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Effect of Covid-19 on the Lifestyles of Vaccinated and Unvaccinated Elite Athletes: A Cross-Country Analysis

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A B S T R A C T

The global COVID-19 pandemic has led to widespread home confinement and quarantine measures. Despite ongoing vaccination efforts, some elite athletes have shown hesitancy about getting vaccinated. This study sought to analyze the impact of COVID-19 on the lifestyles of vaccinated and unvaccinated elite athletes through a cross-country comparison. In 2021, an online survey was administered to 581 elite athletes aged 18-35 from different countries across four continents. The survey included socio-individual data, the International Physical Activity Questionnaire (IPAQ), the Rapid Eating Assessment for Participants (REAP-S), and the Petersburg Sleep Quality Questionnaire (PSQI). The participants voluntarily agreed to take part in the survey. The data analysis employed U-Mann-Whitney Wilcoxon tests, with a significance level of alpha $p< 0.05$. The findings demonstrated a significant disparity in the physical activity and dietary habits of vaccinated versus unvaccinated elite athletes ($p<0.001$). However, no notable variance was observed in sleep quality between the two groups ($p=0.270$). Despite nearly half of the surveyed elite athletes being unvaccinated, their physical activity levels surpassed those of vaccinated counterparts during the pandemic. Furthermore, vaccinated elite athletes exhibited better eating habits compared to their unvaccinated counterparts. Notably, no significant difference was evident in sleep quality between the two groups.

Keywords: *COVID-19, elite athletes, vaccination, lifestyle.*

1. Introduction

On December 12, 2019, the initial case of coronavirus disease (COVID-19) was reported in Wuhan, Hubei province, China. This disease was caused by a novel genetically modified virus belonging to the coronavirus family, known as COVID-19 (1, 2). In less than four months, this highly contagious pathogenic viral infection spread rapidly worldwide due to its onward transmission. The COVID-19 home confinement negatively impacted sports activities and led to psychological and emotional disorders, as well as changes in sleep quality and nutrition behavior in people worldwide, particularly affecting athletes (2-4). The viral outbreak had a significant impact on sports events at all levels, including recreational, professional, and elite levels, resulting in the cancellation and postponement of the 2020 Olympics. Athlete vaccination during the pandemic lacked specific guidelines

compared to the general population, leading to most athletes refusing to be vaccinated due to possible side effects (5, 6). Many athletes were concerned about the potential impact of the vaccine on their sports performance, including disruptions to nutrition and sleep cycles (5). The importance of nutrition in supporting and promoting the immune system, as well as the critical role of micronutrients in immune function, has been extensively documented (7, 8). The quarantine measures during the pandemic likely impacted the dietary habits and behaviors of athletes (3). Dietary habits refer to the habitual food choices made by individuals or groups. Additionally, the closure of food manufacturing companies during the pandemic has also influenced people's eating behaviors (1). Sleep plays a crucial role in cognition, learning, memory consolidation, well-being, cell growth and repair, glucose metabolism, hormone secretion, and immune function (3, 4, 9-11). Quality sleep is particularly important for athletes in terms of recovery and energy conservation (12, 13). Athletes have reported lower sleep quality and mental health status during the pandemic, with elevated sleep disturbances possibly leading to disruptions in nutrition behavior and metabolism (14, 15). Physical activity is known to have neuroprotective and antidepressant effects, stimulating factors in the brain such as neurotropic factors and endorphins (16). Regular exercise is believed to improve circulation, breathing processes, and anti-inflammatory reactions, making it essential during the pandemic. During exercise, neurotrophic factors and endorphins originating in the brain are stimulated, potentially benefiting the nervous system (17, 18). Vaccination has a significant impact on global health, reducing mortality and population growth. However, some elite athletes have refused to be vaccinated due to concerns about side effects, safety, and trust in the vaccine production process. Therefore, this study aimed to analyze the impact of COVID-19 on the lifestyles of vaccinated and unvaccinated elite athletes through a cross-country comparison, as there is currently no research examining this topic during the quarantine period.

2. Methods and Materials

2.1. Study Design

A cross-sectional study design was utilized to compare the lifestyle of vaccinated and unvaccinated international elite athletes during the COVID-19 pandemic. A convenience non-probabilistic and snowball sampling method was employed for participant selection.

2.2. Participants

The study included 581 elite athletes, with 68.67% men and 31.33% women, from four different continents (Turkey, Brazil, UAE, Malaysia, Tunisia, and Iran) in 2021. The inclusion criteria were: a) Age≥18 years; b) quarantine experience during the pandemic (at least one week); c) financial independence from sports. Ethical considerations based on the Declaration of Helsinki were followed.

2.3. Research Instruments

An online survey was conducted from March to October 2021, including the International Physical Activity Questionnaire (IPAQ), the REAPS questionnaire, and the Petersburg Sleep Quality Questionnaire (PSQI). The questionnaires were provided through a Google Docs form to the elite athletes.

2.4. Data Analysis

The data's homogeneity and equality of variances were confirmed using the Kolmogorov–Smirnov (K-S) test and Levene's test, respectively. The data were presented as frequency, percentage, mean, and standard deviation. U-mann Whitney and Wilcoxon tests were used for data analysis, with the level of significance set at alpha $p < .05$. All statistical analyses were conducted using SPSS v. 23 and Excel spreadsheet.

3. Findings

The study included 581 elite athletes, with 31.3% female and 68.7% male respondents. Among male elite athletes, 36% were unvaccinated. Approximately 41% of athletes had contracted Covid-19, with 59% of those cases occurring in unvaccinated individuals. Of the vaccinated athletes, 75.2% received one dose, 24.4% received two doses, 21.9% received three doses, and 0.9% received a fourth dose. Additionally, 18.1% of vaccinated athletes experienced side effects after vaccination. The majority of

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unvaccinated elite athletes expressed concerns about vaccination negatively impacting their sports performance (10.2%), increasing the risk of injury (9.3%), and causing various side effects (6.9%). The Sinopharm vaccine was predominantly used by elite athletes for the first (41.5%), second (38.4%), and third (18.8%) doses. Furthermore, 31.8% of unvaccinated elite athletes spent one to two months in home confinement, while 28.6% of vaccinated athletes spent only one week in home confinement. After the pandemic, 50.4% of elite athletes reported intense activity levels, compared to 63.3% before the pandemic. Additionally, 37.2% of elite athletes trained at home, and 17.2% had access to sports clubs for muscle strengthening and resistance exercises. Most elite athletes (71.3%) did not have children, and 22% considered the situation somewhat stressful.

Table 1

Descriptive Statistics Findings

Research Variables	Elite Athletes	
	Vaccinated	Unvaccinated
Physical Activity Level		
Pre-pandemic	3.79 ± 1.36	4.86 ± 0.49
During pandemic	3.38 ± 1.30	4.74 ± 0.64
Sleep Disorder Score (0-21)	5.64 ± 2.62	6.07 ± 3.15
Eating Behavior Score (13-39)	24.89 ± 5.35	21.49 ± 4.44

Figure 1

Sleep quality sub-scales of vaccinated and unvaccinated elite athletes during Covid-19.

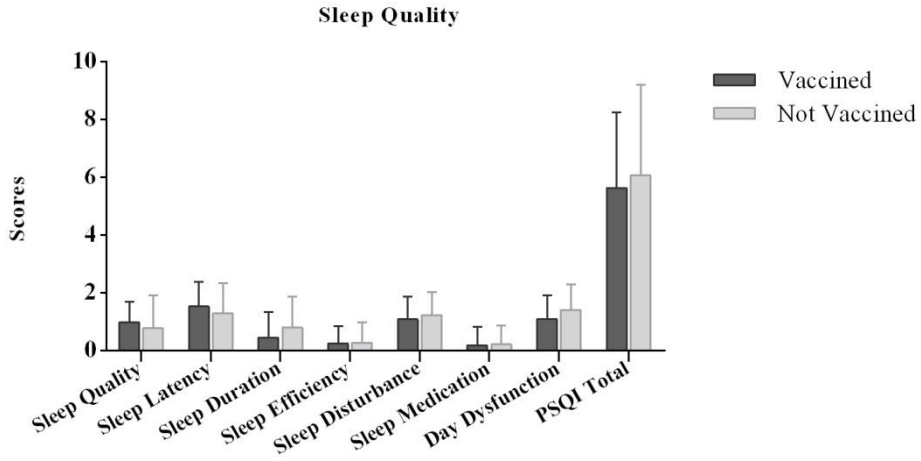

Figure 2

Shows the IPAQ and REAP-S of vaccinated and unvaccinated elite athletes during covid-19.

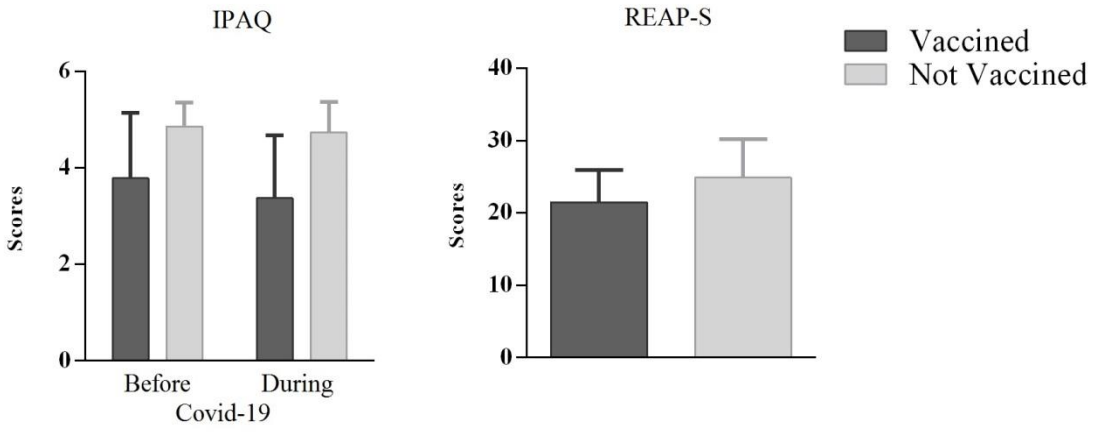

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Figure 1 displays the descriptive data depicting the sleep quality of vaccinated and unvaccinated elite athletes during Covid-19, as indicated by the sub-scales of the PSQI. Figure 2 illustrates the physical activity levels (before and during Covid-19) and dietary behavior of vaccinated and unvaccinated elite athletes throughout the pandemic (Table 1).

Table 2

The Results of Mann-Whitney U Test (Inter-Group) for Physical Activities

Stage	Sample	Mean ± SD	N	Mean Ranks	Sum of Ranks	Mann-Whitney U	Z Score	Significance
Pre-COVID	Vaccinated	3.79 ± 1.36	294	212.4	62449.5	19084.5	-13.30	P < .001
	Unvaccinated	4.86 ± 0.49	287	371.5	106621.5			
During COVID	Vaccinated	3.38 ± 1.30	294	195.8	57572.5	14207.5	-14.96	P < .001
	Unvaccinated	4.74 ± 0.64	287	388.5	111498.5			

Table 3

The Results of Wilcoxon Rank-Sum Test (Intra-Group) for Physical Activities

Sample	Stage	Mean ± SD	Rank	N	Mean Ranks	Sum of Ranks	Z Score	Significance
Vaccinated	Pre-COVID	3.79 ± 1.36	+	28	68.04	7411	-4.12	P < .001
	During COVID	3.38 ± 1.30	-	108	68.62	1905		
Unvaccinated	Pre-COVID	4.86 ± 0.49	+	10	24.30	243	-6.18	P < .001
	During COVID	4.74 ± 0.64	-	40	25.80	1032		

The physical activity of vaccinated and unvaccinated elite athletes was compared using the Mann Whitney U (Table 2) and Wilcoxon Rank Sum Tests (Table 3) for inter-group and intra-group comparisons, respectively. The median physical activity level before Covid-19 was 212.4 and 371.5 for vaccinated and unvaccinated elite athletes, respectively, with a significant difference in distribution between the two groups (Mann-Whitney U = 19084.5, n1 = 294, n2 = 287, P < .001). During Covid-19, the median physical activity level was 195.8 and 388.5 for vaccinated and unvaccinated elite athletes, respectively, with a significant difference in distribution between the two groups (Mann-Whitney U = 14207.5, n1 = 294, n2 = 287, P < .001). The Wilcoxon Test revealed that the physical activity level before the pandemic was higher than during the pandemic for both vaccinated (p < .001) and unvaccinated athletes (p < .001).

Table 4

The Results of Mann-Whitney U Test (Inter-Group) for Sleep Disorder

Variables	Mean ± SD	N	Mean Ranks	Sum of Ranks	Mann-Whitney U	Z Score	Significance
Vaccinated	5.64 ± 2.62	294	283.5	85729.5	39976.5	-1.10	.270
Unvaccinated	6.07 ± 3.15	287	298.7	83341.5			

Table 5

The Results of Mann-Whitney U Test (Inter-Group) for Eating Behavior

Variables	Mean ± SD	N	Mean Ranks	Sum of Ranks	Mann-Whitney U	Z Score	Significance
Vaccinated	24.89 ± 5.35	294	283.5	83341.5	25371.5	-8.33	P < .001
Unvaccinated	21.49 ± 4.44	287	298.7	85729.5			

According to Table 4, the median sleep disorders before the pandemic were 283.5 and 298.7 for vaccinated and unvaccinated groups, respectively, with no significant difference in distribution between the two groups (Mann-Whitney U = 39976.5, n1 = 294, n2 = 287, P = .270). Finally, Table 5 demonstrates that the median eating behavior before Covid-19 was 283.5 and 298.7 for vaccinated and unvaccinated groups, respectively, with a

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significant difference in distribution between the two groups (Mann-Whitney U = 25371.5, n1 = 294, n2 = 287, P < .001).

4. Discussion

Given the critical nature of the Covid-19 pandemic, it is essential to conduct thorough investigations to implement effective strategies. Therefore, it is imperative to consider elite athletes in this context. Consequently, we aimed to compare the lifestyles of vaccinated and unvaccinated elite athletes during the pandemic. The findings indicated a significant difference in dietary behavior and physical activity levels between the two groups. However, there was no notable variance in sleep quality between vaccinated and unvaccinated elite athletes. The results revealed a decrease in physical activity levels for both vaccinated and unvaccinated elite athletes during the pandemic compared to the pre-pandemic period. Furthermore, unvaccinated elite athletes demonstrated higher physical activity levels during Covid-19 than their vaccinated counterparts. This disparity may be attributed to psychological fear, as athletes who are apprehensive about contracting the virus tend to adhere to social distancing principles and avoid outdoor activities, resulting in lower physical activity levels. Additionally, vaccination status may contribute to the difference, as vaccinated athletes may exhibit more caution due to their vaccination status. On the other hand, unvaccinated athletes may not experience this psychological fear. The variation in eating behavior between vaccinated and unvaccinated elite athletes may be linked to the emphasis on optimal nutrition among vaccinated athletes, as studies have shown that nutritional adequacy can enhance immune responses to vaccines (4). Furthermore, the average sleep quality score for elite athletes was 5.58. It appears that elite athletes experienced sleep issues during the Covid-19 pandemic. While there is no specific research on the variance in sleep quality between vaccinated and unvaccinated elite athletes, existing research indicates that maintaining optimal sleep behavior (quality and duration) in the initial period after vaccination could enhance vaccine effectiveness (5). The study had several limitations, including the small size of the study samples and the inability to accurately control the participants' sleep status, eating behavior, and sports activity. Additionally, factors such as climate, geography, and time differences could have influenced the lifestyle of elite athletes.

5. Conclusion

Based on the findings, the physical activity levels of elite athletes decreased during the pandemic compared to pre-pandemic conditions. Additionally, unvaccinated elite athletes exhibited higher physical activity levels than vaccinated athletes during the pandemic. Furthermore, the study revealed that the nutritional behavior of vaccinated elite athletes was superior to that of unvaccinated athletes, and some athletes experienced a decrease in sleep quality. Consequently, it is crucial to prioritize the physical activity level, sleep quality, and dietary behavior of elite athletes in the pandemic

Authors' Contributions

M. A: Conceptualization, Methodology, Formal analysis and investigation, Writing; S. N. N. T: Data collection, Data curation, Writing; K. G: Software, Validation, Resources, Writing. H. S: Supervision, Project administration, Funding acquisition, Writing.

Declaration

In order to correct and improve theacademic writing of our paper, we have used the languagemodel ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

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All procedures were approved by Research Ethics Committees of Qazvin University of Medical Sciences (IR.QUMS.REC.1401.311). Informed consent was obtained from all subjects and/or their legal guardians, who agreed to participate in this study. The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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