FOUR-WEEK UNSTRUCTURED BREAK IMPROVED ATHLETIC PERFORMANCE IN COLLEGIATE RUGBY PLAYERS

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ABSTRACT

Jensen, CD, Gleason, D, and VanNess, JM. Four-week unstructured break improved athletic performance in collegiate rugby players. *J Strength Cond Res* 32(6): 1671–1677, 2018—This study analyzed the changes in athletic performance and anthropometric characteristics in collegiate male club rugby athletes ($n = 14$) after a 4-week winter break. All measurements were collected before and after the break. Body composition was assessed by body mass index and hydrostatic weighing. Performance measurements were as follows: $\dot{V}O_2$max, vertical jump, 10-yard sprint, squat max, and bench press max. Before testing, each subject was acclimated to the protocols to reduce learning effects. During the 4-week break, no workouts were provided for the athletes; it was unsupervised and unstructured. Participants were required to maintain and submit self-reported nutritional and activity logs during this period. After the break, the athletes demonstrated a 5.0% improvement in $\dot{V}O_2$max (absolute increase of 2.25 $ml \cdot kg^{-1} \cdot min^{-1}$), 6.8% improvement in vertical jump (1.50 inches), and a 14.3% increase in squat max (38.64 lb). Although increases in body mass (1.0%) were not significant, the body fat percentage exhibited a relative increase of 19.3% (absolute change from 13.35 to 15.93%). A significant discriminate function analysis indicated statistical differences between groups based on these variables. Self-reported behavior logs confirmed participation in >3 days of moderate to intense physical activity per week but somewhat poor dietary habits. These results indicate that collegiate rugby athletes may not need prescribed exercise routines during seasonal breaks in the athletic schedule. However, it may be beneficial to provide structured nutritional advice during unsupervised periods.

KEY WORDS detraining, unloading, overtraining, overreaching

INTRODUCTION

The design of strength-training programs, coordination of team practices, and implementation of nutritional structure are important components of collegiate rugby. Although optimal athletic characteristics differ based on the field position (11,28), greater strength, speed, and aerobic capacity typically correspond to improved sport performance (14,16,17). Thus, these are fundamental goals of a well-designed exercise prescription.

Although exercise routines are typically standardized during the preseason and competitive season, there is less agreement about the proper management of athletes during unsupervised offseason phases. One such phase is the winter academic break in which the bond between the coach and athlete is severed for 4 weeks. During such breaks, athletic personnel commonly worry about detraining effects in their athletes, which could potentially impair performance on their return to play (23). From the coach's perspective, there are 2 possible strategies to manage athletes during these periods: (a) allow them to behave autonomously and hope for the best or (b) implement strict training protocols to be completed throughout the unsupervised periods.

In other sports, such as tennis, an absence of supervision during seasonal breaks has elicited decrements in aerobic capacity, speed, and power when the athletes return to play (24). The consequence of this is an increased focus on structure and accountability during unsupervised periods. Other studies have reported detraining effects after reduced exercise load or complete exercise cessation in populations such as older adults (31), kayakers (20), and rugby players (23).

The limitation of the currently existing research models is that they lack real-world extrapolation; they maintain structure and/or supervision in a way that is not compatible with collegiate rugby. For example, in the study investigating detraining on rugby athletes, the participants ($n = 34$) were allowed to engage in "light physical activity" but "advised not to conduct any programmed series of conditioning." (23) Such restrictions do not represent a true unsupervised, unstructured break. The sample of tennis players was more realistic but maintained a rigid exercise prescription.

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Although the players ($n = 8$) experienced a 5-week unsupervised break, they were prescribed specific training protocols throughout that duration (24). By comparison, the present study investigated the effects of a complete lack of structure and supervision among collegiate rugby players over a 4-week winter break. Players were given no guidance from coaches or trainers but were evaluated for training level, nutritional behavior, and physiological outcomes. The anthropometric and performance variables we chose to measure were body mass index (BMI), body fat percent, $\dot{V}O_2$max, bench press max, squat max, vertical jump, and 10-yard dash. Each of these is well established in the literature as an important component of rugby performance.

Body mass and body fat percent vary depending on the time of year (10) and field position (22). In general, compared with backs, forwards are taller, heavier, and carry more fat (7,10,15). Dividing up forwards and backs into specific positions, props tend to be taller and heavier (and have higher body fat percentages), whereas hookers and halves tend to be shorter and lighter; backrowers and outside backs reside in-between (15). There are also major anthropometric differences between levels of play. In a sample of elite rugby players, the forwards weighed 237 lb, whereas the backs weighed 196 lb; those same forwards had a 40% higher sum of skinfolds (10). Among Italian A-league rugby players, the forwards were 2.2% taller and weighed 213 lb, whereas the backs weighed 179 lb (7). Among 35 amateur players, forwards and backs were the same height, but the forwards weighed 13.6% more (200 lb compared with 176 lb) and had body fat percentages that were 13.7% higher (19.9% compared with 17.5%) (12). Among a group of Australian players, semiprofessional athletes were 71.4 inches tall and weighed 206 lb, whereas professional athletes were 72.5 inches tall and weighed 207 lb; the semiprofessional athletes had skinfold thickness that was 39% higher (17). Although early thinking regarding body composition was that elevations in fat mass may aid players in tolerance of contact and collisions (5), contemporary training aims to increase lean body mass while reducing body fat for more optimal on-field performance (10,17).

Aerobic capacity is also a critical component of performance. Among 30 elite New Zealand rugby players, a $\dot{V}O_2$max of 52.7 ± 5.9 $ml\cdot kg^{-1}\cdot min^{-1}$ was recorded (9). Among 20 Irish rugby forwards, a $\dot{V}O_2$max of 51.1 ± 1.4 $ml\cdot kg^{-1}\cdot min^{-1}$ was recorded (33). Values vary based on positions; early work reported $\dot{V}O_2$max ($ml\cdot kg^{-1}\cdot min^{-1}$) to range from 43.2 for the hooker, 50.9 for the flanker, and 55.8 for the number 8 (5). Compared with subelite and junior players, elite players typically have better aerobic power. In a sample of Australian rugby athletes, second-grade players had an estimated $\dot{V}O_2$max (using a multistage fitness test) of about 45 $ml\cdot kg^{-1}\cdot min^{-1}$, whereas first-grade players had an estimated $\dot{V}O_2$max of about 50 $ml\cdot kg^{-1}\cdot min^{-1}$ (14).

The constant demands of pushing, pulling, and tackling make strength and power requisite attributes of a successful play; moreover, resistance to (and tolerance of) pushing, pulling, and tackling is partly a function of high levels of strength (15). A common way to measure strength among rugby athletes is the 1 repetition maximum (1RM) in bench press and squat. In both exercises, the level of play (elite vs. subelite) corresponds to 1RM performance (3,4,8). For example, 20 elite, first-division Australian players had a mean 1RM squat of 386 lb, whereas 20 second-division state league players had a mean 1RM of 330 lb (4).

Vertical jump is a common assessment of lower-body power among rugby players, with performances ranging from 15 to 26 inches, depending on age, position, and level of play (12,14,17). Higher-level athletes (elite professional and first class players) typically outperform lower-level athletes (second class and junior players) in vertical jump (13,14,18). Among a group of amateur players, jump heights of 14.6 inches (forwards) to 15.5 inches (backs) were found (12). In 2005, Gabbet (15) found vertical jump to vary among junior rugby league players based on the position ranging from 16.9 inches (fullbacks) to 19.8 inches (centers and halfbacks). Among second-grade Australian rugby players, forwards had a mean height of 16.1 inches, and backs had a mean height of 16.9 inches; among first-grade players, forwards had a mean height of 19.2 inches and backs 20.0 inches (14). Among Australian rugby players, semiprofessional athletes had a vertical jump of 24.4 inches, whereas the professional athletes had vertical jumps of 25.5 inches (17).

The ability of an athlete to cover varied, often short distances very quickly is critical to optimal rugby performance (11,26). In previous work, the 10-m sprint time has been used to evaluate speed. Among semiprofessional players, completion time ranges from 1.98 to 2.08 seconds for backs (first and second grade) and 2.05–2.14 seconds for forwards (first and second grade) (14). In a sample from an Under-19 league, both forwards and backs completed the 10-m spring in 2.19 seconds (14). Among Australian players, semiprofessional athletes completed the 10-m sprint in 1.74 seconds, whereas professional athletes completed it in 1.69 seconds (17), and a group of elite, first-division players from the National Rugby League completed it in 1.60 seconds (4). Elite professional and first-class rugby players have been found to perform better than second-class and junior players on speed tests evaluated by 5-, 10-, 20-, and 40-m sprint times (12,14,18,19). In amateur rugby players, Gabbett (12) found sprint times of 2.62 for forwards and 2.53 for backs, a second slower than elite players.

Using anthropometry, aerobic capacity, strength, power, and speed, we evaluated the effect of an unstructured, unsupervised 4-week break on the athlete's frame and function. To date, research on scheduled, seasonal breaks has typically involved some degree of structure concerning exercise prescription. Understanding how unstructured downtime affects the student-athlete is important to know, as coaches and strength coaches learn to navigate the academic calendar.

METHODS

Experimental Approach to the Problem

During the competitive season of collegiate rugby, the athletes encounter a 4-week winter break. Each year, coaches must decide how to address this break. Currently, there is a shortage of information regarding whether the application of structure and/or supervision is necessary to preserve athletic capacity. In an attempt to formulate best practices, this study evaluated the effect of that 4-week period, when taken with no formal exercise prescription and no supervision, on the anthropometric characteristics and physical capacities of the athletes. Initial data were collected before winter break (first week of December), weekly self-reported behavioral logs were submitted to the researchers throughout the break, and follow-up data were collected when the athletes returned (second week of January).

The data collected were as follows: self-reported dietary log, self-reported exercise log, BMI, body fat percent, $\dot{V}O_2$max, bench press max, squat max, vertical jump, and 10-yard dash time. The independent variable was the temporal aspect of the winter academic break. The duration of the testing period was determined to be the time between the participants' prebreak and postbreak measurements.

Subjects

This study was approved by the Institutional Review Board at the University of the Pacific, a private D1 university in central California. Participation was voluntary, and no data were collected before approval. Subjects were informed of the purpose of the study and the risks and benefits of participation before signing the institutionally approved consent documents. Criteria for inclusion were as follows: (a) active membership on the university's club rugby organization, (b) an age range of 18–29 years, and (c) willingness to participate in all testing batteries. The criteria for exclusion were as follows: (a) a "yes" response to any question on the Physical Activity Readiness Questionnaire and (b) an inability to perform any of the tests of physical function. At the time of the recruitment, there were 25 players affiliated with the team; 17 of these players qualified for enrollment and 14 completed all testing. These 14 male athletes were analyzed as the study sample. The mean age was 19.6 ± 2.0 years; the youngest was 18 ($n = 3$), the oldest was 26 ($n = 1$), and the most common age was 19 ($n = 7$).

Procedures

All participating athletes were exposed to the data collection paradigm in a practice trial before having their performances recorded. This was performed to limit the possibility of a learning effect associated with any of the tests. A minimum of 3 days of rest separated the familiarization protocol and the initial testing battery. For each subject, all tests were performed within a single 6-hour block. Once testing was initiated on a subject, the entire protocol was completed within that timeframe. Methods for the testing protocol were adopted from the *American College of Sports Medicine's Exercise Testing and Prescription Guidelines* (1).

Subject height and body mass were gathered before testing and were used to calculate BMI. After collecting dry body mass, underwater body mass was measured, and hydrostatic body composition was calculated using the Brozek equation (21). Vertical jump was assessed using the Vertec vertical jump measuring device (Senoh, Columbus, OH, USA). Subjects were given 3 attempts, and the best performance was recorded. Power was then assessed with a 10-yard dash. Subjects ran 2 submaximal sprints as warm-ups on a standard track surface. After warm up, subjects completed 2 maximal effort sprints with 3 minutes of rest separating each trial. The better of the 2 attempts was recorded for analysis. Strength was then assessed with a 1RM in bench press and squat. Subjects were instructed to complete submaximal repetitions of each exercise at 50–70% 1RM to serve as both warm-up and determination of 1RM load. With each exercise, subjects were then given 4 attempts (with progressively increasing load) to achieve 1RM, with 3–5 minutes rest between trials. The highest weight achieved in each exercise was recorded as the 1RM. Last, aerobic capacity was assessed using a progressive treadmill test to voluntary exhaustion (Bruce Protocol). The workloads attained by the subjects were used to estimate oxygen consumption.

After completing all initial testing, the athletes were instructed to complete a weekly self-reported form over winter break outlining frequency, duration and intensity of exercise, and to rate their dietary habits regarding the quality of nutrition and quantity of consumption (Table 1). The nutritional reporting for quantity and quality used a 6-point scale; subjects were given a qualitative description corresponding to each point to limit variability of definitions (i.e., one subject's 4 is another subject's 5). The completed self-reported logs were emailed to the researchers at the end of each week. The relatively open-ended nature of these logs allowed participants to document their actions with minimal external influence. No directions were given to the participants regarding nutrition or training over break. All dietary habits and engagement in exercise were voluntary. On returning from winter break, the testing battery was repeated using the same methods.

Statistical Analyses

Paired-sample *t*-tests were used to evaluate differences between mean values collected at the 2-time points. In addition, to control the experimentwise error rate and to take into account the correlations between the individual variables, a stepwise discriminant function analysis was performed with body fat, sprint time, $\dot{V}O_2$max, bench press, squat, and vertical jump. Discriminant analysis computes linear equations based on the independent variables, which maximize the variability between the 2 time points in which the data were collected, i.e., before and after the winter break. Accuracy of the discriminant function as a predictor

TABLE 1. Weekly self-reported form for the 4-week unstructured break.*

Cardiovascular training	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Duration (min)							
Intensity (RPE)							
Resistance training	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Muscle groups							
Sets and repetitions							
Intensity (% 1RM)							
Nutritional analysis		**1 (poorest)**	**2**	**3**	**4**	**5**	**6 (best)**
Last week's food quality							
Last week's food quantity							

*% 1RM = percentage of one-repetition maximum; RPE = rating of perceived exertion.

of group membership was evaluated by a classification analysis. The contribution of the individual predictors was ascertained by the *F*-to-enter values (higher values indicate a greater contribution). Univariate *F*-tests provided further information on differences between the 2 groups. Significance was accepted with *p* values $\leq$0.05 for all analyses.

RESULTS

All 14 subjects had complete anthropometric data recorded. From pretest to posttest, BMI decreased in 3 athletes and increased in 11. Every athlete increased his body fat percent. All 14 subjects had complete data on vertical jump and 10-yard sprint. One subject's vertical jump was reduced, 2 subjects remained unchanged, and 11 improved. The 10-yard sprint time change was evenly split: 7 performed marginally worse and 7 performed marginally better. There were 11 subjects with complete data on bench press max and squat max. For bench press, 6 subjects increased strength, 4 remained unchanged, and 1 lost strength. For squat max, all 11 subjects improved. There were 12 athletes with complete data on $\dot{V}O_2$max; all 12 improved. Descriptive and percent changes for all variables are presented in Table 2 and Figure 1, respectively. Paired-sample *t*-tests found significant changes in body fat percent, $\dot{V}O_2$max, squat max, and vertical jump.

The results of the discriminant analysis were significant, Wilke's Lambda = 0.649, chi-square = 7.782 (2), $p = 0.02$. Only 2 of the variables entered the single significant function. The *F*-to-enter values indicated that $\dot{V}O_2$max contributed most to the difference between groups, with body fat second. Although there were large percent changes in squat weight and vertical jump, group mean values did not differ significantly for any other measures according to univariate analyses. The postbreak group had a higher $\dot{V}O_2$max and higher body fat percentage than that recorded before the break. A test of the classification accuracy of the derived discriminant function

TABLE 2. Demographics, anthropometric characteristics, and performance measurements.*†

			Baseline
N			14
Age (y)			19.6 ± 2.0
Height (inches)			70.8 ± 2.3
	Pretest	**Posttest**	**Significance**
Bodyweight (lb)	179.7 ± 23.3	181.5 ± 23.6	$p = 0.071$
BMI ($kg \cdot m^{-2}$)	25.2 ± 2.8	25.4 ± 2.8	$p = 0.073$
Body fat percent	13.4 ± 4.3	15.9 ± 4.3	$p < 0.001$
$\dot{V}O_2$max ($ml \cdot kg^{-1} \cdot min^{-1}$)	45.5 ± 5.2	47.7 ± 5.8	$p = 0.001$
Bench press max (lb)	186.7 ± 50.2	190.8 ± 51.6	$p = 0.218$
Squat max (lb)	269.5 ± 68.9	308.2 ± 58.1	$p < 0.001$
Vertical jump (inches)	22.2 ± 3.9	23.7 ± 4.3	$p = 0.002$
10-yard dash (s)	1.7 ± 0.1	1.7 ± 0.1	$p = 0.593$

*BMI = body mass index.
†Significance calculated via paired-samples T-Test.

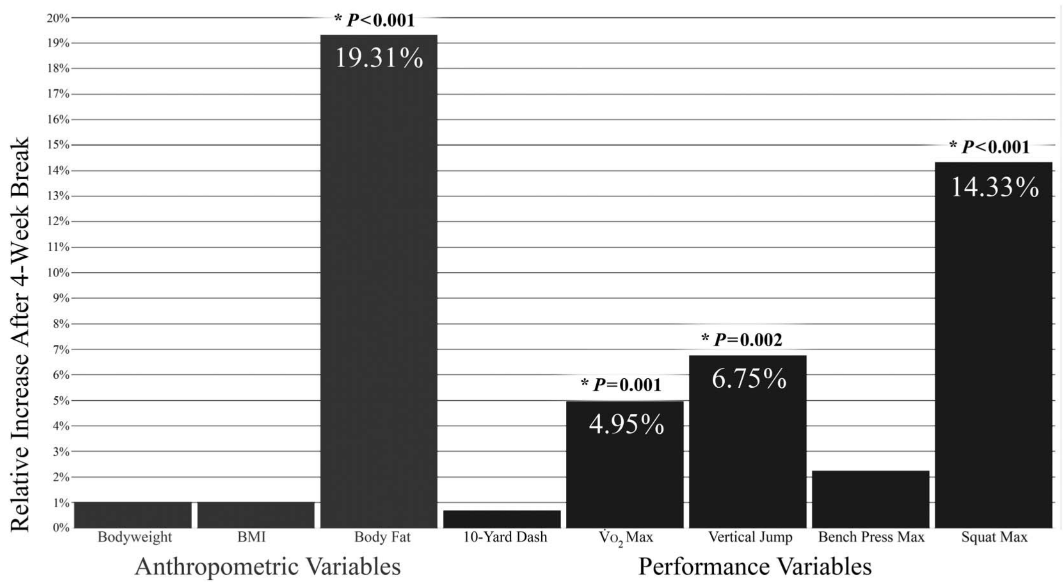

Figure 1. Relative percentage increase in all outcome measurements following the unstructured in-season break.

indicated that 85.7% of the cases were correctly classified. These findings indicate significant differences between groups across the winter break.

According to self-reported activity logs, participants averaged 15 exercise sessions throughout the 28-day unsupervised academic break. Self-reported data regarding nutrition indicated that the mean quality of food was rated as 3.65 out of 6.00, and the quantity was rated as 2.75 out of 6.00. The qualitative description corresponding to the median value of quality was "Balanced–a mixture of meals prepared and eating out, fats/carbohydrates/proteins fairly proportional to standard guidelines, and food groups generally balanced." The qualitative description corresponding to the median value of quantity was "Over-consumption–consumed more calories than recommended for my daily/weekly allotment." Nutritional quality and quantity were correlated ($r = 0.589$; $p = 0.027$). Nutritional quality was not related to baseline characteristics or changes in performance measurements ($p > 0.080$); nutritional quantity was weakly associated with baseline body mass ($p = 0.058$) and unrelated to changes in performance ($p > 0.080$). Neither nutritional quality ($p = 0.339$) nor quantity ($p = 0.271$) predicted change in body composition. A post hoc power analysis with power set at 0.80 determined 22 subjects would be needed for both variables to significantly predict body composition changes over the 4-week break.

DISCUSSION

Previous research, although limited, has indicated that brief bouts of training cessation in competitive athletic populations may elicit significant losses in physiological capacities (20,23). A similar outcome has been found when training structure is provided, but the training itself is unsupervised (24). To the authors' knowledge, this is the first study that has evaluated the effect of an unstructured and unsupervised training period in rugby athletes. This is an important consideration in the context of collegiate rugby, as there is a naturally occurring 4-week break during the competitive season. Although coaches are unable to supervise this break, their concerns about detraining commonly compel the implementation of strict training protocols.

What the current study found was that these protocols may be unnecessary. Our results indicate that 4 weeks of unstructured and unsupervised training did not impair performance and in some ways enhanced it. Three of the 5 performance measurements displayed patterns of improvement, and none exhibited decrement. A possible explanation is that this break falls at a time during the season in which a small reduction of allostatic load may enhance physical recovery through decreases in cortisol, increases in testosterone, and recovery of adrenal function (6,20,30,32).

Strength and conditioning coaches recognize a period of recovery after intense training periods produce an unloading phase that can contribute to improved athletic performance (2). However, many coaches and athletes fear that prolonged recovery periods can result in losses in physical capability (27). Finding balance between these positions, the 4-week unstructured winter break elicited a detrimental effect on body composition but not athleticism. The increase in body fat percent may be partly attributable to nutrition, as the break fell over the holiday season, and the athletes reported relatively poor eating habits, particularly related to overconsumption. In our sample, the athletes' perceptions that they were eating too much was consistent with the changes in their body compositions. Although our sample size was inadequate to support this statistically, the increase in food intake coupled with the slight decrease in physical activity may have contributed to the observed increase in adiposity.

Body composition changes can substantially affect the performance for strength, speed, and aerobic power (25). Typically, reductions in body fat percent and increases in lean body mass associate with enhanced physical performance (10,29); however, the present study indicated improvements in performance despite increases in fat mass.

A period of unloading or tapering generally lasts 10–20 days and reduces training volume by 60–75%, or in cases of athletes experiencing overreaching, a taper could last 14–28 days and reduce training volume by 60–90% (34). It seems that the participants in this study unknowingly self-selected an amount of exercise that allowed an appropriate amount of rest for recovery yet still had sufficient exercise stress to offset the risk of detraining.

Practical Applications

Collegiate rugby has a naturally occurring 4-week break during the competitive season. During this time, coaches can either implement a rigid exercise prescription, or they can let the athletes determine their own training practices. Typically, coaches attempt to control the athletes' exercise behaviors, concerned that the alternative will elicit detraining effects. Our findings indicate that this may be unnecessary. An unstructured, unsupervised 4-week break did not result in a cessation of exercise behavior; the athletes voluntarily participated more than half of all days. Nor did the lack of structure associate with decrements in strength, power, or aerobic capacity on the athletes' return to play. Conversely, all 3 showed signs of improvement; $\dot{V}O_2$max, vertical jump, and squat max improved by 5, 7, and 14%, respectively. However, the athletes did report relatively poor nutritional habits over the break, and the average body fat increased by 2.6% points. Our advice for collegiate rugby coaches, when managing athletes over winter break, is to allow the athletes to exercise freely but emphasize the importance of maintaining body composition.

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