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Enhancing Anaerobic Performance in Kickboxers: The Strategic Role of Short-Duration Napping

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Abstract

The intricate relationship between sleep and athletic performance has long been a subject of interest in sports science. This study delves into the specific impact of short-duration napping on anaerobic performance parameters in the study of kickboxing, an intense combat sport demanding both physical prowess and strategic acumen. We conducted a controlled investigation with 14 young elite male kickboxers, characterized by an average age of 20.29 ± 0.80 years, a height of 174.48 ± 4.11 cm, body masses of 70.46 ± 7.78 kg, and a body mass index (BMI) of 23.12 ± 2.02 kg/m². The experimental design encompassed three distinct conditions: no napping (N0), a 25-minute nap (N25), and a 45-minute nap (N45). The evaluation focused on several key performance metrics, including countermovement jump (CMJ), mean power, and peak power outputs. Intriguingly, our findings indicated that while CMJ values remained relatively unaffected by the napping conditions, significant variations were observed in both mean and peak power outputs, particularly among participants who napped. These variations suggest that napping, even for short durations, can significantly influence certain anaerobic performance parameters in kickboxers, with a marked improvement in power-related aspects. This research contributes to the expanding body of literature on the role of sleep and rest in athletic performance, specifically highlighting the potential of napping as an effective strategy for enhancing physical capabilities in combat sports. The implications of these findings extend beyond the realm of kickboxing, offering valuable insights and practical applications for athletic training and performance optimization across various sports disciplines where anaerobic capabilities are crucial.
Keywords: Anaerobic performance, Kickboxing, Napping, Peak power output, Sports performance optimization

Kickboksta Anaerobik Performansı Arttırmak: Kısa Süreli Şekerlemenin Stratejik Rolü

Öz

Uyku ile atletik performans arasındaki karmaşık ilişki, uzun zamandır spor bilimlerinin ilgi alanında yer almaktadır. Bu çalışma, fiziksel güç ve stratejik akıl gerektiren yoğun bir dövüş sporu olan kickboks bağlamında kısa süreli şekerlemenin anaerobik performans parametreleri üzerindeki özel etkisini incelemektedir. Ortalama yaşları 20.29 ± 0.80, boy ortalamaları 174.48 ± 4.11 cm, vücut ağırlıkları 70.46 ± 7.78 kg ve vücut kütle indeksi (VKİ) 23.12 ± 2.02 kg/m² olan 14 genç elit erkek kickboksçu ile kontrollü bir araştırma gerçekleştirilmiştir. Deneysel tasarım, üç farklı durumu kapsamaktadır: şekerleme yok (N0), 25 dakikalık şekerleme (N25) ve 45 dakikalık şekerleme (N45). Değerlendirme, countermovement sıçraması (CMJ), ortalama güç ve tepe güç çıkışları dahil olmak üzere birçok anahtar performans metriğine odaklanmıştır. Bulgularımız, ilginç bir şekilde, şekerleme koşullarının CMJ değerlerini nispeten etkilememiş olmasına karşın, özellikle şekerleme yapan katılımcılar arasında hem ortalama hem de zirve güç çıkışlarında önemli değişiklikler gözlemlendiğini göstermektedir. Bu değişiklikler, kısa süreli şekerlemenin, özellikle güçle ilgili yönlerde, kickboksçularda belirli anaerobik performans parametrelerini önemli ölçüde etkileyebileceğini düşündürmektedir. Bu araştırma, uyku ve dinlenmenin atletik performanstaki rolü üzerine genişleyen literatüre katkıda bulunmakta, özellikle kısa süreli şekerlemenin dövüş sporlarında fiziksel yetenekleri arttırmak için etkili bir strateji olarak potansiyelini vurgulamaktadır. Bu bulguların etkileri, kickboks alanını aşarak, anaerobik yeteneklerin kritik olduğu çeşitli spor disiplinlerinde antrenman ve performans optimizasyonu için değerli içgörüler ve pratik uygulamalar sunmaktadır.
Anahtar Kelimeler: Anaerobik performans, Kickboks, Şekerleme, Zirve güç çıkışı, Spor performansı optimizasyonu

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INTRODUCTION

The exploration of effective performance enhancement strategies in combat sports has become a focal point in sports science research (Matsumoto et al., 2009; Russo & Ottoboni, 2019). Among various interventions, strategic napping has garnered attention for its potential to augment athletic capabilities (Teece et al., 2023; Yagin et al., 2022). This study specifically investigates the impact of strategic napping on anaerobic performance parameters in kickboxers.

Anaerobic performance is crucial in martial arts sports, where short bursts of high-intensity activity are paramount (Bayer et al., 2023; Bayrakdaroğlu & Can, 2018; Chaabène et al., 2015; Slimani et al., 2017). Parameters such as power output and explosive strength are key determinants of success in the ring (Laett et al., 2023). Understanding how various factors, including rest and recovery strategies like napping, affect these parameters can provide valuable insights for training and preparation. The concept of strategic napping, particularly in high-intensity sports like kickboxing, goes beyond mere rest. It encompasses a targeted approach to optimize physiological and cognitive functions that are critical for peak performance (Nindl et al., 2015). In disciplines such as kickboxing, where split-second decisions and rapid force generation are essential, even marginal gains in performance can be the difference between victory and defeat (Chaabene et al., 2019). Thus, understanding the nuanced effects of napping on physical and cognitive abilities becomes paramount (Marshall & Turner, 2016).

Previous research has indicated that sleep quality and duration significantly influence athletic performance, recovery, and overall well-being (Jones et al., 2020; Sawczuk et al., 2018). However, the specific role of napping, especially of varied durations, remains underexplored, particularly in the context of combat sports (Dinges, 1989; Lovato & Lack, 2010). This gap in research presents an opportunity to delve deeper into how short-term rest periods during the day can affect physical performance, especially in sports requiring high anaerobic capacity.

This study endeavors to fill a notable gap in sports science research by rigorously assessing the impact of napping of varied durations on key anaerobic performance metrics within the context of kickboxing. Focusing on quantifiable outcomes such as the countermovement jump (CMJ), mean power, and peak power, this research aims to provide robust empirical evidence regarding the efficacy of napping as a tool for enhancing athletic performance. The choice of kickboxers as the subject population is particularly pertinent, considering the sport's inherent requirements for both physical strength and strategic acumen. Consequently, this investigation into the effects of napping is especially relevant and timely. The overarching significance of this research is anchored in its potential to fundamentally transform training and recovery methodologies in combat sports, with a specific focus on kickboxing. By integrating the concept of strategic napping into athletic routines, this study posits a novel and pragmatic approach to performance enhancement. The central hypothesis underpinning this research posits that napping, particularly of short durations, will exert a positive influence on specific anaerobic performance parameters in kickboxers, most notably in the domains of mean and peak power outputs. This hypothesis is predicated on the assumption that adequate rest, even when administered in brief periods, can substantially enhance high-intensity athletic performance. This enhancement is theorized to occur through the optimization of physiological recovery processes and the enhancement of mental acuity. This study, therefore, not only aims to substantiate the utility of napping in sports contexts but also seeks to lay the groundwork for future explorations into the broader implications and benefits of rest and recuperation strategies in high-performance athletic settings.

MATERIAL AND METHODS

Research Model

This study employs a crossover randomized controlled trial to investigate the effects of strategic napping on anaerobic performance among kickboxers. Participants were subjected to three distinct conditions: No nap, a 25-minute nap, and a 45-minute nap, with each session separated by a 48-hour washout period to minimize carry-over effects. This design not only facilitates the evaluation of nap durations in a controlled, randomized setting but also allows participants to act as their own controls, thereby enhancing the reliability of the data.

Participants

In maintaining the scientific rigor and ensuring the validity of the data collected, a meticulous approach was adopted in selecting the study's participants. The requisite sample size for the investigation was determined using the G-power software 3.1.9.7 (University of Dusseldorf, Dusseldorf, Germany) (Faul et al., 2007). The power analysis was conducted with F tests (ANOVA: repeated measures, within factors) tailored to the design of our study. The parameters set for this analysis included an alpha error probability of 0.05, a minimum effect size of 0.45, and a power (1-β error probability) of 0.80, yielding an actual power of 81.2%. Based on this analysis, a minimum of 10 participants was deemed necessary. To mitigate the risk of participant attrition, 18 young elite athletes were initially recruited. However, four athletes were subsequently excluded from data analysis due to their inability to complete all required sessions. Consequently, the study was conducted with 14 young elite athletes. These participants' ages ranged from 20.29 ± 0.80 years, their heights were 174.48 ± 4.11 cm, body masses were 70.46 ± 7.78 kg, and body mass indices were 23.12 ± 2.02 kg/m². Their maximum heart rate values averaged at 195.56 ± 1.39 beats per minute, and resting heart rate values at 61.99 ± 3.16 beats per minute.

The selection of participants was based on criteria established by Matsudo et al., in 1987, (Matsudo et al., 1987) requiring athletes to have ranked within the top nine positions in their age categories at national championships. Further inclusion criteria encompassed: a) a top 9 ranking in national competitions organized by the Turkish Kickbox Federation, b) registration in the database of the Turkish Kickbox Federation, and c) engagement in training sessions for a minimum of three days per week (Schoenfeld et al., 2019). Exclusion criteria were stringently applied to uphold the study's internal validity and ensure robust outcomes. Participants were excluded if they: a) used exogenous substances affecting health functions, b) exhibited hyperactivity, c) demonstrated unacceptable behaviors, d) failed to adhere to research protocols, or e) encountered difficulties in complying with the study's guidance. The diligent enforcement of these criteria ensured a participant pool of kickboxers without significant health issues that could confound the research outcomes. Notably, the participants were not habitual nappers.

Ethical Approval

This study was conducted in strict adherence to the ethical guidelines outlined in the Helsinki Declaration. Comprehensive information regarding the study's objectives, rationale, and hypotheses was communicated to all participants, following which informed consent was duly obtained. Additionally, requisite ethical approvals were secured from the Inonu University, Non-Interventional Health Sciences Research Ethics Committee (decision number 2022-4280), ensuring that the research was conducted in line with established ethical standards and guidelines.

Experimental Design

The research employed a meticulously structured experimental design to evaluate the impact of strategic napping on the anaerobic performance of kickboxers. Initial preparatory stages involved three familiarization sessions, designed to acquaint participants with the designated nap location and the specific procedures for assessing anaerobic performance post-napping. These sessions were crucial for minimizing variability in responses attributable to unfamiliarity with the testing environment or protocol.

Subsequent to the familiarization phase, participants were scheduled for three distinct testing sessions. These sessions were separated by a minimum interlude of 48 hours to mitigate any potential carry-over effects. The testing conditions were as follows: No nap opportunity (N0), a 25-minute nap opportunity (N25), and a 45-minute nap opportunity (N45). On arrival at the laboratory for each session, participants were accorded a ten-minute acclimatization period to adapt to the sleeping environment.

The nap intervention protocol was initiated at precisely 1:40 p.m., where participants were allowed to choose their preferred lying position. Starting at 2:00 p.m., they engaged in the respective napping protocols (N0, N25, N45) within darkened, quiet sleeping chambers, designed to optimize conditions for rest. It is pertinent to note that during the nap period, participants in all conditions were instructed to refrain from engaging in activities that could impair nap quality, such as the use of mobile phones or playing video games. This directive was based on existing literature underscoring the detrimental impact of visual stimuli on sleep quality (Stowe et al., 2023; Yagin et al., 2022).

Post-napping, participants underwent a standardized warm-up regimen lasting five minutes. This warm-up included two minutes of easy running followed by three minutes of specific exercises, encompassing foot sweeps, finger, wrist, and ankle rotations, trunk side stretches, trunk rotator stretches, hip circles, and knee bends. This routine was designed to prepare the athletes physically and mentally for the subsequent performance assessments.

At 5:00 p.m., following the warm-up, participants performed the countermovement jump (CMJ) test. The conclusion of each session involved expressing gratitude to the participants for their involvement. Furthermore, upon the culmination of the entire experimental series, a comprehensive debriefing was conducted, during which participants were thanked for their contribution and provided with insights into the study's preliminary findings and objectives. This procedure ensured ethical compliance with research norms and fostered a sense of contribution and acknowledgement among the participants.

Data Collection

Anthropometric Measurements

In the process of data collection, rigorous anthropometric measurements were conducted using state-of-the-art equipment. Participants' body dimensions were assessed utilizing a SECA® device (Gmbh, Hamburg, Germany), renowned for its precision in anthropometric measurement. The measurements were taken under standardized conditions to ensure consistency and accuracy. Participants were positioned upright, barefoot, and with their body - including ankles, calves, hips, scapula, and head - aligned against a flat wall surface. This posture was critical for obtaining accurate body dimension data. The method adhered to the Frankfurt plane principle for determining the head position, a standard approach in anthropometry to ensure a reproducible and natural head posture during measurement. The height of each participant was recorded during the inhalation phase, as this is recognized to be a moment when the body's stature is maximally extended, thus providing the most accurate height measurement. For the assessment of body mass, participants were required to wear standardized lightweight clothing (Toledo 2096 PP, São Bernardo do Campo, Brazil), which minimized the potential variance introduced by heavier or bulkier attire. The Body Mass Index (BMI) was subsequently calculated, adhering to the standard formula. This calculation involved dividing the participant's weight (expressed in kilograms) by the square of their height (expressed in meters) (Sales et al., 2018). This method of BMI calculation is universally accepted in clinical and research settings due to its simplicity and effectiveness in providing a quick assessment of body fat distribution and potential health risks associated with weight categories.

Countermovement Jump (CMJ) Assessment

The Countermovement Jumps (CMJs) were a critical component of the study's data collection process, focusing on evaluating the explosive lower-body power of the volunteer kickboxers. This assessment was conducted using a high-precision force platform (Newtest 2000, Oulu, Finland), which is instrumental in capturing accurate biomechanical data. Each participant was instructed to perform a series of three CMJs, with a standardized one-minute rest interval between each jump to ensure recovery and maintain the consistency of performance across trials. The protocol for the CMJ required participants to begin and conclude in a standardized upright stance, with feet positioned at hip-width apart and hands placed firmly on the hips. This specific posture was mandated to ensure uniformity across participants and to mitigate any extraneous influences that could affect the jump's outcome. Notably, hand movement was restricted during the entire measurement process to eliminate any potential impact on the jump height. Upon receiving the command, participants were required to initiate the jump by swiftly lowering their center of mass through knee flexion to a self-selected depth, followed immediately by a vertical leap exerted with maximal effort from the lowest position reached (Pedersen et al., 2019; Tayech et al., 2020). This action is essential for eliciting the stretch-shortening cycle, a key element in assessing explosive strength. For the analysis, the highest of the three jump heights recorded for each participant was used. This selection criterion is based on the premise that the maximum jump height best represents the participant's explosive power capabilities. In addition, anaerobic power metrics, including peak and average power outputs, were calculated for each participant utilizing the Johnson & Bahamonde Formula (Johnson & Bahamonde, 1996). This formula integrates variables such as jump distance, body weight, and height, thereby allowing for a comprehensive and nuanced analysis of the participants' explosive power capacities in the context of their individual physical characteristics.

Statistical Analysis

Comprehensive statistical analyses were conducted utilizing the GraphPad Prism software version 8.0.1 (GraphPad Software Inc, San Diego, California, USA), a sophisticated tool recognized for its robustness in statistical computations and data visualization. The alpha threshold for statistical significance was established at $p < 0.05$, aligning with conventional standards in empirical research. The preliminary step in the statistical analysis involved verifying the normality of the data distribution. This verification was crucial to determine the appropriateness of subsequent statistical tests. The Shapiro–Wilk test, supplemented by assessments of skewness and kurtosis values, was employed for this purpose. The data adhered to the criteria of a normal distribution, thereby justifying the use of parametric statistical methods. Consequently, the variables were summarized as mean ± standard deviation (SD), a standard approach for presenting central tendency and variability in normally distributed data. To ensure the appropriateness of the analytical techniques, the homogeneity of variances across groups was assessed using the Levene Test. This test is fundamental in validating the assumptions underlying parametric tests such as Analysis of Variance (ANOVA). Following this, a Repeated Measures ANOVA was utilized to analyze the differences in CMJ, mean power, and maximum power across the different napping conditions (N0, N25, N45). The Repeated Measures ANOVA is particularly suited for designs where the same subjects are exposed to different conditions over time. In cases where significant differences were identified by the ANOVA, the Bonferroni post-hoc test was employed to ascertain specific pairwise differences. To quantify the magnitude of the observed effects, effect sizes were calculated using Cohen's d formula. Additionally, for the ANOVA results, effect sizes were expressed as partial eta squared (ηp2) values, providing a nuanced understanding of the effect magnitude. The interpretation of these values followed standard conventions, with $\eta p2 \leq 0.01$ indicating a small effect size, $0.01 \leq \eta p2 \leq 0.06$ indicating a medium effect size, and $\eta p2 \geq 0.14$ indicating a large effect size (Hopkins et al., 2009).

FINDINGS

The demographic information of the participants. According to the table, the participants' age was determined to be 20.29 ± 0.80 years, height 174.48 ± 4.11 cm, weight 70.46 ± 7.78 kg, and BMI value 23.12 ± 2.02 kg/m², Maximum Heart Rate value 195.56 ± 1.39 (beats/min), Resting Heart Rate value 61.99 ± 3.16 (beats/min) (Table 1.).

Table 1. Descriptive characteristics of soccer players (M ± SD)

Variables	Mean ± SD	95% CI Lower	95% CI Upper
Age (year)	20.29 ± 0.80	19.88	20.71
Height (cm)	174.48 ± 4.11	172.32	176.63
Body Mass (kg)	70.46 ± 7.78	66.39	74.53
BMI (kg/m²)	23.12 ± 2.02	22.06	24.18
BFR (%)	17.39 ± 4.89	14.84	19.95
HRmax (beats/min)	195.56 ± 1.39	194.84	196.29
HRrest (beats/min)	61.99 ± 3.16	60.33	63.64

BMI: Body mass index, HRmax: Maximum heart rate, BFR: Body fat ratio, HRrest: Rest heart rate

Table 2 compares the countermovement jump of the participants in N0, N25, and N45. According to the table, the participants' countermovement jump (CMJ) values were not significantly differed (p=.372, ηp2=.049). The post-hoc Bonferroni test revealed no significant differences between the N0 and N25 CMJ values (respectively; p>0.999, [-4.595 to 3.024 95% CI], N0 and N45 CMJ values (respectively; p= 0.501, [-5.952 to 1.666 95% CI], N25 and N45 CMJ values (respectively; p >0.999, [-5.166 to 2.452 95% CI].

Table 2. Comparison of the vertical jump of the participants

Parameters	Time	M±S.D.	Between groups	F	p	η_p^2	95% CI
CMJ (cm)	N0	39.64±3.91	N0-N25: >0.999 N0-N45:0.501 N25-N45:>0.999	1.014	.372	.049	(37.38,41.90)
	N25	40.43±4.11					(38.06,42.80)
	N45	41.79±4.06					(39.44,44.13)

N0: No-nap control, N25: a 25-minute nap, N45: a 45-minute nap, * p<.05

Table 3 compares the mean power of the participants in N0, N25, and N45. According to the table, the participants' mean power (MP) values were significantly differed (p <0.000, ηp2= 0.624). The post-hoc Bonferroni test revealed significant differences between the N0 and N25 MP values (respectively; p= 0.008, [-5689 to -816.8 95% CI], N0 and N45 MP values (respectively; p= 0.001, [-13907 to -3836 95% CI], N25 and N45 MP values (respectively; p= 0.001, [-8905 to -2332 95% CI].

Table 3. Comparison of the mean power of the participants

Parameters	Time	M±S.D.	F	p	η_p^2	95% CI
Mean power (watt)	N0	184532±28754	21.65	. 000*	.624	(167929 to 201134)
	N25	187784±29212				(170918 to 204651)
	N45	193403±28610				(176884 to 209922)

MP: Mean power, N0: No-nap control, N25: a 25-minute nap, N45: a 45-minute nap, * p<.05

Table 4 compares the peak power of the participants in N0, N25, and N45. According to the table, the participants' peak power (PP) values were significantly differed (p =0.730, ηp2= 0.015). The post-hoc Bonferroni test revealed significant differences between the N0 and N25 PP values (respectively; p >0.999, [-59712 to 47376 95% CI], N0 and N45 MP values (respectively; p >0.999, [-70365 to 36722 95% CI], N25 and N45 MP values (respectively; p >0.999, [-64197 to 42890 95% CI].

Table 4. Comparison of the peak power of the participants

Parameters	Time	M±S.D.	F	p	η_p^2	95% CI
Peak power (watt)	N0	340432±56353	0.316	.730	0.015	(307894.372969)
	N25	346600±57325				(313501.379698)
	N45	357253±56199				(324805.389702)

PP: Peak power, N0: No-nap control, N25: a 25-minute nap, N45: a 45-minute nap, * p<.05

DISCUSSION AND CONCLUSION

The findings of this study provide valuable insights into the impact of strategic napping on anaerobic performance parameters in elite kickboxers. The data revealed that while the countermovement jump (CMJ) did not show significant variations across different napping conditions, there were notable changes in mean and peak power outputs, particularly in the napping groups. These results suggest that short-duration napping may have a significant influence on specific aspects of physical performance, especially those related to power. There are no studies in the literature suggesting no significant change in CMJ performance across nap conditions; This suggests that explosive power measured by the CMJ may not be as sensitive to short-term rest interventions such as napping, although no evidence has been seen in previous studies.

However, the observed variations in mean and peak power outputs are particularly intriguing. These findings corroborate the hypothesis that even brief periods of rest can enhance certain aspects of anaerobic performance. This could be attributed to the restorative effects of napping on central nervous system (CNS) fatigue, which plays a crucial role in power generation and muscular endurance (Ajjimaporn et al., 2020; Boukhris et al., 2023; Souabni et al., 2021).

A substantial body of scholarly literature exists which encompasses research on the provision of napping opportunities (Hsouna et al., 2019; Souabni et al., 2023). However, no study has been found to examine its impact on CMJ, mean and peak power performance in kickboxers. The study by Hsouna et al., (2023) and our current research share a common focus on the effects of napping on athletic performance, yet they exhibit distinct differences in methodology and outcomes. Both studies investigate the impact of varying nap durations on aspects of physical performance, with Hsouna et al. examining a broader range of parameters including attention, emotions, and stress, in addition to physical metrics. Our research, on the other hand, is more narrowly concentrated on the physical prowess of kickboxers, specifically analyzing countermovement jump (CMJ) and power outputs. Hsouna et al. found significant improvements in 5-jump performance with longer naps (35 and 45 minutes), whereas our study did not observe significant changes in CMJ across different napping conditions (Hsouna et al., 2019). However, we noted considerable variations in mean and peak power outputs, particularly in napping groups, highlighting the benefits of short-duration naps in enhancing specific anaerobic performance parameters in kickboxers. These differences underscore the nuanced and varied impacts of napping on different aspects of athletic performance, suggesting that the effectiveness of napping may vary depending on the specific performance metric being assessed and the sport in question. The study by Souabni et al., (2023) and our current research both examine the effects of napping on athletic performance, yet they present notable differences in their focus and outcomes. Souabni et al. explored the impact of a 40-minute nap on various physiological responses and specific abilities, observing improved performance in defensive, offensive, and upper body power in the napping condition compared to the control (Souabni et al., 2023). This aligns with our research, which also highlights the positive effects of napping on athletic performance, specifically in kickboxers. However, while Souabni et al. reported overall better performance in specific combat skills and power with a longer nap duration, our study concentrated on mean and peak power outputs as a result of shorter naps, without observing significant changes in the countermovement jump (CMJ), a measure of explosive leg strength. Both studies reinforce the concept that strategic napping can enhance certain aspects of performance in athletes, yet the specific benefits appear to be influenced by the duration of the nap and the particular performance metrics evaluated. Our research adds to this understanding by suggesting that even short-duration naps can significantly impact anaerobic performance parameters, especially in power-related aspects, in a sport like kickboxing. The study by Boukhris et al., (2020) and our research share a central theme of examining the impact of napping on athletic performance, yet they differ in their specific focus, methodologies, and findings. Boukhris et al. explored a broader spectrum of outcomes including attention, mood states, sleepiness, perceived exertion, recovery, and muscle soreness in addition to physical performance measures like maximal voluntary isometric contraction (MVIC) and shuttle run in amateur team sport players. They observed that both 40-minute and 90-minute naps enhanced various performance metrics and mood states compared to no napping, with more pronounced improvements following the longer nap duration (Boukhris et al., 2020). Conversely, our study specifically targeted the physical prowess of kickboxers, focusing on measures such as the countermovement jump (CMJ) and power outputs. While we did not observe significant changes in CMJ performance across napping conditions, our research highlighted significant improvements in mean and peak power outputs, particularly in the napping groups. This suggests that even short-duration napping can effectively enhance specific anaerobic performance parameters in high-intensity sports. Both studies underscore the positive influence of napping on athletic performance, but they diverge in their approach to nap duration and the range of performance metrics evaluated. Boukhris et al., (2020) suggest that longer naps might be more beneficial for a broader range of physical and cognitive outcomes, while our study indicates that shorter naps can also yield significant benefits, particularly in power-related aspects of performance in combat sports. These differences highlight the nuanced and varied impacts of napping on different aspects of athletic performance and suggest that the optimal napping strategy may vary depending on the specific demands of the sport and the performance metrics of interest.

The strategic implementation of napping as a performance enhancement tool could therefore be especially beneficial in combat sports like kickboxing, where bouts of high-intensity activity are interspersed with periods of lower intensity. Incorporating napping into the training and competition schedules of athletes could optimize their performance, particularly in sports requiring quick, explosive movements and high levels of power output. One limitation of this study is the homogeneity of the participant pool, which consisted solely of young, elite male kickboxers. Future research could expand on these findings by including a more diverse range of athletes, including female athletes and those at different levels of expertise and training. Additionally, investigating the impact of napping on other performance parameters, such as reaction time and cognitive function, would provide a more comprehensive understanding of its benefits.

The present study embarked on an exploration of the effects of strategic napping on key anaerobic performance parameters in elite kickboxers. It provides empirical evidence that short-duration napping can significantly influence certain aspects of physical performance, particularly in terms of mean and peak power outputs. These findings enhance our understanding of the complex interplay between rest and physical performance in high-intensity sports. While the countermovement jump (CMJ) did not demonstrate significant variations across napping conditions, the notable improvements in power output parameters point towards the specific benefits of napping on aspects of performance reliant on the central nervous system and muscular endurance. This study contributes to a nuanced appreciation of the role of rest and recovery, particularly in the form of napping, in enhancing athletic performance. It underscores the potential of integrating strategic napping into the training and recovery protocols of athletes, especially in sports where power and explosiveness are crucial.

The strategic use of napping appears to be a promising and practical approach to enhance certain aspects of anaerobic performance in athletes, particularly in sports demanding high levels of power and explosiveness. The simplicity and non-invasiveness of this intervention make it an attractive option for athletes and coaches seeking to gain a competitive edge.

Recommendations

A comprehensive recommendation is to integrate structured, short-duration napping into athletic training programs, particularly in disciplines requiring high anaerobic capacity. This integration should consider varying durations (25 to 45 minutes) to accommodate individual physiological responses and training schedules. Further academic exploration in diverse sports settings is recommended to substantiate the generalizability of napping as a performance-enhancing strategy, potentially extending its application beyond combat sports to other anaerobic-intensive disciplines. This approach advocates for a more nuanced understanding of sleep's role in optimizing athletic performance.

Conflict of Interest: The authors hereby affirm that no conflict of interest, either financial or personal, has influenced the research and findings presented in this study. This declaration encompasses all potential conflicts that might impinge upon the integrity and objectivity of the research.

Authors' Contribution: Study Design- Adanur & Eken; Data Collection- Adanur; Statistical Analysis- Eken; Manuscript Preparation- Adanur & Eken.

Ethical Approval

Ethic Committee: Inonu University, Non-Interventional Health Sciences Research Ethics Committee
Date: 27/12/2022
Decision/Protocol Number: 2022-4280

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