Effects of short-term detraining in female football players: an approach based on initial level

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doi: 10.18176/archmeddeporte.00181

Received: 02/07/2023
Accepted: 16/10/2024

Summary

Introduction: The main aim of this study was to examine the effects of detraining period based on the initial physical fitness level determined through the Total Score of Athleticism (TSA) in female soccer players.
Material and method: Fourteen football players underwent pre- and post-detraining period (*i.e.*, 2 weeks) assessments, which included a countermovement jump test (CMJ), a 30-meter sprint test, and a repeated sprint ability test (RSA: 8 sprints of 30 meters with 25 seconds of recovery). The players were classified based on TSA obtained before detraining period (TSA_B = group of players with TSA <0 and TSA_A = group of players with TSA >0).
Results: A performance decline was observed in both TSA_B and TSA_A groups in CMJ (TSA_B: $P = 0.007$, ES = 1.12; TSA_A: $P = 0.000$, ES = 2.15, respectively) and in the average time of the RSA test (TSA_B: $P = 0.001$, ES = 1.86; TSA_A: $P = 0.000$, ES = 2.19, respectively), with no changes in the 30-meter sprint (TSA_B: $P = 0.319$, ES = 0.43; TSA_A: $P = 0.072$, ES = 0.63, respectively) or TSA (TSA_A: 0.42 ± 0.31 *vs*. 0.24 ± 0.55, $P = 0.369$, ES = 0.20; TSA_B: -0.57 ± 0.40 *vs*. -0.32 ± 0.59, $P = 0.302$, ES = 0.28).
Conclusion: A short period of detraining (2 weeks of inactivity) results in a decrease in jump performance and repeat sprint ability, but it does not affect the outcome of a 30-meter sprint test. This response remains independent of the initial fitness level of the players.

Key words:
Fatigue. Team sports. Women's sports. Performance.

Efectos del desentrenamiento de corta duración en jugadoras de fútbol: aproximación en función del nivel inicial

Resumen

Introducción: El objetivo principal de este estudio fue analizar los efectos del desentrenamiento en función del nivel inicial de condición física determinado a través del *Total Score of Athleticism* (TSA) en jugadoras de fútbol.
Material y método: Se llevó a cabo un estudio descriptivo, longitudinal de medidas repetidas, donde 14 jugadoras de fútbol realizaron una evaluación pre- y post- periodo de desentrenamiento (*i.e.*, 2 semanas) consistente en un test de salto con contramovimiento (CMJ), un test de sprint de 30-m y un test para evaluar la capacidad de realizar sprints repetidos (RSA: 8 sprints de 30-m con 25 s de recuperación). Se clasificó a las jugadoras en función del valor obtenido en el TSA previo al periodo de desentrenamiento (TSA_B = grupo de jugadoras con TSA <0 y TSA_A = grupo de jugadoras con TSA >0).
Resultados: Se obtuvo un descenso del rendimiento en TSA_B y TSA_A en CMJ (TSA_B: 27,76 ± 2,43 *vs* 26,26 ± 2,44 cm, p = 0,007, ES = 1,12; TSA_A: 27,01 ± 1,77 *vs* 24,98 ± 1,65 cm, p = 0,000, ES = 2,15 respectivamente) y en el tiempo medio en el test RSA (TSA_B: 5,19 ± 0,07 vs 5,44 ± 0,19 s, p = 0,001, ES = 1,86; TSA_A: 5,04 ± 0,12 *vs* 5,34 ± 0,11 s, p = 0,000, ES = 2,19, respectivamente), sin cambios el sprint de 30 m (TSA_B: 4,97 ± 0,06 *vs* 5,05 ± 0,15 s, p = 0,319, ES = 0,43; TSA_A: 4,82 ± 0,07 *vs* 4,96 ± 0,20 s, p = 0,072, ES = 0,63, respectivamente) ni en TSA (TSA_A: 0,42 ± 0,31 *vs*. 0,24 ± 0,55, p = 0,369, ES = 0,20; TSA_B: -0,57 ± 0,40 *vs*. -0,32 ± 0,59, p = 0,302, ES = 0,28).
Conclusión: Un periodo de desentrenamiento de corta duración (2 semanas de inactividad) provoca una disminución del rendimiento de la capacidad de salto y de repetir esprints, pero no modifica el resultado de un test de sprint de 30 m, siendo esta respuesta independiente del valor de condición física inicial de las jugadoras.

Palabras clave:
Fatiga. Deportes de equipo. Deporte femenino. Rendimiento.

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Introduction

Women's football is considered to be a predominantly technical and tactical sport in which physical fitness plays a major role given that players are subject to significant physical demands during the competition[1]. The importance of physical fitness in performance means that coaches regularly assess the physical condition of players throughout the season using various tests[2]. The results obtained from these tests can be examined to analyse the effectiveness of any training programmes being used[3], to determine the relationship between physical fitness and performance in competition[4], to establish the relationship between physical fitness and injury rates[5], to analyse performance trends during the season[6] and to analyse the effects of detraining on the fitness level of players[7].

A number of different tests have been traditionally used by coaches and physical trainers over the years to achieve those assessment goals[8]. The main tests used in women's football are the 30-15 IFT[9] and the Yo-Yo[2] for assessing aerobic factors, the CMJ for assessing neuromuscular factors[7] and the best time over 5-40-m measured using photocells to assess speed[10,11]. More recently, Beato, *et al.*[12] proposed the inclusion of tests that assess strength, repeated sprint ability and the ability to make direction changes in female football players. These tests provide information on performance condition regarding the physical skill they specifically assess but not regarding holistic performance by the player. It would therefore be of interest to incorporate the result from each one of these tests into a global indicator so as to gain a holistic overview of performance profiles in players[13]. One approach to this ecological and holistic player assessment has been made via the analysis of their behaviour in specific tasks that reproduce match situations (*i.e.* small-sided games). This proposal has been used to both determine the level of physical fitness[14,15] and to detect adaptation to training[16.] However, this alternative has not shown itself to be a valid and reliable indicator of physical fitness for male or female football players[17]. Hence, and to the best of our knowledge, few tests currently exist that analyse physical fitness in female football players from a holistic perspective.

The *Total Score of Athleticism* (TSA) is one proposed method for defining a single global performance indicator for athletes within a team[8], combining the results from different physical performance tests so as to facilitate decision-making for the coaching staff[18]. The main advantage of this method is the ability to compare the overall physical fitness level of a group of athletes from a holistic perspective without needing to analyse the results of each one of the tests and group players together based on their performance. One decisive aspect in the result obtained from the TSA lies in the tests that are included to determine the score, so it will be necessary to select and include those that assess the factors that are decisive to performance for the sport in question[8,18]. This indicator has not shown any changes following a training programme based on small-sided games in young male football players, despite increased performance in an intermittent fitness test (30-15 IFT)[19]. However, to the best of our knowledge, there are no studies that analyse whether it is sensitive to changes in performance as a result of detraining.

As stated above, the comprehensive analysis of physical fitness in female football players is relevant at certain points in the season. For example, there may be periods of no training stimulus that last 1-6 weeks following an injury, holidays or the end of a competition20. This reduction or complete lack of regular training stimulus can lead to reduced sport performance, also referred to as detraining[21]. Detraining has been defined as a total or partial loss of the adaptations induced by training as a result of reduced or suspended training activity[22]. A classification method for detraining has been established according to the time over which a training stimulus reduction or suspension takes place, distinguishing between short-term (<4 weeks) and long-term (>4 weeks)[22,23]. The scope of any detraining will depend on the duration of the period in which there is an absence thereof, leading to various degrees of de-adaptation based on the athlete's years of experience in the training, their age and their level of physical fitness[23].

Scientific evidence in various populations of male athletes has shown that a short period of detraining causes a 4% decrease in performance assessed using a specific running test on the pitch and a decrease in oxidative enzyme activity, but no changes in maximal oxygen uptake (VO_{2max}) or the percentage of type I and type II muscle fibres[24]. However, besides decreases in performance in the *Yo-Yo Intermittent Recovery* Test Level 2 (845 ± 160 m *vs*. 654 ± 99 m; P <0.01) and in the capacity to repeat high-intensity actions (33.41 ± 0.96 s *vs*. 34.11 ± 0.92 s; P <0.01), Christensen, *et al.* (2011) showed decreases in the fraction of slow fibres (56 ± 18% *vs*. 47 ± 15%; P <0.05) over a detraining period of 2 weeks. On the other hand, other studies have shown that two weeks of detraining are not sufficient to reduce performance in an agility test (8.06 ± 0.16 s *vs*. 8.09 ± 0.22 s, time in *arrow head agility test*) or a speed test (4.23 ± 0.07 s *vs*. 4.30 ± 0.12 s, time in 30-m)[20]. These discrepancies in the literature may be due to differences in the samples analysed, and especially to the differences in the level of physical fitness between the subjects taking part. In this regard, the decreased performance in repeated sprint ability (RSA) was shown to be greater (~1.9 *vs*. ~3.0 %) in faster football players when compared to slower football players, with impacts to both the best sprint (3.82 ± 0.002 s *vs*. 3.98 ± 0.04 s; P <0.001) and the total time (32.45 ± 0.7 s *vs*. 33.21 ± 0.29 s; P <0.01) obtained in an RSA test of eight 30 m sprints with 25 s of recovery over a period of two weeks[25].

To the best of our knowledge, there have been two studies that analysed the effects of a period of detraining in women's football. Parpa and Michaelides (2020) showed a significant reduction to VO_{2max} (51.92 ± 4.30 ml/kg/min *vs*. 49.60 ± 4.89 ml/kg/min; P = 0.001) and the time to exhaustion in an incremental test (10.86 ± 1.56 minutes *vs.* 11.82 ± 1.48 minutes; P = 0.000), alongside an increase in weight (58.29 ± 6.49 kg *vs.* 59.44 ± 5.83 kg; P = 0.001) and body fat percentage (19.81 ± 3.46% *vs.* 21.51 ± 3.14%; P = 0.000) during the transition period between seasons. In turn, Rodríguez Fernández, *et al*. (2022) showed that only two weeks of inactivity during the competition period were sufficient to reduce

performance in jump ability ($P = 0.009$; ES = 1.39) and the average time in an RSA test ($P = 0.000$; ES = 2.01) in female football players. However, it is unknown whether an assessment based on a global marker such as the TSA might be sensitive to change in performance over a period of detraining during the competition period. The goal of this study was therefore two-fold: a) to analyse the effects of detraining based on the initial level of performance determined using the TSA indicator; and b) to analyse the sensitivity of the TSA indicator to a short period of detraining in female football players. Our hypothesis was that female players with a higher level of physical fitness will show a greater decrease in performance after detraining[25] and that the TSA will not be sensitive to the changes caused by detraining given that it has not shown itself to be a marker of changes in performance after periods in which the specific training is suspended[19].

Material and method

Experiment design

A longitudinal, observational study with repeated measures was conducted to analyse the changes in performance using a counter movement jump (CMJ) test, a 30-m sprint test and an RSA test. The pre- and post- two-week detraining period TSA indicator was determined using the values obtained from those tests in female football players. During the period of detraining, the female players were instructed to only engage in their day-to-day physical activity while refraining from any kind of training. The pre-detraining assessment took place during the final training session before the suspension of activity, and the post-detraining assessment took place immediately after the resumption of training. All the tests comprising the pre- and post-detraining assessment were conducted on the same day of the week, following the same order of completion in each assessment and on the usual training pitch. The study was conducted between December and January. The CMJ test was conducted first. After a five-minute recovery period, the 30-m sprint test was conducted. Finally, after another five minutes of recovery, the RSA test was conducted. Before conducting the CMJ test, a standardised warm-up session of 15 minutes was performed similar to the team's pre-competition warm-up. This consisted of five minutes of low intensity running, eight minutes of joint mobility exercises and dynamic stretching, and two minutes of high-intensity activities. The players were already familiar with the procedures because they had performed the same tests during the pre-season period. None of the players were suffering from any kind of injury or disease while taking part in the study (assessment tests or intervention period).

Participants

Fourteen out of seventeen female football players (age: 17.2 ± 1.5 years, height: 163.1 ± 4.7 cm and body mass 54.1 ± 4.9 kg) belonging to the same team and in tier 2 of the Participant Classification Framework[27] met the criteria for inclusion established for participation in the study: a) at least six years of prior experience; b) having suffered no injury whatsoever in the three months prior to the study; c) complete all the tests in the pre- and post-detraining assessment; and d) comply with the suspension of activity during the period that the experiment stage lasts. Three players were excluded because two met criteria c) and one suffered an injury while performing the RSA test. In the three months before starting the study, the players engaged in three training sessions per week (90 minutes per session) as well as one official match. The training sessions consisted of a warm-up (15-20 minutes), a technical section (15 minutes), tasks based on small-sided games (20 minutes) and, depending on the day of the micro-cycle, strength exercises in the gym or specific physical fitness tasks on the pitch (20 minutes). All the sessions concluded with a cool-down that included mobility and lumbo-pelvic stability exercises (10 minutes). Before starting the study, all the participants were informed of the benefits and risks of taking part and they all signed the corresponding informed consent form. This form was signed by the father/mother/legal guardian of any minors taking part in the study. The study design was approved by the Ethics Committee of the University of León (Code: ETICA-ULE-004-2021).

Procedure

Performance in terms of jump ability was assessed using the CMJ test. The MyJump 2.0 mobile app was used for the test, which showed a valid strength (r = 0.995, $P < 0.001$) and reproducibility (r = 0.997, $P < 0.001$) for assessing vertical jump height[28]. The athletes performed three jumps with 45 s of passive recovery time between each attempt. Each jump was recorded on a mobile telephone (iPhone XS Apple Inc. CA, USA) at a recording speed of 240 Hz. The height in cm of the best attempt from the three jumps was selected for subsequent analysis. No restrictions were set for knee angle during the excentric stage of the jumps. Participants were required to keep their knees straight during the flight stage of the jumps and free/restricted movement of the arms.

Maximum speed was assessed by performing three 30-m sprints with three minutes of passive recover time between them. For this test, the player began from a stationary position at 0.5-m from the first photocell (DSD Laser System; DSD Inc., León, Spain) and completed the distance as quickly as possible. The photocells were positioned at a height of 75 cm from the ground, coinciding with the hip height of the players. The best time in seconds was selected for subsequent analysis.

The ability to repeat maximum intensity efforts was determined via a test that consisted of eight 30-m sprints with an active recovery time of 25 s. Each player began the test from a stationary position at 0.5-m from the first photocell (DSD Laser System; DSD Inc., León, Spain). The photocells were positioned at a height of 0.75-m from the ground, coinciding with the hip height of the players. After each sprint, the players returned to the starting position and were asked by an assessor to take their place on the starting line five s before the start of the next sprint. The time in s used in the speed test was used as the criteria of maximality. When the female player obtained a time in the first sprint

of the RSA test that was 2.5% worse than in the speed test, the test was concluded and resumed after 5 minutes of recovery. The RSAaverage corresponding to the average value of the times obtained in the 8 sprints was selected as the test performance variable[29].

After establishing the performance values, the TSA indicator was calculated as the average of the *Z-Scores* obtained by the player[18] in the CMJ test, the 30-m sprint test and the RSAaverage expressed in arbitrary units (AU). Using the TSA value obtained in the initial assessment, the players were classified into one low TSA group (TSA_B =TSA <0) and another high TSA group (TSA_A = TSA >0)[19]. The following formula was applied for this purpose:

$$Z\text{-}Score = \frac{(\text{Result from the athlete in the test - Team average})}{(\text{Standard deviation of the team})}$$

$$TSA = \frac{(Z\text{-}Score\ \text{CMJ} + Z\text{-}Score\ \text{RSAaverage} + Z\text{-}Score\ \text{sprint 30 m})}{3}$$

Statistical Analysis

The results are presented as an average ± standard deviation. No data transformation was applied as it was not necessary. After confirming a normal data distribution using the Shapiro Wilk statistics test, a repeated measures ANOVA test was applied (group [TSA_B vs TSA_A] x time [pre *vs* post]) to analyse the effects of detraining between groups. The partial eta-squared (ηp^2) was calculated to determine the magnitude of the interaction and the main effects, and was interpreted as: small (<0.06), *moderate* (0.06 – 0.13) or *large* (>0.14). The effect size was calculated by determining the Cohen's d (ES) for independent samples so as to establish the differences between groups. The Cohen's dz (ES) was also determined between the pre- and post-detraining assessment[30], using a classification of trivial (0 – 0.19), small (0.20 – 0.49), medium (0.50 – 0.79) or large (>0.80). The change percentage was determined via the difference between the post- and pre-detraining assessment divided by pre-detraining and multiplied by one hundred. It was also multiplied by the correction factor -1 when a lower result from the test indicated a better performance. The statistical analysis was conducted using the specific statistics software SPSS version 25.0 (SPSS, Inc., Chicago, IL, USA) and the statistical significance level was set at P <0.05.

Results

The results from the pre- and post-detraining period physical fitness tests are shown in Table 1. No interaction effect (time x category) was obtained for the CMJ (P = 0.403; ηp^2 = 0.059 *small*), time in 30 m sprint (P = 0.623; ηp^2 = 0.021, *small*) and RSAaverage (P = 0.381, ηp^2 = 0.065, *moderate*). The *post hoc* comparison between groups revealed that the time in the 30 m sprint test (P = 0.003, ES = 2.45, *large*) and the RSAaverage (P = 0.020, ES =1.58, *large*) was significantly higher in TSAA than TSAB in the pre-detraining assessment. Furthermore, a time effect was obtained for CMJ (P = 0.000, = ηp^2 = 0.738, large) and RSAaverage (P = 0.000, ηp^2 = 0.823, *large*), with no effects for the time in the 30 m sprint (P = 0.060, ηp^2 = 0.264, *large*). The *post hoc* analysis revealed in TSA_B and in TSA_A a significant loss of performance in CMJ (TSAB: P = 0.007, ES = 1.12; TSA_A: P = 0.000, ES = 2.15 respectively) and in RSAaverage (TSA_B: P = 0.001, ES = 1.86; TSA_A: P = 0.000, ES = 2.19, respectively), but no changes in the 30 m sprint (TSA_B: P = 0.319, ES = 0.43; TSA_A: P = 0.072, ES = 0.63, respectively).

The TSA values based on the initial value for this indicator in pre- and post-detraining are shown in Figure 1. No main interaction effect (time x category) was obtained (P = 0.179, ηp^2 = 0.145, large), nor was a time effect obtained (P = 0.842, ηp^2 = 0.003, small). The *post hoc* analysis revealed significant differences in the pre-detraining assessment between TSA_A and TSA_B (P = 0.000, ES = 3.0). No significant differences were obtained between pre- and post-detraining in TSA_A (0.42 ± 0.31 *vs.* 0.24 ± 0.55, P = 0.369, ES = 0.20) and TSA_B (-0.57 ± 0.40 *vs.* -0.32 ± 0.59, P = 0.302, ES = 0.28).

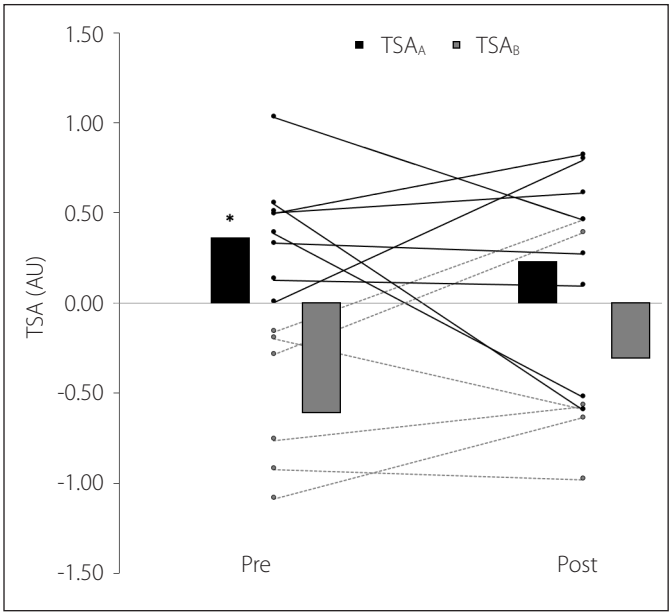
Table 1. Results from the physical fitness tests pre and post the detraining period based on initial TSA.

Variable	Level	Pre Detraining	Post Detraining	Δ (%)	*P*-value	ES
CMJ (cm)	TSA_B	27.76 ± 2.43	26.26 ± 2.44	-5.36 ± 4.66	0.007	1.12 *large*
	TSA_A	27.01 ± 1.77	24.98 ± 1.65	-7.46 ± 3.24	0.000	2.15 *large*
	Total	27.33 ± 2.03	25.53 ± 2.05	-6.56 ± 3.89	0.000	1.62 *large*
30 m (s)	TSA_B	4.97 ± 0.06	5.05 ± 0.15	-1.66 ± 3.26	0.319	0.43 *small*
	TSA_A	4.82 ± 0.07 *	4.96 ± 0.20	-2.81 ± 4.38	0.072	0.63 *medium*
	Total	4.89 ± 0.10	5.00 ± 0.18	-2.31 ± 3.85	0.060	0.60 *medium*
RSAaverage (s)	TSA_B	5.19 ± 0.07	5.44 ± 0.19	-4.63 ± 2.47	0.001	1.86 *large*
	TSA_A	5.04 ± 0.12 *	5.34 ± 0.11	-6.18 ± 2.87	0.000	2.19 *large*
	Total	5.11 ± 0.12	5.38 ± 0.15	-5.51 ± 2.72	0.000	2.06 *large*

Note. Δ = change percentage; ES = effect size; CMJ = counter movement jump; RSAaverage = average time in RSA test of 8 sprints of 30-m with 25 s of recovery; TSA_A = group of female players with a TSA >0 in the pre-detraining assessment; TSA_B = group of female players with a TSA <0 in the pre-detraining assessment. * Differences with TSA_B. Level of significance P <0.005.

The *Z-Score* values obtained by the players in each one of the pre- and post-detraining period tests based on the initial TSA value are shown in Figure 2. No interaction effect (time x group) was obtained in the CMJ *Z-Score* ($P = 0.412$, $\eta p^2 = 0.057$, *small*), the 30 m sprint time ($P = 0.174$, $\eta p^2 = 0.148$, *large*) or the RSAaverage ($p = 0.238$, $\eta p^2 = 0.114$, *moderate*). The *post hoc* analysis showed that the TSA_B group presented a lower *Z-Score* in the 30 m sprint time ($P = 0.003$, ES = 2.17) and RSAaverage ($P = 0.020$, ES = 1.57) in the pre-detraining assessment.

Figure 1. Values pre- and post-detraining period based on the initial value (TSAB = TSA value <0 =; TSAA = TSA value >0).



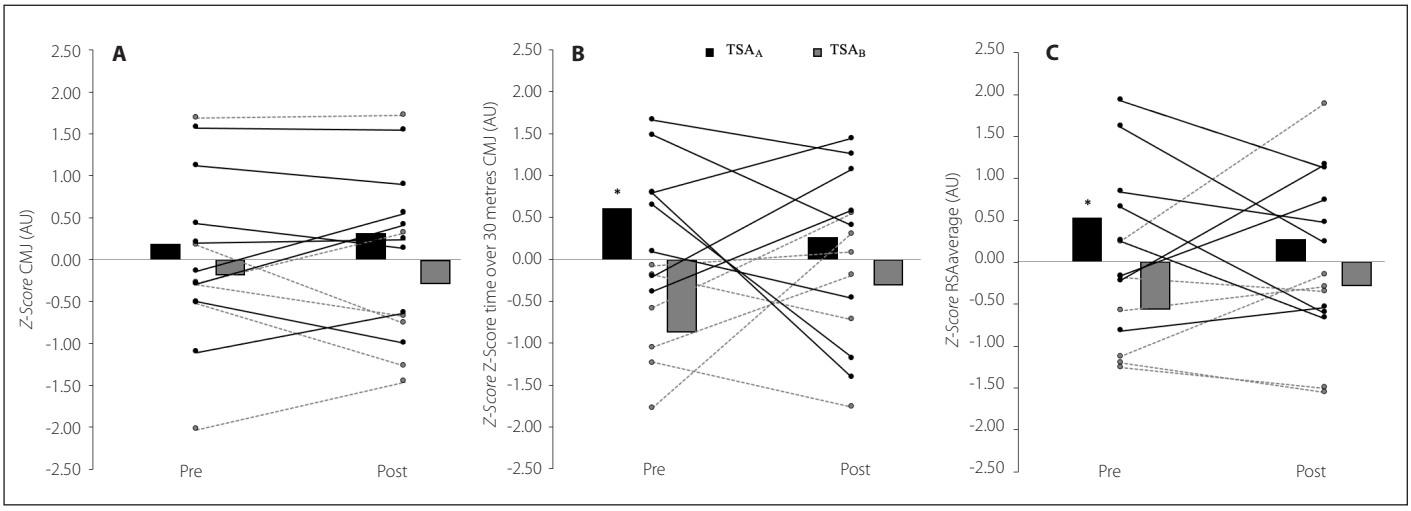
*Differences with TSA_B in pre-detraining. Level of significance P <0.005.

Discussion

This study sought to analyse the effects of detraining based on physical fitness level and whether a global performance indicator such as TSA is sensitive to changes in physical performance as a consequence of a short-term period of detraining in female football players. To the best of our knowledge, this is the first study that shows the changes in TSA after a short-term period of detraining in female football players. The main findings from this study were that: a) regardless of initial TSA level, the average time in an RSA test and the jump height in CMJ are reduced, with no changes in the 30 m sprint time; and b) a global performance indicator (TSA) is not sensitive to changes in performance as a consequence of a short-term (two weeks) period of detraining in female football players.

Our results have revealed the manifestation of negative effects on performance in vertical jump capacity (*i.e.* CMJ) and on the ability to perform repeated sprints (*i.e.* RSAaverage) in female football players as a consequence of a short-term period of detraining (two weeks). These results were consistent with those observed in previous studies, in which reductions were obtained in the performance of football players after a short-term period of detraining[20,25,31]. More specifically, it was documented that young amateur female football players (17.2 ± 1.5 years) see reduced performance in CMJ ($P = 0.009$; ES = 1.39) and in RSAaverage ($P = 0.000$; ES = 2.01) after two weeks of detraining[7]. In line with these findings, our results show a reduction in height jump in the CMJ ($P = 0.000$; ES = 1.62) and in the RSAaverage ($P = 0.000$; ES = 2.06). The decreased RSAaverage values are possibly related to a deterioration in function by the Na^+-K^+ pump that could impact recovery capability between sprints[32]. This could be caused by the de-adaptation caused by less exposure to high-intensity running inherent to the period in which that specific load is suspended[33]. It is important to note that our

Figure 2. Z-score values pre- and post-detraining period in the CMJ (A), time over 30 metres (B) and in RSAaverage (C) based on the initial value (TSA_B = TSA value <0 =; TSA_A = TSA value >0).



Note: *Differences with TSA_B in pre-detraining. Level of significance P <0.005

explanations about the underlying mechanisms are speculative and require further research.

Besides reducing performance level in the player, the changes experienced after the detraining period may cause an increased risk of injury in athletes when they return to normal training[34]. Nonetheless, it was also shown that short-term periods of suspended activity (*i.e.* 1-4 weeks) can have a taper effect (*i.e.* refinement and supercompensation) and lead to improvements in performance in such neuromuscular activities as jumping[35,36] or sprinting[20,35,36]. In fact, and contrary to our results, Pereira, *et al.* (2020) showed that a 26-day period of suspended activity in young football players improved performance in CMJ. Similarly, Joo (2018) showed that no negative effects were seen on sprinting (*i.e.* 5, 10 and 30 m sprints) during a five-week period of suspended activity. Another study even showed improvements in performance in the 5 and 10 m sprint test after one week of detraining[37]. These findings partly coincide with those of our study as our results showed no losses in performance in the 30 sprint test among female football players. There may be several reasons to explain these differences from the results obtained in our study. On the one hand, the taper effects in performance seem to depend on the previous training undertaken and the duration of the detraining period2[2,23]. In our study, the players engaged in their usual training in the month prior and a detraining period of two weeks was analysed. However, studies that have shown improvements in jumping or maintaining a sprint engaged in plyometrics training before the detraining[36], presented a shorter period of detraining (one *vs.* two weeks)[37] or used subjects of a higher level (elite *vs.* local level)[35].

Analysis of the detraining effect based on the physical fitness of female players determined via the global TSA indicator showed that, regardless of level (TSA_A and TSA_B), performance in CMJ and RSAaverage fell after the period of detraining. This is contrary to that reported by previous studies with football players, which showed more significant performance losses in those athletes with a higher physical fitness level[25]. These differences may be due to the criteria used for categorising the athletes (TSA *vs.* RSAaverage) or the prior physical fitness level. Nonetheless, it may be that the TSA indicator is not sensitive to the fitness level of the female players and that the relationship between physical fitness level and the degree of detraining has therefore not manifested. In fact, a previous study with football players categorised according to the TSA showed that both the group with a low TSA (-1.7 ± 1.4 AU) and a high TSA (1.0 ± 1.1 AU) improved their result in a 30-15 IFT (7.3% and 6.3%, respectively) and in a 30 m sprint test (2.7% and 3.8%, respectively) with a training programme, without obtaining changes in the TSA value[19]. One possible explanation for these results could be that the TSA indicator is obtained from the result of tests with varying physical and physiological approaches, which could dilute the relationship between this global performance indicator and the detraining effect. In this regard, a number of studies have shown that the loss of performance stemming from short-term detraining could be observed in such anaerobic tests as the YYIR2[20,32,38] or RSA[7,25], but not in other tests more closely related to the aerobic component such as the YYIR1[25]. Hence, regardless of fitness level, it is important for coaches to monitor fitness level changes in female football players during the periods of inactivity that occur over the course of a season with tests based on different physical and physiological approaches so as to observe specific changes, preventing performance from being compromised and injury risk in athletes from increasing[39].

Conducting this study did encounter certain limitations. The study was conducted during a period of suspended competition, during the Christmas holidays to be precise. The main limitation lies in the length of the period analysed given that the longitudinal analysis of a shorter (*i.e.* one week) or longer (*i.e.* four weeks) period could provide a more complete perspective on the similarity of the changes when compared with the period of detraining that was studied. Furthermore, it is acknowledged that the absence of an aerobic physical fitness test (*i.e.* Yo-Yo or 30-15 IFT) could represent an important limitation and represent a more complete TSA of the players. The inclusion of said test would enable a more comprehensive analysis of the players, which might reveal whether the detraining has effects on a global performance indicator. Additionally, it should be stressed that the sample used in this study was small and specific, limiting the generalisation of the results to different populations.

Conclusions

A short-term period of detraining (two weeks of inactivity) leads to reduced performance in jump capacity and repeated sprint capacity but does not impact the result of a 30 m sprint test, this response being independent of the initial physical fitness value obtained from the female players. Furthermore, the value of the TSA global performance indicator did not change after the period of detraining regardless of the initial level obtained from the female football players. Coaches and physical trainers will need to propose specific training strategies during periods of suspended competition and plan suitable training sessions after that detraining so as to offset the negative effects on performance in female football players

Conflict of Interest

The authors declare no conflict of interest whatsoever.

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