

## Sleep quality and sports performance in physically impaired athletes of individual sports

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### ABSTRACT

**Aim:** To investigate the relationship between sleep quality and sports performance of individuals with physical impairments in individual sports.

**Methods:** Three hundred and thirty-eight athletes (age:  $36.43 \pm 10.81$  yrs.; 145 women and 193 men) participated in the study. Volunteers completed a five-part questionnaire on sleep quality. Based on the information available in the Provincial boards and the Veterans and Disabled Federation, the positions obtained by each athlete were considered as a criterion measure of sports performance.

**Results:** Result showed that in women the positions obtained at the Provincial, National and International level was significantly higher compared with male athletes ( $p < 0.05$ ). There was no significant relationship between sleep quality and athletic performance of women, men and total (both men and women) athletes in individual sports at the Provincial level (women:  $r = 0.070$ ,  $p = 0.409$ ; men:  $r = -0.844$ ,  $p = 0.242$  and men and women:  $r = -0.029$ ,  $p = 0.600$ ); National level (women:  $r = 0.093$ ,  $p = 0.271$ ; men:  $r = 0.020$ ,  $p = 0.785$ , men and women:  $r = 0.039$ ,  $p = 0.474$ ) and International level (women:  $r = 0.024$ ,  $p = 0.781$ ; men:  $r = 0.094$ ,  $p = 0.191$ , men and women:  $r = -0.078$ ,  $p = 0.151$ ).

**Conclusion:** There was no significant difference in sleep quality between male and female athletes with physical impairments. No significant relationship was observed between athletic performance and sleep quality between the two groups. In future research, field studies can be used to evaluate this relationship.

**Keywords:** sleep quality, disabled athletes, sports performance

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## Качество сна и спортивные результаты у спортсменов с ограниченными физическими возможностями в индивидуальных видах спорта

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### АННОТАЦИЯ

**Цель:** изучить взаимосвязи между качеством сна и спортивными результатами спортсменов с ограниченными физическими возможностями в индивидуальных видах спорта.

**Методы:** В исследовании приняли участие триста тридцать восемь спортсменов (возраст:  $36,43 \pm 10,81$  года; 145 женщин и 193 мужчины). Участники заполнили пятичастный опросник о качестве сна. В качестве основного критерия спортивной результативности рассматривались места, занятые каждым спортсменом, на основании информации, имеющейся в провинциальных советах и Федерации ветеранов и инвалидов.

**Результаты:** Результаты показали, что у женщин места, полученные на провинциальном, национальном и международном уровне, были значительно выше по сравнению с мужчинами ( $p < 0,05$ ). Не было обнаружено значительной связи между качеством сна и спортивными результатами женщин, мужчин и обоих полов в индивидуальных видах спорта на провинциальном (женщины:  $r = 0,070$ ,  $p = 0,409$ ; мужчины:  $r = -0,844$ ,  $p = 0,242$ , оба пола:  $r = -0,029$ ,  $p = 0,600$ ); национальном (женщины:  $r = 0,093$ ,  $p = 0,271$ ; мужчины:  $r = 0,020$ ,  $p = 0,785$ , оба пола:  $r = 0,039$ ,  $p = 0,474$ ) и международном (женщины:  $r = 0,024$ ,  $p = 0,781$ ; мужчины:  $r = 0,094$ ,  $p = 0,191$ , оба пола:  $r = -0,078$ ,  $p = 0,151$ ) уровнях.

**Выводы:** Между спортсменами и спортсменками с ограниченными физическими возможностями не было выявлено существенной разницы в качестве сна. Между спортивными результатами и качеством сна в этих двух группах не наблюдалось значительной взаимосвязи. В будущих исследованиях для оценки этой взаимосвязи могут быть использованы полевые исследования.

**Ключевые слова:** качество сна, спортсмены-инвалиды, спортивные результаты

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### 1. Introduction

Sleep is a dynamic and organized biological process that has an important impact on resilience and health and is an important part of human life [1] and therefore poor sleep quality can be considered an indicator of disease(s) [2]. Research findings show that decreased sleep quality has a significant effect on fatigue, impaired cellular repair, impaired memory and learning, gastrointestinal disorders, metabolic diseases, decreased immune function, and ultimately reduced quality of life and reduced life expectancy [3]. On the other hand, physically active people have good health in various physical and mental dimensions, and in connection with sleep, the American Sleep Disorders Association considers

exercise and physical activity an important part of the sleep process [4].

Exercise and sports activity are mentioned as an effective factor in improving the quality of sleep [5]. Accordingly, sleep quality is hypothesized to affect the performance and athletic outcomes of athletes. Many athletes, despite having good performance in individual or group training, have poor performance in the field and the cause of these problems, apart from effective technical factors, can be attributed to factors affecting their mental state, including sleep status [6]. Reports also indicated that athletes are particularly concerned about the impact of insomnia caused by exercise programs, travel, or pre-competition stress on their athletic performance [7]. Research

findings in this field are contradictory as Abbasi et al. reported that sleep deprivation adversely affects reaction time and balance but had no effect on their agility and neuromuscular coordination [8]. While Bougard et al. reported no effect of sleep deprivation on balance [9]. It was reported that short-term sleep deprivation has no effect on anaerobic performance, but adversely affects reaction time as cognitive function [10].

However, despite proving the effect of quality sleep on different aspects of health, athletes may not have good sleep quality due to their training and competitive conditions, which can affect their athletic performance. In people with impairments and veterans, apart from these conditions, their physical condition also has a greater impact on their sleep quality compared with a 'normal' population [11]. However, an impairment is considered as a deprivation and an inappropriate status (representation) of the person that interferes with the natural social and cultural roles of the person and thus affects their sleep quality [12]. Attending sports activities for this group of people in the community can improve their physical and mental health and can also positively affect their sleep quality [13]. However, sleep plays a very important role in regulating the physiological functions of the body, and any disturbance in these functions can affect the quality of sleep. The veterans and the physically impaired people may have these problems exacerbated due to physical impairments [5, 14].

It has been shown that stress, depression and anxiety caused by the physical condition can strongly and negatively affect sleep quality. Research findings suggest that increased stress impairs sleep quality [15], an issue that can be more pronounced in athletes with impairments depending on their unique physical condition. Although in some previous studies, the quality of sleep of physically impaired people has been reported to be better than physically inactive impaired people [11]. However, the impact of sleep quality of impaired and veteran athletes at National and International levels on their athletic performance has been less studied. Accordingly, the purpose of the present study was to investigate the relationship between sleep quality and sports performance among physically impaired and veteran athletes.

## 2. Methods

This descriptive-analytical research (correlational study) was conducted in 2021 in Iran.

### Volunteers

All physically impaired athletes participating in Provincial, National and International competitions made up the population of the present study via their local sport in body. Three hundred and thirty-eight individual sports (Such as Archery, weightlifting, shooting, Track and Field) athletes participated in the present study (age:  $36.43 \pm 10.81$  yrs.; 145 women and 193 men). Criteria for entering the study included informed consent to participate, no mental illness, and a willingness to cooperate and complete a questionnaire. All ethical considerations regarding the confidentiality of the volunteers' information were observed and the present study received ethical

approval with the code IR.JUMS.REC.1399.045 from the Ethics Committee of Jahrom University of Medical Sciences (Fars Province, Iran).

### Procedure

After the approval of the plan by the Veterans and Disabled Federation and with the co-operation of the various sports delegations of the Veterans and Disabled of the Provinces, all stages of the work were sent in writing to the sports delegations through the Federation. Before data collection, the Petersburg Sleep Questionnaire, as well as how to implement the research plan, were fully explained to the participants. Each volunteer completed a questionnaire of the Petersburg Sleep Questionnaire and, based on the information available from the Provincial boards and the Veterans and Disabled Federation, the positions ('position' refers to whether the athlete competed at Provincial, National, or International level) obtained by each athlete was considered as a criterion measure for sports performance.

### Petersburg Sleep Questionnaire

To assess sleep quality, the Petersburg Sleep Questionnaire was used which included 9 questions that are categorized into 7 clinically derived components of: mental quality of sleep, delayed sleep, duration of sleep, efficiency and effectiveness of sleep, sleep disturbance, amount of sleeping pills, dysfunction [16]. All of the above components are calculated based on the results of the questionnaire. The score of each question is in the form of a Likert-type scale and between 0 and 3, and a score of 3 on each scale indicates a maximum negative score. The overall score of this questionnaire is between 0 and 21, and high scores indicate low sleep quality. A score above 5 indicates poor sleep quality. Its reliability and validity have been confirmed in various studies, which have a reliability of 0.83 and validity between 86.5 and 89.6 [17].

### Sports performance

Based on the information available in the Provincial sports delegations and the Veterans and Disabled Federation, the positions obtained by each athlete were considered as a criterion for sports performance.

### Information analysis method

Descriptive statistics were used to determine the mean and standard deviation and a regression correlation test (Pearson Product Moment Correlation Coefficient) was used to investigate the relationship between research variables in the inferential statistics section. Where the data was not normally distributed a Mann—Whitney *U* test was used to compare men versus women.  $P \leq 0.05$  was considered to indicate a statistically significant difference.

## 3. Results

### Assessing the sleep quality of individual athletes

The results of the Mann—Whitney *U* test about sleep quality of individual athletes showed that there was no

statistically significant difference between women and men in the subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, daytime dysfunction and overall sleep quality ( $p > 0.05$ ) (Table 1).

#### Assessing the number of winning positions by individual athletes

The results of the Mann–Whitney  $U$  test of the positions obtained by female and male athletes in individual sports showed that in women the positions obtained at the Provincial level, National and International level was significantly higher than their male counterparts ( $p < 0.05$ ), (Table 2).

#### Assessing the relationship between sleep quality and sports performance of athletes at different Provincial, National and International levels

The results showed that there was no significant relationship between sleep quality and athletic performance of women athletes in individual sports at the Provincial ( $r = 0.070$ ,  $p = 0.409$ ), National ( $r = 0.093$ ,  $p = 0.271$ ) and International

( $r = 0.024$ ,  $p = 0.781$ ) levels. Also in male athletes, there were no significant relationship found between sleep quality and sports performance at the Provincial ( $r = -0.844$ ,  $p = 0.242$ ), National ( $r = 0.020$ ,  $p = 0.785$ ) and International ( $r = -0.094$ ,  $p = 0.191$ ) levels. Overall, no significant relationship was observed between sleep quality and sports performance of athletes (total male and female) at the Provincial ( $r = -0.029$ ,  $p = 0.600$ ), National ( $r = 0.039$ ,  $p = 0.474$ ) or at the International ( $r = -0.078$ ,  $p = 0.151$ ) levels (Table 3).

значимым.

#### 4. Discussion

In the present study, the relationship between sleep quality and sports performance of physically impaired athletes in individual disciplines was investigated. The results of this study showed that the sleep quality of athletes was “good” based on scores from the Petersburg Sleep Questionnaire. There was no significant difference between sleep quality and its components in the two groups of male and female athletes. In the study of Ahmadi et al, professional cyclists had better sleep quality than non-athletes [11], which shows the importance of exercise and physical activity in improving the sleep

Table 1

Results of the Mann–Whitney  $U$  test on the sleep quality of individual athletes

Таблица 1

U-критерий Манна-Уитни по качеству сна у спортсменов

Variable	Women		Men		$p$ value
	MR	SoR	MR	SoR	
Subjective sleep quality	159.63	22667	176.65	32624	0.081
Sleep latency	161.98	23001	174.95	34289	0.208
Sleep duration	167.77	23823	170.76	33468	0.773
Habitual sleep efficiency	164.15	23310	173.37	33981	0.368
Sleep disturbances	176.06	25001	164.74	32290	0.226
Use of sleeping medication	169.41	24056	169.56	33234	0.986
Daytime dysfunction	165.33	23477	172.52	33814	0.188
Overall sleep quality	161.96	22998	174.96	34293	0.225

Note: MR — Mean Rank, SoR — Sum of Ranks, \* —  $p$  value less than 0.05 considered as significant.

Примечание: MR — Средний ранг, SoR — сумма рангов, \* — значение  $p$  меньше 0,05 считается статистически значимым.

Table 2

The results of the Mann–Whitney  $U$  test on the number of winning positions (Gold, silver and bronze medals) by individual athletes

Таблица 2

U-критерий Манна-Уитни по количеству завоеванных золотых, серебряных и бронзовых медалей отдельными спортсменами

Variable	Women		Men		$p$ value
	MR	SoR	MR	SoR	
Provincial Championship	180.50	25631	161.53	31660	0.030*
National Championship	180.35	25609	161.64	31682	0.020*
International Championship	189.27	26.877	155.17	30414	0.001*

Note: MR — Mean Rank, SoR — Sum of Ranks, \* —  $p$  value less than 0.05 considered as significant.

Примечание: MR — Средний ранг, SoR — сумма рангов, \* — значение  $p$  меньше 0,05 считается статистически значимым.

Table 3

The relationship between sleep quality and sports performance of athletes at different levels, Provincial, National and International

Таблица 3

Взаимосвязь между качеством сна и спортивными результатами спортсменов на провинциальном, национальном и международном уровнях

	Sports performance						
		Provincial Level		National Level		International level	
		<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
Sleep Quality	Women	0.070	0.409	0.93	0.271	-0.024	0.781
	Men	-0.084	0.242	0.020	0.785	-0.094	0.191
	Women and Men	-0.029	0.600	0.039	0.474	-0.078	0.151

Note: \* — *p* value less than 0.05 considered as significant.

Примечание: \* — значение *p* меньше 0,05 считается статистически значимым.

quality of people with physical impairments. Another study showed that people with physical impairments participating in public sports have better sleep quality [18]. Tofighi et al. also showed that 12 weeks of aerobic activity improved the quality of sleep of both physically active and inactive people with impairments [5].

However, in the present study, no significant difference was observed between male and female athletes in terms of sleep quality and its components, which shows the positive effect of exercise and physical activity on sleep quality in both sexes. Research by Monama et al. showed that in blind football players, there was no correlation between 'burnout' and sleep quality [19]. Another study showed that the participation of children with physical and hearing impairments in three months' ice skating program significantly improved their sleep quality. In the study reported by Dursun et al, the psychological components of children with impairments increased with exercise, which can also improve their quality of sleep and life [20]. All these findings show that exercise and physical activity is an effective intervention to improve the sleep quality of people with impairments that can, in turn, improve their health.

In the present study, the average number of medals won by women in all three levels of Province, National and International representation was higher than men, which can be probably attributed to the greater number of competitions held for women. But an important result of our study was that there was no significant difference between sleep quality and exercise performance of men and women with impairments, which can be attributed to the positive effect of exercise and physical activity on improved sleep quality. Our findings show the importance of exercise and physical activity on the quality of sleep and ultimately the quality of life of people with impairments. Because women are at greater levels of stress affecting sleep quality; example a study by Hrozanova et al found that women accounted for approximately 2% of the variance in poor sleep quality, which may be caused by the general experience of women's anxiety

and stress [21]. The study of Rodrigues et al showed that all the psychological parameters of the physically impaired participants in the 2012 Paralympic Games in men and women were normal and 67.5% of them possessed good sleep quality [22]. Although in the latter study, the relationship between sports performance and sleep quality was not studied, however, considering the importance of sleep quality for athletes, it can be considered an important factor in their overall performance.

However, in the present study, no significant relationship was observed between athletic performance and sleep quality in either male or female athletes. In the study of Esteves et al it was reported that athletes with visual impairments, who had more sleep, have better athletic performance [23]. However, in the latter study, a stress test was used in simulating formal conditions, while in the present study, sports performance was based on medals won. Therefore, considering the achievements of these athletes and the amount of "good" sleep, it can be hypothesised that their medals (in other words, their athletic performance) was influenced by the quality of their sleep. Wheelchair rugby players in a study reported by Sanz-Milonr et al also did not show a decrease in the amount and quality of their sleep, which indicated the effect of exercise on their sleep quality and athletic performance [24]. However, research findings emphasize the benefits of physical activity on improving sleep quality, and epidemiological studies have shown a positive and significant relationship between exercise and physical activity and sleep quality. Exercise improves sleep, which improves athletes' health, and thus improves individual performance in various areas [25]. It seems that in relation to athletes with impairments, whose abilities are less affected by physical limitations, this issue can have an effect on the quality of sleep and ultimately athletic performance by having a positive psychological impact. While collecting information from the subjects, their classification status has not been investigated. Therefore, this can be mentioned as a limitation of the present study.

## 5. Conclusion

In general, the results of the present study showed that the sleep quality of male and female athletes with impairment was not significantly different, while in the relationship between sports performance and sleep quality, there was no

### Author contributions:

**Fatemeh Ahmadi** — conceptualization and design of the research, data collection or data analysis and interpretation, preparation of the article or its critical revision in terms of meaningful intellectual content.

**Mohammad Amin Safari** — preparation of the article or its critical revision in terms of meaningful intellectual content.

**Hamid Reza Sadeghipour** — preparation of the article or its critical revision in terms of meaningful intellectual content.

**Sara Zare Karizak** — preparation of the article or its critical revision in terms of meaningful intellectual content.

**Abdossaleh Zar** — conceptualization and design of the research, data collection or data analysis and interpretation, preparation of the article or its critical revision in terms of meaningful intellectual content

**Pantelis Theo Nikolaidis** — preparation of the article or its critical revision in terms of meaningful intellectual content.

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significant relationship between the two groups of male and female athletes. In the present study, sports medals were used as indicators of sports performance, which is recommended in future research to use practical tests to identify this relationship in order to compare the sexes.

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