Original article

The Effect on Performance of Detraining During Covid-19 Pandemic Period in Amateur Soccer Players

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Summary. *Background and aim:* Covid-19 pandemic has dramatically affected football, one of the most popular sports in the world, and significantly changed the competitive football sphere. This study was conducted to examine the effects of the suspensions and isolation process applied in leagues due to Covid-19 on the performance levels of amateur football players. *Methods:* Twenty male amateur football players (19.05±1.3 years) participated in the study as volunteers. Certain physical tests were applied to examine participants' performance levels. The detraining period was 80 days. Pre-testing started in March 2020 when the restrictions first introduced in Turkey as the post-test process was initialized in the first week of June after normalization signals. *Results:* Results showed that there are statistically significant variances in the parameters of body weight, body mass index, sit-and-reach, hand grip strength, medicine ball throw, 30-m speed, Illinois agility, 30-sec sit-ups, 30-sec push-ups, counter movement jump, peak power, Yo-yo IR-Level 1 and $\dot{V}_{O2max}$ ($p<0.05$). *Conclusions:* It was concluded that the performance levels of amateur football players deteriorated significantly during the detraining period due to the pandemic.

Key words: Coronavirus, performance losses, soccer, training cessation

Introduction

Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) leading the 'Corona Virus Disease-2019' (COVID-19) started in Wuhan, China, in December 2019 has rapidly spread to the rest of the world (1). A pandemic was declared by the World Health Organization (WHO) on March 11, 2020 (2). WHO and health authorities have suggested quarantine, isolation, and social distancing worldwide to combat the spread of the COVID-19 virus (2, 3). This pandemic still maintains its global impact. Several countries affected by the pandemic have gradually implemented quarantine (4). Since activities that bring communities together, in particular, are closely related to human health problems (5), sports activities were canceled or postponed (6,7). As the competition organizations are conducted in large stadiums with large audiences, hence a favorable environment for spreading viruses (8). Gilat and Cole (9) stated that the rapid spread of the virus in large sports organizations carried out under the influence of the virus will create a "biological bomb" effect. Indeed, this is due to the audience effect (10). For example, the UEFA Champions League football match was held in Bergamo, Italy, on February 19, 2020, between Atlanta (Italy) and Valencia (Spain). It is thought that the virus was exchanged among 45,792 fans participating in the competition, and this contributed to the large-scale virus outbreak in Italy and Spain (9).

Thus, the COVID-19 pandemic has dramatically affected football, one of the most popular sports in the world, and significantly changed the competitive football sphere (11). The professional footballers mostly returned to their routine, though varying in countries, after a mandatory restriction and longer

than the regular annual holiday (6). For example, this process was initialized on May 16 in Germany and June 17 in England and Italy. Due to the unstable evolution of COVID-19, competition restarts have been specially designed considering the pandemic status of each country (12). Professional leagues were re-launched on June 12 in Turkey with a series of measures, such as other European countries (test requirements, playing with no fans). However, no progress has yet been made for amateur footballers. Their restart in sports took longer than professional footballers, as they were restrained from the activity longer than ever before. Although athletes use various in-door workouts to maintain their physical condition and reduce the harmful effects of isolation (13), they were deprived of a regular training period. This situation hindered training gains (14), and the "Detraining" process due to COVID-19, especially for amateur athletes, has become a relevant research subject.

Detraining is a reduction or interruption in the frequency, intensity, or duration of exercise required to maintain physiological and performance gains through training (15, 16). It may be caused by injury, illness, or an unplanned periodic transition phase (17). The reversibility level of adaptations formed by exercise depends on the individual's training status and duration of the detraining (18). Since not all physical and physiological variables adapt at the same pace (between days and months), the process is not reversed at the same rate (19). Although training adaptations are more relevant in the literature, information on detraining is relatively narrow (20). Moreover, the regaining process of the outcomes obtained through different exercises is not explained clearly yet (21). Bompa and Haff (22) stated that the duration of the gaining process regarding conditional features determines how long it will take to lose them. Therefore, it is considered substantial to examine possible performance deterioration, especially of amateur players who are known to have less training history, during the isolation process caused by COVID-19.

This study was conducted to examine the effects of the suspensions and isolation process applied in leagues due to COVID-19 on the performance levels of amateur football players.

Methods

Participants

The research participants only include volunteer amateur footballers. 20 male footballers (avg. age: 19.05±1.31; height: 175.15±7.29) registered to the Konya amateur league, under the Turkish Football Federation, participated in this research. The preliminary tests of the study were carried out with 23 football players. However, in the last tests, the test scores of 20 players were determined because one football player was in quarantine, and both players reported that they did not feel well due to COVID-19 disease. Eight of the footballers were midfielders, six were defenders, four were forwards, and two were goalkeepers. Players who participated in training for three days or more a week before isolation and had at least three years of competition and training experience were selected for this study.

Experimental protocol

The club officials and coaches were consulted to obtain necessary permissions for tests and measurements. The study was conducted in line with the Declaration of Helsinki and the Social, and Humanities Scientific Research Ethics Committee of Necmettin Erbakan University approved the protocol numbered 2020/54. All of the research volunteers signed an informed consent (volunteer) form and filled a personal information form.

Players' pre-testing and measurements were performed in mid-March when the restrictions were first introduced in Turkey. The post-tests were conducted in the first week of June after (the permission regarding training processes and using facilities) normalization signals. There were 80 days between pre-test and post-tests. Participants were invited to a football field in the afternoon (04:00 pm—06:00 pm) for testing with a two-day interval in both testing periods. It was ensured that the athletes did not drink alcoholic and caffeinated beverages before the measurement days, and the tests were applied. It was also informed that they should avoid intense physical activity in the pre-test period. Tests were conducted in two stages.

Anthropometric measurements, flexibility, balance, agility, and speed test scores were recorded on the first test day. Strength and endurance tests were then carried out on the second test day. Researchers applied a warm-up protocol (such as jogging, stretching, and skipping) for 15 minutes before the tests.

The measurements included several parameters within the focus of this study. *30-m speed and sit-and-reach* tests were measured according to the method reported by Eston and Reilly (23). *Flamingo balance* and *30-s push-ups* were applied according to the method introduced by Tsigilis et al. (24). The criteria suggested by Mackenzie (25) were applied in the application of *Illinois agility, 30-s sit-ups,* and *standing long jump* tests. The *handgrip strength* test was applied to the dominant hand through the standard procedures recommended by the American Society of Hand Therapists (26). *Medicine ball throw* test was applied with the method introduced by Stockbrugger and Haennel (27). *Aerobic strength* was assessed through Yo-Yo intermittent recovery (IR-Level 1) test and formula (VO_2max (mL/min/kg=IR1 distance (m) × 0.0084 + 36.4) developed by Bangsbo et al. (28). Vertical jump height *was measured with the Counter movement jump (CMJ)* test. This measurement was performed in the exact way described by Pagaduan et al. (29). *Peak power* tests were applied in line with the equation (Peak Power (W) = 60.7 × (jump height (cm)) + 45.3 × (body mass (kg)) - 2055) developed by Sayers et al. (30).

Statistical analysis

The SPSS 24.0 (Statistical Package for Social Science) program was used in data analysis as the minimum, maximum, arithmetic mean, and standard deviation values were measured. A nonparametric test was applied because the data did not exhibit normal distribution according to Kolmogorov-Smirnov test results. Differences between pre-test and post-test were determined by Wilcoxon signed-rank test. The confidence interval was determined as $p<0.05$. Additionally, the effect size (Cohen's d) was calculated to determine practical differences (31). The effect size was interpreted as trivial < 0.2, small $= 0.2 < 0.5$, moderate $= 0.5 < 0.8$, and large > 0.8.

Results

Table 1 shows the physical characteristics of amateur football players participating in the study.

The differences between participants' pre-test and post-test average values are presented in Table 2.

Table 1. The physical characteristic averages of the football players

	Pre-test (n= 20)			Post-test (n= 20)		
Parameters	**Min**	**Max**	**Mean ± SD**	**Min**	**Max**	**Mean ± SD**
Weight (kg)	51.80	82.00	68.74±8.14	51.00	84.00	69.45±8.66
BMI (kg·m $^{-2}$)	19.03	26.13	22.35±1.81	18.73	26.30	22.58±1.97
Sit-and-reach (cm)	31.00	50.00	39.15±5.56	31.00	48.00	38.72±5.06
HGS (kg)	33.10	66.00	46.51±8.53	31.40	63.20	45.82±8.63
SLJ (cm)	184.00	267.00	227.00±24.92	186.00	264.00	224.40±23.06
MBT (cm)	605.00	1415.00	1054.10±249.96	598.00	1412.00	1028.65±236.77
FB (number)	2.00	7.00	3.90±1.88	2.00	7.00	4.15±1.63
30 m speed (s)	3.73	4.82	4.28±0.28	3.90	5.12	4.51±0.37
Illinois agility (s)	15.04	17.98	15.99±0.79	15.15	17.88	16.46±0.76
30 s sit-up (number)	14.00	46.00	28.20±7.72	14.00	43.00	26.60±6.83
30 s push-up (number)	16.00	48.00	29.35±6.89	15.00	40.00	27.70±5.92

Table 1. (*Continued*)

Parameters	Pre-test (n= 20)			Post-test (n= 20)		
	Min	Max	Mean ± SD	Min	Max	Mean ± SD
CMJ (cm)	32.50	54.20	44.17±5.48	31.80	51.50	42.87±5.17
Peak Power (W)	2701.52	4755.30	3740.04±519.10	2656.04	4706.29	3693.82±508.63
Yo-yo IR-Level 1 (m)	1260.00	3100.00	2313.00±541.12	1180.00	2560.00	1977.00±424.97
$\dot{V}O_{2max}$ (ml·kg·min $^{-1}$)	46.98	62.44	55.82±4.54	46.31	57.90	53.00±3.56

HGS: Handgrip strength; SLJ: Standing long jump; MBT: Medicine ball throw; FB: Flamingo balance; CMJ: Counter movement jump

Table 2. Wilcoxon signed-ranks test and ES results of the football players

Parameters		Mean rank	ES	MoC	z	p	Performance Differences %
Weight	Pre-test	5.25	0.62	moderate	-2.813	0.005*	1.03
	Post-test	10.71					
BMI	Pre-test	5.50	0.61	moderate	-2.765	0.006*	1.02
	Post-test	10.64					
Sit-and-reach	Pre-test	6.65	0.48	small	-2.191	0.028*	1.11
	Post-test	5.75					
HGS	Pre-test	11.50	0.46	small	-2.095	0.036*	1.5
	Post-test	8.17					
SLJ	Pre-test	12.29			-1.591	0.112	1.15
	Post-test	7.81					
MBT	Pre-test	11.79	0.50	moderate	-2.240	0.025*	2.47
	Post-test	7.50					
FB	Pre-test	6.00			-1.291	0.197	6.41
	Post-test	6.75					
30 m speed	Pre-test	2.00	0.86	large	-3.847	0.000*	5.37
	Post-test	10.95					
Illinois agility	Pre-test	3.50	0.84	large	-3.790	0.000*	2.93
	Post-test	10.87					
30 s sit-up	Pre-test	10.65	0.66	moderate	-2.956	0.003*	6.01
	Post-test	3.63					
30 s push-up	Pre-test	10.00	0.74	moderate	-3.318	0.001*	5.95
	Post-test	5.50					
CMJ	Pre-test	10.79	0.83	large	-3.735	0.000*	3.03
	Post-test	5.00					
Peak Power	Pre-test	12.38	0.77	moderate	-3.472	0.001*	1.25
	Post-test	3.00					
Yo-yo IR-Level 1	Pre-test	10.50	0.87	large	-3.922	0.000*	16.99
	Post-test	0.00					
$\dot{V}O_{2max}$	Pre-test	10.50	0.87	large	-3.922	0.000*	5.32
	Post-test	0.00					

*p<0.05; ES = Effect Size; MoC= Magnitude of Change; HGS= Hand grip strength; SLJ= Standing long jump; MBT= Medicine ball throw; FB= Flamingo balance; CMJ= Counter movement jump

While there are no significant differences in standing long jump and Flamingo balance values ($p>0.05$), statistically significant differences were detected in all other parameters ($p<0.05$).

Discussion

This study was conducted to examine the effects of the isolation process on the performance levels of amateur football players. Amateur players were selected intentionally for the research sample. While professional football players could continue their training even during strict quarantine measures (utilizing private facilities and camps with COVID-19 negative participants), amateur football players did not have the same opportunity. In-person interviews with the participants during the study also confirmed this situation. The strict isolation period ended as of June 1, 2020, in Turkey. Despite the regional differences, the training process started in the first week of June for amateur footballers. Therefore, the final test measurements of the participants were carried out in the first week of June, 80 days after the pre-tests, to observe the effect of detraining fully.

Tests were applied for several parameters within the focus of this study. Major findings indicated a decline in all values. Moreover, the deteriorations in all test scores except for the standing long jump and flamingo balance tests were statistically significant. These results are in accord with numerous previous studies in which similar parameters were measured in detraining periods (19, 32-37).

Scholars emphasized the importance of duration in the detraining process (18, 20, 22, 38-40). Mujika and Padilla (16) asserted that the detraining period could be categorized as short-term (less than 4 weeks) and long-term (more than 4 weeks). However, there are different findings in the studies focusing on short-term detraining. For example, Gavanda et al. (39) argued that the three-week detraining process did not affect muscle strength or athletic performance. Similarly, scholars observed that the lower extremity isokinetic muscle strength in a four-week detraining process (41), the speed and strength performances after the 26-day training interruption (38), and the vertical jump height after the two-week detraining process (42) did not change. However, it has also been reported that the two-week detraining period significantly worsened the repeated-sprint ability (19, 43), and the one-week detraining process worsened the speed endurance performance of football players (44). On the other hand, it can be argued that whether the novel data obtained during the long-term detraining period is coherent with relevant previous studies on long-term detraining. In terms of the long-term detraining period, almost all research findings indicate a performance loss. For example, Dauty et al. (32) observed 25% aerobic capacity loss after the two-month restriction period despite young football players continued their home exercises. Contemporary studies on long-term detraining examining parameters such as vertical jump (37, 45, 46), speed (37), agility (46), flexibility (33), balance (47), anaerobic power (33, 48), and aerobic fitness (20, 37, 46, 48, 49) propound results indicating significant deteriorations, which is parallel to our findings.

This study does not include interim tests due to the pandemic and restrictions, and this impeded detecting potential differences between short and long-term detraining processes. Some results were reached before the restrictions ended as the retraining process began. The measured performance losses varied between 1.1% and 16.9%. Although flexibility and grip strength losses were statistically significant, they ranged between 1-1.5%. This data can be interpreted as evidence for the argument regarding the conservative effect of certain individual activities participants practice in the home environment. Moreover, the finding that there are no statistically significant losses in balance performances despite deterioration supports this argument and may be provided through home training. However, the biggest deterioration (16.9%) was observed in the Yo-Yo IR1 test results, as well as the average 6% decrease in push-up and sit-up parameters and large performance losses in speed/agility parameters. These findings are coherent with several previous studies Dauty et al. (32), Vianna et al. (50), and Chatzinikolaou et al. (35). Additionally, higher aerobic performance deterioration compared to anaerobic performance parameters may be due to reductions in mitochondrial cells and capillarization. In fact, it is stated in previous

studies (15, 16, 51, 52) that physiological adaptations such as decreased blood volume are among the main reason behind the deterioration in cardiovascular function.

This study had certain limitations, as well. First, it comprises a small sample of amateur footballers. The research findings may not apply to other football populations, such as women and professional football players in this regard. Second, food intake was not controlled during the detraining period. Thus, eliminating these limitations in future studies and refining these findings may contribute significantly to the literature.

Conclusion

It was concluded that the performance levels of amateur football players deteriorated significantly during the suspension in the leagues due to COVID-19 and the isolation process. The long-term detraining period of 80 days caused negative effects in all measured parameters. Aerobic performance deterioration, in particular, was at the highest level. Research findings indicate that football coaches and sports scientists should better organize their strategies and take necessary precautions. It is recommended to keep training interruptions in the transition period as short as possible and to continue exercises programmed to maintain the physical fitness levels throughout this period.

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