. Furthermore, because taking a nap is a useful strategy for improving cognitive and physical development, the results can assist athletes, coaches, and sports scientists in making improvements.

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