

## INFLUENCE OF SPORTS ON THE QUALITY OF SLEEP OF ATHLETES AND NON-ATHLETES

Influência da Prática Desportiva na Qualidade de Sono de Atletas e Não-Atletas

Influencia del deporte en la calidad del sueño de deportistas y no deportistas

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## Abstract

**Background:** several studies have addressed the issue of sleep and its importance for physical and mental recovery, which is particularly important for team sports athletes. **Objective:** to compare the quality of sleep of athletes with non-athletes. **Methodology:** prospective and quantitative study, comprising a sample of 62 participants (31 athletes and 31 non-athletes) who had access to a questionnaire for self-completion, a questionnaire that includes sociodemographic characterization and the Pittsburgh index to assess sleep quality. **Results:** it was observed that athletes sleep on average about eight hours per night, presenting a longer sleep latency time compared to non-athletes (the latter without statistical significance). It was also found that there is a greater number of individuals with good sleep quality in the group of athletes in relation to non-athletes. **Conclusion:** in this study, being an athlete seems to contribute to an average number of hours of sleep higher than non-athletes. Raising awareness of adopting healthy practices to optimize sleep quality in athletes can improve their sports performance.

**Keywords:** physical exercise; sleep; sleep disorders; life style

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## RESUMO

**Enquadramento:** têm sido vários os estudos que abordam a problemática do sono e a importância deste para a recuperação física e mental, sendo particularmente importante para os atletas de desporto coletivo. **Objetivo:** comparar a qualidade de sono dos atletas com não atletas. **Metodologia:** estudo prospetivo e quantitativo, com 62 participantes (31 atletas e 31 não atletas) que tiveram acesso a um questionário para autopreenchimento, que incluía uma caracterização sociodemográfica e o índice de Pittsburgh para avaliação da qualidade de sono. **Resultados:** observou-se que os atletas dormem em média cerca de oito horas por noite, apresentando, um tempo maior de latência do sono em comparação aos não atletas (este último sem significado estatístico). Apurou-se também que existe um maior número de indivíduos com boa qualidade de sono no grupo dos atletas em relação aos não atletas. **Conclusão:** neste estudo, ser atleta parece contribuir para um número médio de horas de sono superior em relação aos não atletas. A consciencialização da adoção de práticas saudáveis para otimizar a qualidade de sono nos atletas pode melhorar a sua performance desportiva. **Palavras-chave:** Exercício físico; Sono; Distúrbios do sono; Estilo de vida

## RESUMEN

**Marco contextual:** se han realizado varios estudios sobre la cuestión del sueño y su importancia para la recuperación física y mental, que es especialmente importante para los atletas que practican deportes de equipo. **Objetivo:** comparar la calidad del sueño de los atletas con los no atletas. **Metodología:** estudio prospectivo y cuantitativo, compuesto por una muestra de 62 participantes (31 atletas y 31 no atletas) que tuvieron acceso a un cuestionario para autocompletar, un cuestionario que incluye la caracterización sociodemográfica y el índice de Pittsburgh para evaluar la calidad del sueño. **Resultados:** se observó que los atletas duermen en promedio alrededor de ocho horas por noche, presentando un tiempo de latencia de sueño más largo en comparación con los no atletas (estos últimos sin significación estadística). También se encontró que hay un mayor número de individuos con buena calidad de sueño en el grupo de atletas en relación con los no atletas. **Conclusión:** en este estudio, ser un atleta parece contribuir a un número promedio de horas de sueño más alto que los no atletas. Crear conciencia sobre la adopción de prácticas saludables para optimizar la calidad del sueño en los atletas puede mejorar su rendimiento deportivo. **Palabras-clave:** ejercicio físico; trastornos del sueño; sueño; estilo de vida



## INTRODUCTION

Sleep is a physiological process and is essential for maintaining health and homeostasis in human beings (Demirel, 2016).

The main indicators of deteriorating health are sleep disorders (difficulty falling asleep, fragmented sleep), fatigue, cardiovascular changes (increased risk of acute myocardial infarction and ischemic disease) and gastrointestinal changes (appetite changes), psychological symptoms (anxiety, depression) and eating disorders (excessive food intake) (Bamonde, 2020).

A healthy lifestyle combined with regular physical exercise, in the right measure, can be a highly effective way of improving the quality and efficiency of sleep, which has been lost over time. As well as being an integral part of recovery and the adaptive process between exercise sessions, evidence suggests that increased sleep duration and improved sleep quality in athletes are associated with better performance and competitive success. In addition, quality sleep can reduce the risk of injury and illness in athletes, not only optimizing health, but also improving performance through greater participation in training (Kunfinke, 2017).

As well as being a basic requirement for human health, sleep has been proposed as a modifiable factor that influences the performance of athletes. There seems to be a consensus that athletes may need more sleep than sedentary individuals to allow for adequate recovery and adaptability between workouts. The most widely agreed upon number of hours of sleep for the specific population of athletes seems to be 9 to 10 hours, as opposed to the recommended 7 to 9 hours for adults. It is important to note that there is currently no standard procedure or guidelines indicating what

would be desirable in terms of sleep duration or quality for athletes (Fullagar, 2015).

Sleep plays an important role in different psychological aspects and physiological functions, such as memory consolidation, immune response regulation and lymphatic function, functions that can support sports performance (Leduc, 2019).

Inadequate, low quality or reduced quantity sleep has been studied and shown to negatively influence various parameters related to physical performance (e.g. endurance, speed and muscle strength) and cognitive performance (e.g. attention, reasoning and learning) (Fullagar, 2015).

The general aim of this study was to relate the training intensity and sleep quality of a soccer team, and specifically to define the training intensity of the athletes in the sample and compare the sleep quality of athletes with that of non-athletes based on the Pittsburgh Sleep Quality Index (PSQI).

Although sleep is recognized as an important factor for optimal athletic performance and general health, little is known about the athlete's sleep during competition. One study reports that poor sleep quality is common before major competitions in Australian athletes, but most athletes are unaware of strategies to improve the quality of their sleep. It is essential that coaches and scientists monitor and transmit sleep hygiene strategies to athletes in individual and team sports to improve sleep before important competitions (Jullif, 2014). Despite this, the relationship between the intensity of sports practice and sleep quality is still little explored in the scientific literature.

One study (Knufinke, 2017) indicates that when athletes have strenuous workouts, their sleep is not fully efficient in recovery even though they have healthy sleep durations because it is fragmented.

In 2016, another study of athletes found that they had a statistically higher Pittsburgh Sleep Quality Index than non-athletes, indicating that their sleep was failing them (Demirel, 2016). In the same year, another author carried out a study that included samples of team sports athletes and found a positive relationship between competitive success and increased sleep duration and quality. This study involved 576 Brazilian athletes of both sexes and invited each of them to describe their sleep quality and mood immediately before a competition. The athletes rated their sleep quality as normal or good, but poor sleep quality was an independent predictor of failure in the competition (Brandt, 2016).

## BACKGROUND

Several studies have addressed the issue of sleep and its importance for physical and mental recovery, and it is particularly important for team sports athletes. Chen's 2019 study concluded that shorter sleep duration is associated with poorer physical performance in elite male basketball players. A systematic review concluded that sleep deprivation negatively affects athletic performance, as well as increasing the risk of injury (Fullagar, 2015).

Although the evidence is limited, there are studies that indicate the influence of poor sleep and an increased likelihood of training injuries in top-level athletes. An example of this is the study involving 496 adolescent athletes with the inclusion of 16 different types of individual and team sports that found that increased training load and decreased self-reported sleep duration were independently associated with an increased risk of injury (Dobrosielski, 2021).

Training with medium to high intensities has been shown to impair sleep quality as well as sleep

efficiency, affecting athletes' well-being and reducing the quality of sports performance (Mateus, 2021).

Sleep is an important component in the sports arena, but it is often neglected and therefore has become a growing concern, coaches, team doctors and psychologists should pay attention to the importance of implementing proper sleep hygiene and focus on ways to improve this dimension in the teams where they play, with a view to improving team performance and the well-being of their athletes (Chandrasekaran, 2019).

This study addresses issues of relevance to the scientific community and of particular interest in the context of sport, as it assesses the relationship between the intensity of sports practice and sleep quality in athletes and then compares the sleep quality of athletes with non-athletes. From what we have been able to investigate in the literature, this subject is little explored, and there is a need to fill this gap and simultaneously respond to a part of the population with high sporting habits, who may have difficulty managing their sleep and the relationship with physical intensity.

## METHODOLOGY

A prospective, quantitative study was carried out, based on a non-probabilistic convenience sample of 63 individuals (32 athletes and 31 non-athletes). The athletes were approached at a soccer club and the non-athletes were approached in selected streets in order to find individuals in the same age group as the athletes. We approached the club president selected for the study and obtained authorization to carry out the study with their athletes, as well as including an informed consent in the questionnaire. They were provided with a digital questionnaire that combines

the Pittsburgh sleep quality index with sociodemographic characterization questions. At the same time as the questionnaires, the inclusion criteria were applied. The inclusion criteria applied were to be eighteen years of age or older. One athlete was excluded for refusing to take part in the study.

The project was authorized by the Ethics Committee of the Polytechnic Institute of Castelo Branco.

Data collection was preceded by informed consent duly signed by the participants, and compliance with the ethical requirements of the Declaration of Helsinki (World Medical Association, 1964) was guaranteed.

For data collection, a questionnaire was implemented to assess sleep quality, which is the PSQI (Pittsburgh Sleep Quality Index) for determining sleep quality, version approved in Portuguese (João, 2017). This questionnaire was used with the prior authorization of the authors.

Sports practice was defined through a question on the questionnaire given to the participants, which asked whether they practiced any type of physical activity.

High-intensity training was considered to correspond to all individuals who, in the question 'How intense is your training?', selected the option 'I practice high-intensity exercise almost every day of the week'; moderate-intensity training corresponded to individuals who selected the option 'I practice moderate-intensity physical activity almost every day

and/or do high-intensity exercise two to four times a week' and was classified as not practicing physical exercise when they selected the option 'I do little or no physical exercise on a weekly basis'.

As for the classification of sleep quality, questionnaires that obtained PSQI scores of up to and including 4 points were classified as having good sleep quality, poor sleep quality from 5 to 9 points and possible evidence of a sleep disorder above 10 points (to be proven/diagnosed in the clinic or through sleep studies).

All the data collected was analyzed using statistics with the aid of the IBM SPSS Statistics® (IBM Statistical Product and Service Solutions) statistical data analysis and processing program, and the p-value <0.05 will be considered the indicator for defining a statistically significant difference. The statistical tests carried out were Pearson's Correlation and Spearman's Correlation.

**RESULTS**

The questionnaire showed that the individuals in the sample were aged between 18 and 39, with an average age of 26 and a standard deviation of 4.25. It was found that the athletes practiced high-intensity physical activity, corresponding to 61.3% of the athletes, while only 3% of the non-athletes practiced high-intensity physical exercise.

Table 1  
Characterization of the sample

Sample Characterization			
	Group	Athletes	No Athletes
Age	Minimum	18	18
	Maximum	37	39
	Averaged	22	30

	Standard deviation	4,25	5,41
Training intensity	High (n)	19	1
	Moderated (n)	12	14
	No practice (n)	0	16
PSQI Score	Good Quality (n)	19	13
	Bad Quality (n)	12	15
	Sleep Disturbance (n)	1	2
Sleep efficiency (%)		95	92
Sleep duration (hours)	Mean ± Standard deviation	8 ± 1.28	7 ± 1.36
Sleep latency (minutes)	Mean ± Standard deviation	23 ± 20.73	18 ± 15.23

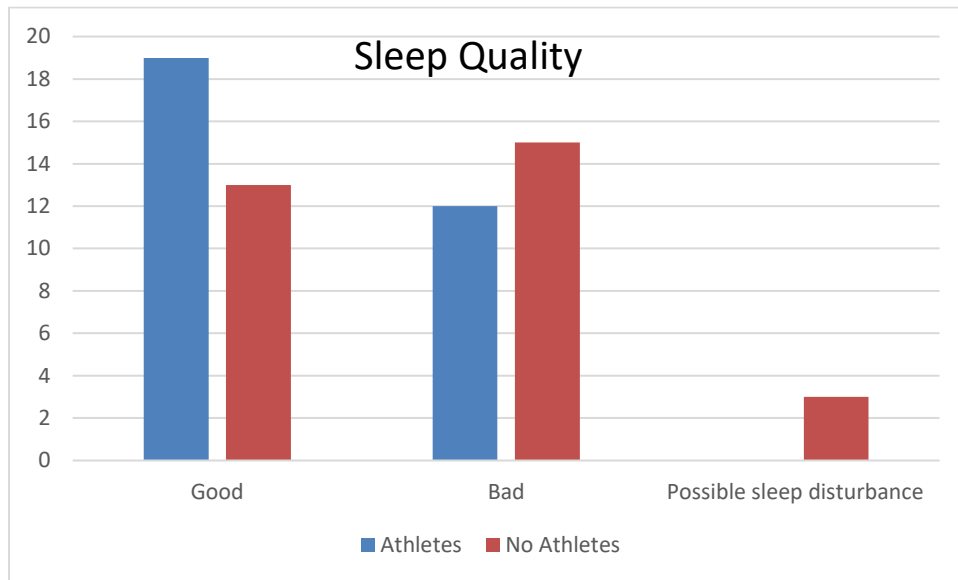
Caption: PSQI - Pittsburgh Sleep Quality Index

Spearman's correlation test showed a correlation between PSQI score and training intensity with a p-value = 0.915, between training intensity and latency with a p-value = 0.412 and between group and PSQI score with a p-value = 0.640. Pearson's correlation test showed that the correlation between PSQI and sleep duration had a p-value = 0.002, the correlation between PSQI and latency had a p-value = 0.001 and the correlation between group and sleep duration had a p-value = 0.004.

The total average sleep time of athletes was higher than that of non-athletes, at 8 and 7 hours respectively. The maximum sleep latency in athletes was 90 minutes, with a minimum of 2 minutes and an average of 23 minutes, while in non-athletes the maximum sleep latency was 60 minutes, with a minimum of 1 minute and an average of 18 minutes.

The participants' self-perception of sleep quality contradicts the results obtained, as only 19.3% of athletes and 9.7% of non-athletes say they have poor sleep quality, but the majority of individuals perceive poor sleep quality. After analyzing the results of the Pittsburgh sleep quality index, 45% of non-athletes and 61.3% of athletes have good sleep quality and 55% of non-athletes and 38.7% of athletes have poor sleep quality.

The significance of the variables was studied using Spearman's correlation test, which obtained a P-value of <0.005 for sleep latency and sleep quality. It can be said that although latency is higher in athletes, average latency values are normal in both groups and sleep quality is better in athletes than in non-athletes, as can be seen in the graph below.

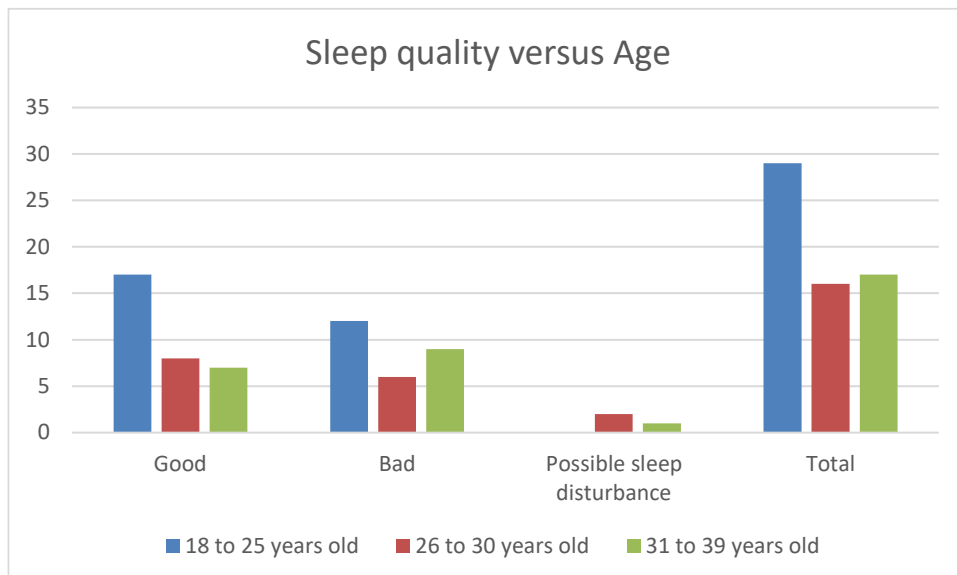


Graph 1  
Sleep quality of the sample

We found that of the individuals who practiced high-intensity training (20 in total), 11 had good sleep quality, corresponding to 55%, and of the individuals who practiced moderate-intensity training (26 in total), 15 had good sleep quality, corresponding to 57.7%.

With regard to sleep efficiency, the average value was 92% for non-athletes and 95% for athletes, which is considered normal for both groups.

It was found that the 18-25 age group had the highest number of individuals with good sleep quality.



Graph 2  
Sleep Quality Vs. Age Group

**DISCUSSION**

This study contains relevant information for the scientific community, because in addition to assessing sleep quality in each group of individuals in the sample, it also assesses this item considering the different age ranges determined in the sample, allowing us to see if there is a difference in sleep quality according to the age range of the individuals. This study presents some interesting results on the relationship between high-intensity and low-intensity physical activity and sleep quality and efficiency in athletes and non-athletes. It was found that a significant percentage of individuals practice high-intensity physical activity, which can have a positive impact on sleep quality, and that sleep latency is higher in athletes than in non-athletes, although both are considered to be within the normal range. However, despite these differences, the participants' self-perception of sleep quality was contradictory in relation to the results obtained by the Pittsburgh sleep quality index, as the individuals had the perception of having poor sleep quality and the results show that the majority of individuals have good sleep quality. The results indicate that the 18-25 age group has a higher number of individuals with good sleep quality and that sleep efficiency is higher in athletes than in non-athletes. These results are relevant for promoting a healthy lifestyle in individuals who practice high-intensity physical activity.

Regular physical exercise promotes benefits such as improving the cardiovascular, respiratory, endocrine, muscular and humoral systems, as well as improving sleep quality. A study carried out by Podhorecka in 2017 showed that there is a statistically significant correlation between physical exertion and sleep, with people who perform intense or moderate physical

activity waking up less often during the night, falling asleep faster and reporting better quality sleep (Podhorecka, 2017).

The perception of sleep quality is described as difficulty falling asleep and staying asleep; waking up too early in the morning; how rested the person feels after a night's sleep; in the case of the present study it was found that the individual's self-perception of their sleep quality is positive, however paradoxically when we evaluate the PSQI scores obtained, we have 38.7% of athletes and 55% of non-athletes who actually have poor sleep quality. With regard to self-perception of sleep quality, it is interesting to note that many participants reported having a good quality of sleep, despite the results of the Pittsburgh Sleep Quality Index suggesting otherwise. These paradoxical results highlight the importance of using objective instruments to assess sleep quality, as self-perception can fail to be accurate (Liu et al., 2020). Psychological, social and environmental changes, as well as factors such as the use of medication, smoking, drinking alcohol and frequent caffeinated beverages, can reduce sleep quality (Ropke, 2017). Any of these variables could be particularly important in athletes who are under intense pressure to achieve sporting results.

Although a positive correlation was found between training intensity and sleep latency, we would point out that the average sleep latency in both groups was within the normal range. However, it is important to monitor sleep latency in athletes through actigraphy or sleep studies, as sleep deprivation can negatively affect sports performance and increase the risk of injury (Chennaoui, 2014).

In the systematic review carried out by Gupta in 2017, it was found that athletes have higher sleep latency values compared to individuals who do not exercise. In

Kunfinke's 2017 study, with a sample of 98 elite athletes (56 women and 42 men), who used the actigraphy diagnostic method with single-channel electroencephalography recording, he found that the athletes in his sample slept an average of eight hours (Kunfinke, 2017). Camila Cassemiro Rosa's study carried out in 2021, with a sample of 65 individuals who practiced judo and ball games, also found that physical exercise has benefits for sleep quality (Rosa et al, 2021).

In this study, it was found that athletes slept an average of around eight hours versus an average of seven hours in non-athletes, and there were higher sleep latency values in athletes than in non-athletes (respectively 23 minutes versus 18 minutes on average). A study carried out by Rendall in 2021 on a sample of 313 athletes (243 men, 70 women) that included different sports such as running, basketball, soccer and rugby, found that athletes who practiced running slept fewer hours than athletes in other sports and that 19% of the individuals reported shorter sleep duration than normal for a healthy adult (Rendall, 2021).

Bleyer's 2015 study with a sample of 452 athletes from team and individual sports found that athletes who received sleep instructions during their training sessions had longer sleep duration and a lower PSQI score, indicating better sleep quality, which may suggest that giving some instructions/knowledge about healthy sleep practices can boost sleep quality. The results obtained in this study suggest that athletes have a higher quality of sleep than non-athletes. We can justify this, albeit partially, if we take into account certain factors, including regular physical exercise, which is associated with an improvement in sleep quality (Kredlow et al., 2015). In addition, other studies have shown that athletes can have better sleep

regulation due to a more consistent circadian rhythm, but this requires proper sleep hygiene and the implementation of a healthy sleep routine (Chennaoui, 2014).

After analyzing the results found in the Pittsburgh sleep quality index of the present study, it was possible to see a substantial number of individuals with poor sleep quality, 55% of non-athletes and 38.7% of athletes with poor sleep quality and 45% of non-athletes and 61.3% of athletes with good sleep quality. The consequences of poor sleep quality for athletes are manifold and include, among others, fatigue, irritability, poor performance, decreased coordination and reaction time, increased risk of injury, decreased ability to recover after training and competitions, and decreased overall quality of life.

Igor Lima carried out a study in 2015 with a sample of twenty-six professional athletics athletes (20 men and 6 women) taking part in national and international competitions and found that the majority of the athletes assessed had efficient sleep in pre-competition periods and did not have significant sleep disturbances (Lima, 2015). Regarding sleep efficiency in this study, we obtained an average value of 92% for the non-athletes and 95% for the athletes, both values being within what is parameterized as normal.

It was also found that athletes have better sleep quality than non-athletes and that individuals who practice high-intensity physical activity have a lower percentage of individuals with good sleep quality, although there was no statistically significant relationship. It was also found that the 18-25 age group has a higher number of individuals with good sleep quality. As for sleep efficiency, the results of this study indicate that athletes have slightly higher sleep efficiency than non-athletes. These results are in line with other studies



that have also reported higher sleep efficiency in athletes (Lui, 2020).

In short, the new knowledge that emerges from this study is the fact that the intensity of the physical activity practiced directly influences the quality of sleep and sleep latency of each athlete, as well as age, since the younger the better the quality of sleep even when practicing high intensities of training and it was also noticed that the intensity of training that most benefits the quality of sleep of athletes is moderate intensity.

The size of the sample and the cross-sectional study are important limitations of this study, so it would be important in the future to use objective instruments to assess sleep quality, such as actigraphy or sleep studies.

## CONCLUSION

This study showed that athletes have a higher quality of sleep and sleep more hours on average than non-athletes, regardless of training intensity, with a slightly higher percentage of sleep efficiency in the athlete group. It was found that it is important to monitor latency in athletes in order to prevent sleep deprivation and injuries, and that moderate-intensity sports practice is the one that most benefits individuals' sleep quality. Further studies are needed to identify the barriers that athletes face in improving sleep quality and to better understand how this element may affect their athletic performance. It is important to note that the sample size and the cross-sectional study are important limitations of this study, so it would be important in the future to use objective instruments to assess sleep quality, such as actigraphy or sleep studies. The use of objective instruments would make

it possible to assess the sleep-related parameters of the individuals and to see whether the self-perception of sleep quality and all the parameters involved, such as sleep duration, latency and efficiency obtained in the questionnaires corresponds to the actual reality of each individual.

It is important to develop studies that can structurally provide new data on the sleep behaviours of adult athletes and suggest strategies for improving sleep duration and quality that could optimize their sporting ability. More research is still needed to understand what the main barriers/difficulties are in developing a better quality of sleep in athletes and what impact this has on athletic performance; this information is fundamental for building athletic performance guidelines.

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