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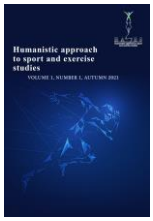

Virtual reality games and mental skills of elite athletes during the COVID-19 pandemic

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Abstract: The current study's prime objective was to assess virtual reality games' impact on the mental skills of elite athletes during the COVID-19 pandemic.

In this study, 228 elite athletes were randomly selected and divided into four groups of 57 controls and experiments. All subjects in the control and experimental groups received virtual reality games for 15 minutes for ten sessions; then, each group was re-examined. The control group performed a follow-up test according to the posttest after two weeks using the Ottawa mental skills assessment questionnaire (OMSAT-3), and repeated measures analysis of covariance and Bonferroni post hoc test were used to test the hypothesis ($P \leq 0.05$).

The results obtained using repeated measures analysis of covariance and Bonferroni post hoc test showed that virtual reality games influenced elite athletes' mental skills in COVID.

From these findings, it can be said that virtual reality games can improve the mental skills of elite athletes during COVID-19

Keywords: virtual reality games, mental skills, elite athletes, COVID-19, athletic performance.

1. Introduction

With coronavirus outbreaks in 2019, the world contracted an unprecedented pandemic and, as a result, endured house quarantine and the banning of all gatherings, such as sports competitions, which had a significant impact on any sports activity, including sports competitions and important events related to it.(Bertollo, Siekańska, Bondar, di Fronso, & Blecharz, 2021; Fitzgerald, Rubin, Fitzgerald, & Rubin, 2021; Fortes et al., 2021; Gao, Lee, McDonough, & Albers, 2020; Hurley, 2021)

Restrictions on implementing specific sports strategies during quarantine and the closure of sports venues made things more complicated than usual, forcing athletes to practice at home or use home training programs and video conferencing. (Ling et al., 2020; Lundqvist, Macdougall, Noguchi, Malherbe, & Abejean, 2021; Mulcahey, Gianakos, Mercurio, Rodeo, & Sutton, 2021; Purwanto, Lumintuarso, & Burhaein, 2021)

In addition to affecting mobility skills, Suspension in seasons and cancellation of competitions can also affect the psychological skills of athletes, which is strengthened by eliminating the social support network and regular training routine. (Jia et al., 2022; Krzywański et al., 2022; Uroh & Adewunmi, 2021; Wang, Han, & Li, 2021)

Psychological skills are innate or learned traits that enable an athlete to succeed. Athletes can use these skills to increase performance and pleasure or achieve greater satisfaction with sports and physical activity. Psychological exercises are performed with their help and different methods. (Facer-Childs, Hoffman, Tran, Drummond, & Rajaratnam, 2021; Ling et al., 2020; Pensgaard, Oevreboe, & Ivarsson, 2021; Wang et al., 2021)

In recent years, numerous studies and experiments have been conducted on individual psychological factors such as self-confidence, motivation, attention, etc. and the impact of each of these factors on athletic performance and to examine the effect of psychological skills on sports skills and different training methods and different ways of using this skill.(Ling et al., 2020; Lundqvist et al., 2021; Mulcahey et al., 2021; Sanderson & Brown, 2020; Schinke et al., 2020; Violant-Holz et al., 2020).

Research has shown that today more attention is paid to psychological training. And several studies have been conducted to compare the effects of using these skills and the subsequent success or failure of athletes, all of which indicate that to achieve their goals, coaches and athletes need mental skills more than physical skills. (Sanderson & Brown, 2020; Schinke et al., 2020; Twizell, Hess, Howland, & Center, 2021; Violant-Holz et al., 2020)

Psychological preparations familiarize the athlete with techniques to overcome psychological and emotional barriers. Many athletes use goal setting, imagery, relaxation, concentration, and self-talk to achieve this goal. (Leguizamo et al., 2021; Ling et al., 2020; Lundqvist et al., 2021; Mulcahey et al., 2021)

On the other hand, due to the importance of psychological skills on athletes 'athletic performance, there is a need to use new methods to help improve these skills. Therefore, researchers consider the importance of athletes' psychological skills to examine new options and ways; one of these methods is the virtual reality game. (Dubreuil-Vall et al., 2020; Lambez, Harwood-Gross, Golumbic, & Rassovsky, 2020; Park et al., 2020; Reardon et al., 2021; Sanderson & Brown, 2020; Schinke et al., 2020; Twizell et al., 2021; Violant-Holz et al., 2020; Wang et al., 2021)

A virtual reality game is a game simulated from a world separate from the reality that allows the user to enter a space different from her surroundings and have the desired experience; that can be entertaining or scientific and educational, medical or service.

Of course, VR-style technology includes two types augmented reality and combined reality, sometimes known as augmented/developed reality or XR.(Afridi, Nawaz, Tariq, & Rathore, 2022; Gao et al., 2020; Pirker, 2020; Tieri, Morone, Paolucci, & Iosa, 2018; Twizell et al., 2021; Wiley, Khattab, & Tang, 2022)

According to the results of previous studies, the current state of society, due to the prevalence of COVID virus 19, and the importance of maintaining improving the mental health of athletes, there is a need to find effective and new ways to improve cognitive skills. The present study seeks to answer whether virtual reality games will affect the

psychological skills of athletes or not? And if this intervention is effective, what will be the effect? Further study of the effectiveness of this method and the importance of following up and knowing how to use it to help elite athletes can significantly contribute to improving the life and athletic performance of these athletes and the awareness of the sports community during the COVID 19 era.

2. Materials and Methods

The present research method is a quasi-experimental type of pre-test-post-test and follow-up with the control group and is applied in terms of purpose. The population of this study was athletes aged 10 to 17 years. From this community, 228 athletes were randomly selected using Power * G software with 25% effect size and 95% statistical power. They were randomly divided into four groups of 57 controls and individuals (individual sports, group sports).

The criteria for inclusion in this study were that participants should be athletes and the age range of 10 to 17 years. The deprivation criteria from this study were any sensory and mobility disabilities, diseases, and not participating in intervention sessions.

Consent was obtained from all participants' parents to be in this study.

This study by the Research Ethics Committee of Sport Sciences Research Institute was approved according to compliance with Ethical Standards in Research of the Ministry of Science, Research and Technology, with the code SSRI.REC-2201-1455.

Demographic Form

Demographic information was collected using a form that included four questions: age, gender, field, and history of sports activity.

Pre and Post Tests

The Ottawa Mental Skills Questionnaire (OMSAT) is chosen to evaluate the participants' mental skills before and after the interventions.

Ottawa Mental Skills Questionnaire

In this study, the Ottawa Mental Skills Questionnaire on the Likert scale with 48 items and 12 Targeting subscales was used to assess the mental skills of athletes. Self-confidence, commitment, stress response, relaxation, fear control, empowerment, concentration, illustration, competition design, mental training, and concentration recovery, are its subscales. The validity and reliability of this test are confirmed. (Aversa, de Almeida, Moreira, Vilela Lima, & Noce, 2021; Miçooğullari, Edwards, & Ekmekçi, 2021)

PlayStation 4

PlayStation 4 is a home console offered since 2013 with three models, Fit, Slim, and Pro, with at least eight GB of RAM, Radeon graphics processor, and 500 GB of a hard disk. This study used the PlayStation 4 Pro with eight GB of RAM and one terabyte hard drive.(Burak, 2021; Hartanto, 2019)

This PlayStation VR headset comprises a 5.7-inch screen with a 1920 x 1080 pixels resolution, and its image-matching speed reaches 120 Hz. This headset is made so that it can be used with Move controllers and Dual Shock four controllers of the PlayStation 4 console.(Afridi et al., 2022; Yan, 2022)

Next to this headset is a small device responsible for processing tasks such as displaying video on TV or creating a 3D sound effect. The headset has nine small LED lights that can be detected by the PlayStation Camera and used to detect 360-degree movements. (Habgood, Moore, Alapont, Ferguson, & van Oostendorp, 2018; Mohanraj, Dhivagaran, Kavimalar, Cousik, & Mohan, 2021)

Beat Saber game

In this study, the Beat Saber game was used. This game has a rhythmic style of gameplay, in which the subject must use light swords to strike blocks that are musical bits. This game is done in conjunction with the rhythm of the music, and as the game progresses, the songs become more complex, and their rhythm becomes faster, so for this reason, making it very difficult to play the beats.(Chen, Chang, & Chan, 2022; Szpak, Michalski, & Loetscher, 2020)

Data collection method

Initially, the General Directorate of Sports and Youth's necessary coordination, there was a meeting with athletes and their parents to complete the written consent form, to get acquainted with the purpose of the research, how to implement the interventions and the location of the study.

Subjects were then randomly divided into four groups of 57 control and experiments (Athletes in individual sports) and control and experiments (group athletes). They played Beat Saber virtual reality for ten minutes in 10 sessions.

After ten intervention sessions, the groups were re-examined as a pretest using the Ottawa mental skills assessment questionnaire (OMSAT) Psychological Skills Questionnaire. After one month, a follow-up test was performed to evaluate the effectiveness of

motion video gameplay over a more extended time. It was done according to the posttest.

In this study, the mean and standard deviation were used as descriptive statistics to analyze the data, and the Smirnov Kolmogorov test was used to check the normality of the data. In addition, in the inferential statistics section, repeated measures analysis of covariance and the Bonferroni post hoc test were used to analyze the data. Data analysis was performed at a significance level of 0.05 using SPSS software version 26.

3. Results

Previous studies have shown the impact of different interventions on athletes and non-athletes causes improve the cognitive processes.(Logan, Henry, Hillman, & Kramer, 2022; Mohammadi, Hadian, & Olyaei, 2021) Still, few papers investigate the impact of VR in athletes during pandemics like covid 19.(Jia et al., 2022; Romeas, More-Chevalier, Charbonneau, & Bieuzen, 2022) So, in this study, we evaluated the impact of virtual reality games on the mental skills of elite athletes during the COVID-19 pandemic.

Table 1: Descriptive findings of research variables

Types of sport	Gender	Group	Step	Basic Mental Skills	Psychosomatic Skills	Cognitive Skills
Individual	Girl	Control	pretest	3.26±81.33	8.59±87.66	12.63±115.16
			posttest	1.36±82.66	7.88±96.16	11.64±122.50
			Follow	1.36±82.66	7.88±96.16	11.64±122.50
		Exercise	pretest	4.60±79.00	9.26±89.33	13.57±111.00
			posttest	1.16±85.83	3.26±95.66	2.96±137.16
			Follow	1.16±85.83	3.26±965.66	2.96±137.16
	Boy	Control	pretest	5.26±72.77	9.00±80.33	7.22±99.66
			posttest	2.35±82.44	6.26±98.55	10.28±123.44
			Follow	2.35±82.44	6.26±98.55	10.28±123.44
		Exercise	pretest	4.46±79.22	10.66±85.20	11.70±109.44
			posttest	1.66±85.55	3.83±92.22	4.28±138.88
			Follow	1.66±85.55	3.83±92.22	4.28±138.88
Team	Girl	Control	pretest	4.84±75.66	17.78±78.33	14.02±100.50
			posttest	4.84±77.50	16.00±77.50	12.43±103.66
			Follow	4.84±77.50	16.00±77.50	12.43±103.66
		Exercise	pretest	6.00±76.00	5.99±74.50	19.69±95.83
			Posttest	1.76±83.50	14.59±83.50	4.11±129.83
			Follow	1.76±83.50	14.39±83.33	4.11±129.83
	Boy	Control	pretest	11.89±70.44	14.72±73.66	30.60±81.77
			posttest	12.00±78.33	11.65±76.66	10.38±102.44
			Follow	12.00±78.33	11.65±76.66	10.38±102.44
		Exercise	pretest	4.87±75.55	14.16±78.77	12.51±100.00
			posttest	1.22±84.00	4.99±95.22	2.73±134.00
			Follow	1.30±84.22	4.96±95.11	2.73±134.00

To analyze the data of the present study, we used 3-way analysis of variance (group (control and training) × gender (male and female) × type of exercise (individual and team)) with repeated measures (pre-test-post-test-follow-up).

Table 2: The results of a three-way analysis of variance with repeated measures for the essential psychological skills variable

constituent	DF	F	Sig	Partial Eta
Measurement steps	2	35.11	0.001	0.403
Sport	1	9.59	0.003	0.156

Gender	1	0.84	0.326	0.016
Group	1	12.02	0.001	0.188
Gender× sport	1	0.24	0.62	0.005
Group× sport	1	0.87	0.35	0.017
Group× Gender	1	0.97	0.32	0.018
Gender× Sport Group×	1	0.10	0.74	0.002
sport × Levels	2	0.03	0.96	0.001
Gender× Levels	2	3.14	0.047	0.057
Group ×Levels	2	1.01	0.365	0.019
sport × Levels Gender×	2	0.008	0.99	0.001
sport × Levels Group×	2	0.24	0.783	0.005
Gender × Levels Group×	2	2.69	0.07	0.049
sport × Levels Group × Gender×	2	0.207	0.813	0.004

As shown in Table 2, the main effect of the measurement steps (η2=0.403, sig = 0.001, F = 11.35), the main effect of exercise (η2=0.156, sig = 0.003, F = 9.59), the main effect of the group (η2 = 0.188 = sig = 0.001, F = 12.02) and the interactive effect of the measurement steps on gender (η2= 0.057 = η2, sig=0.047, F=3.14) is significant.

Considering that the main effect of exercise is significant (η2 = 0.156, sig = 0.003, F = 9.59); the results of the Bonferroni post hoc test showed that the basic psychological skills of individual sports were higher (82.11) compared to team sports (78.71) (P≤0.05).

Also considering that the main effect of the group is significant (η2 = 0.188, sig = 0.001, F = 12.02);

The results of the Bonferroni post hoc test showed that the basic psychological skills of the participants in the training group (82.31) were higher compared to the control group (78.50) (P≤0.05). In addition, because the main effect of the measurement steps is significant (η2 =40, sig = 0.001, F = 11.35); The results of the Bonferroni post hoc test showed an increase in basic mental skills from the pretest stage to the posttest stage (with an average difference of 6.22) and the follow-up stage (with an average difference of 6.25) (P≤0.05).

Other results of this section indicated that the interactive effect of the measurement steps on gender was significant (η2 = 0.0547, sig = 0.047, F = 3.14).

The Bonferroni post hoc test showed that in the pretest stage (with an average difference of 3.50) did; women have higher basic psychological skills (P≤0.05).

In the posttest and follow-up stages, no significant difference was found between the essential psychological skills of men and women (P> 0.05).

Table 3 presents the results of a three-way analysis of variance with repeated measures for the variable of psychosomatic skills.

Table 3: Results of a three-way analysis of variance with repeated measures for the variable of psychosomatic skills

constituent	DF	F	Sig	Partial Eta
Measurement Levels	2	20.06	0.001	0.287
Sport	1	32.59	0.001	0.385
Gender	1	0.04	0.829	0.001
Group	1	2.92	0.093	0.053
Gender× Sport	1	2.58	0.114	0.047
Group× sport	1	6.51	0.014	0.111
Group× Gender	1	0.94	0.335	0.018
Gender × sport Group×	1	3.71	0.059	0.067
Sport× Levels	2	0.95	0.387	0.018
Gender× Levels	2	2.43	0.093	0.045

Group× Levels	2	0.63	0.531	0.012
sport × Levels Gender×	2	0.014	0.982	0.001
sport × Levels Group×	2	4.62	0.012	0.082
Gender× Levels Group×	2	0.028	0.827	0.001
sport × Levels ×gender× group	2	0.39	0.53	0.008

As can be seen in Table 3, the main effect of the measurement steps (η2 = 0.278 = sig = 0.001, F = 20.06), the main effect of exercise (η2 = 0.385, sig = 0.001, F = 59.52), the interactive effect of exercise × group (η2 = 0.111, sig = 0.014, F = 6.51) and the interactive effect of measurement steps × exercise × group (η2 = 0.082, sig = 0.02, F = 4.62) is significant.

Considering that the main effect of exercise is significant (η2= 0.385, sig = 0.001, F = 32.59), The results of the Bonferroni post hoc test showed higher physical and mental skills of individual sports (92.08) compared to team sports (80.89) (P≤0.05).

Also, considering that the main effect of the measurement steps is significant (η2 = 0.278, sig = 0.001, F = 20.06);

The results of the Bonferroni post hoc test showed an increase in psychosomatic skills from the pretest stage to the posttest stage (with an average difference of 8.80) and follow-up stage (with an average difference of 8.87) (P≤0.05).

Other results of this section indicated that the interactive effect of exercise was significant in the group (η2 = 0.111. sig = 0.014, F = 6.51).

Bonferroni's post hoc test showed that in team sports, the participants of the training group (with an average difference of 8.35) had higher mental and physical skills compared to the participants of the control group (P≤0.05).

However, in individual sports, no significant difference was found between the participants in the training group compared to those in the control group (P> 0.05). In addition, the results of Table 3 showed that the interactive effect of the measurement steps × exercise × group is significant (sig = 0.082 = sig = 0.02, F = 4.62).

The Bonferroni post hoc test showed that in individual sports, the Psychosomatic skills of the control group and the training group improved significantly from the pretest to posttest and follow-up (P≤0.05).

However, in team sports, the Psychosomatic skills of the participants in the training group improved significantly from the pretest to posttest and follow-up (P≤0.05).

Table 4 presents the results of a three-way analysis of variance with repeated measures for the cognitive skills variable.

Table 4: Results of a three-way analysis of variance with repeated measures for the cognitive skills

constituent	DF	F	Sig	**Partial Eta**
Measurement Levels	2	81.86	0.001	0.612
Sport	1	41.64	0.001	0.445
Gender	1	0.66	0.418	0.013
Group	1	60.77	0.001	0.539
Gender× Sport	1	0.01	0.903	0.001
Group× sport	1	6.38	0.015	0.109
Group× Gender	1	3.87	0.054	0.069
Gender × sport Group×	1	0.52	0.471	0.010
Sport× Levels	2	0.067	0.935	0.001
Gender× Levels	2	3.55	0.032	0.064
Group× Levels	2	12.10	0.001	0.189
sport × Levels Gender×	2	0.013	0.987	0.001
sport × Levels Group×	2	0.993	0.374	0.019
Gender× Levels Group×	2	2.41	0.094	0.044

sport × Levels Group× Gender	2	0.048	0.953	0.001

As shown in Table 4, the main effect of the measurement steps (sig = 0.612 = sig = 0.001, F = 81/86), Main effect of exercise (η2= 445.5, sig = 0.001, F= 64/41), the main effect of the group (sig = 0.539 = sig = 0.001, F = 77.60), Interactive effect of exercise × Group (η2 = 0.109 = sig = 0.015, F = 6.38). And the interactive effect of the measurement steps × group is significant. (η2 = 0.189 = sig = 0.001, F = 12.10)

According to that the main effect of exercise is significant (4 = 0.245 = sig = 0.001), F = 41.64); the results of Bonferroni post hoc test showed higher cognitive skills in individual sports (123.27) compared to team sports (109.83) (P≤0.05). Also, considering that the main effect of the group is significant (sig = 0.539, sig = 0.001, F = 60.77);

The results of the Bonferroni post hoc test showed higher cognitive skills in the training group (124.67) compared to the control group (108.43) (P≤0.05).

In addition, considering that the main effect of the measurement steps is significant (η2 = 0.612, sig = 0.001, F = 81.86); the results of The Bonferroni post hoc test indicate an increase in cognitive skills from the pretest stage to the posttest stage (with an average difference of 22.31) and follow-up stage (with an average difference of 22.31) (P≤0.05). Other results of this section showed that the interactive effect of exercise in the group was significant (sig = 0.0109 = sig = 0.015, F = 6.38).

The results of the Bonferroni post hoc test showed that in team sports (with an average difference of 21.50) and individual sports (with an average difference of 10.97), the participants in the training group had higher cognitive skills compared to the participants in the control group (P≤0.05).

In addition, the results of Table 4 showed that the interactive effect measurement steps × gender is significant. (η2 = 0.064 = sig = 0.032, F = 3.55)

The Bonferroni post hoc test showed that in both women and men, the participants' cognitive skills improved significantly from pretest to posttest and follow-up (P≤0.05).
Also, the other results of Table 4 showed that the interactive effect measurement steps × group are significant. (η2 = 0.189 = sig = 0.001, F = 12.10)

The Bonferroni post hoc test showed that participants' cognitive skills improved significantly in the training group from pretest to posttest and follow-up (P≤0.05).

The results show that virtual reality games can improve the mental skills of elite athletes during the COVID-19 pandemic.

4. Discussion and Conclusion

The current study aimed to investigate the effectiveness of virtual reality games on the psychological skills of elite athletes at COVID 19. Psychological skills were assessed by the Ottawa (OMSAT) Mental Skills Questionnaire. This questionnaire includes basic psychological skills, Psychosomatic and cognitive skills. These skills include Targeting, self-confidence, guarantee, Reaction to stress, propitiation, fear control, repowering, concentration, illustration, Competition plan, intellectual exercise, mental training, and Focus Recycling.

As stated in the Findings section, the difference between pretest and posttest and follow-up was significant. Virtual reality games have affected the psychological skills of elite athletes. They have led to their improvement because the difference between posttest and follow-up in the components of mental skills was not significant. Therefore, the effects created by the virtual reality game intervention were stable in the mentioned constituent.

Therefore, virtual reality games significantly affected the psychological skills of elite athletes, which are in the basic mental skills section and cognitive skills; Individual sports athletes received a more positive impact from virtual reality games.In the section on psychosomatic skills, the share of team athletes was more impactful than in virtual reality games, but there was no gender difference between the athletes.

Therefore, in general, the findings of this study, with the results of Wiley et al. (2020) and Hobgood et al.

(2018), are based on the lack of impact of virtual reality technology and video games based on it on the psychological skills of elite athletes in the section on cognitive skills Due to the lack of effect on attention, reaction time and distractions in the environment, despite having additional benefits, providing immediate feedback and changing the difficulty is inconsistent.

On the other hand, the results of the researcher of Lambez et al. (2020), Piker et al. (2020), and Dubreuil et al. (2020) showed video games, and virtual reality technology on attention, Cognitive skills, working memory, Decision making, and executive functions have a positive effect. This impact is due to the use of the technology's ability to simulate complex environments, Stadiums, and equipment sports courses, Due to restrictions such as safety, providing scientific and accurate teaching and learning, and knowing how to create a collection with visualization in sports.

Also, the results of Zan Gao et al. (2020) and Fortes et al. (2021) Showed that Virtual reality-based sports interventions at home could help reduce the stress of resulting health care services, especially in the time of COVID 19, it is consistent.Research by Tieri et al. (2018), Afridi et al. (2022), and Yan et al. (2022) showed that Virtual reality effectiveness and video games using neurological rehabilitation, Cognitive and mobility by Using immersion and visualization features that are effective is consistent.

Thus, considering the psychological impact of the COVID era on the sports community and the difference created, and the significance of this change, then virtual reality games can be used for safety reasons, use in terms of COVID 19, and the effect on the psychological skills of elite athletes and made significant improvements to these skills were used by elite athletes during the COVID 19 era. This use of virtual reality games alongside other therapeutic approaches can be examined.

This study is the first to investigate the impact of virtual reality games (Beat saber) on the mental skills of elite athletes during the COVID-19 pandemic. Therefore, the results of the current study cannot be compared to any previous studies in the literature of similar design.

Limitations and directions for future research

One of the limitations of the present study is that its statistical population is limited to elite athletes, which was the most critical limitation of this study, and it is suggested that similar studies be performed on Beginner athletes; it's also indicated in future research, the effect of virtual reality games on the performance of a cognitive or physical activity should be investigated In addition, make a comparison between the impact of different types of digital interventions and video games and other interventions and be included in athletes' treatment and rehabilitation programs.

The current study is the first to investigate the impact of virtual reality games (Beat saber) on the mental skills of elite athletes during the COVID-19 pandemic and found that Beat saber could improve the mental skills of elite athletes.

This result suggests that virtual reality games (Beat saber) can be used to improve the mental skills of elite athletes. Which is the cause, of the ability of these games to create different types of environments, create a sense of immersion in the game, increase motivation, and improve an exercise program by creating a task-oriented exercise, repetitive, compact, and at the same time Flexible, are reasons for the results obtained in this study. Also, VR, with the help of creating complete safety for the players, the ability to view a play from any angle, better analysis capability, and the possibility to try new plays and strategies without any risk allows fans to be part of the action. Use the virtual reality teacher option and generate the opportunity to "learn by imitation" by stimulating mirror neurons and the use of enhanced performance feedback that is provided at the same time as the performance.

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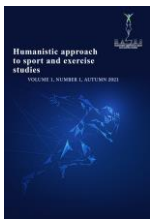

بازی های واقعیت مجازی و مهارت های ذهنی ورزشکاران نخبه در طول همه گیری COVID-19

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چکیده: هدف اصلی مطالعه حاضر ارزیابی تأثیر بازی های واقعیت مجازی بر مهارت های ذهنی ورزشکاران نخبه در طول همه گیری COVID-19 بود.

در این مطالعه ۲۲۸ ورزشکار نخبه به صورت تصادفی انتخاب و به چهار گروه ۵۷ تایی کنترل و آزمایش تقسیم شدند. تمامی آزمودنی‌های گروه کنترل و آزمایش بازی‌های واقعیت مجازی را به مدت ۱۵ دقیقه به مدت ۱۰ جلسه دریافت کردند. سپس هر گروه مجددا مورد بررسی قرار گرفت. گروه کنترل پس از دو هفته با استفاده از پرسشنامه ارزیابی مهارت های ذهنی اتاوا (OMSAT-3)آزمون پیگیری را طبق پس آزمون انجام دادند و برای آزمون فرضیه از تحلیل کوواریانس اندازه گیری های مکرر و آزمون تعقیبی بونفرونی استفاده شد.($P\leq 05/0$)

نتایج به‌دست‌آمده با استفاده از تحلیل کوواریانس با اندازه‌گیری‌های مکرر و آزمون تعقیبی بونفرونی نشان داد که بازی‌های واقعیت مجازی بر مهارت‌های ذهنی ورزشکاران نخبه در-COVID 19تأثیر می‌گذارد.

از این یافته ها می توان گفت که بازی های واقعیت مجازی می توانند مهارت های ذهنی ورزشکاران نخبه را در دوران کووید-۱۹ بهبود بخشند.

واژه‌های کلیدی: بازی های واقعیت مجازی، مهارت های ذهنی، ورزشکاران نخبه، کووید-۱۹، عملکرد ورزشی.