The Effect of Long-Term COVID-19 Confinement on Physical Fitness, BMI, and Psychological Profile in Professional Iranian Female Swimmers

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ABSTRACT

Background: several studies reported lockdown-related adverse effects on physical activity levels and mental health conditions among professional athletes during the COVID-19 pandemic. **Objectives**: This study aimed to compare physical activity levels, BMI, and psychological Profile during the pre-COVID and post-COVID-19 pandemic period in Professional Iranian Female Swimmers. **Methods:** Twenty-seven young female swimmers were evaluated pre-COVID (January 2020) and post-COVID (February 2022). For data collection, a questionnaire was used including sample demographic questions, DASS-21, UCLA LS3, Perceived physical fitness, and IPAQ-SF. **Results** Swimmers presented increased depression (pre-COVID = 9.48±3.14 vs. post-COVID= 14.81±4.55, p = 0.001, d = 1.69), anxiety (pre-COVID = 6.88±2.24 vs. post-COVID= 13.55±3.50, p = 0.024, d = 2.97), stress (pre-COVID = 10.55±4.03 vs. post-COVID= 25.18±3.60, p = 0.001, d = 3.63), UCLA-LS3 (pre-COVID = 24.33±2.44 vs. post-COVID= 40.14±9.22, p = 0.001, d = 6.47), and BMI (pre-COVID = 20.29±1.14 vs. post-COVID= 24.18±1.8, p = 0.001, d = 2.16) and significant decreases in IPAQ-SF (pre-COVID = 5475.74±903.22 vs. post-COVID= 3728.62±631.67, p = 0.023, d = 1.93), and PPFS (pre-COVID = 61.92±6.12 vs. post-COVID= 30.55±4.29, p = 0.001, d = 5.12). **Conclusion** Professional Iranian female swimmers presented

increased psychological profile scores and BMI, decreased physical activity levels, and perceived physical fitness after 2 years of COVID-19 confinement compared to the pre-COVID period.

KEYWORDS COVID-19, Anxiety, Swimmers, Stress, Physical Fitness.

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INTRODUCTION

The appearance of the novel Coronavirus disease 2019 (COVID-19), the respiratory disease caused by the SARS-CoV-2 virus, has arisen restrictive measures, such as maintaining social distance and staying at home. Despite the fact that a quarantine Strategy is the best option to limit the spread of infections, it has had negative effects on other dimensions of people's health such as economic, social, and even personal life (1).

Athletes have not been exempted from these issues. Recent studies have investigated the consequences of confinement period caused by COVID-19 on athletes in different sports. Cholewinski et al. examined the physiological effects of the COVID-19 Pandemic on football players and reported that they experienced significant decrease in fat free mass, and increase in fat mass and body fat percentage during the COVID-19 Quarantine (2). According to Crowley et al., young badminton athletes showed increased sedentary time, and decreased total physical activity, time in moderate-to-vigorous physical activity, and time in vigorous activities during the COVID-19 pandemic (3). Furthermore, in a Brazilian study, the quarantine's effects were evaluated on professional soccer players. The results showed that COVID-19-related restrictions had adverse effects on the cardiovascular and performance of participants (4).

On the other hand, several studies reported lockdown-related mental health conditions among professional athletes during the COVID-19 pandemic. Two studies have shown that during the quarantine period, with decreasing importance and prominence of the role of exercise, depression, stress, and anxiety of elite athletes increased (5, 6). Moreover, Pease et al. found that Covid-19 has taken basketball student athletes away from the strict routine of student sports and their daily structure, and their mental health has also been challenged during this time (7). Also, Nematikia and Gholami investigated the effect of physical activity on perceived mental stress during home quarantine and stated that physical activity has been able to significantly reduce the perceived mental pressure of the experimental group compared to the control group (8).

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Today, it is believed that some psychological effects caused by Covid-19 have caused major problems and after reducing the spread of the virus, the psychological effects left over from it will affect some people for several years (1, 9). Swimming is one of the popular sports that has not been spared from these effects. During the outbreak, swimmers around the world were not only forced to stop their regular training sessions and routine events but also confined to their homes (10). So far, many researches have been investigated the effect of inactivity caused by covid-19 on the physical and mental fitness of athletes in different sports, but there is limited research on the effect of covid-19 on swimmers.

Although recent studies have documented the adverse psychological effects of pandemic, to our knowledge, few studies have investigated the long-term psychological impacts of COVID-19 in professional athletes in Iran. Considering the harmful impact of reduced physical activity caused by the covid-19 quarantine on the physical and mental health of athletes, as well as the lack of research on the effects of the Covid-19 quarantine on swimmers (pre pandemic period vs at the end of pandemic period), the overall goal of the present study was to investigate the effect of Covid-19 restrictions on physical fitness and psychological profile of elite Iranian female swimmers. Therefore, the aim of the current research is to investigate the effect of the restrictions of Covid-19 on the training patterns, physical fitness and psychological profile of female swimmers. We hypothesized that swimmers would experience worse physical fitness and training patterns, with higher BMI and increased feelings of depression, stress, anxiety, and loneliness after the COVID-19 pandemic period, compared to the pre pandemic period.

MATERIALS AND METHODS

Participants. A sample of 27 Iranian Professional Female Swimmers participated in this study for convenience through contact with the coach of the Mashhad Swimming team (age = 23.06 ± 3.1 years). The inclusion criteria were: age 19 to 30 years old, signing the written consent, having normal menstrual cycle phases at the time of study, compliance with all quarantine protocols (approved by the Iran ministry of Health).

All athletes had at least 5 years swimming experience and participated in national and international competitions. Before participation, research procedures were described to all the swimmers who gave their voluntary written informed consent. All the procedures were approved by the

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Committee for Ethical Considerations in Human Experimentation of Medicine College, Azad University of Rasht Branch (approval number:1400.042).

There were two assessments before the beginning of quarantine period (pre-COVID period) and after 2 years at the end of quarantine period (post-COVID period). The first assessment was performed in 31 female swimmers during pre-COVID period (January 2020) one month before the national competition of the women swimming premier league. All athletes trained 4-6 times weekly (3 to 4 hours per day) and were regularly evaluated every year before the league competitions. The latter was administered online via Porsline (Tehran, Iran) 3 to 10 February 2022 after 2 years of closing the swimming pools and returning to regular training. All swimmers had not participated in any events or their regular activity for two years, according to the state laws during the pandemic. Four participants who were infected with COVID-19 did not participate in the second assessment.

Instruments and Procedures

DASS-21. The DASS-21, a brief version of the 42-item, is a three-dimensional self-reporting scale which measures 3 subscales (depression, anxiety, and stress) symptoms experienced in the last week on a 4 -point Likert response scale ranging from 1 (did not apply to me at all) to 4 (applied to me very much). Each subscale includes 7 items and assess the loss of motivation and self-esteem, symptoms of persistent anxiety and fear, and symptoms of continual arousal and irritability, respectively. Higher scores reveal higher levels of depression, anxiety, or stress (11). The alpha coefficients for the reliability of the three subscales were 0.94 (DASS-Depression), 0.87 (DASS-Anxiety), and 0.91 (DASS-Stress) (12).

UCLA LS3. The UCLA Loneliness Scale Version 3 (UCLA LS3), revised version of UCLA, developed by Russell in 1996. It consists of twenty items that measure the subjective feelings of loneliness and social isolation (11 negative or lonely items and nine positively or nonlonely items) on a 4-point Likert scale ranging from 1 (never) to 4 (always). Higher scores reveal higher levels of loneliness. The reliability of the revised version was reported as 78% (13).

Perceived physical fitness (PPF). The Perceived Physical Fitness Questionnaire (14) includes 12 questions in the four main scales of physical fitness, such as physical condition, flexibility, muscle condition, and body composition by self-report on a 5-point Likert scale. The alpha coefficients for the reliability of the four subscales were 0.86 (physical condition), 0.88 (flexibility), 0.82 (muscle condition), and 0.80 (body composition).

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IPAQ-SF. International Physical Activity Questionnaire Short-Form (IPAQ-SF), developed by Craig et al. (2003), evaluates the physical activity levels of individuals over the last week in the age range between 15 and 65. In IPAQ-SF, the activity is divided into three categories: intense (questions 1 and 2), moderate (questions 3 and 4), and walking (questions 5 and 6). Physical activity levels were classified as non-physically active (<600 MET – min/week), low physical activity level (600-3000 METdk/week), and adequate physical activity level (beneficial in health) (>3000 METdk/week) (15).

BMI. BMI was obtained through dividing weight (kg) by height squared (m^2).

Statistical analysis. Data are presented as mean ± standard deviation (SD) (see table 1). Descriptive statistics were utilized to analyze the demographic data of all participants. Data normality was measured by the Shapiro-Wilk test and all parameters met parametric assumption. The paired t-test was conducted to compare research variables between the pre-COVID and post-COVID-19 Confinement. The effect size was calculated via Cohen's d, whereby a value of > 0.20 was considered small, > 0.50 moderate, and > 0.80 large, and the 95% Confidence Intervals are reported (95% CI). All statistical analyses were performed using SPSS® 26.0 (IBM Corporation, Armonk NY, USA) for Windows® with a significance level set at $p<0.05$.

RESULTS

Table 1 shows the characteristics of the participants. The athletes presented mean age 24.38±2.38 years. They also had swimming experience of 7.14 years.

Table 1 Characteristics of participants

Variables	Pre-covid (n=27)	Post-covid (n=27)
Height (cm)	1.54±0.078	-
Body weight (kg)	48.88±6.97	58.07±7.22
Swimming experience (y)	7.14±1.51	-

Table 2 shows the comparisons between DASS-21 subscales (depression, anxiety, and stress), loneliness, IPAQ-SF, BMI, and total score of PPFS and its subscales (physical condition, flexibility, muscle condition, and body composition) during the pre-COVID and post-COVID in professional female swimmers.

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Table 2 Comparison between depression, anxiety, stress, loneliness, IPAQ-SF, BMI, and PPFS subscales during the pre-COVID and post-COVID in professional female swimmers

Variables	**Pre-COVID (n=27)**	**Post-COVID (n=27)**	P	ES
depression	9.48±3.14	14.81±4.55	0.001	1.69
anxiety	6.88±2.24	13.55±3.50	0.024	2.97
stress	10.55±4.03	25.18±3.60	0.001	3.63
UCLA LS3	24.33±2.44	40.14±9.22	0.001	6.47
IPAQ-SF	5475.74±903.22	3728.62±631.67	0.023	1.93
BMI	20.29±1.14	24.18±1.8	0.001	2.16
physical condition	20.11±4.86	8.33±2.13	0.003	2.42
flexibility	7.62±1.88	3.55±1.33	0.001	2.15
muscle condition	16.07±4.18	9.14±2.83	0.001	1.65
body composition	18.11±3.54	9.51±2.83	0.004	2.42
PPFS (total score)	61.92±6.12	30.55±4.29	0.001	5.12

ES effect size. Values are mean ± standard deviation

20.29±1.14

Athletes presented increases in depression (pre-COVID=p = 0.001, d = 1.69, 95% CI = − 16.63 to − 12.62), anxiety (p = 0.024, d = 2.97, 95% CI = − 8.28 to − 5.05), stress (p = 0.001, d =3.63, 95% CI = − 6.48 to − 4.1), UCLA-LS3 (p = 0.001, d = 6.47, 95% CI = − 19.50 to − 12.12), and BMI (p = 0.001, d = 2.16, 95% CI = 3.12 to 4.66) after 2 years COVID-19 Confinement, with large effect sizes.

There was a significant decrease in IPAQ-SF (p = 0.023, d = 1.93, 95% CI =1422.87 to 2071.34), and PPFS (p = 0.001, d = 5.12, 95% CI = 28.38 to 24.35). The effect sizes were large for all variables.

DISCUSSION

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Recently, everyone tries to maintain social distance and stay at home to reduce the spread of the COVID-19. This issue, along with increased weight, body fat, and higher risk of metabolic diseases, has had many psychological and mental health consequences for athletes. It has been shown that COVID-19 may result in emotional distress and mental disorders in athletes (1). Although many researches have been focused on effects of COVID-19 confinement in athletes during the COVID-19 pandemic, to the best of our knowledge, there are no study evaluating the long-term effects of Covid-19 restrictions simultaneously on the physical fitness, BMI, and psychological profile of professional swimmers.

The results indicated that professional female swimmers presented increased level of psychological indicators, including depression, anxiety, stress, and loneliness after two years of COVID-19 confinement compared to the pre-COVID period. This finding is consistent with the results of Demirchi et al. (5). They found that during the Covid-19 quarantine, the depression score of athletes increased.

Many studies have revealed beneficial effects of regular physical activity on psychological health (16-18). These results may be explained by some mechanisms. Physiologically, this may be due to increasing cerebral monoamine serotonin levels, occurring lipolysis and altering the distribution of tryptophan which is related to mood. Moreover, aerobic exercise (such as swimming) could increase levels of brain-derived neurotrophic factor (BDNF) that reduce depressive and anxious symptoms (18).

While national swimming events were postponed or canceled due to COVID-19, the swimmers were not allowed to train regularly in swimming pools. They had to use individual exercises and other useful alternatives, including strength training, plyometrics, or home-work machines to escape an entirely training cessation. Even though positive effects of these types of training, swimmers exposed to various degrees of detraining (19). They confronted reduction in the physical training levels in many of their physical capacities and experienced psychological consequences such as stress, loneliness, and anxiety (20). Inability to manage stress and lack of adequate coping may lead to short-term or long-term depression. In addition, because the goals of athletes become longer and less attainable, their motivation may be affected and the tendency to laziness and lack of motivation increases (21).

In addition to this, our results revealed that BMI significantly increased during post-COVID-19 confinement compared to the pre-COVID period. This finding is consistent with the results of

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Rahmani et al. (22) and Cholewinski et al (2). Rahmani et al investigated the effect of a period of inactivity caused by the spread of the corona virus on the body composition and maximum oxygen consumption of teenagers. The findings showed that lifestyle changes caused by the spread of the corona virus caused a significant increase in body mass index and weight. Cholovinski et al. also investigated the changes in the body composition and activity level of a first division football team during Covid-19. The results demonstrated an increase in mass fat and body fat percentage, and a significant decrease in fat-free mass of participants.

Since performing physical activities requires the expenditure of energy, provided by the consumption of carbohydrates and fats in the body, physical exercises prevent the accumulation of fat and, consequently, overweight and obesity. On the other hand, lack of physical activity leads to the accumulation of excess energy over the basic metabolism, so this excess energy in the form of fat accumulation (visceral and subcutaneous fat) causes overweight and obesity (22). Recent findings revealed that prolonged home stay and long-time confinement could increase body fat, decrease muscle mass and strength, and disturb the body's immunity (1, 23).

Moreover, our results demonstrated decreased levels of physical activity and perceived physical fitness in professional Iranian female swimmers. This finding is in line with da Silva Santos et al. (3) and de Albuquerque Freire et al. (4). They found that during the COVID-19 pandemic, there was an increase in sedentary time, and a decrease in total physical activity and performance in young badminton and professional soccer players.

Despite the importance of this study, some limitations should be mentioned. First, we did not check which menstrual cycle the participants were in at the time of the study. Second, athletes were evaluated objectively and there was no subjective measurement of research variables which could contribute to greater understanding of the results.

CONCLUSION

In conclusion, professional Iranian female swimmers presented reduced physical activity levels and perceived physical fitness after 2 years of COVID-19 confinement. Additionally, the results showed that the restrictions and home quarantine caused by COVID-19 significantly increased body mass index and psychological profile score of professional female swimmers.

APPLICABLE REMARKS

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- After 2 years of COVID-19 confinement, decreased levels of physical activity caused reduced perceived physical fitness among professional Iranian female swimmers.
- The restrictions and home quarantine caused by COVID-19 significantly increased body mass index and psychological profile score of professional female swimmers.

CONFLICT OF INTERESTS

There are no conflicts of interest to declare by any of the authors of this study.

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REFERENCES

1. Chen P, Mao L, Nassis GP, Harmer P, Ainsworth BE, Li F. Coronavirus disease (COVID-19): The need to maintain regular physical activity while taking precautions. Journal of sport and health science. 2020;9(2):103. doi: 10.1016/j.jshs.2020.02.001
2. Cholewinski MC, Buzzard JA, Gordon Q, Ross RN, Funderburk LK, Galucci A. Changes in Body Composition and Activity Levels of a Division-1 Football Team During COVID-19. Journal of Exercise and Nutrition. 2021;4(1).
3. da Silva Santos AM, Rossi FE, de Sousa Junior AVM, Machado DC, Neves LM, Brito AS, et al. COVID-19 pandemic impacts physical activity levels and sedentary time but not sleep quality in young badminton athletes. Sport Sciences for Health. 2021:1-9. Doi:10.1007/s11332-021-00763-6
4. Albuquerque Freire LD, Tannure M, Sampaio M, Slimani M, Znazen H, Bragazzi NL, Aedo-Muñoz E, Sobarzo Soto DA, Brito CJ, Miarka B. COVID-19-related restrictions and quarantine COVID-19: effects on cardiovascular and yo-yo test performance in professional soccer players. Frontiers in Psychology. 2020;11:589543. https://doi.org/10.3389/fpsyg.2020.589543

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5. Ghabel Damirchi B, Dabbagh H, Khanjani G, Gharayagh Zandi H. The relationship between exercise addiction and depression of elite athletes during quarantine and closure of sports venues and events due to Corona Virus (Covid-19). journal of motor and behavioral sciences. 2020;3(4):493-501.
6. Sut Txi MR, Ishak A, Mat Salleh FN, Pau K, Anuar Hashim H. The Prevalence of Emotional Distress among Athletes during COVID-19 Movement Control Order Period in Malaysia. Annals of Applied Sport Science. 2022;10(2). Doi: 10.52547/aassjournal.1018
7. Pease SM. Transitional Impact of COVID--19 on Division I Men's and Women's Basketball Student-Athletes: A Case Study (Doctoral dissertation, The University of North Carolina at Wilmington). 2021.
8. Naeimikia M, Gholami A. Effect of physical activity on the level of perceived mental pressure during home quarantine due to coronavirus outbreak. The Scientific Journal of Rehabilitation Medicine. 2020;9(3):217-24. Doi: 10.22037/JRM.2020.114158.2503
9. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, Wang Y, Fu H, Dai J. Mental health problems and social media exposure during COVID-19 outbreak. Plos one. 2020;15(4):e0231924. https://doi.org/10.1371/journal.pone.0231924
10. Haddad M, Abbes Z, Mujika I, Chamari K. Impact of COVID-19 on swimming training: practical recommendations during home confinement/isolation. International Journal of Environmental Research and Public Health. 2021;18(9):4767. https://doi.org/10.3390/ijerph18094767
11. Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behaviour research and therapy. 1995;33(3):335-43. https://doi.org/10.1016/0005-7967(94)00075-U
12. Antony MM, Bieling PJ, Cox BJ, Enns MW, Swinson RP. Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. Psychological assessment. 1998;10(2):176.
13. Shirani A. On the relationship between loneliness and social support and cell phone addiction among students. Journal of school psychology. 2017;5(4):7-30.
14. Abadie BR. Relating trait anxiety to perceived physical fitness. Perceptual and Motor Skills. 1988;67(2):539-43. https://doi.org/10.2466/pms.1988.67.2.5

Accepted Uncorrected Proof

15. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. International journal of behavioral nutrition and physical activity. 2011;8(1):1-1. https://doi.org/10.1186/1479-5868-8-115
16. De Mello MT, de Aquino Lemos V, Antunes HKM, Bittencourt L, Santos-Silva R, Tufik S. Relationship between physical activity and depression and anxiety symptoms: a population study. Journal of affective disorders. 2013;149(1-3):241-6. https://doi.org/10.1016/j.jad.2013.01.035
17. Teychenne M, White RL, Richards J, Schuch FB, Rosenbaum S, Bennie JA. Do we need physical activity guidelines for mental health: What does the evidence tell us? Mental health and physical activity. 2020;18:100315. https://doi.org/10.1016/j.mhpa.2019.100315
18. Kajtna T, Vučković V. Effect of decrease of physical activity on depression and anxiety after the COVID-19 lockdown: A survey study. Frontiers in Psychology. 2022;13. DOI 10.3389/fpsyg.2022.961798
19- Costa MJ, Garrido ND, Marinho DA, Santos CC. How much the swimming performance leading to Tokyo 2020 Olympic Games was impaired due to the covid-19 lockdown?. Journal of Sports Science & Medicine. 2021;20(4):714. doi: 10.52082/jssm.2021.714
20. Kumar S, Sharma A, Sharma S, Pal S, Singh Ak. Adaptation to Online Technology for Learning during COVID-19 Pandemic: An Observational Study of Effectiveness and Student's Perception in Various Universities. Journal of Clinical & Diagnostic Research. 2021;15(3).
21. Frank A, Fatke B, Frank W, Förstl H, Hölzle P. Depression, dependence and prices of the COVID-19-Crisis. Brain, behavior, and immunity. 2020;87:99. doi: 10.1016/j.bbi.2020.04.068
22. Rahmani Chegni S, Fathi M, Mohammad Hosseini Sarvak R. The effect of imposed inactivity due to coronavirus outbreak on adolescent body composition and Vo2max. Armaghane Danesh. 2021;25:852-60. http://armaghanj.yums.ac.ir/article-1-2996-en.html
23. Halabchi F, Ahmadinejad Z, Selk-Ghaffari M. COVID-19 epidemic: exercise or not to exercise; that is the question!. Asian Journal of Sports Medicine. 2020;11(1). DOI: 10.5812/asjsm.102630

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