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How did athletes train and avoid injuries during the COVID-19 quarantine period?

WESAM SALEH A. AL ATTAR[1,2,3], MOHAMED A. HUSAIN[4]

Abstract

Introduction. During the isolation period of COVID-19, athletes may not train, which leads to an increased risk of injury, which can be slight or more severe depending on their fitness level. Aim of Study. The current study aimed to investigate training exercises and injury prevention programs during the COVID-19 quarantine period among athletes. Material and Methods. A self-administered web-based survey was developed. The survey aimed to obtain information concerning exercises and injury prevention protocols implemented by athletes during the COVID-19 quarantine period. The survey's other goal was to investigate the type of exercises such as running, strength, stretching, plyometrics, balance, or injury prevention programs and the average training time. Data was collected in the period between April to June 2020. Results. A total of 606 respondents completed the survey, with a response rate of 80% from 132 countries worldwide. Most respondents were male (n = 353, 58.3%), and aged between 30 to 39 years (n = 175, 28.9%). Sixty-one percent of the total sample reported that they had been training during the quarantine period. They consisted of amateur-level (n = 180, 29.7%) and semi-professional athletes (n = 159, 26.2%). Squat, push up, single-leg squat, and side lunges were the top five implemented exercises with an average training time of 30 to 60 minutes. Most injury prevention protocols (18.8%) were reported as non-specified programs, followed by the Knee Injury Prevention Program (KIPP) (12.5%) and the iSPRINT Injury Prevention Program (10.6%). Conclusions. Most athletes continued their training and exercise during the COVID quarantine period to maintain their physical fitness level and reduce injury levels once they resume their regular training.

KEYWORDS: COVID-19, isolation, athletes, injury prevention.

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Corresponding author: wsattar@uqu.edu.sa

[1] Umm Al-Qura University, Department of Physiotherapy, Makkah, Saudi Arabia
[2] The University of Sydney, Discipline of Exercise and Sport Science, Sydney, Australia
[3] University of Basel, Department of Sport, Exercise and Health, Basel, Switzerland
[4] University of Bahrain, Department of Physiotherapy, Manama, Bahrain

Introduction

The coronavirus disease 2019 (COVID-19) pandemic started spreading in Wuhan, China, in December 2019. It was identified as the cause of respiratory failure, including also such symptoms as fever, fatigue, diarrhoea, cough, and muscle soreness [8]. It is also believed that COVID-19 may result in multiple organ failure, RNAaemia, as well as cardiac, liver and renal damage [24]. These manifestations are thought to be mediated by a specific cytokine profile response associated with COVID-19 disease [24]. Athletes infected with the COVID-19 virus may display varying levels of symptoms ranging from no symptoms at all to severe symptoms requiring hospitalization [25]. Of all complications, myocarditis seems to be the most feared sequelae of viral infections, resulting in further damage to the heart following COVID-19. Therefore, prevention of COVID-19 spread among athletes is essential to avoid the cardiorespiratory complications and their negative impact on training [23]. It can be achieved by practising preventive strategies such as

good hand hygiene, wearing a face mask in public, and self-isolation while planning for a safe return to participation insports events [23].

Close contact sports with several players may pose a high risk of infection. Potential infection sources in sports competitions are related with the physical contact between athletes and their teammates, the competing team, the environment, or equipment. Transmission of the virus between team members and spectators may occur by inhaling the droplets or aerosols of infected persons while sneezing or coughing or when coming in close contact. Additionally, studies have indicated that the virus may remain viable for hours and days on surfaces [26]. Several major sporting events have been either canceled or postponed as a precautionary measure, such as the Tokyo Olympic and Paralympic 2020 games, which were postponed to 2021 [23].

The training volume and aim of professional athletes vary from those of amateur athletes. In contrast to amateur athletes, professional athletes train to participate in tournaments and events based on monetary prizes and rewards and are highly competitive [10]. Additionally, professional athletes are more satisfied socioeconomically, psychologically, and spiritually when compared to their semiprofessional and amateur colleagues [20]. Anthropometric characteristics can also differ. Jones et al. [13] found that professional rugby union players were heavier, taller and leaner. It may be due to the variation in the training volume, physical requirements and the augmented strength and conditioning that professional players receive.

Lockdown due to COVID-19 may have negatively affected all athletes' categories. Reduced physical activity of athletes due to the lack of training and the imposed quarantine may lead to consequential effects. It may cause psychological, physical, and functional deterioration [1, 21, 26]. Moreover, Castrogiovanni et al. [4] found that prolonged inactivity can decrease the lubrication and nutrition of joint cartilage leading to degeneration and imbalance in the joint structures, cartilage, ligaments, and synovium [4]. In a joint statement by the National Collegiate Athletic Association (NCAA) and the National Strength and Conditioning Association (NSCA), 60% of non-contact injuries in athletes occur following periods of inactivity due to a sudden increase of activity load [5]. To mitigate the risks of developing injuries, researchers recommend implementing a conditioning training program and maintaining a balanced diet that meets reduced physical activity requirements [1, 5, 23].

General muscle strengthening exercises and sport-specific exercise help decrease the risk of getting injured [4], while maintaining optimal body weight, decreasing pain and fatigue, and increasing muscle strength and joint flexibility [6]. Regular exercises to maintain physical fitness can also be performed to maintain body strength and balance [14]. Research shows that resistance training can effectively increase muscle strength, whereas sustaining participation in a resistance training program during the preseason may reduce the risk of injuries [1, 9]. Other effective strategies include nutrition monitoring, mental fatigue reduction, alternative training protocols, and adequate recovery [14].

Aim of Study

Maintaining regular exercise during the lockdown period has many benefits. Based on the differences in the training volume and objectives between athletes and the deconditioning effects of the COVID-19 pandemic on the athletes, the current research aims to explore current training exercises and injury prevention programs implemented by athletes during the COVID-19 isolation interval.

Material and Methods

Study design and survey development

A self-administered questionnaire was developed, consisting of socio-demographic questions and three questions related to sports-specific practices to avoid injuries during the isolation period of the COVID-19 disease. Respondents were prompted to respond to every question provided in the survey before the next questions were presented. A respondent was required to answer a maximum of ten questions categorized into three sections: (1) the study invitation and participation agreement, (2) demographic questions, and (3) sports-specific questions. The study invitation and agreement represented the informed consent to participate in the study. Questions 1 to 6 in the demographics section were related to gender, age, country, type of sports practice, and its level. For questions 1 to 3 in the sports-specific section, participants were asked if they were currently training and practising injury prevention exercise during the COVID-19 period. Those who answered "yes" were asked to select options from various exercises such as running exercises, strength exercises, stretching exercises, plyometrics exercises, balance exercises, and injury prevention programs. They were also asked about the average training time (minutes per day). The participants who answered "no" were directed to submit the form. This project was reviewed and approved by the Biomedical Ethics Committee at Umm Al Qura University. Approval

No. HAPO-02-K-012-2020-10-461. Consent was obtained from each participant in the study before data collection began.

Participants and survey dissemination

The eligibility criterion for participants was their status as athletes. We followed the definition of athletes, described by the European Society of Cardiology as "individuals of young and adult age, engaged in exercise training regularly and participate in official sports competition, either amateur or professional" [18]. To have a convenient sample of athletes, the survey invitation was distributed through LinkedIn (LinkedIn Corporation, Sunnyvale, California, United States) identifying potential athlete participants. The invitation provided a brief background on the survey and encouraged athletes with or without injury prevention experience to participate. Interested respondents clicked on an electronic link that led them to the survey description, and they were able to provide their informed consent and access the survey. Surveys were completed anonymously via Google Forms (Alphabet Inc., Mountain View, California, United States). The survey was open for respondents to complete from April through June 2020.

Sample size and statistical analysis

Seven hundred and fifty participants were invited, considering a 4% margin of error at a 95% confidence level; responses were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corp., Armonk, New York, United States). Descriptive statistics were computed to describe sample characteristics and survey data. A chi-square test for association was conducted between gender, training during the isolation period, while Phi (φ) was used to assess the association's strength between the variables. The Cochran–Armitage test of the trend was applied to determine whether a linear trend existed between the respondent's athletic-level, age groups, and training during the isolation period. Kendall's tau-b correlation was used to determine the relationship between the respondents' athletic-level and daily workout time. The alpha level for all analyses was set at 0.05.

Results

A total of 606 respondents from 132 countries completed the survey with a response rate of 80%, as depicted in Figure 1.

Male respondents (n = 353, 58%) and those aged between 30 to 39 years (n = 175, 29%) represented most of the total sample. Participation from the European region was the highest among all regions (n = 226, 37%). Amateur-level athletes represented 30% of the total athletes in the sample (n = 180). Of the total sample, 61% reported that they had been training during the isolation period. The most-reported average training time was 30 to 60 minutes per day. The respondents' demographic characteristics are described in Table 1.

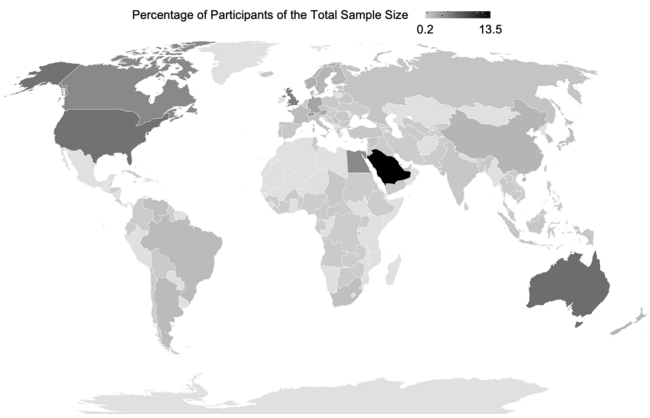

Figure 1. Sample distribution across countries

Table 1. Respondents' information

Gender	N	%
male	353	58.3
female	253	41.7
Age group (years)	N	%
15-19	139	22.9
20-29	167	27.6
30-39	175	28.9
>40	125	20.6
Region	N	%
Africa	65	10.7
Asia and the Western Pacific Region	208	34.3
European Region	226	37.3
North America and Caribbean Region	78	12.9
South America Region	29	4.8
Level	N	%
professional	130	21.5
semi-Professional	159	26.2
amateur	180	29.7
recreational	137	22.6

Duration of training (min/day)	N	%
0	237	39.1%
10-30	54	8.9%
30-60	91	15.0%
60-90	71	11.7%
90-120	60	9.9%
120-150	49	8.1%
150-180	43	7.1%
270-300	1	0.2%

Association between gender and training during the isolation period

There was no statistically significant association between gender and training during the isolation period, $\chi^2(1) = 0.174$, $p = 0.676$, $\varphi = 0.017$. A large proportion of the male (36%) and female (25%) athletes were training during the isolation period (Figure 2).

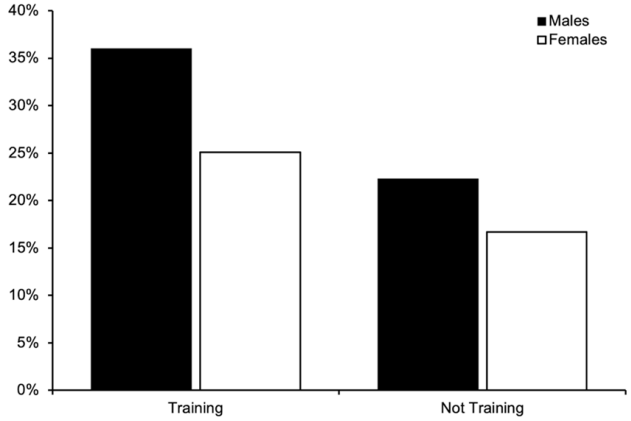

Figure 2. Percentages of participants' training during isolation based on sex

Association between age groups, athletic level, and training during the isolation period

The Cochran–Armitage test of trend showed a statistically significant linear trend, with higher athletic levels associated with a greater proportion of reported training during isolation ($p = 0.005$). The respondents' athletic levels were recreational (n = 137), amateur (n = 180), semi-professional (n = 159), and professional (n = 130) with the proportion of respondents reporting training during isolation amounting to 54%, 56.7%, 66.7%, and 67.7%, respectively (Table 1).

There was a statistically significant linear trend with the younger age groups associated with a higher proportion of reported training during isolation ($p = 0.008$). The respondents' age groups were 15-19 years (n = 139), 20--29 years (n = 167), 30-39 years (n = 175), and >40 years (n = 125) with the proportion of respondents within each age group reporting training during isolation at 66.2%, 65.3%, 55.1%, and 53.6%, respectively (Table 2).

Table 2. The participants' age groups and proportion of reported training during isolation

Age group (years)	N	Proportion of reported training
15-19	139	66.2%
20-29	167	65.3%
30-39	175	55.1%
>40	125	53.6%

Association between athletic level and daily workout time

A Kendall's tau-b correlation revealed a trivial, negative, and non-significant association between athletic-level and daily workout time, $\tau b = -0.036$, $p = 0.394$.

Injury Prevention Programs (IPPs)

For those who reported that they had been training during the isolation period, there was a significant variability in the reported IPPs and exercise regimens. Figure 3 shows the variability of the self-reported IPPs, with the majority of IPPs (19%) non-specified, followed by knee injury prevention programs (13%) and the iSPRINT injury prevention program (11%).

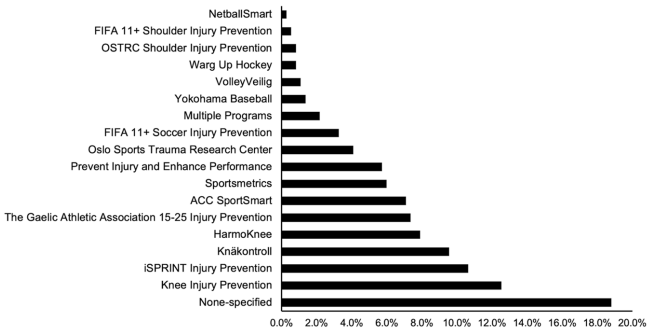

Figure 3. Injury Prevention Programs followed by the participants

Exercises performed by the participants

The exercises performed by the participants via the IPPs were aggregated. The results showed that the most performed exercises with frequencies ranging from 76 to 100% across the participant groups included squat,

push up, single-leg squat, and side lunges, which were the top five implemented exercises with an average training time of 30 to 60 minutes. The most practised exercises also included the Nordic hamstring, kneeling lunge, Copenhagen adduction, pelvic lift and deep sumo squat. Dspin, side-lying adduction, pelvic mobility, squat with rotation and jumping with shoulder contact, jumping lunge and hamstring stretch, and other exercises were reported second with frequencies between 51 to 75%. Data also showed that ankle mobility, hip thrusts and single-leg jump were performed by 26 to 50% of the participants. However, most exercises such as walking lunge with a high knee lift, kneeling hip stretch, duckwalk, stand up were performed by less than 25% of the participants.

Discussion

The purpose of this study was to explore the current training exercises and injury prevention programs applied by athletes during the COVID-19 pandemic. Numerous national and international sporting events have been cancelled or suspended in efforts to keep all individuals socially distanced, which negatively affected athletes who were unable to continue regular training [1]. Home workouts and self-applied training programs were the only options to stay active and practice sport-related activities [1, 23].

This study indicated that about 30% of professional athletes were not training during the isolation period. It is expected that athletes will be returning with a spectrum of conditioning levels due to the lifestyle modifications associated with the COVID-19 pandemic. Evidence has shown that cessation of training leads to muscular morphological and functional alterations in athletes leading to a decline in their physical fitness and performance [3, 14]. In addition to physical health issues, high levels of anxiety over the COVID-19 can harm athletes' mental health and readiness [1, 7]. Consequently, it puts them at risk of developing non-contact injuries once they resume regular exercise at a pre-COVID-19 level [5, 11]. Therefore, it is imperative to reach out to athletes, sports organizations, and those involved in sports programs to address the proper resumption of sports activities and training [14, 21].

Lack of knowledge on the appropriate manner of return to sport among athletes, coaches, trainers and physical therapists may jeopardize athletes' health and safety [16, 27]. The current study showed that exercises such as squat, push-up, side plank, forward lunge, Nordic hamstring, and Copenhagen adduction exercises, etc. were the most commonly applied exercises by athletes to avoid injuries. Also, most athletes trained for 30 to 60 minutes per day, which is considered less than the average training duration [19]. Jagim et al. [12] also found that only 46% of 71 athletes in the United States were still training for 5-6 days per week. It is also evident that the participants' exercises in the current study are based on body weight, which is similar to the findings of Pillay et al. [19]. Such valuable information can assist the athletes, coaches, trainers, physical therapists, or any other related professionals in designing injury prevention programs during lockdown periods. Given that a decreased physical activity has been documented [22], such exercises can also help design intervention strategies to reverse the negative effects of inactivity across a wide range of the population, including athletes, children, and patients.

Our study results showed that most athletes were continuing their training and exercise regimens during the COVID-19 isolation period using workout equipment at home despite restrictions enforced on training facilities and workout routines. It appears that most of the athlete respondents are overcoming the challenges, continuing with alternative training, and adapt to maintain their physical fitness level and to reduce the possibility of post-lockdown injury. However, while some athletes were able to cope during the pandemic, other athletes were not. In a cross-section study by Pillay et al. [19] on 692 South African elite and semi-elite athletes, 31% of the respondents expected to return to sport after 1 to 3 months. Regarding their training behavior, most athletes trained alone (61%) at a moderate intensity (58%) for 30-60 minutes daily (61%). Lockdown also affected their lifestyle, as 76% reported eating excessive carbohydrates, 52% felt depressed, and 55% required motivation to keep active. Spanish handball players were surveyed by Mon-López et al. [17], who also found reduced training intensity and deteriorated sleep quality as well as increased sleep hours during the lockdown period. Thus, the COVID-19 pandemic impacted the physical activity status of athletes and their nutritional and psychological well-being. In terms of the financial aspect, elite sportswomen reported impacted financial status due to reduced sponsorship or match fees. Interestingly, in their opinion, men's sport was a higher priority, leading to reduced access to sports facilities. Overall, the systematic review by Stockwell [22] revealed decreased physical activity and increased sedentary behaviour of adults, children, patients and athletes reported by the sixty-six studies included in the review.

This study also showed that more significant proportions of training reported during isolation were accompanied by higher athletic performance levels. This may be

explained by the variation in sport commitment among athletes. Higher athletic levels were associated with a higher proportion of respondents who reported training during isolation. Differences in strength, power, personality, and mindsets were found among athletes with varying participation levels [2, 15]. The younger age groups were associated with a higher proportion of respondents who reported training during isolation and variability in the IPPs and exercise regimens that those respondents reported. The trivial and non-significant relationship between athletic level and daily workout time might be related to the lack of variability in the workout time reported by participants in each athletic level. In a similar study to the one conducted by Pillay et al. [19], Jagim et al. [12] reported a significant reduction in the self-reported training goal of athletes in the United States for strength training (–1.65 ± 4.32 h/wk), conditioning (–1.47 ± 3.93 h/wk), and sport-specific activities (–6.44 ± 6.28 h/wk) post-shutdown. The authors reported an apparent reduction in the frequency of training across various self-reported training goals.

Conclusions

This study involved athletes from different countries across the world. This study's highlight was that many athletes were keen on continuing their training and exercising during the COVID-19 isolation period to maintain their physical fitness level and prevent injury levels once they are back on the field to play matches and competitions. Squats, lunges, Nordic hamstring, and Copenhagen adduction exercises were amongst the most applied exercises. These findings suggest that young age groups and high athletic levels represent a higher proportion of respondents in the study who reported training during the isolation period.

Conflict of Interests

The authors declare no conflict of interest.

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