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Jean-Benoît Morin
University of Nice Sophia Antipolis

Yann Le Meur
AS Monaco Football Club

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Supercompensation Kinetics of physical qualities during a Taper in Team Sport Athletes

Bruno MARRIER[1, 2*], **Julien ROBINEAU**[2], **Julien PISCIONE**[2], **Mathieu LACOME**[2], **Alexis PEETERS**[2], **Christophe HAUSSWIRTH**[1], **Jean-Benoît MORIN**[3], **Yann LE MEUR**[1,3,4]

[1] Laboratory of Sport, Expertise and Performance (INSEP), EA 7370, National Institute of Sport, Expertise and Performance, Paris, France
[2]Research Department, French Rugby Federation (FFR), Marcoussis, France
[3]Université Côte d'Azur, LAMHESS, Nice, France
[4]AS Monaco Football Club, Monaco

***Corresponding author:**
Bruno MARRIER
French Rugby Federation (FFR) Research Department
3-5 rue Jean de Montaigu
91463 MARCOUSSIS Cedex, fRANCE
Email: brunomarrier@yahoo.fr
Tel: +33 1 69 63 64 65

Abstract

Purpose: Peaking for major competition is considered critical for maximizing team sports performance. However, there is little scientific information available to guide coaches in prescribing efficient tapering strategies for team sports players. The aim of this study was to monitor the changes in physical performance in elite team sports players during a 3-week taper following a pre-season training camp. **Methods:** Ten male international rugby sevens players were tested before (Pre) and after (Post) a 4-week pre-season training camp focusing on high-intensity training and strength training with moderate loads, and once each week during a subsequent 3-week taper (T1, T2, T3). During each testing session, mid-thigh pull maximal strength, sprint acceleration mechanical outputs and performance as well as repeated sprint ability (RSA) were assessed. **Results:** At Post, no single peak performance was observed for maximal lower limb force output and sprint performance, while RSA peaked for only one athlete. During the taper, 30-m sprint time decreased *almost certainly* (-3.1 ±0.9%, large), while maximal lower limb strength and RSA respectively improved *very likely* (+7.7 ±5.3%, small) and *almost certainly* (+9.0 ±2.6%, moderate). Of the peak performances, 70%, 80%, and 80% occurred within the first two weeks of taper for RSA, maximal force output and sprint performance, respectively. **Conclusions:** These results show the sensitivity of physical qualities to tapering in rugby sevens players and suggest that a ~1-2 week tapering timeframe appears optimal to maximize the overall physical performance response.

Key words: Rugby sevens, pre-season, training load, peak performance, detraining

Introduction

Team sports involve a combination of physical, physiological, psychological, technical and tactical factors that contribute to competitive performance. Given that most team sports require well-developed speed, acceleration, power, endurance, and agility, it is likely that effective training load management through training camps and taper periods would improve many or all of these athletic attributes [1]. The taper has been defined as "a progressive, nonlinear reduction of the training load during a variable amount of time that is intended to reduce physiological and psychological stress of daily training and optimize sport performance" [2]. The training taper can be considered at different times: at the end of the pre-season period to prepare for the start of the competition or during the competitive season to prepare for special events such as a major match, a series of important matches or an international tournament [3].

Since the early 1990s, tapering has been the focus of many training studies [3-9]. A 2-week taper (training volume exponentially reduced by 41-60% with no change in intensity/frequency) was shown to be the most efficient strategy to maximize performance gains [4]. However, most research has been conducted in individual and endurance sports (running, swimming, cycling, rowing and triathlon) [5-8]. In contrast, very little information is available in team sports [9], certainly because of their multifaceted nature in relation to physiological demands, training and performance [3].

Research investigating tapering in team sports has shown a supercompensation of physical qualities in most cases. After a 7-day taper, Coutts et al. [10] observed an increase in peak hamstring torque and isokinetic work, as well as increases in the multistage fitness test, vertical jump, 3-repetition maximum squat, 3-repetition maximum bench press, chin-up and 10-m sprint performance in semi-professional rugby league players. Similarly, Bishop and Edge [11] showed an increase in repeated sprint ability (RSA) after a 10-day taper in recreational level team-sport female athletes, with an improvement in total work, peak power output, and a reduced work decrement during RSA testing. Elloumi et al. [12] observed a systematic increase in performance during physical tests performed by elite rugby sevens players following a 14-day taper (30-m sprint, agility test, lactic test, five-jump test, Yo-Yo test level 2). Finally, de Lacey et al. [13] reported an increase in maximal power output and jump height in professional National Rugby League players after a 21-day taper. Altogether, these results show the sensitivity of physical qualities to tapering in team sport players. Nevertheless, the physical performance supercompensation reported in these studies was systematically observed at a single point in time, making it difficult to characterize and to compare the supercompensation kinetics for different physical qualities. It remains therefore difficult to determine which taper duration may be optimal to maximize physical performance peaking during the taper phase leading to a major competition in team sport athletes. Additionally, while previous research has highlighted a high inter-individual variability in individual sports in response to tapering [4], this aspect requires further investigation to be characterized in team sport players.

Rugby sevens is a team sport that requires players to repeatedly sprint, change direction and contest tackles and rucks, interspersed with periods of low to moderate intensity running [14]. The maximal physical performance of each player must be reached concomitantly during international sevens tournaments, which take place every five weeks in the World Series or after a 10-12 week training period for the Olympic Games. Accordingly, the period between tournaments gives the opportunity to optimize the length of tapering before each competition. The aim of the present study was to describe the supercompensation kinetics of physical qualities in international rugby sevens players during a step taper phase at the end of a pre-season training camp. We specifically aimed to examine the changes in lower limb maximal strength, sprint running performance and repeated sprint ability during a 3-week experimental taper programmed after a 4-week intense training period.

Methods

Subjects

10 elite male rugby sevens players (age: 26 ± 5 years, height: 179 ± 9 cm, body mass: 90 ± 11 kg), from the French team qualified for Rio 2016 Olympic Games, gave their written informed consent to participate in this study. This protocol was conducted in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). Before participation, all players had already completed a maximal aerobic speed (MAS) test. The MAS of each player was determined in an incremental test named "University Test of Bordeaux 2" (UTB 2). This test consisted of repeated 3-min runs, interspersed with 1-min rest periods (passive) between each 3-min. The speed was increased by 2 $km.h^{-1}$, between 8 and 12 $km.h^{-1}$, and 1 $km.h^{-1}$ from 12 $km.h^{-1}$ to volitional exhaustion [15]. Players were familiar with this test.

Design

The training content was monitored for a period of 7 weeks in total, divided into two distinct phases (Table 1). The first phase (I) consisted of 4 weeks during which the players completed a pre-season training program with progressive increase in training load. The second phase (II) involved a 3-week step taper. This tapering strategy was characterized by a reduction in: 1) the total distance covered during rugby sessions [about -30%, global positioning system (GPS) surveillance], 2) the number of sets during strength and high-intensity training sessions (about -50%) and 3) the frequency of training sessions (about -20%). The training intensity and session content remained the same during the taper than during the pre-season training camp. All testing occurred at the same time of the same day for all subjects (i.e. Monday morning, 10 a.m. - 1 p.m.). Warm up was performed prior to testing. To ensure that performance variations during each testing session were due to the global training regime and not to the training session(s) performed the day before, the players were required to respect a 24h rest period before each testing session.

Methodology

Training monitoring

During rugby training sessions, training volume and intensity were calculated on the basis of recordings from 8-Hz GPS units worn by all players during all the rugby sessions (Sensor Everywhere, Digital Simulation, France, mass: 87 g size: 102x52x19 mm). Preliminary work was conducted to ensure the quality of the GPS data and their high reliability in comparison with timing gate measurements (unpublished data). High-levels of validity (intra-class correlation: 0.99, typical error of measurement: 2.7 ± 0.3 %) and reliability (typical error of measurement: 1.0 ± 0.4 to 3.8 ± 1.8 %) were demonstrated from walking to high-velocity running. The maximal aerobic speed was used to individualize each player's speed thresholds.

During resistance training sessions, training volume and intensity were calculated according to the methods suggested by Baker et al. [16]. On the basis of the type of exercise, number of repetitions, sets, load, order of exercises, speed of lifting, rest period between sets and/or exercise, and periodization structure. Numbers of repetitions and the sets performed were chosen to regulate both volume and intensity.

Testing Methodology

During each testing session, players were asked to perform three tests in the same order, separated by approximately 10 min of rest between tests: two 30-m sprints to assess sprint acceleration mechanical output and sprint time; two isometric mid-thigh clean pull trials to assess maximal lower limb isometric strength and a repeated-sprint test (2 sets of five 6-s sprints) on a cycle ergometer to assess the repeated sprint ability. These physical tests were selected because faster sprint times are associated with greater attacking performance (e.g. line breaks, tries scored, defenders beaten) while performance in defensive measures and rucks are associated with sprint, jump and RSA performance during rugby Sevens tournaments [17]. The

Table 1. *Weekly average training during the 7-week protocol. Differences in training load parameters between weeks: * likely, ** very likely, *** almost certain vs. Training Camp. No clear difference were reported for weekly values during the taper phase. HIT: High Intensity Training*

		PRE-SEASON TRAINING CAMP	TAPER		
Duration (week)		4	1	1	1
Weekly total number of sessions		11	9 ***	9 ***	9 ***
Rugby Sessions	***Number of sessions***	5	5	5	5
	Total distance covered (m)	19671 ± 2143	14169 ± 1116 ***	14479 ± 1746 ***	14161 ± 1844 ***
	Distribution of training intensity <MAS / >MAS (%)	88 ± 8 / 12 ± 3	88 ± 7 / 12 ± 3	88 ± 5 / 12 ± 2	87 ± 6 / 13 ± 3
Resistance Training Sessions	***Number of sessions***	4	3 ***	3 ***	3 ***
	Total number of exercises / sets	40 ± 4 / 137 ± 15	22 *** / 74 ***	22 *** / 74 ***	22 *** / 74 ***
HIT Sessions	***Number of sessions***	2	1 ***	1 ***	1 ***

RSA test was performed on a bike [18] to limit large spikes in mechanical stress at the beginning of the pre-season training camp [19]. Subjects familiarized with each test during a preliminary session, in the conditions of the protocol. Before each testing session, body mass was measured to the nearest 0.1 kg with the same digital body weight scales (ADE Electronic Column Scales, Hamburg, Germany).

Measurements

Sprint performance and mechanics. The performance during two 30-m sprint was measured using a wireless sports timing system (Smart Speed, Fusion Sport, Australia) with a 0.01 s accuracy. Players started each sprint from a standing position with their feet set 0.5 m behind the first timing gate [20]. The latter was continuously measured during the 30-m acceleration using a radar device sampling at 48 Hz (Stalker Pro II Sports Radar Gun, Plano, TX). The radar was placed on a tripod, 5 meters behind the player and 1 meter above the ground, which approximately corresponded to the height of the players' center of mass. Air temperature, atmospheric pressure and wind speed (Pro Weather Station, Oregon Scientific, US) were used to estimate air density and friction force during the sprint [21]. The sprint acceleration mechanical outputs (theoretical maximal horizontal force, F_0; maximal horizontal sprinting power, P_{max}; theoretical maximal sprinting velocity, V_0) were then computed using the method of Samozino et al. [21], which is based on instantaneous speed-time measurements.

Isometric mid-thigh clean pull. All isometric testing was conducted on a force plate (Kistler 9286B, Kistler, Winterthur, Switzerland). The bar was positioned to correspond to the players' power clean second pull position, where the knee and hip angles were 140 ± 7° and 138 ± 13°, respectively. All force plate data were sampled at 1,000 Hz using Bioware version 5.2 (Kistler, Winterthur, Switzerland). The recommendations of Haff et al. [22] were followed for the implementation of this test. All analyses were performed on the 2 isometric mid-thigh clean pull trials. All force-time curves were analyzed with the use of a custom Matlab (version R2016a MathWorks, Naticks, US) program. The maximum force generated during the 5-s isometric mid-thigh clean pull trial was reported as the relative peak force (PF, $N.kg^{-1}$) [23].

Repeated sprint ability. The RSA protocol consisted of repeated 6-s sprints on a on an air-braked cycle ergometer (Wattbike Pro, Nottingham, UK) [24], interspersed with 24-s rest periods between each sprint. Two sets of 5 sprints separated by 60-s recovery were performed. Players were familiarized with cycle ergometer sprints during a first session in the conditions of the protocol. During the actual testing session, the warm-up consisted of pedaling at 100, 150, 200 and 250 W against medium friction loads every minute during 4 minutes and performing one 6-s sprint against maximum friction loads. After 3 minutes of rest and appropriate adjustment of the handlebar and saddle height to individual anthropometric characteristics, players performed the first 6-s sprint from a standardized similar starting position (preferred leg 45° forward). The relative mean power output (MPO, $W.kg^{-1}$) was selected for analysis.

Statistical analysis

In order to assess the practical meaning of the results, data were analyzed using the magnitude-based inference approach [25]. To reduce any possible bias arising from non-uniformity of error, all data were log transformed before analysis. The magnitude of the within-group changes was interpreted by using effect size (Cohen's *d*) values of 0.2, 0.6, 1.2, 2.0 and 4.0 of the between-athlete variation at Pre as thresholds for small, moderate, large, very large and extremely large differences [25]. Quantitative chances of higher or lower values than the smallest worthwhile change (SWC, equal to a Cohen's *d* of 0.2) were evaluated qualitatively as follows: <1%, almost certainly not; 1%–5%, very unlikely; 5%–25%, unlikely; 25%–75%, possible; 75%–95%, likely; 95%–99%, very likely; and >99%, almost certain. In the case of having beneficial/better or detrimental/power changes were both >5% higher or lower values was 5%, the true difference was assessed as unclear [25].

Results

Training Load between phase I and phase II (Table 1).

The total distance covered during the rugby sessions, decreased *almost certainly* very largely between pre-season training camp and the taper (-28 ± 7%, -26 ± 5% and -29 ± 11% for T1, T2 and T3, respectively). During the tapering phase, changes in total distance were systematically *unclear* with a trivial effect size. For all the other parameters, weekly changes were *almost certainly* trivial within the taper phase.

Performance changes throughout the protocol are shown in Figures 1 and 2.

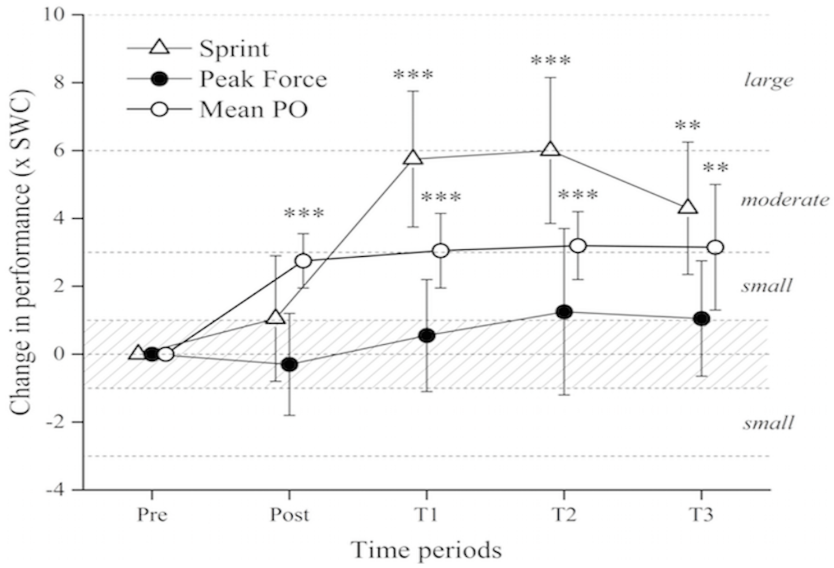

Figure 1. *Changes in performance (x SWC) from baseline during the three physical tests after the intensive training phase (Post) and each week of the tapering period (T1-T3). Differences in tests results from Pre: *likely, **very likely, ***almost certain.*
Note: a possible small decrease in sprint performance was reported from T2 to T3.

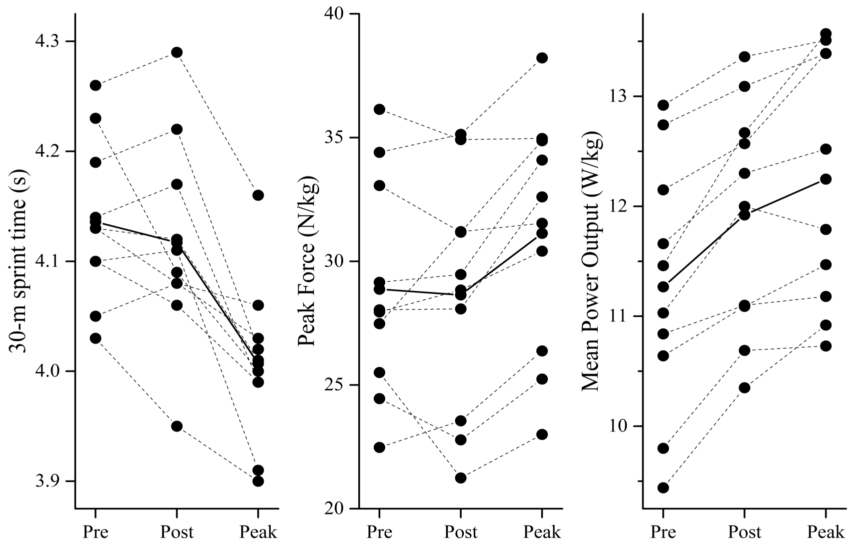

Figure 2. *Individual changes (dotted lines) and group mean (solid line) between Pre, Post and Peak (best performance during the taper) for 30-m sprint time (A), for Peak Force (B) and for MPO (C).*

Phase I (Table 2).

At the end of the pre-season training camp (Post), changes in 30-m sprint time (-0.5 ± 0.8%), P_{max} (-4.2 ± 5.4%), F_0 (-4.4 ± 6.4%) and V_0 (0.2 ± 1.6%) were *unclear*. Change in maximal isometric force output (PF) was also *unclear* (-1.1 ± 4.9%) while an *almost certain* increase in cycling MPO was observed (+6.0 ± 1.7%, moderate).

Phase II (Table 2).

During the tapering period, the group showed an *almost certain* performance supercompensation at T1 and T2 for the 30-m sprint time (-2.5 ± 0.9%, moderate and -2.6 ± 1.0%, large, respectively) and MPO (+6.7 ± 2.3%, large and +7.1 ± 2.1%, large, respectively) while isometric mid-thigh pull performance changes were *unclear*. At T3, the group *very likely* improved its performance during the 30-m sprint (-1.9 ± 0.9% in 30-m time, moderate) and the RSA tests (+6.9 ± 4.0% in MPO, moderate) while isometric mid-thigh pull performance changes remained *unclear*, when compared to Pre values. Between T2 and T3, the group showed a *possible* increase for the 30-m sprint time (+0.8 ± 1.0%, small) while isometric mid-thigh pull and RSA performance changes were *unclear.*

Performance peak (Table 3 and 4).

Individual data points for peak performance are presented in Figure 2 (A, B, C). The 30-m sprint time decreased *almost certainly* largely from baseline to peak performance (ES: -1.61 ± 0.47) and V_0 increased *likely* with a small magnitude (ES: 0.38 ± 0.36). Similarly, mid-thigh pull PF peaked *very likely* with a small increase (ES: 0.43 ± 0.30). RSA performance was *almost certainly* moderately increased (ES: 0.79 ± 0.23).

Table 2. *Mean values (± SD) at baseline (Pre), after the pre-season camp (Post) and at the end of each week of the tapering period (T1-T3). Differences in tests results from Pre: *likely, **very likely, ***almost certain.* P_{max}*: Maximal power output produced in the horizontal direction,* F_0*: Maximal horizontal force capability,* V_0*: Maximal velocity capability PF: Peak Force, MPO: Mean power output; QD: Qualitative Difference*

		PRE	POST	T1	T2	T3
Sprint Performance	**30-m (s)** Change % QD	4.14 ± 0.07	4.12 ± 0.09 -0.5 ± 0.8 % *Unclear*	4.03 ± 0.07*** -2.5 ± 0.9 % *Almost certain moderate decrease*	4.03 ± 0.07*** -2.6 ± 1.0 % *Almost certain large decrease*	4.06 ± 0.09** -1.9 ± 0.9 % *Very likely moderate decrease*
Sprint Mechanical Outputs	**P_{max} (W.kg^{-1})** Change % QD	18.77 ± 1.31	18.00 ± 1.43 -4.2 ± 5.4 % *Unclear*	18.40 ± 0.88 -1.8 ± 3.9 % *Unclear*	18.08 ± 1.08 -3.6 ± 5.0 % *Unclear*	18.92 ± 1.53 0.7 ± 5.5 % *Unclear*
	F_0 (N.kg^{-1}) Change % QD	8.19 ± 0.61	7.83 ± 0.53 -4.4 ± 6.4 % *Unclear*	7.94 ± 0.41 -2.9 ± 4.8 % *Unclear*	7.79 ± 0.37 -4.8 ± 6.1 % *Unclear*	8.23 ± 0.62 0.5 ± 6.7 % *Unclear*
	V_0 (m.s^{-1}) Change % QD	9.24 ± 0.29	9.27 ± 0.30 0.2 ± 1.6 % *Unclear*	9.35 ± 0.34 1.2 ± 1.5 % *Unclear*	9.36 ± 0.31 1.3 ± 1.6 % *Unclear*	9.27 ± 0.36 0.2 ± 1.6 % *Unclear*
Mid-thigh Pull Performance	**PF (N.kg^{-1})** Change % QD	28.87 ± 4.43	28.64 ± 4.87 -1.1 ± 4.9 % *Unclear*	29.42 ± 4.84 1.4 ± 5.5 % *Unclear*	30.27 ± 5.27 4.4 ± 7.4 % *Unclear*	30.05 ± 5.49 3.5 ± 5.7 % *Unclear*
RSA Performance	**MPO (W.kg^{-1})** Change % QD	11.27 ± 1.16	11.92 ± 1.05*** 6.0 ± 1.7 % *Almost certain small increase*	12.00 ± 0.99*** 6.7 ± 2.3 % *Almost certain moderate increase*	12.06 ± 1.19*** 7.1 ± 2.1 % *Almost certain moderate increase*	12.04 ± 1.21** 6.9 ± 4.0 % *Very likely moderate increase*

Table 3. Tests results (Mean ± SD) - PRE / PEAK

*Differences in tests results between Pre and Peak (best performance during the taper): *likely, ** very likely, ***almost certain.*
ES: Effect size, CL: Confidence limits, P_{max}: Maximal power output produced in the horizontal direction, F_0: Maximal force capability, V_0: Maximal velocity capability, PF: Peak Force, MPO: Mean power output.

		PRE	PEAK	Change in mean (%)	ES, ±90% CL	Qualitative difference
Sprint *Performance*	***30-m (s)***	4.14 ± 0.07	4.01 ± 0.07***	-3.1 ± 0.9	-1.61 ± 0.47	*Almost certain large decrease (0/0/100)*
Horizontal Mechanical Properties	***P_{max} ($W.kg^{-1}$)***	18.77 ± 1.31	18.89 ± 1.30	0.6 ± 3.5	0.08 ± 0.46	*Unclear (51/23/27)*
	F_0 ($N.kg^{-1}$)	8.19 ± 0.61	8.12 ± 0.45	-0.7 ± 4.1	-0.10 ± 0.58	*Unclear (28/20/52)*
	V_0 ($m.s^{-1}$)	9.24 ± 0.29	9.37 ± 0.32*	1.4 ± 1.3	0.38 ± 0.36	*Likely small increase (93/4/3)*
Mid-thigh pull	***PF ($N.kg^{-1}$)***	28.87 ± 4.43	31.13 ± 4.88**	7.7 ± 5.3	0.42 ± 0.37	*Very likely small increase (98/1/1)*
RSA	***MPO ($W.kg^{-1}$)***	11.27 ± 1.16	12.27 ± 1.15***	9.0 ± 2.6	0.79 ± 0.23	*Almost certain moderate increase (100/0/0)*

Table 4. *Occurrence (number of subjects) of the best performance during the taper (Peak) in response to the pre-season camp: Post, immediately after the intense period; T1-3, after 1,2 or 3 week(s) of tapering. PF = Peak force; MPO = Mean power output.*

	Post	***T1***	***T2***	***T3***
30-m sprint	0	3	5	2
PF	0	1	7	2
MPO	1	4	3	2

Discussion

The aim of this study was to investigate the taper-induced supercompensation kinetics of three major physical qualities associated with performance in team sports. The major findings were: 1) sprint performance, maximal strength and RSA were sensitive to the taper; 2) a tapering period of ~1-2 weeks seemed optimal, even if a minority of players may benefit from a longer period of reduced training; 3) sprint performance might decline earlier than peak force and RSA during a prolonged taper phase.

Optimal taper duration

One of the main findings was that mean performance in sprint, maximal strength and RSA peaked after 1-2 weeks of tapering. The largest part of the performance rebound occurred within the first week of the taper phase for RSA and sprint performance. A 6.7% increase in RSA was observed after one week of taper and reached 7.1% at the end of the following week. Similarly, 30-m sprint time improved after one week of reduced training and peaked a week after (-2.5% and -2.6%, at T1 and T2, respectively). Despite changes in maximal strength remaining *unclear* throughout the taper, a small improvement in this parameter was observed after the second week of reduced training. In this regard, Buchheit et al. [26] showed a *likely* small increase in isometric mid-thigh pull peak force after a 2-week Christmas break (reduction in training load), including 8 to 10 training sessions, in a professional Australian Football League club. These results demonstrate that a 2-week taper may represent an effective window to optimize the physical performance response, when a ~30% decrease in total distance and ~50% decrease in strength and high-intensity training is prescribed. They suggest that a positive yet smaller response to taper can already be expected after only one week of reduced training, when it is not possible to program a longer tapering period. These observations are consistent with previous research that has systematically shown supercompensation phenomena after 7-, 10- and 14- days of taper but without showing which duration may be optimal to maximize the physical performance response to taper in team sport players [11, 27]. Only the results reported by Coutts et al. [10] contrast with our observations. These authors showed that 40-m sprint performance was not improved at the end of a 7-day taper while a phenomenon of supercompensation was observed during other performance tests (multistage fitness test, vertical jump, 3-RM squat, 3-RM bench press and chin-up and 10-m sprint performance). This observation was likely due to the overreaching state induced by the pre-taper phase in this study suggesting that a 7-day period may not be sufficient for sprint performance to supercompensate, when the fatigue accumulated during the pre-taper phase is very high. This was already suggested by the mathematical modeling study of Thomas et al. [28] and indicates that the results of the present study could have been different with a more severe state of fatigue in the players.

'Fast-' and 'slow-peaking' profiles

When looking at individual performance, no single peak performance was observed before tapering (i.e. at the end of the intense training phase) for maximal lower limb force output and sprint performance, while RSA peaked for only one athlete at Post. This result clearly demonstrates the importance of tapering for team sport players when high physical performance is expected. Additionally, the majority of peaks occurred within the two first weeks of tapering (70%, 80%, 80% for RSA, sprint and peak force, respectively), while only 20% of performance peaks were observed at T3 for all the physical qualities. Interestingly, no single player with at least one peak performance at T3 reached his peak performance at Post or at T1 for another physical quality. These findings show that ~1-2 weeks may represent an optimal tapering duration in rugby sevens but also that a minority of players may benefit from longer tapering period (~3 weeks). These observations also underline the difficulty to organize a training program adapted to each individual. Because the synchronization of these performance peaks for all players may represent a real added value for the overall team success in a match/tournament, the present findings encourage differentiation of the taper duration for 'fast-' and 'slow-peaking' profile athletes. Further investigations are required to confirm this result on a larger population of elite team sport players and to determine whether these responses to taper are reproducible.

Detraining
The present results showed that sprint performance might decline earlier than peak force and RSA during a prolonged taper phase. A *possible* small decrease in sprint performance was indeed observed after 3 weeks of taper even if this parameter remained higher at this time point than at the end of the training camp. While 3 players reached their peak sprint performance at T3, substantial declines were observed in other players (up to 3.5% in one player). This result demonstrates that the sprint performance response to a prolonged period of reduced training was highly individual in the present group of players. It also suggests that either sprint qualities are more sensitive to detraining than RSA and maximal strength or, that the strategy used in the present study to reduce the training load during the taper was not optimal for this physical quality. Future studies are necessary to clarify this point. In contrast, the present study also shows that RSA and maximal strength might be maintained during a 3-week taper when training intensity is preserved, despite a large decrease in training volume and a small decrease in training frequency. With regard to maximal strength, these results are in line with the meta-analysis of Bosquet et al. [29] who showed that the decrease in maximal force became significant from the third week of inactivity and with the recommendations provided by Pritchard et al. [27], suggesting that tapering duration may extend up to 4 weeks for this physical quality. Similarly, the robustness of RSA performance response, which has been shown to strongly rely on aerobic qualities [30, 31], was in line with the recent results reported by Aubry et al. [8], who showed that endurance performance can be preserved during a 4-week taper despite a 50% reduction in training volume. These findings may be particularly interesting when multiple peaking is expected over several consecutive weeks, as is often the case in team sports championships or tournaments.

Practical Applications

This study potentially provides valuable practical information for team sport coaches. They demonstrate that 1) key physical qualities are sensitive to taper in team players, 2) a window of ~1-2 weeks seems effective for most athletes and 3) sprint performance decline earlier. These observations can help coaches better control their training program and to ensure that the players reached their peak of physical performance at specific times of the competitive season. Further studies are now required to determine if these findings are confirmed in a larger population of elite team sport players and in female players.

Conclusions

This study is the first to characterize and to compare the effects of taper on three major physical qualities in elite team sport players, through a prolonged period of reduced training (i.e. > 2 weeks) involving repeated performance assessments. Sprint performance, maximal strength and RSA were sensitive to the taper. A tapering period of ~1-2 weeks seemed optimal, even if a minority of players may benefit from a longer period of reduced training. Finally, sprint performance might decline earlier than peak force and RSA during a prolonged taper phase.

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