Journal of Strength and Conditioning Research Publish Ahead of Print
DOI: 10.1519/JSC.0000000000002138



# Effects of a Tapering Period on Physical Condition in Soccer Players

***Optimal periodization to boost soccer players' fitness***

Beltran-Valls, Maria Reyes; Camarero-López, Guillermo; Beltran-Garrido, José Vicente; Cecilia-Gallego, Pau.

Beltran-Valls, Maria Reyes. Affiliation: EUSES Health and Sport Sciences School, Rovira i Virgili University, Tarragona, Spain. Postal address: C/ Sebastià Joan Arbó, 2, 43870, Amposta (Spain). Phone number: +3497448093. Email: reyes.bel@outlook.com (**corresponding author**).

Camarero-López, Guillermo. Affiliation: EUSES Health and Sport Sciences School, Rovira i Virgili University, Tarragona, Spain. Postal address: C/ Sebastià Joan Arbó, 2, 43870, Amposta (Spain). Phone number: +3497448093. Email: guillermo.camarero@euseste.es

Beltran-Garrido, José Vicente. Affiliation: EUSES Health and Sport Sciences School, Rovira i Virgili University, Tarragona, Spain. Postal address: C/ Sebastià Joan Arbó, 2, 43870, Amposta (Spain). Phone number: +3497448093. Email: jose.vicente@euseste.es

Cecilia-Gallego, Pau. Affiliation: EUSES Health and Sport Sciences School, Rovira i Virgili University, Tarragona, Spain. Postal address: C/ Sebastià Joan Arbó, 2, 43870, Amposta (Spain). Phone number: +3497448093. Email: pau.cecilia@euseste.es

No external financial support was received for this study.

**Abstract**

The aim of this research was to analyze the effects of a two-week step tapering period on lower-limb muscle power, change of direction (COD) and acceleration capacities, and on the stress-recovery state in an amateur soccer team. Twenty-two male players were included in the study. Following a six-week progressive training, the sample was divided into: experimental group (n = 11), who did a two-week period of taper in which training volume was 50% reduced (intensity was kept high) and control group (n = 11), which kept on with the training. Muscle power (countermovement jump test), acceleration (10m sprint test), COD (Illinois test) and stress and recovery perceptions (RESTQ questionnaire) were evaluated before training, at the end of it (pre-tapering, PRE-TP) and after the tapering period (post-tapering, POST-TP). Following the taper, the experimental group in comparison to the control group showed significantly improved power (1029.71 ± 108.51 W/kg vs. 1084.21 ± 110.87 W/kg; $p < 0.01$), acceleration (1.72 ± 0.09 s vs. 1.67 ± 0.07 s; $p < 0.05$), and lower stress levels (1.9±0.5 vs. 1.6±0.5; $p < 0.01$) (PRE-TP vs. POST-TP, respectively). COD did not show significant changes. In conclusion, a two-week step tapering program was found to be an effective periodization strategy to increase muscle power and acceleration, and to reduce stress perception in soccer amateur players.

**Key Words:** Periodization, Team Sports, Recovery, Physical Fitness.

**INTRODUCTION**

Soccer is a high-intensity intermittent and multi-component sport in which performance relies not only on individual factors such as physical fitness or technical skills but also on the interaction among the players within the team for optimal tactical strategies (31). The game involves multiple motor skills and running is the predominant one, yet explosive type efforts such as sprints, jumps, dribbling, kicking, are also important for successful performance (2). These quick efforts depend on optimal physical capabilities, among which lower limb anaerobic power is particularly important (9,27).

Soccer League championships are characterized by a long competitive season with frequent matches and training sessions that could induce chronic fatigue on the players (34). Due to this fact, a balance between training stimulus and physical recovery is fundamental to optimize physiological adaptations and physical performance while avoiding excessive fatigue (24). In order to achieve this goal, progressive planning of the training load around the competitive phases and its continuous monitoring are relevant procedures (36). High training loads with insufficient periodization of recovery periods has been suggested to cause overreaching and overtraining in team sport players such as soccer (22). In an attempt to maximize performance after an intense training period, a short-term reduction of training load at the end of a mesocycle has been found beneficial to avoid excessive physiological and psychological stress (5). This periodization strategy, known as "tapering", is characterized by reducing the volume and/or frequency of training while intensity is maintained (5).

The improvements in physical condition and performance following a tapering period have been mostly studied in individual sports, with less research performed in team sports (5). Research done in semi-professional male rugby players (10), elite female basketball players (28), young male (16) and elite soccer players (14) support the benefits of tapering on team sports performance, too. However, there is still a paucity of information on the effectiveness of manipulating training load on specific physical condition components such as anaerobic muscle power and related components such as change of direction (COD), which are relevant to reach optimal fitness level in soccer players (29).

A better understanding of the training stimulus and adaptations occurring during progressive loading and tapering periods may improve training load prescription and periodization for soccer players. Therefore, the aim of this research was to examine the effect of a two-week step taper period on physical condition characteristics such as muscle power, COD and acceleration in an amateur soccer team. In addition, we evaluated the effect of decreasing training load (TL) during taper weeks on subjective stress and recovery perceptions.

## METHODS

### Experimental Approach to the Problem

The study period was divided into a 6-week mesocycle of progressive training followed by a 2-week tapering period. During the study period, 3 training sessions and one match per week were completed by the players. All the team performed plyometric and COD training, as well as small-sided games during the training sessions. Following the 6-week mesocycle, participants were randomly divided into experimental group (EG), which followed the taper, and control group (CG), which continued with regular training. During the taper, TL was decreased by reducing the duration of each training session. A battery of tests that included muscle power, COD, acceleration and a stress/recovery questionnaire was performed before the progressive training period, at the end of this 6-week training period, which was used as baseline evaluation for the tapering period (pre-tapering, PRE-TP), and at the end of the taper (post-tapering, POST-TP). Internal training load (ITL) was also evaluated after every training session. Participants were well familiarized with the standard technique of each exercise.

### *Subjects*

Twenty-two male amateur soccer players from the same team volunteered to take part in the study (age: 23 ± 5 years; body mass: 74.5 ± 7 kg; height: 1.77 ± 5 m; experience as federated players: 11 ± 5 years). All participants were informed of the benefits and risks of the investigation and gave written informed consent prior to participation in the study. The research project was approved by the EUSES-TE Institutional Review Board.

## Procedures

### *Training intervention*

Plyometric training sessions were performed twice a week after the warm-up, with 48-72h of rest between them. The design of the plyometric intervention was progressed based on the players' previous training records. Before beginning the training period, players were instructed on how to perform all the exercises. Horizontal and vertical jumps (with only left, only right or both legs) were performed with involvement of stretch-shortening cycle muscle activity and immediately after the jumps, a COD drill was performed (changing running direction and starting-stopping quickly). The total number of contacts performed in the first study session was 96 (including 48 foot contacts unilateral and 48 bilateral distributed in 4 sets) and the starting jump height was 60cm for vertical jumps and 120cm for horizontal jumps. Training volume (number of foot contacts) was increased 10% every 3 successive training session by augmenting the number of jumps, repetitions or sets. After that, the intensity was increased 5% by augmenting the height of vertical jumps and the distance of horizontal jumps, according to previous height or distance measured for each participant. Each exercise set of repetitions lasted between 8-12 seconds. A complete recovery between sets was allowed, following a ratio load:recovery of 1:6 (1), so that recovery lasted between 50s and 70s. The order of the tasks was based on exercise complexity, from more to less intense jumps.

Small Sided Games for the sport-specific training were performed in the three training sessions completed per week. In alternate weeks, volume and intensity of the exercises were increased. Volume was modified firstly by increasing the duration of each task or the number of tasks per session performed. Then, intensity was progressed by allowing lower number of ball contacts per player or by decreasing the playing area (30).

A step tapering period lasting 2 weeks was applied to the EG following the 6-week mesocycle. They continued training at the same intensity but training volume was reduced 50% by lowering time spent in each specific training modality, thus total session duration was reduced. Training frequency was maintained. The CG continued training with the same volume and intensity performed the 6th week of the training mesocycle.

## Measurements

*Internal Training Load*

ITL was calculated using the method developed by Foster (15). Briefly, thirty-minutes after completing the training session each athlete provided a rating of perceived exertion (RPE; CR-10 scale) for each session by answering the question: "How was your workout?" The session RPE method has been shown to be a valid method for monitoring training load in soccer players (20). An ITL was calculated by multiplying the session RPE score (indicator of global intensity) by training duration (in minutes). Data from all training sessions were combined to provide an absolute ITL score for each week of training.

*Recovery-Stress State*

The Spanish version of the Recovery-Stress Questionnaire for Athletes (RESTQ-76) was used to identify the physical and mental stress experienced by the players and their current state of recovery (17). RESTQ-76 is composed by 12 General Stress and Recovery scales along with 7 Sport-specific Stress and Recovery scales. A Likert-type scale, with values ranging from 0 (*never*) to 6 (*always*), indicates how often the athlete participated in various activities during the past three days and nights. Total stress state was calculated as the sum of the subscale scores representing stress (stress subscales), and total recovery state was assessed by the sum of the subscale scores representing recovery (recovery subscales). The test retest reliability of RESTQ-76 Sport has been previously reported (r = 0.51–0.81) (21). The questionnaire was completed 3 times: before the 6-week training mesocycle, PRE-TP and POST-TP. A high mean score in the stress-associated activity scales represents intense subjective strain whereas high mean scores in the recovery-orientated scale represent adequate recovery.

*Performance tests*

All tests were conducted 48 hours following a competition or hard physical training to minimize the influence of fatigue on test performance. Participants performed three trials of each test, with 5 minutes of rest between trials and tests. The best performance was considered for data analyses.

Lower-limb muscle power was evaluated by a countermovement jump (CMJ). Following a regular 10-minute warm up, the CMJs were performed on a contact mat (ChronoJump-Boscosystem platform) validated by DeBlas (4). Participants started from a standing position with hands on their hips and were instructed to perform a fast-downward movement up to 90° of knee flexion followed by an upward movement trying to jump as high as possible. The trial reporting maximum jump power was selected for further analysis (CMJ ICC = 0.94).

The Illinois COD Test (Figure 1) was set up and administered using according to Hoffman (2006). The test is set up with four cones forming a square for the COD test area (10 m x 5 m). Participants started on the ground in a prone position, with their head just behind the start line and hands shoulder-width apart. On the “Go” command, they got up and sprinted 10 m, touched the cone opposite the start line. Then, they turned back and sprinted down to the cones placed at the middle of the course. Next, they swerved in and out through four middle cones and once done, sprinted to the top right hand corner cone, ran around the cone and finally sprinted to finish the COD course. COD outcomes were recorded using photocell chronometric devices (Chorno-jump Bosco System). The infrared timing gates were positioned at the start and the finish lines at a height of 1 m. This test has been reported to be a highly reliable and valid measure of a general athletic ability to change direction (37) (COD ICC = 0.91).

****Figure 1 near here****

Running acceleration was assessed by a 10-m test. The time in sprinting 10 m as fast as possible was recorded using photocell chronometric devices (Chorno-jump Bosco System). The test began from a static starting position with the toe of the preferred forward foot behind the starting line. The photocells were positioned in a straight direction and timing started when the first photocell was crossed. Time was measured to the nearest 0.01 s. (Sprint ICC = 0.88).

**Statistical analyses**

The assumption of normality was verified using the Shapiro-Wilk test. The paired sample T-test was used to evaluate changes between pre-training and post-training in all the players. The independent samples T-test was used to examine between group differences in the baseline measurements of interest. The analysis of variance (ANOVA) with two-way repeated measures for time (pre-tapering and post-tapering) and group (experimental and control) was performed to assess the tapering intervention. Whenever a significant group x time interaction was observed, Bonferroni's post hoc correction was used to aid interpretation of these interactions. Cohen’s *d* was calculated to evaluate the effect size (ES) of the intervention within the groups with the following interpretation: small (0.2), medium (0.5) and large (0.8) (8), whilst analyses for between-groups differences were calculated using partial eta-squared ($\eta^2_p$) where < 0.01 = small; 0.06 = moderate; 0.14 = large. All values are reported as mean ± SD. The delta percentage was calculated trough the standard formula: Change (%) = [(posttest score - pretest score) / pretest score] · 100. The level of significance was set at $p < 0.05$. All statistical analyses were performed using IBM SPSS Statistics 22 (IBM Corporation).

## RESULTS

Baseline differences were not found between groups for all the variables analyzed. All physical condition parameters significantly improved following the progressive overload training period. Lower limb muscle power increased by 3.15% (pre vs. post: 957.3 ± 111.4 W/kg vs. 987.5 ± 110.1 W/kg; $p < 0.001$; ES = 0.3); acceleration time was reduced by 2.91% (pre vs. post: 1.77 ± 0.07 s vs. 1.72 ± 0.07 s; $p < 0.001$; ES = 0.7); and COD time test was reduced by 1.35% (pre vs. post: 15.80 ± 0.41 s vs. 15.59 ± 0.40 s; $p < 0.001$; ES = 0.5).

Figure 2 shows the mean weekly ITL completed by the team during the progressive overload training period as well as the ITL completed by the EG and CG during the tapering period. During the training period ITL was progressively increased every week compared to the previous measures ($p < 0.05$). A significant time x group interaction was found for the ITL measures during the tapering weeks ($F_{2,40} = 53.5$; $p < 0.001$; $\eta^2_p = 0.7$). The EG group in comparison with the CG achieved a lower ITL during the tapering weeks ($p < 001$). The EG significantly decreased the ITL in tapering weeks 1 and 2 in comparison to PRE-TP measure (344.7 ± 24.4 and 372.45 ± 24.8 vs. 754.9 ± 58.7, respectively; $p < 0.001$; ES = 8.0 and 7.5, respectively). However, the CG did not show significant changes in ITL (749.7 ± 24.4 and 746.2 ± 24.8 vs. 754.9 ± 58.7 respectively; $p > 0.05$; ES = 0.1 and 0.2 respectively).

****Figure 2 near here****

Table 1 shows the physical condition parameters evaluated before and after tapering for both EG and CG. The between-groups analysis showed a significant time x group interaction for the lower limb muscle power test ($F_{1,20} = 7.1$; $p < 0.01$; $\eta^2_p = 0.3$). The EG training group in comparison with the CG showed increased lower limb muscle power following the tapering period ($p < 0.01$). The EG improved muscle power from PRE-TP to POST-TP by 5.3% (1029.7 ± 108.5 W/kg vs. 1084.2 ± 110.9 W/kg respectively; $p < 0.01$; ES = 0.5). However, CG muscle power did not show significant changes between PRE-TP and POST-TP (945.3 ± 98.7 W/kg vs. 950.0 ± 113.3 W/kg respectively; $p > 0.05$; ES = 0.04). Moreover, a significant time x group interaction was also found for the acceleration test ($F_{1,20}$ = 5.8; $p < 0.05$; $\eta^2_p$ = 0.2) in the between-groups analysis. The EG group in comparison with the CG performed a faster acceleration test ($p < 0.05$). The EG decreased the time needed to complete the acceleration test from PRE-TP to POST-TP by 2.8% (1.72 ± 0.09 s vs. 1.67 ± 0.07 s respectively; $p < 0.01$; ES = 0.6). However, the CG did not show significant differences in acceleration test from PRE-TP to POST-TP (1.72 ± 0.06 s vs. 1.70 ± 0.06 s; $p > 0.05$; ES = 0.3). The COD test between-groups analysis did not show a significant time x group interaction ($F_{1,20}$ = 3.4; $p > 0.05$; $\eta^2_p$ = 0.1). COD remained unchanged for both EG (15.39 ± 0.35 s vs. 15.19 ± 0.16 s; $p > 0.05$; ES = 0.6) and CG (15.78 ± 0.37 s vs. 15.72 ± 0.41 s; $p > 0.05$; ES = 0.1) from PRE-TP to POST-TP respectively.

****Table 1 near here****

Total stress (Σ 10 stress subscales) and total recovery (Σ 9 recovery subscales) were not significantly different from pre- to post-training period ($p >$ 0.05). Total stress and total recovery pre-tapering vs. post-tapering are shown in table 2. The between-groups analysis showed a significant time x group interaction for total stress ($F_{1,20}$ = 8.4; $p < 0.01$; $\eta^2_p$ = 0.3). The EG in comparison with the CG experienced a significant decrease in total stress following tapering ($p < 0.01$). The EG significantly decreased total stress from PRE-TP to POST-TP by 17% (1.9 ± 0.5 vs. 1.6 ± 0.5 respectively; $p < 0.01$; ES = 0.6) whereas the CG did not show any significant modification in total stress (1.7 ± 0.5 vs. 1.9 ± 0.4 respectively; $p > 0.05$; ES = 0.4). The between-groups analysis showed a significant time x group interaction for total recovery ($F_{1,20}$ = 14.4; $p < 0.001$; $\eta^2_p$

= 0.4). The EG in comparison with the CG showed higher total recovery after the taper ($p < 0.001$). The EG did not show significant differences in total recovery from PRE-TP to POST-TP (3.2 ± 0.2 vs. 3.3 ± 0.3 respectively; $p > 0.05$; ES = 0.4). However, the control group reported lower levels of recovery after tapering (3.4 ± 0.3 vs. 3.0 ± 0.3 respectively; $p < 0.01$; ES = 1.1).

****Table 2 near here****

**DISCUSSION**

Our study provides singular data about the effect of decreasing TL during a tapering period on physical condition compared with regular training in amateur soccer players. We found that two weeks of tapering, characterized by decreasing the duration of training sessions while maintaining intensity, improved lower limb muscle power and acceleration capacities while lowered stress state in the experimental group compared to the control group. However, changes in COD or in recovery state were not observed.

TL was progressively increased during 6-week period by alternating increases in training duration and intensity. However, this progression did not reduce muscle performance at the end of the training period. ITL was found to decrease in line with the pre-programmed tapering phase, which corroborates its usefulness to quantify TL during a periodized program and reflects the decrease in training volume in the tapering group.

Our results are in agreement with previous research reporting improvements in anaerobic performance evaluated by muscle power and acceleration variables in team (10,28) and individual sports (7,39) following a tapering period. The magnitude of the improvements are in line with previous studies evaluating muscle or acceleration capacities (10,28). Despite the fact that a positive effect of tapering on COD has been reported previously (28), our results showed a tendency to improve but it did not reach statistical significance ($p$ = 0.08). This fact could be due to a major dependence of technical and coordinative abilities not influenced by the characteristics of the tapering period applied.

Tapering has been suggested to increase muscle performance by reducing muscle damage (10), increasing neural drive (18) and increasing cross-section area (CSA) in type IIA muscle fibers (39). These adaptations might be obviously related to the type of training performed previously and during tapering. Since muscle power and acceleration are determinant physical capabilities for quick and high-intensity actions over short distances common in soccer (6,26), its optimization before an important competition could positively influence the outcomes.

Accelerations and vertical jumping are common match actions in soccer which are involved in goal scoring, creating space and gaining ball possession (12,13). Power production capacity is one of the most important neuromuscular capacities involved in these soccer explosive abilities and overall performance

(3,23). In addition, soccer players with greater muscle power usually experience lower performance decrements in a match (33) and that may also have important consequences on fatigue development and injury risk during games. Therefore, maximizing lower-limb muscle power and running acceleration capacities following a tapering period may positively influence technical and tactical aspects of the match.

We also found out that the perception of stress evaluated by the RESTQ-76 in the experimental group was significantly reduced following the tapering period in comparison to the control group, who felt less recovered at the same time point. This psychological improvement following a tapering period could also influence the enhancement in physical condition reported. Our results are in accordance with previous studies showing reductions in training stress following a tapering period in team sports (11,28). High training load and psychological stress have been related to increased risk of injury and illness in athletes (32,35). Therefore, monitoring the individual stress-recovery state in athletes could be implemented as a useful prevention tool.

Tapering is not a common practice in soccer; consequently, players could initiate the competitive season with impaired neuromuscular performance due to high volume trainings or reduced recovery (22,38). From a practical point of view, our results support the importance of considering the taper in the periodization of TL and recovery in order to improve fundamental physical capacities for soccer, such as acceleration and power, and to prevent chronic fatigue and illness. Scheduling training duration reductions while maintaining intensity should be considered by strength and conditioning coaches when designing their preseason training programs to optimize soccer players' physical capacities and stress-recovery state at the onset of the competitive season (25).

The positive results from our study were obtained following general tapering recommendations made from the meta-analyses of Bosquet et al. (5) who, in terms of duration and variables modification, demonstrated that performance may be maximized with a 2-week tapering period consisting in an exponential reduction of training volume (approximately 41%–60%) without changing training intensity or frequency. However, a step-taper was implemented to accentuate the results due to the short duration of the study (29). Despite other tapering strategies also being helpful to improve soccer performance (14), we think that the approach used in our study is feasible in terms of time planning and appropriate to induce physical adaptations. The inclusion of a control group permitted the isolation of the intervention effects from the general outcomes expected as consequence of the regular training. Nevertheless, the results could be influenced by the fact that control group maintained training load during the tapering period while the experimental group decreased it.

The main limitation of our study was that only physical condition improvements and stress-fatigue parameters were analyzed. Given the complexity of a soccer match, the improvements reported do not guarantee transference to match success after tapering since physical condition is not the only aspect important for it. Numerous factors such as tactics or motivation, which are not necessarily influenced by training periodization, could influence better final results in soccer matches. More studies are needed to further investigate the effects of tapering on other relevant aspects influencing a soccer match such as technical and tactical abilities or mental fatigue. In order to evaluate which is the most useful tapering strategy, it would be also interesting to assess the effect of different tapering modalities in terms of shorter or longer duration, amount of intensity reductions or number of training variables modified.

## PRACTICAL APPLICATIONS

The results of our study suggest that tapering can be a useful periodization strategy to be used by coaches in order to achieve players' peak physical performance and to reduce stress at the onset of the competitive season. Coaches should consider that two weeks of step-taper characterized by decreasing TL 50% through reduction of training session duration while maintaining intensity can improve lower-limbs muscle power and acceleration ability while reducing the perception of stress. At a practical level, these improvements may positively influence soccer players' performance.

## ACKNOWLEDGMENTS

No external financial support was received for this study. The authors would like to thank all the participants for their involvement in the study. The authors report no conflicts of interest. The results of the present study do not constitute endorsement of the product by the authors or the NSCA

## REFERENCES

1. Baechle, TR and Earle, RW. Essentials of Strength Training and Conditioning. Champaign (IL): Human Kinetics, 2008.

2. Bangsbo, J, Mohr, M, and Krustrup, P. Physical and metabolic demands of training and match-play in the elite football player. *J Sports Sci* 24: 665–674, 2006.

3. Barnes, C, Archer, D, Hogg, B, Bush, M, and Bradley, P. The Evolution of Physical and Technical Performance Parameters in the English Premier League. *Int J Sports Med* 35: 1095–1100, 2014.

4. De Blas, X, Padullés, JM, López del Amo, JL, and Guerra-Balic, M. Creation and Validation of Chronojump-Boscosystem: A Free Tool to Measure Vertical Jumps. (Creación y validación de Chronojump-Boscosystem: un instrumento libre para la medición de saltos verticales). *RICYDE Rev Int Ciencias del Deport* 8: 334–356, 2012.

5. Bosquet, L, Montpetit, J, Arvisais, D, and Mujika, I. Effects of tapering on performance: a meta-analysis. *Med Sci Sports Exerc* 39: 1358–65, 2007.

6. Bradley, PS, Di Mascio, M, Peart, D, Olsen, P, and Sheldon, B. High-Intensity Activity Profiles of Elite Soccer Players at Different Performance Levels. *J Strength Cond Res* 24: 2343–2351, 2010.

7. Chtourou, H, Chaouachi, A, Driss, T, Dogui, M, Behm, DG, Chamari, K, et al. The effect of training at the same time of day and tapering period on the diurnal variation of short exercise performances. *J Strength Cond Res* 26: 697–708, 2011.

8. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale: Lawrence Erlbaum, 1988.

9. Cometti, G, Maffiuletti, NA, Pousson, M, Chatard, J-C, and Maffulli, N. Isokinetic Strength and Anaerobic Power of Elite, Subelite and Amateur French Soccer Players. *Int J Sports Med* 22: 45–51, 2001.

10. Coutts, A, Reaburn, P, Piva, T, and Murphy, A. Changes in Selected Biochemical, Muscular Strength, Power, and Endurance Measures during Deliberate Overreaching and Tapering in Rugby League Players. *Int J Sports Med* 28: 116–124, 2007.

11. Coutts, AJ and Reaburn, P. Monitoring changes in rugby league players' perceived stress and recovery during intensified training. *Percept Mot Skills* 106: 904–16, 2008.

12. Dalen, T, Jørgen, I, Gertjan, E, Geir Havard, H, and Ulrik, W. Player Load, Acceleration, and Deceleration During Forty-Five Competitive Matches of

Elite Soccer. *J Strength Cond Res* 30: 351–359, 2016.

13. Faude, O, Koch, T, and Meyer, T. Straight sprinting is the most frequent action in goal situations in professional football. *J Sports Sci* 30: 625–631, 2012.

14. Fessi, MS, Zarrouk, N, Di Salvo, V, Filetti, C, Barker, AR, and Moalla, W. Effects of tapering on physical match activities in professional soccer players. *J Sports Sci* 34: 2189–2194, 2016.

15. Foster, C, Florhaug, J a, Franklin, J, Gottschall, L, Hrovatin, L a, Parker, S, et al. A new approach to monitoring exercise training. *J Strength Cond Res* 15: 109–15, 2001.

16. Freitas, CG, Aoki, MS, Franciscon, CA, Arruda, AFS, Carling, C, and Moreira, A. Psychophysiological Responses to Overloading and Tapering Phases in Elite Young Soccer Players. *Pediatr Exerc Sci* 26: 195–202, 2014.

17. González-Boto, R, Salguero, A, Tuero, C, and Márquez, S. Validez concurrente de la versión española del cuestionario de recuperación-estrés para deportistas (RESTQ-SPORT). *Rev Psicol del Deport* 18: 53–72, 2009.

18. Häkkinen, K, Kallinen, M, Komi, P V, and Kauhanen, H. Neuromuscular adaptations during short-term “normal” and reduced training periods in strength athletes. *Electromyogr Clin Neurophysiol* 31: 35–42, 1991.

19. Hoffman, J. Norms for fitness, performance and health. Champaign (IL): Human Kinetics, 2006.

20. Impellizzeri, FM, Rampinini, E, Coutts, AJ, Sassi, A, and Marcora, SM. Use of RPE-based training load in soccer. *Med Sci Sports Exerc* 36: 1042–7, 2004.

21. Kellmann, M and Kallus, WK. Recovery-Stress Questionnaire for Athletes. User Manual. Champaign (IL): Human Kinetics, 2001.

22. Kraemer, WJ, French, DN, Paxton, NJ, Häkkinen, K, Volek, JS, Sebastianelli, WJ, et al. Changes in exercise performance and hormonal concentrations over a big ten soccer season in starters and nonstarters. *J Strength Cond Res* 18: 121–128, 2004.

23. Loturco, I, Pereira, LA, Kobal, R, Zanetti, V, Gil, S, Kitamura, K, et al. Half-squat or jump squat training under optimum power load conditions to counteract power and speed decrements in Brazilian elite soccer players during the preseason. *J Sports Sci* 33: 1283–1292, 2015.

24. Meeusen, R, Duclos, M, Foster, C, Fry, A, Gleeson, M, Nieman, D, et al. Prevention, diagnosis, and treatment of the overtraining syndrome: joint consensus statement of the European College of Sport Science and the American College of Sports Medicine. *Med Sci Sports Exerc* 45: 186–205, 2013.

25. Mujika, I. Thoughts and considerations for team-sports peaking. *USOC Olympic Coach* 18: 9–11, 2007.

26. Newman, MA, Tarpenning, KM, and Marino, FE. Relationships between isokinetic knee strength,single-sprint performance, and repeated-sprint ability in football players. *J Strength Cond Res* 18: 867–872, 2004.

27. Nikolaidis, PT, Ruano, MAG, de Oliveira, NC, Portes, LA, Freiwald, J, Leprêtre, PM, et al. Who runs the fastest? Anthropometric and physiological correlates of 20 m sprint performance in male soccer players. *Res Sport Med* 24: 341–351, 2016.

28. Nunes, JA, Moreira, A, Crewther, BT, Nosaka, K, Viveiros, L, and Aoki, MS. Monitoring Training Load, Recovery-Stress State, Immune-Endocrine Responses, and Physical Performance in Elite Female Basketball Players During a Periodized Training Program. *J Strength Cond Res* 28: 2973–2980, 2014.

29. Pyne, D, Mujika, I, and Reilly, T. Peaking for optimal performance: Research limitations and future directions. *J Sport Sci* 27: 195–202, 2009.

30. Rampinini, E, Impellizzeri, FM, Castagna, C, Abt, G, Chamari, K, Sassi, A, et al. Factors influencing physiological responses to small-sided soccer games. *J Sports Sci* 25: 659–666, 2007.

31. Di Salvo, V, Baron, R, Tschan, H, Calderon Montero, F, Bachl, N, and Pigozzi, F. Performance Characteristics According to Playing Position in Elite Soccer. *Int J Sports Med* 28: 222–227, 2007.

32. Schwellnus, M, Soligard, T, Alonso, J-M, Bahr, R, Clarsen, B, Dijkstra, HP, et al. How much is too much? (Part 2) International Olympic Committee consensus statement on load in sport and risk of illness. *Br J Sports Med* 50: 1043–1052, 2016.

33. Silva, JR, Magalhães, J, Ascensão, A, Seabra, AF, and Rebelo, AN. Training status and match activity of professional soccer players

throughout a season. *J Strength Cond Res* 27: 20–30, 2013.

34. Slattery, KM, Wallace, LK, Bentley, DJ, and Coutts, AJ. Effect of training load on simulated team sport match performance. *Appl Physiol Nutr Metab* 37: 315–322, 2012.

35. Smith, MR, Coutts, AJ, Merlini, M, Deprez, D, Lenoir, M, and Marcora, SM. Mental fatigue impairs soccer-specific physical and technical performance. *Med Sci Sports Exerc* 48: 267–276, 2016.

36. Soligard, T, Schwellnus, M, Alonso, J-M, Bahr, R, Clarsen, B, Dijkstra, HP, et al. How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. *Br J Sports Med* 50: 1030–1041, 2016.

37. Stewart, PF, Turner, AN, and Miller, SC. Reliability, factorial validity, and interrelationships of five commonly used change of direction speed tests. *Scand J Med Sci Sports* 24: 500–506, 2014.

38. Taylor, JM, Portas, MD, Wright, Matthew, D, Christopher, H, and Weston, M. Within-Season Variation of Fitness in Elite Youth Female Soccer Players. *J Athl Enhanc* 1: 1–5, 2012.

39. Trappe, S, Costill, D, and Thomas, R. Effect of swim taper on whole muscle and single muscle fiber contractile properties. *Med Sci Sports Exerc* 33: 48–56, 2001.

## FIGURE LEGENDS

**Figure 1.** Illustration of the Illinois COD test.

**Figure 2**. Internal Training Load during training and during tapering. Data presented as mean ± SE. #Significantly different to previous measures for the whole team during the training period analyzed by paired t-test ($p$ < 0,05). *Significantly different results between and within groups compared to pre-tapering measure at week 6 analyzed by two-way repeated measures ANOVA ($p < 0.001$). TWK: training week; TPWK: tapering week; GC: control group; GE: experimental group; AU- arbitrary units.

Table 1. Physical condition results of both groups at different time points.

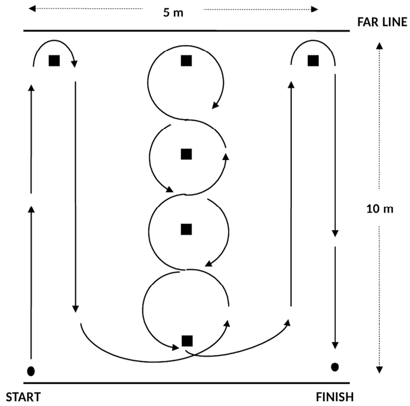
| | EG | | | CG | | | | |
|---|---|---|---|---|---|---|---|---|
| | PRE-TP | POST-TP | ΔEG% | PRE-TP | POST-TP | ΔCG% | $p$ | $\eta^2_p$ |
| Power (W/kg)[a] | 1029.71 ± 108.51 (964.47 – 1095.96) | 1084.21 ± 110.87* (1013.71 – 1154.72) | 5.4 | 945.31 ± 98.72 (880.07 – 1010.56) | 949.99 ± 113.32 (879.49 – 1020.50) | 0.4 | < 0.01[#] < 0.01* | 0.26 |
| Acceleration (s)[b] | 1.72 ± 0.09 (1.67 – 1.76) | 1.67 ± 0.07* (1.63 – 1.71) | -2.8 | 1.72 ± 0.06 (1.67 – 1.76) | 1.70 ± 0.06 (1.66 – 1.74) | -0.9 | < 0.05[#] < 0.01* | 0.23 |
| COD (s)[d] | 15.39 ± 0.35 (15.2 – 15.6) | 15.19 ± 0.16 (15.0 – 15.4) | -1.4 | 15.78 ± 0.37 (15.5 – 16.0) | 15.72 ± 0.41 (15.5 – 15.9) | -0.4 | 0.08 | 0.15 |

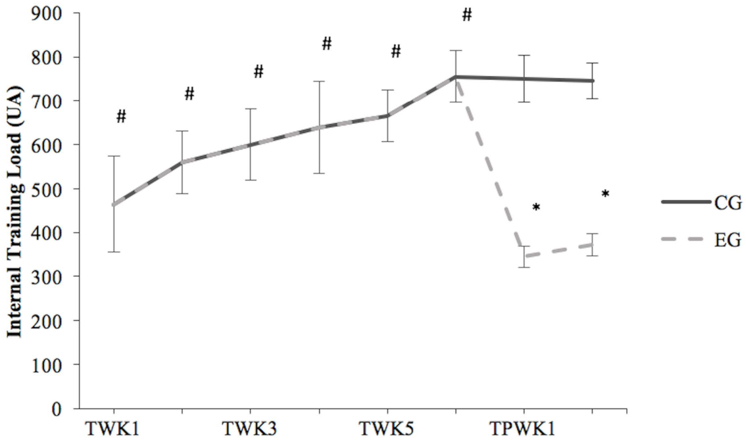
Data presented as mean ± SD; 95% confidence interval in brackets. [#]Significant interaction group x time from the between-groups analysis. *Significant results within-subject pre/post taper period ($p < 0.05$). COD: change of direction; GC: control group; GE: experimental group; PRE-TP: pre-tapering; POST-TP: post-tapering; $\eta^2_p$: partial eta-squared.

Table 2. REST-Q recovery-stress results of both groups at different time points.

| | EG | | | CG | | | | |
|---|---|---|---|---|---|---|---|---|
| | PRE-TP | POST-TP | Δ% | PRE-TP | POST-TP | Δ% | *p* | $\eta^2_p$ |
| Total Stress | 1.9 ± 0.5 (1.6 – 2.1) | 1.6 ± 0.5 * (1.3 – 1.9) | -17 | 1.7 ± 0.5 (1.4 – 2.1) | 1.8 ± 0.4 (1.5 – 2.1) | 10 | < 0.01# <br> < 0.01* | 0.3 |
| Total Recovery | 3.2 ± 0.2 (3.0 – 3.4) | 3.3 ± 0.3 (3.1 – 3.5) | 4 | 3.4 ± 0.4 (3.2 – 3.6) | 3.0 ± 0.3* (2.9 – 3.3) | -10 | < 0.001# <br> < 0.01* | 0.4 |

Data presented as mean ± SD and 95% confidence interval in brackets. #Significant interaction group x time from the between-groups analysis. *Significant results within-subject pre/post taper period ($p < 0.05$). GC: control group; GE: experimental group; PRE-TP: pre-tapering; POST-TP: post-tapering. $\eta^2_p$: partial eta-squared


5 m
FAR LINE
10 m
START
FINISH



Internal Training Load (UA)
900
800
700
600
500
400
300
200
100
0
TWK1
TWK3
TWK5
TPWK1
#
*
CG
EG