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DETRAINING EFFECT OF THE POST-SEASON ON SELECTED AEROBIC AND ANAEROBIC PERFORMANCE VARIABLES IN NATIONAL LEAGUE RUGBY UNION PLAYERS: A FOCUS ON POSITIONAL STATUS

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Abstract

Introduction: The study aimed to assess the effects of 6 weeks post-season detraining in relation to player position on selected anaerobic, aerobic and anthropometric characteristics in sub-elite rugby union players.

Methods: 34 English National Division One rugby players (mean age 24.6 ± 3.7 years; stature 184 ± 8 cm) were recruited from one professional club and divided into four groups based on playing positions: Tight five forwards (T5), loose forwards (LF), inside backs (IB), and outside backs (OB). Participants were assessed for body mass, sum of 7 skinfolds, countermovement and squat jump performance, 1 repetition maximum bench press and squat, 40m sprint time, 5m multiple shuttle test, and 20m multi-stage fitness test at baseline and 6 weeks later following the post-seasonal break.

Results: Performance deteriorated in all fitness tests (all $P<0.05$) for each playing position following detraining. Following detraining, sum of seven skinfolds increased significantly for each player position ($P<0.05$), and in the T5 group, body mass also increased ($P<0.05$).

Conclusions: Six weeks of training cessation led to deleterious changes in aerobic and anaerobic performance variables in national league rugby union players irrespective of positional status. The T5 group increased body mass ($P<0.05$) unlike other playing positions.

***Key words**: Strength and conditioning, training cessation, close season, maintenance training*

Introduction

The modern concept of periodisation can be described as the 'long-term cyclic structuring of training and practice to maximise performance to coincide with important competitions' (p.314) [1]. An essential part of the periodised training programme occurs during transitional phases, which allow athletes to recover and rest after completion of a strenuous training programme [2]. One common occurrence during a transition phase is at the conclusion of the sporting year where, during a post-seasonal break, the athlete may reduce or even stop exercising at their typical training load [3]. This decreased activity allows recovery of body tissues as well as a psychological break from the demands of training and competition [4]. During these periods training levels are typically lowered, therefore, the physiological adaptations gained as a result of a series of programmed conditioning may be lost or reduced [5]. Detraining negatively affects physical capabilities and can therefore impact greatly on subsequent training and competition performance. If athletic potential is decreased over a post-season break more time will have to be spent retraining to overcome deficiencies and increasing physical capabilities above baseline, rather than improving technical and tactical play [6].

The focus of detraining research in athletes has examined either in-season changes in physical capabilities and characteristics or post-seasonal alterations. In-season fitness changes and possible detraining effects have previously been examined in soccer [6], amateur rugby union [7], handball [3], and college football [8]. Inter-study comparisons are difficult because of differences in study design, and consequently study outcomes are equivocal. A general profile of physical characteristics specific to playing position is well established in rugby union [9]. Thus, heterogeneity between playing position in relation to anaerobic, aerobic, and anthropometric performance characteristics has been previously documented [10]. Therefore, the aim of our study was to characterise the detraining effect of National League rugby union players by analysing a variety of anthropometric, aerobic, and anaerobic performance measures after 6-weeks of post-season detraining, and then investigating the role of positional status on these variables.

Materials and methods

Participants

Institutional ethical approval was gained prior to the study and all participants provided written informed consent. A total of 34 male National Division One rugby players, aged between 18 and 30 years (24.4 ± 3.7 years) volunteered to participate. The Division One Championship is the second tier of rugby union (behind the Premiership) in the United Kingdom. The inclusion criteria required participants to be injury free, playing first-team National League rugby union, and free from ergogenic aids including creatine for three weeks prior to initial testing. Ergogenic practices were determined through a self-report process. A total of 38 participants matched the selection criteria, however two volunteers dropped out because of other commitments during the data collection and a further two were omitted because of injuries sustained in games that may have impaired performance during testing.

General procedures

Players were recruited from the first team squad and were divided into four positional groups: the tight five forwards (T5) (hookers, props and second rows) (n=10), loose forwards (LF) (flankers and number eights) (n=9), inside backs (IB) (scrum halves, fly halves, inside and outside centres) n=8, and outside backs (OB) (wingers and full backs) (n=7). Data collection was conducted over a total of six days, split into three days pre-break testing (>72 hours after final game of the season) followed exactly six weeks later by three days of post-break testing. During the intervening 6-week post-seasonal break, participants were allowed to take part in light physical activity (running, cycling, swimming), but were advised not to conduct any programmed series of conditioning. For monitoring purposes, 3-day diet diaries were given to participants for completion during week 3 of the post-season break, as well as training diaries for the entirety of the break. Exercise testing followed the same protocol, using specific field tests of aerobic and anaerobic performance (5m multiple shuttle test, 20m multi-stage fitness test, 40m sprint test, countermovement and squat jump, 1 repetition maximum bench press and squat) and anthropometric measures (body mass, sum of seven skinfolds, and girths). Specific changes in field tests and measures of anthropometry were used to identify if the effect of detraining had caused alterations in physical performance or body composition.

Experimental standardisation

All measurements conducted during the study were taken and recorded by the same researcher in order to reduce the likelihood of measurement error. Testing sessions were standardised, with anthropometric measures and field tests being conducted at the same times of the day. The impact of variation in environmental conditions could not be controlled during outdoor field-testing. However, the effect of air temperature on selected anaerobic performance variables were minimised if suitable clothing and warm-up protocols were adhered to before testing [11]. Participants were asked to report to testing sessions wearing standardised clothing and footwear. All outdoor field tests were completed on grass surfaces to increase external validity. Participants were reminded to maintain the same diet for the 24-hrs prior to each testing period, in addition to limiting alcohol consumption 48-hrs prior to testing.

Procedures

5m multiple shuttle test

The 5-m multiple shuttle test (5m MST) is a repeated sprint test that aims to assess the ability to resist fatigue during a number of high-intensity efforts. Whilst performance in the test may be hampered by high body mass the test recreates typically rugby union movement patterns with similar work:rest ratios [12]. The 5m MST was completed on the first day of testing on a grass surface. All participants had prior experience of completing the test. Participants reported at separate times depending on positional group, and conducted a standardised warm-up prior to beginning the test. The warm-up consisted of a 10 min regular team warm-up (light jogging and dynamic stretching) followed by 2 submaximal repetitions of the shuttle pattern, completing a distance of 110m, with 35 seconds rest between. Participants were then fitted with a downloadable heart rate monitor (Polar Vantage XL, Polar Electro, Kempele, Finland). A shuttle grid was laid out, with a start line and lines 5m apart in a straight line up to 30m. Participants were instructed to perform maximally throughout the test, with no pacing strategies. On an auditory signal, participants began the test, sprinting to the first (5m) line, touching the line with either foot and returning to the start. Participants then sprinted to the 10m line, back to the start, and so on, until 30 seconds had been completed. Participants were tested in pairs, with strong verbal encouragement given to ensure maximal effort. In addition, heart rates and ratings of perceived exertion (RPE) on Borg Scale 6-20 [13] were taken after each repetition to assess whether participants were exercising maximally [14]. Distance achieved, to the nearest 2.5m, was then recorded for each effort. Participants completed 6 repetitions, with 35-seconds rest. Total and peak distances were recorded.

40m-sprint test

Participants sprinting performance was assessed over 40m on a grass surface on the second day of testing. The 40m distance was measured using a fiberglass measuring tape to the nearest centimetre. Infra-red timing gates (Brower Timing Systems, Salt Lake City, Utah, USA) were placed at a height of 1m at the start and at the end of the 40m. Prior to testing, participants were required to complete the same standardised warm-up used before the 5m MST. Two submaximal attempts over 20m were then completed to familiarise participants with the starting technique. A 3-point crouched stance was utilised to minimise the possibility of prematurely starting the timer as weight can be evenly distributed over three limbs [15]. During testing, participants sprinted from the starting position, and timing commenced when the timing beam was broken. Participants sprinted all-out until the final beam was broken. Participants completed three sprints interspersed with a 60-second recovery and the best 40m-sprint time was then recorded.

20m multi-stage fitness test (20m MSFT)

Participants completed the 20m MSFT in pairs on a grass surface, 10-15 minutes after completing the final 40m sprint bout. Participants were required to shuttle run between two markers placed 20m apart to meet audible 'bleeps'. Participants continued to volitional fatigue or were removed from the test when two consecutive bleeps were missed. Heart rate and RPE was taken immediately after completion of the test, and recorded. Level and shuttle number completed was also recorded for the prediction of $\dot{V}O_2$max [16].

Vertical jump test (VJT)

VJT was conducted on day three using portable jump mats (Takei Jump Meter, Tokyo, Japan). A standardised warm-up and two familiarisation efforts of each type of jump preceded testing. Participants then completed three countermovement jumps (CMJ) and squat jump (SJ) separated by a 60-second recovery. For both jumps, participants were prohibited from using arms swings, so hands were placed on hips, and were instructed to jump using triple extension of the ankles, knees, and hips, landing without flexion in any of these joints. For CMJ, participants were allowed to pre-load on the downward motion at their own pace. SJ required participants to pause for two seconds when their posterior thigh was parallel to the ground before exploding upwards. The best CMJ and SJ heights were then recorded to the nearest 0.1cm.

1-repetition maximum strength testing

Evaluation of upper and lower body muscular strength using a 1-repetition maximum (1RM) protocol, took place after VJT testing. 1-RM was defined as the heaviest resistance that can be lifted for one complete repetition of an exercise. Maximal isotonic strength testing was conducted using free weights. All participants had long histories of strength training utilising free weights, as well as experience of 1-RM strength testing. Test-retest reliability of 1-RM assessments are known to be high among experienced lifters [17]. Thus, participants were able to estimate their maximum 1-RM, possibly diminishing the difficulties associated with fatigue during trial and error weight selection [18]. It has been suggested that 1-RM testing poses a greater risk of injury to individuals [19], therefore all testing was monitored by a qualified strength and conditioning coach to ensure participants adopted correct technique when performing their lifts. Upper body muscular strength was assessed using the bench press, with lower body strength using the back squat. Such core lifts mimic common body positions and movement patterns found in rugby union, such as hand offs and scummaging. 1-RM bench press was completed first. All participants completed a brief upper body warm-up, consisting of two sets of shoulder external rotation, upright row, and lateral pull-downs. Participants then familiarised themselves with the bench press technique with five repetitions at 50kg, using a pronated grip with arm width no closer than shoulder width. Participants were instructed to lower the weight until it touched the sternum and, without bouncing off their chest, lift until both elbows were fully extended. 1-RM was to be achieved within five attempts, with a 3-4 minute recovery allowed between each effort.

1-RM back squat then took place after a 3-4 minute recovery. Eight squats with no weight were used as a warm-up, along with five repetitions at 60 kg. Participants then increased the weight so that 1-RM was achieved within five attempts. Back squats were performed with feet just outside shoulder width, with the weight lowered until the posterior thigh was parallel to the floor. Participants then lifted the weight, without a bounce, until they were standing upright with both knees fully extended. Participants were encouraged to lift with their legs, staying upright, and driving their hips forwards, to minimise the pressure placed on their lower back. Strong verbal encouragement was given for both 1-RM bench press and back squat, along with instructions to maintain technique throughout the lift. Participant's score were recorded to within 2.5 kg of their maximum effort.

Anthropometric testing

Participants body mass was measured to the nearest 0.1 kg on electronic scales (Seca, Hamburg, Germany) and stature was measured using a stadiometer (Seca, Hamburg, Germany) to the nearest 0.1 cm. Sum of seven skinfolds was taken using Harpenden skinfold calipers (John Bull, British Indicators, St Albans) on the right hand side of the body, when relaxed and standing upright, to within 0.2 mm. The average of the three measurements was then recorded. The seven sites measured were as follows: biceps brachii (vertical fold at the midacromiale-radiale line on the anterior surface of the upper arm); triceps (vertical fold at the mid-acromiale-radiale line on the posterior surface of the upper arm); subscapular (oblique fold running distal to the inferior angle of the scapula); suprailiac (oblique fold on the midaxillary line 5 cm superior to the iliac crest); abdominals (vertical fold 5 cm lateral to, and at the level of, the umbilicus); anterior thigh (vertical fold on the anterior surface of the thigh midway between the inguinal crease and the patella with the participants knee flexed at 90° and foot relaxed on a box); medial calf (vertical fold on the medial aspect of the calf at the point of greatest circumference, with the participants knee flexed at 90° and foot relaxed on a box) [20, 21].

Diet and exercise diaries

An assessment of nutritional and exercise habits during the close season was required for each participant. We used 3-day diet diaries as these have been shown to have greater compliance rates in athletes and may provide a more accurate account of nutritional intake [22]. Exercise patterns are also known to vary in participants during unsupervised breaks resulting in differences in physical performance [6]. Although dependent on participants' compliance, exercise diaries may also provide a rough estimation of energy expenditure. Three-day diet diaries and 6-week exercise diaries were given to the participants on the final day of baseline testing. Three-day diet diaries were completed 3 weeks later. Participants were instructed to record all food and drink ingested during those days, using exact weights, household measures, or approximate amounts to describe quantities consumed, as well as cooking methods used. Diet diaries were then collected during follow up testing, to be later analysed using CompEat Pro nutritional analysis software (CompEat, Banbury) for calorific and nutritional content. Participants were also asked to record all exercise performed during the entire 6-week break, noting type, volume, duration, and intensity of activity where possible.

Data and Statistical Analyses

All statistical analyses were completed using SPSS 17 for windows (SPSS Inc, Chicago). Descriptive statistics for each of the anthropometric, anaerobic and aerobic performance measures were calculated for each positional group including mean and standard error of the mean. The Shapiro Wilk test of normality was conducted prior to further statistical testing since there were four independent samples with less than twenty-five observations. Analysis of variance (ANOVA) with repeated measures was used to identify differences between the playing positions and Tukey *post-hoc* testing identified where the differences were found. Statistical significance was set at $P<0.05$.

Results

Thirty four male English National Division One rugby union players (mean age 24.6 ± 3.7 years; stature 184 ± 8 cm) were recruited to the study. Baseline demographic data in relation to playing position are shown in Table 1. Following 6 weeks of detraining, sum of seven skinfolds increased significantly from 61 ± 9 to 65 ± 9 mm (P=0.001) in all players, and this trend

Table 1. *Baseline descriptive data separated by playing position*

Player position (mean ± SEM)	T5	LF	IB	OB	Total
Participants	10	9	8	7	34
Age (years)	24.8± 2.9	25.5± 4.6	24.2± 3.7	23.8± 3.8	24.6± 3.7
Stature (cm)	184.4± 9.4	187.7± 6.9	178.7± 5.0	184.6± 5.4	184.0± 7.6

T5: tight five; LF: loose forwards; IB: inside backs; OB: outside backs

Table 2. Changes in anthropometric profile following detraining

Group (mean ± SEM)	n	Mass (kg)				Sum of 7 Skinfolds (mm)			
		Baseline	Follow up	P-value	Mean % Change	Baseline	Follow up	P-value	Mean % Change
T5	10	111.4 ± 6.1	113.4 ± 5.6	0.01*	1.7 ± 1.2	68.7 ± 9.8	74.5 ± 8.1	0.003*	8.5 ± 7.9
LF	9	105.8 ± 7.9	105.7 ± 8.9	1.00	-0.03 ± 1.6	62.2 ± 5.9	64.4 ± 4.5	0.025*	3.6 ± 4.0
IB	8	94.5 ± 10.9	94.4 ± 9.9	0.73	- 0.2 ± 1.3	56.2 ± 7.0	59.3 ± 7.0	0.034*	5.4 ± 5.7
OB	7	93.2 ± 6.3	93.7 ± 6.9	0.22	0.6 ± 1.0	55.1 ± 4.5	57.0 ± 4.2	0.028*	3.5 ± 7.5
Total	34	102.2 ± 10.9	102.8 ± 11.3	0.04*	- 0.6 ± 1.6	61.2 ± 8.9	64.7 ± 9.4	<0.001*	5.5 ± 6.6

*Significant difference (P<0.05)

Table 3. *Changes in anaerobic performance tests*

Group	n	CMJ (cm)				SJ (cm)			
		Baseline	Follow up	*P*-value	Mean % Change	Baseline	Follow up	*P*-value	Mean % Change
T5	10	47.9 ± 5.8	47.1 ± 5.7	0.005*	- 1.6 ± 1.1	44.2 ± 6.1	43.8 ± 6.3	0.062	- 0.8 ± 1.3
LF	9	50.2 ± 3.1	49.0 ± 3.3	0.001*	- 2.3 ± 1.3	46.4 ± 3.2	45.8 ± 3.1	0.043*	-1.3 ± 1.8
IB	8	55.5 ± 4.4	53.1 ± 3.9	0.001*	- 4.5 ± 2.0	50.3 ± 5.2	49.5 ± 4.5	0.060	- 1.7 ± 1.7
OB	7	58.6 ± 7.9	56.3 ± 6.8	0.003*	- 3.9 ± 0.2	53.5 ± 9.4	52.2 ± 8.9	0.003*	- 2.5 ± 1.1
Total	34	52.5 ± 6.7	50.9 ± 6.0	<0.001*	- 2.9 ± 0.2	48.1 ± 6.9	47.4 ± 6.5	0.02	- 1.5 ± 1.6

*Significant difference ($P<0.05$)

Table 4. *Changes in 1RM strength testing*

Group	n	1RM Bench Press (kg)				1RM Squat (kg)			
		Baseline	Follow up	*P*-value	Mean % Change	Baseline	Follow up	*P*-value	Mean % Change
T5	10	125.8± 7.9	117.8± 4.6	<0.001*	- 6.4± 2.9	173.8± 11.1	162.5± 6.4	0.005*	- 6.5± 2.9
LF	9	120.0± 6.7	115.3± 5.2	0.001*	- 3.9± 2.3	163.3± 3.5	155.3± 3.6	<0.001*	- 4.9± 2.5
IB	8	118.1± 11.9	112.5± 8.5	0.011*	- 4.8± 3.6	167.2± 6.6	157.2± 5.3	0.010*	- 6.0± 1.5
OB	7	112.1± 10.3	108.6± 8.8	0.008*	- 3.2± 2.0	162.5± 15.6	152.1± 13.4	0.001*	- 6.4± 2.5
Total	34	119.6± 10.0	114.0± 7.3	<0.001*	- 4.6± 2.9	167.1± 10.6	157.2± 8.2	<0.001*	- 5.9± 2.4

* Significant difference ($P<0.05$)

Table 5. *Changes in 40m sprint and 20m MSFT tests*

Group	n	40m Sprint Time (s)				20m MSFT (shuttles completed)			
		Baseline	Follow up	*P*-value	Mean % Change	Baseline	Follow up	*P*-value	Mean % Change
T5	10	6.1 ± 0.2	6.2 ± 0.2	0.03*	1.6 ± 1.2	99.0 ± 10.0	91.6 ± 7.7	0.004*	- 7.5 ± 5.2
LF	9	6.0 ± 0.1	6.1 ± 0.1	0.02*	1.0 ± 0.6	107.6 ± 12.1	97.2 ± 8.1	<0.001*	- 9.6 ± 3.6
IB	8	5.8 ± 0.2	5.9 ± 0.1	0.03*	2.3 ± 0.9	117.5 ± 10.6	102.3 ± 9.1	<0.001*	- 13.0 ± 3.2
OB	7	5.6 ± 0.3	5.7 ± 0.3	0.02*	2.7 ± 1.4	113.6 ± 11.1	97.4 ± 14.2	0.018*	- 14.2 ± 11.4
Total	34	5.9 ± 0.3	6.0 ± 0.3	0.01*	1.8 ± 1.2	108.6 ± 12.7	96.8 ± 10.1	<0.001*	- 10.5 ± 6.6

* Significant difference ($P<0.05$)

Table 6. *Changes in predicted maximal oxygen uptake values and 5m MST testing*

Group	n	20m MSFT Predicted $\dot{V}O_2max$ (ml.kg.min-1)				5m MST Total Distance (m)			
		Baseline	Follow up	*P*-value	Mean % Change	Baseline	Follow up	*P*-value	Mean % Change
T5	10	51.6 ± 3.0	49.3 ± 2.3	0.001*	- 4.5 ± 2.8	684.8 ± 59.0	666.0 ± 45.8	0.005*	- 2.7 ± 2.3
LF	9	54.4 ± 3.3	51.1 ± 2.4	<0.001*	- 6.1 ± 2.2	697.2 ± 39.8	678.1 ± 31.4	<0.001*	- 2.7 ± 1.3
IB	8	57.0 ± 3.0	52.7 ± 2.5	<0.001*	- 7.5 ± 2.0	720.3 ± 41.2	700.3 ± 37.2	<0.001*	-2.8 ± 1.0
OB	7	55.9 ± 3.1	52.5 ± 2.7	0.001*	- 6.1 ± 2.2	695.4 ± 45.9	676.8 ± 44.4	0.001*	- 2.7 ± 1.1
Total	34	54.5 ± 3.6	51.2 ± 2.7	<0.001*	- 5.9 ± 2.5	698.6 ± 47.4	679.5 ± 40.3	<0.001*	- 2.7 ± 1.5

* Significant difference ($P<0.05$)

was also evident when separated by player position (Table 2). In the T5 group, body mass increased from 111 ± 6 kg to 113 ± 6 kg ($P=0.01$; Table 2).

Decreases in CMJ performance (53 ± 7 cm v 51 ± 6 cm; $P<0.05$; Table 3), 1RM bench press (120 ± 10 kg v 114 ± 7 kg; $P<0.05$; Table 4), 1RM squat (167 ± 11 kg v 157 ± 8 kg; $P<0.05$; Table 4), 40m sprint performance (5.9 ±0.3 seconds v 6.0 ± 0.3 seconds; $P<0.05$; Table 5), 20m MSFT (109 ± 13 shuttles v 97 ± 10 shuttles; $P<0.05$; Table 5), predicted $\dot{V}O_2max$ (55 ± 4 ml/kg/min v 51 ± 3 ml/kg/min; $P<0.05$; Table 6) and for 5m MST distance (699 ± 47 m v 680 ± 40m; $P<0.05$; Table 6) were evident in all players and also when grouped by positional status following 6 weeks of detraining. In the SJ, performance also decreased in the OB (53.5 ±9.4 cm v 52.2 ± 8.9 cm) and LF groups (46.4 ± 3.2 cm v 45.8 ± 3.1 cm), respectively ($P<0.05$; Table 3). All participants were compliant with the completion of the diet and exercise diaries and all reported following the pre-study instructions.

Discussion

Our study showed that six weeks of training cessation led to deleterious changes in aerobic and anaerobic performance variables in national league rugby union players irrespective of positional status. The T5 group increased body mass ($P<0.05$) unlike other playing positions. In all four groups, significant increases in sum of 7 skinfolds were observed, and significant decreases in CMJ height, 1RM bench press and squat strength, 40m sprint performance, 20m MSFT shuttles completed, predicted $\dot{V}O_2max$, and 5m MST total distance were also evident.

In team sports players [6] and power athletes [23], it has been postulated that during periods of detraining there is preferential atrophy of type II muscle fibres, most probably due to a removal of training stimulus from an overloaded state. In the present study, thigh and calf girths in most positional groups decreased over the 6-week break, possibly indicating reduced muscle mass, particularly since skinfolds taken at these sites were considerably lower than those of upper limb and trunk measurements. Anaerobic performance capabilities were significantly lowered after the post-seasonal break. Decreases in mean CMJ for all groups were greater than those previously found in professional handball players [3] after a 7-week detraining period (1.58 cm vs. 0.99 cm, for present study vs. handball players). However, the handball players were able to participate in normal team practices that may have allowed the retention of training induced neuromuscular adaptations.

In addition to the proposed atrophy of muscle fibres and reduction in lean body mass, there may have been reductions in neural drive and coordination, leading to reduced lower limb power. However, due to cost implications we did not attempt to measure this in the study. Speed is thought to be the first ability to be affected by training removal or reduction, as a result of atrophy and degeneration in motor units [2]. 40m sprint performance is known to be related to squat strength and CMJ heights [24], therefore it seems possible that decreased performance in one of these anaerobic variables may subsequently affect related variables. The rapid acceleration, deceleration and changes of direction required in the 5m MST and 20m MSFT may also have been affected by reduced lower limb strength and power. It is already known that large body mass hinders performance in multiple sprint tests [25] and muscular power is related to ability to change direction rapidly [26].

The results from the present study have many implications for the prescription of conditioning programmes in rugby union, as well as training schedules and periodised plans for the year. First, the baseline characteristics found in positional groups were highly related to the specific roles that each group occupies within the team. Whilst, the core principles of team sports players' physical capabilities should also be adhered to, it seems prudent that conditioning programmes must also cater for the individual requirements of positional roles, rather than collectively as a team. Therefore, in addition to the generic increase of muscle mass and decrease in fat mass critical to rugby union [15], and increase in match-related fitness, coaches must also think about increasing position specific physical performance variables. For example, for the T5 and LF groups, in addition to working on aerobic endurance and muscular hypertrophy, maximal strength and power should also be focused on, for the high intensity activities that characterise their roles. Furthermore, IB and OB should also work on maximal speed and ability to accelerate, as they are frequently required to sprint in both defensive and attacking roles [27, 28].

Bompa [4] warned that some athletes may interpret post-seasonal breaks as periods that should promote total rest, including a reduction or cessation of physical activity which would inevitably lead to a detraining effect. It was clear from the data that there were a number of negative implications of 6-weeks of detraining. Whilst they may be difficult to control, diet and exercise levels over the post-seasonal break must be monitored, prescribed or examined, to prevent a rapid deterioration in physical capabilities. Players could be tested in a similar fashion as in our study and encouraged to maintain a certain percentage of baseline fitness capabilities. However, whilst this may serve as a deterrent for any loss of physical fitness, individuals may be unable to devise a suitable training plan, possibly leading to overtraining or attending pre-season in a stale or tired state. Therefore, the objectives of the players break, namely recovery and recuperation [4], may not be met. Consequently, it appears most practical for coaches to prescribe an individualised maintenance programme for the post-seasonal break. This programme should consist of position specific activities and workouts that preserve physical capabilities, whilst also allowing for suitable recovery over the break. It is known that in highly trained endurance athletes, a reduced exercise programme can preserve most of the training induced adaptations for up to 4 weeks [29], possibly longer in moderately trained individuals. Some studies advocate the preservation of in-season training intensities, while reducing volume by 10-40% and frequency by 20-30% [5, 29, 30]. Consequently a rugby union specific maintenance programme should be considered that contains a mixture of strength, power, and match-related endurance type activities.

Conclusion

The results from our study indicate that 6 weeks of training cessation led to a number of deleterious changes to anthropometric, aerobic and anaerobic performance variables in national league rugby union players. Universal performance decreases were observed in all aerobic and anaerobic performance tests conducted, as well as adverse changes in body composition profiles especially in the T5 group. Based on these findings it would be prudent for coaches to devise maintenance training programmes that preserve in-season fitness levels which cater for position specific requirements that may enhance the efficacy of the training protocol. If players report to pre-season training in a higher state of fitness then coaches could focus to a greater extent on tactical and technical training.

Limitations

Although we requested that food intake and exercise diaries were completed over the close season break participant compliance was poor with the majority of records incomplete or not returned. Therefore it was not possible to determine the precise nutritional and activity levels of each participant during this period.

Recommendations

Based on the findings of our study we make the following training-related recommendations:

1) Further investigations into the physical characteristics and capabilities of elite and sub-elite rugby union players.
2) Future investigations into the nature of the detraining phenomenon in team sports, with more frequent testing, to identify the specific time frames of the rates and types of detraining incurred.
3) Future investigations to look at the use of maintenance training programmes over a period of reduced training in team sports players, to identify the intensities, frequencies, and volumes of exercise required to preserve fitness.

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