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Original Article

Effects of self-selected load-training intensity on resistance training within the season of amateur Rugby athletes

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Abstract
Background: Rugby places physiological demands on the athletes, with a high degree of complexity. Therefore, the development of different techniques for resistance training (RT), focused on physical aspects, can directly benefit athletic performance. **Objective:** To analyze the effect of resistance training with self-adjusting load on speed, agility, lower limb power, aerobic capacity, and body composition in amateur rugby players. **Material and methods:** Thirteen male amateur rugby athletes with more than one year of experience in the modality and who had not participated in systematic resistance training performed a 16-week experimental protocol with self-adjusted intensity based on the rating of perceived exertion (RPE) and with characteristics of velocity-based training (VBT). Pre- and post-intervention assessments included tests of speed, agility, lower limb power, aerobic fitness, and body composition. **Results:** The results indicated an improvement in the specific agility test time (Cohen´s d=-6.3 [95.0%CI -7.67, -4.74]. large), and lower limb power, mainly in the squat jump test (Cohen´s d=0.502 [95.0%CI -0.318, 1.29], moderate), as well as a small effect in the countermovement jump (d=0.202 [95.0%CI -0.61, 0.982]). However, no effects were observed in the speed tests, aerobic capacity, or body composition variables after the intervention period. **Conclusion**: The findings of this study suggest that RT with self-selected load using PSE and VBT can be recommended for amateur athletes who aim at greater adaptive control in training and for those who intend to improve agility and lower limb power for the purpose of competitive performance in sports.
Keywords: strength training, sport performance, rugby, amateur players

Introduction

Rugby is a high-impact team sport, characterized by intermittent, low-to-high-intensity efforts with short rest intervals (Duthie et al., 2003; Gabbett, 2005a). Consequently, the game requires varying degrees of different physical qualities such as strength, power, speed, endurance (aerobic and anaerobic), coordination, and agility (Bompa & Claro, 2009), due to the considerable number of sprint runs, multiple accelerations, decelerations, and changes of direction caused by tackles being made by or on the player (Baker & Newton, 2008; Bompa & Claro, 2009). The small differences observed between the physical and physiological demands during the game are because forwards are involved in a greater number of collisions associated with defensive play (i.e., tackling), while the backs tend to be less involved in the defensive elements of the game, but exhibit higher degrees of acceleration and speed (Gabbett, 2005b; Meir et al., 2001). However, some studies point out that among all the physical qualities that determine the game of rugby, the ability to quickly generate high levels of muscle strength and power stand out as important attributes to be optimized by players, regardless of their position in the game (defense or attack) (Baker, 2002; Bompa & Claro, 2009; Gabbett, 2005b; Meir et al., 2001). Due to the high number of physical confrontations in a match (e.g. tackling, being fouled, throwing the ball after being knocked to the ground), it is necessary for the players to develop strength and power (Meir et al., 2001).

In this way, resistance training is a commonly used training method to improve the strength and power of athletes from different sports (Suchomel et al., 2016). Despite this, when considering the methods used for load monitoring, there are several difficulties due to differences in physical characteristics and capabilities between athletes, as well as the indoor environment where monitoring usually occurs (Weakley et al., 2021). Therefore, it is necessary to incorporate different techniques into resistance training (RT), that minimize the flaws inherent to the more traditionally used methods, such as load volume, for example. With this in mind, recently, the validation and increasing popularity of linear position transducers (or force transducers) as a way of monitoring speed, has led to a new form of exercise prescription, velocity-based training (VBT). This training model presents numerous advantages, such as; the possibility to determine a velocity/load profile for athletes,

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predict and monitor changes in maximum strength, control the fatigue effects of resistance training, such as the feasibility of providing immediate performance feedback to the athlete, optimizing their responses to the training program (Banyard et al., 2017; Orange et al., 2018; Weakley et al., 2014).

The few studies that used VBT showed that when applied to individuals involved in resistance training (even recreationally) it promotes positive performance responses in different tests, such as change of direction (COD), countermovement jump (CMJ), and sprint (Banyard et al., 2020; Dorrell et al., 2019; S. Orange et al., 2019; Rauch et al., 2018). These findings suggest that VBT causes adaptations in maximal strength and can serve as a reliable method within an RT program, enabling improvement in muscle strength and power (explosive strength of the lower limbs), as well as the reduction in stress from training and more precise targeting of velocity adjustment (Dorrell et al., 2019; Orange et al., 2019). However, a factor that can make the use of VBT difficult is the necessity for a relatively expensive instrument to control the speed of load displacement, as well as additional time for device configuration and a qualified team to apply it (Dorrell et al., 2019; Orange et al., 2019). Therewith, adapted tools are needed that offer practicality and, at the same time, safety in their application.

The tools adapted to control intensity in VTB could include the rating of perceived exertion (RPE), as the RPE presents the ability to minimize errors by controlling the intensity during RT, without necessarily using 1RM percentage measurements, as well as accelerometers and force transducers. RPE is one the most widely used training load monitoring systems, and it can provide strength and conditioning trainers with a perspective to optimize performance, through monitoring and, consequently, enhance individual adaptations to load. (Comyns & Hannon, 2018; Garnacho-Castaño et al., 2015; Griffin et al., 2020).

In this way, the association between the intensity adjustment by the RPE could be a method used individually (self-adjusting) within the training program of amateur athletes, representing an applicable tool for controlling and increasing load. Therefore, the present study aims to analyze the effect of resistance training with self-adjusting load on speed, agility, lower limb power, aerobic capacity, and body composition in amateur Rugby players, leading to the hypothesis that even if this is a self-adjusting model, improvements would occur for the observed physical capacities.

Material & methods

Study design

This study has a pre-post study design. Amateur rugby players performed 16 weeks of an experimental protocol. The subjects completed tests to assess velocity, agility, lower limb power, aerobic fitness, and body composition. Tests were performed on the same day in the following order: body composition, lower limb power, agility test, velocity test, and aerobic fitness. All tests were measured at baseline and post-training. The training phases were divided into three parts, and every 4 sessions a 5% load increase was implemented. During all workouts, the participant performed basic exercises (CORE and mobility exercises), including squat jump, throw bench press, and free prone bench pull exercise, and at the end free stretching exercises. After four workouts the addition of a 5% load increment in resistance training exercises based on RPE was suggested. All subjects were evaluated at the same time of day on assessment days. The experimental design is displayed in Figure 1. We did not change the technical-tactical schedule previously defined by the technical coach (they prioritized reduced games during all experimental design); the athletes performed 3 sessions per week during the experimental protocol of this specific workout (two during the evening (7 - 9 p.m.), and one during day (3-5 p.m.). In addition, we did not control nutrition intake or hydration during the experimental design.

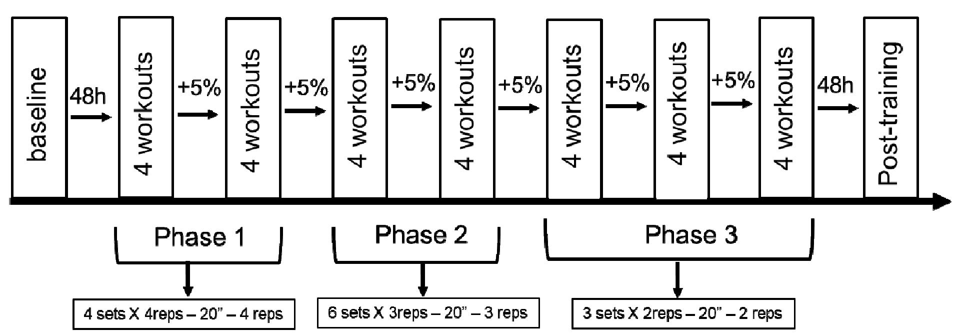

Fig. 1 – Study design. Abbreviation: Reps=repetitions

Participants

Thirteen men participated in the study (29.62 ± 6.34 years; 175.74 ± 6.96 cm; 87.88 ± 15.47 kg). Participants were amateur rugby players with more than a year of experience in the sport and who had not previously participated in systematic resistance training. The study included those who obtained a frequency greater than 50% in the planned training sessions (three VBT sessions and three technical and tactical sessions, separated by at least 24-h). Participants were made aware of the risks and benefits of the study, and soon after they signed the informed consent form according to the Helsinki declaration (2013: Seventh revision, 64th Meeting, Fortaleza).

Vertical Jumps

The vertical jump performance was evaluated by the squat jump (SJ) and countermovement jump (CMJ), and the eccentric utilization ratio (CMJ: SJ) was used to evaluate the performance of the stretching and shortening cycle (SSC) of the lower limbs. Five SJ and CMJ jumps were performed with a 1-minute rest interval between them as a warm-up before the testing session, according to the protocol used by (Bosco et al., 1983). In SJ, athletes were instructed to squat to a position where their legs were flexed at ~ 90º and to remain in that position for 2-3 seconds before jumping. In the CMJ, the athletes were instructed to squat to a self-selected depth followed by a quick jumping movement. Both tests were performed with the hands on the waist. Five attempts of SJ and CMJ were performed, with a 15-second rest between attempts and a 1-minute rest between jump modes. The eccentric utilization rate (EUR) was calculated using the ratio (CMJ: SJ) as proposed by (McGuigan et al., 2006). An experienced appraiser followed the tests to ensure the correct execution of the technique. The jump height was measured by the contact platform (Elite Jump®, S2 Sports, São Paulo, Brazil) validated by the study of (Loturco et al., 2017). The highest attempt at each jump was used for the statistical analysis.

Velocity tests

The sprint velocity was calculated posteriorly using Kinovea® software, all images were captured with an Iphone 7 (IOS system, 1334x750 pixels, 60Hz). Three cones were positioned on the 40 m sprint course (start, 10- and 40-m). The athletes positioned themselves 30 cm from the start and performed two maximum sprints, with an interval of 8 minutes between them. The same evaluator analyzed the two trials and moments (baseline and post-training) (Loturco et al., 2019).

Agility test

The agility test followed the protocol presented by Okamoto (2015) in which participants run 15 m; they perform a 5 m sprint, followed by a 1 m lateral displacement to the right, another 5 m sprint and lateral displacement 1 m to the left, and end with a 5 m sprint. The test was filmed by an evaluator at both moments and later analyzed in Kinovea® software.

Aerobic test

The Carminatti's test (the T-CAR) requires participants to perform repeated bouts of 5 x12 s shuttle running at progressively faster speeds until volitional exhaustion. The 12s bouts were separated by 6s recovery periods, making each stage 90s in duration. The initial running distance was set at 15m and was increased by 1m at each stage (90s). The test protocol has an initial speed of 9km/h^{-1} over a running distance of 30m (15m out and back). The stage length in a single direction was increased progressively by 1m every set. During the test, 4-6 athletes were evaluated simultaneously with running pace dictated by pre-recorded audio cues (beeps) that determined the running speed to be performed between the start and finish lines. The test ended when the participant failed to keep in time with the audio cues for two successive repetitions (objective criteria), or a perceived inability on behalf of the participant to cover more distance at the attained level (subjective criteria) (Da Silva et al., 2011).

Body composition

Anthropometric assessments included height and body mass; and body composition assessments included fat mass and fat-free mass. Height was measured using a stadiometer (Alturexata, Minas Gerais, Brazil) and body mass with a digital balance scale coupled to an air displacement plethysmograph system, measured to the nearest 0.1 cm and 0.1 kg, respectively. The fat mass and fat-free mass were performed with an air displacement plethysmograph (BODPOD–Body Composition System; Life Measurement Instruments, Concord, CA, USA). The evaluation was performed according to the manufacturer's instructions. The instrument was calibrated through the computation of the ratio of the pressure for an empty chamber and a known volume (56.056 l). The scale attached to the device was also calibrated using a known reference (20 kg). After receiving an explanation about the procedures, the participants entered into the ADP wearing minimal clothing. A swimming cap was used to decrease hair volume, and metal objects (for example, earrings, rings, piercing, and so on) were not allowed on the body. The participants remained seated inside the device and for each step of the ADP evaluation the door was opened. The test lasted on average 4 min. During this phase, the participant's raw body volume was determined according to Boyle's law. Because of the difficulty in assessing the pulmonary volume of the participant, the predicted values were used (McCrory et al., 1985). This procedure did not affect the estimation of body composition. The body density was determined by range of pressure and volume. Finally, %BF was calculated by the Siri equation. The Siri equation is based on the two-compartment model (fat mass and fat-free mass), and ADP is a densitometry method that is also based on the two-compartment model (Siri, 1993).

Training program

At the commencement of each training session, participants performed a general warm-up routine involving CORE exercise (two exercise, 2 sets x 10s) and joint mobility (ankle, knee, hip, spine, and shoulder), one exercise for each joint (1set x 10 repetitions). They then performed the following exercises in all training sessions in the smith machine, squat jump, throw bench press, and bent-over row. The intervention was completed in three phases of training: first phase, 4 sets x 8 repetitions with 20s between every four repetitions; second phase, 6 sets x 6 repetitions with 20s between every three repetitions; and the final phase, 3 sets x 4 repetitions with 20s between every two repetitions. At least three minutes of rest was observed between sets and exercises. The initial intensity was based on the individual maximum mean propulsive power test using an accelerometer (Push 1.0, PUSH Pro System, PUSH Inc, Toronto, Canada) in each exercise (squat jump, throw bench press, and bent-over row). All subjects performed a concentric movement phase during the test within a range velocity of 0.8 and 1.1 m/s^{-1}, and the best loading within three attempts was used for the initial load application. These three exercises were previously studied by Loturco et al. (2017, 2020, 2021) and we applied a similar methodology to establish the individual maximum mean propulsive power. After the initial sessions, the intensity was adjusted by 5% up or down, always maintaining the rating of perceived exertion below 4 and above 6 on the OMNI scale, respectively (Lins-Filho et al., 2012). To end the workout a free stretching exercise was stimulated (one exercise for the same joint as the mobility exercise). During all sessions, subjects were stimulated to perform the concentric phase of all exercises, as fast as possible, and self-adjustment of intensity in all exercises after 4 workouts (adding a 5% load increment in resistance training exercises based on RPE).

Statistical analysis

For all analyses, we used estimation statistics, which focus on the effect size of the experiment/intervention, as opposed to significance testing. The bootstrap with 5000 replicates was used to obtain bias-corrected and accelerated 95% compatibility intervals (CI) of the point estimate of each effect. The P value (s) reported represent the likelihood (s) of observing the effect size (s), if the null hypothesis of zero difference is true. For each permutation P value, 5000 reshuffles of the pre and post-test labels were performed. Finally, to avoid dichotomous interpretations of the results, we did not employ null hypothesis significance testing. Instead, the estimation statistics display all observed values, visualize estimate precision, and show mean difference distribution (Ho et al., 2019) (Ho et al., 2018). Cohen's d effect size (ES) was classified as follows: ES of 0.00–0.19 was considered trivial, 0.20–0.49 was considered as small, 0.50–0.79 was considered as moderate, and .0.80 was considered as large (Cohen, 1992).

Results

Power and velocity capacities

To address the primary research question, differential time in the specific agility test, 10- and 40-m, and lower limb power were assessed PRE versus POST. All of the observed effects were high in magnitude. However, the specific agility test presented a positive effect (d=-6.3 [95.0%CI -7.67, -4.74]), while the 10- and 40-m presented a negative effect (d=6.85 [95.0%CI 4.78, 9.06, and 1.53 [95.0%CI 0.733, 2.41]), figure 2 A to C, respectively. Considering lower limb power, the effects were positive but small for the countermovement jump (d=0.202 [95.0%CI -0.61, 0.982]), and moderate for the squat jump (d=0.502 [95.0%CI -0.318, 1.29]), followed by a negative moderate effect in the eccentric ratio (d=-0.773 [95.0%CI -1.48, -0.0167], figure 2 D to F, respectively.

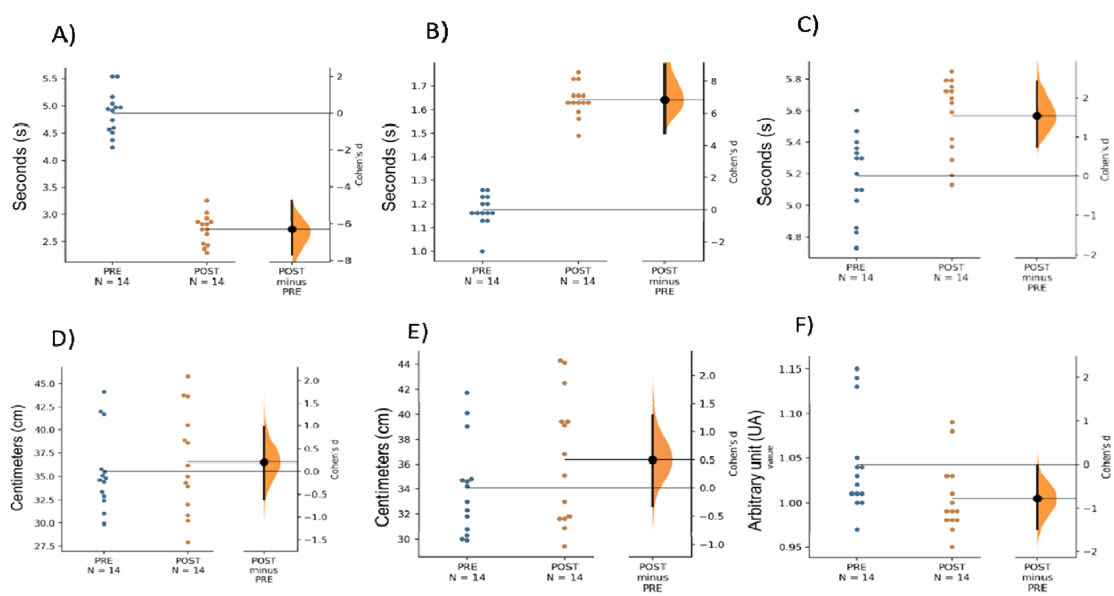

Fig. 2 – The Cohen's d between PRE and POST is shown in the above Gardner-Altman estimation plot. Both groups are plotted on the left axes; the mean difference is plotted on a floating axis on the right as a

bootstrap sampling distribution. The mean difference is depicted as a dot; the 95% confidence interval is indicated by the ends of the vertical error bar. A) Specific agility test, B) 10-m velocity test, C) 40-m velocity test, D) Countermovement jump, E) Squat jump, and F) Eccentric utilization ratio. AU (arbitrary unit).

Aerobic capacity and body composition

Secondary outcomes were related to aerobic capacity and body composition; The T-CAR test showed a negative moderate change for PRE versus POST (VO_2Max, d= 0.606 [95.0%CI -1.39, 0.205]; Speed, d= 0.608 [95.0%CI -1.4, 0.205]; RPE, d=0.541 [95.0%CI -1.2, 0.2], figure 3 A to C, respectively. Conversely, a negligible effect in magnitude was observed for the body composition component (fat mass, d= 0.222 [95.0%CI -0.92, 0.585], and fat free mass, d= 0.246 [95.0%CI -0.948, 0.517], figure 3 D and E, respectively.

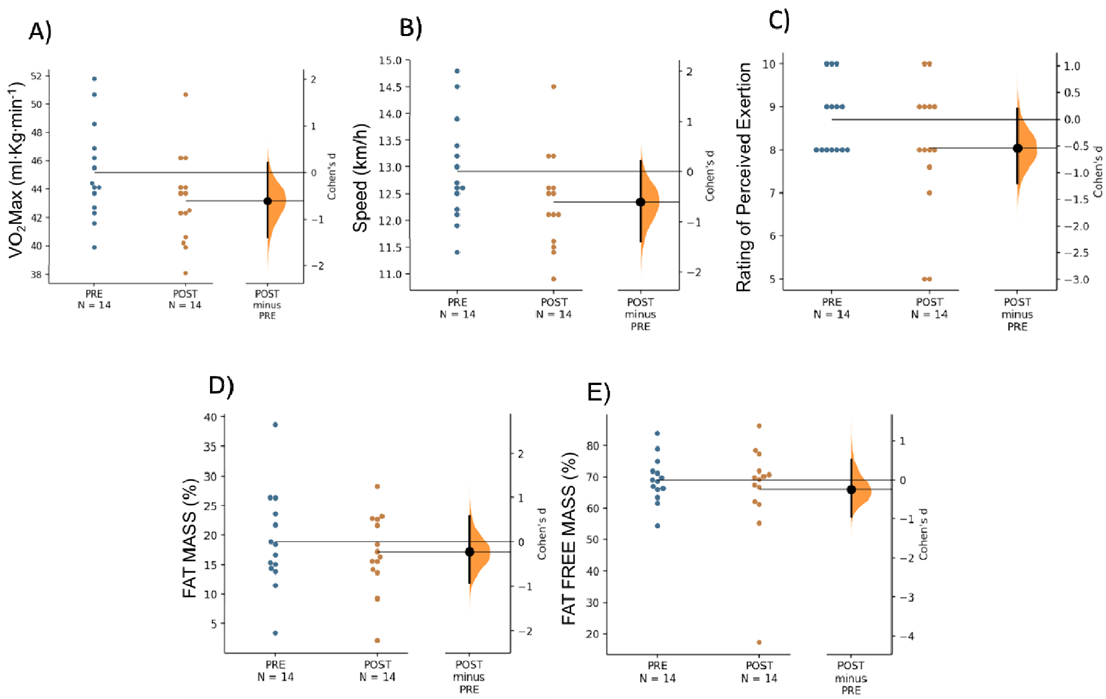

Fig. 3 – The Cohen's d between PRE and POST is shown in the above Gardner-Altman estimation plot. Both groups are plotted on the left axes; the mean difference is plotted on a floating axis on the right as a bootstrap sampling distribution. The mean difference is depicted as a dot; the 95% confidence interval is indicated by the ends of the vertical error bar. A) T-CAR (aerobic test), B) Final speed in aerobic test, C) Final Rating of Perceived Exertion (RPE) in aerobic test, D) Fat mass, and E) Fat free mass.

Discussion

The present study aimed to verify the effects of 16 weeks of resistance training with a self-selected load in amateur rugby players on agility, speed, lower limb power, aerobic capacity, and body composition. The main finding indicates an improvement in the time in the specific agility test (ES= large), and power of the lower limbs, mainly in the squat jump test (ES= moderate), followed by a small effect in the countermovement jump. However, no effects were observed in the speed tests, aerobic capacity variables, or body composition after the experimental design.

The specific agility test showed positive effects after the intervention (Cohen´s d = -6.3, large), confirming the finding by Rauch et al. (2018)**,** who evaluated the effects of two different VBT progressions (progressive speed-based training (PVBT) or ideal training loads (OTL)) in female volleyball athletes, and demonstrated a positive effect for time in the agility test in both groups (PVBT: −1.8%, ES: −0.40 (moderate); and OTL: −2.1%, ES: −0.88 (large), indicating performance improvement. It is worth mentioning that in the aforementioned study, prior to the baseline tests, all subjects completed six familiarization sessions over two weeks, in which during the sets they were presented with feedback from a linear position transducer, as well as receiving guidance about the adequate depth and form to perform the exercises for the purposes of reproduction during the tests. These factors, added to the fact that the study sample consisted of university volleyball athletes considered moderately trained in RT, demonstrate that the sample presented some advantages over the participants in our study who did not regularly practice systematic RT, and who were not subjected to the same procedures before the baseline tests. However, despite this, our effects were large for the agility variable, evidencing that the adaptation of this physical capacity within a training program aiming at performing the concentric phase as quickly as possible can provide more refined adjustments in this capacity.

Conversely, the results of our study regarding sprint speed over 10- and 40-m showed a negative effect (d = -6.85 and d= -1.53, respectively), in contrast to the findings of Banyard et al. (2020), after 6 weeks of VBT intervention, who showed speed improvements in the 5m sprint (ES = -1.17, large), 10m sprint (ES = -0.93, large), and 20 m sprint tests (ES = 1.27, large), with expressive changes based on baseline measures. A possible explanation for this divergence between our results and those in the aforementioned study may be related to the intensity adjustment. Banyard et al. (2020), adjusted the training intensity starting from the determination of relative load values based on 1RM from which individualized load velocity profiles were developed using average velocity from 20% 1RM to 90% 1RM, which served to set target speeds for training sessions. Thus, intensity adjustments took place daily according to real-time speed feedback, which determined the training load of the VBT group based on pre-established intensities and speeds. This is contrary to the present study, which performed self-adjustment every 4 sessions, implementing a load increase (or not) of 5% from the RPE indicated by the individual. From a practical point of view, the use of frequent feedback throughout training sessions provides a more reliable response from the athlete, as emphasized by Weakley et al. (2019). However, the use of immediate feedback, for the most part, requires the use of valid velocity measuring devices (e.g. linear position transducers), timing gates, and measuring tapes, and the cost of these methods and technologies could be a limiting factor (Loturco et al., 2017; Loturco et al., 2021; McGrory et al., 1985). It is important to highlight that, if the load velocity measure is reapplied with a greater frequency, it leads to, in the unavailability of having a daily adjustment, an increase in the effectiveness of the training and, consequently, a reduction in the margin of error (Jiménez-Reyes et al., 2021). Another point of our study, which may indicate the lack of gains in linear displacements, is that particularly in the training phase in which the intervention took place, the team of coaches emphasized the use of reduced games, prioritizing small spaces, and it is also known that this condition does not favor the development of speed capacity, but rather the change of direction (Casamichana et al., 2018).

The data obtained also reveal that lower limb power presented positive effects, however, these were moderate for squat jump (d= 0.502), and small for countermovement jump (d= 0.202). This corroborates the outcome addressed by Orange et al. (2019), who when comparing the effects of VBT vs. training based on percentage of 1-RM in twenty-seven rugby league players in the competition period, found favorable results for the VBT group, who showed probable improvements in height in the CMJ, after 7 weeks of intervention. Similar responses were also found by Dorrell et al. (2019), who reported that VBT resulted in a positive effect on CMJ performance (ES= 0.23, small). Opposite the session control applied on the mentioned studies, already all include feedback during workout, our study built stronger feedback during load determination session suggested that the athletes´ movements always been performed as quickly as possible for the concentric phase during all workout of experimental design for squat jump, as reported by other studies Additionally, in all sessions of the present study, it was suggested that the movements be performed as quickly as possible for the concentric phase, which, as reported by other studies (Baena-Marín et al., 2022; Dorrell et al., 2019; Pareja-Blanco et al., 2014), optimizes the adaptations in power performance and allow for a positive transfer to actions such as the vertical jump.

The secondary outcomes of this study were directed to aerobic capacity, in which the T-CAR test measures showed a reduced effect when comparing the post-training period in relation to the baseline (VO2Max, Cohen´s d = -0.606, moderate; Velocity, Cohen´s d = -0.608, moderate; RPE, Cohen´s d = -0.541, small). This negative effect could be related to the training intensity, which may not have been sufficient to cause adaptations, in addition to the athletes' frequency of specific training in the modality (3 days a week), which was not experimentally controlled in the present study. In fact, as far as we know, this was the first study to use this methodology to assess aerobic capacity, although this, as previously mentioned, was one of the secondary outcomes.

Furthermore, a trivial effect was observed for both components of body composition (fat mass, Cohen´s d = -0.222, small, and fat-free mass, Cohen´s d = -0.246, small), probably due to an insufficient intervention time to cause these changes, which is contrary to the findings of Rauch et al. (Rauch et al., 2018), who indicated a reduction in fat mass (-8.5%) and an increase in fat-free mass (5.4%) after 7 weeks of intervention. However, in contrast to our study, in the aforementioned study each participant received individual advice from a nutritionist (who was blind to the training interventions) to ensure optimal energy intake (total kcal, relative intake of fat, carbohydrate, and protein, being quantified at weeks 0 and 7). In addition, participants received a serving (25g) of whey protein powder (Elite Whey Protein; Dymatize Nutrition, Dallas, TX, USA) immediately after each exercise session. Therefore, as the study by Rauch et al. (2018) highlights, the combination of high-volume training sessions (e.g., 3933.3 kg for criterion exercises per training session) and high protein intake (e.g., ~1.7 g/kg of body mass) may have potentiated the accumulation of lean mass, contributing to the positive effects achieved in body composition post-intervention.

Furthermore, we recognize some limitations of this study. First, the proposal of the present study, which in addition to performing the individual velocity load test using an accelerometer (Push 1.0, PUSH Pro System, PUSH Inc, Toronto, Canada) only to determine the initial intensity of each exercise, the adjustments of intensity performed between sessions were based exclusively on the RPE classification indicated by the individuals on the OMNI scale. This methodology differs from that used by Banyard et al., (2020), because according to Jovanović

& Flanagan (2014) the development of load/speed profiles within a training program that aims at specific adaptations of speed, allows coaches the opportunity to evaluate athlete's progress over time, across a spectrum of speed demands. Thus, we can say that when using a target velocity for intensity adjustment, it seems that Banyard et al., (2020) had a more effective speed control in the exercises and a greater flexibility to adjust the daily load successively (by ± 5% or 10± % of 1RM, for example), given that the loads always considered the supported values previously established for each subject, which may have allowed higher speeds in repetitions with less perceived difficulty. Furthermore, in our study we did not consider participants' RPE scores to calculate their average over each session, which prevents us from comparing our results with those of other studies. In addition, we must consider that the RPE, despite its practicality of application and/or use, is still a limited method, as it may not accurately verify the effect of fatigue on the performance of participants in relation to training sessions (Jiménez-Reyes et al., 2021). Another limitation is related to the lack of nutritional control, which seems to be an important aspect for obtaining positive effects on body composition. Finally, the absence of control over the frequency of physical and technical training specific to the modality studied, which can generate relevant adaptations in the observed physical capacities (speed, agility, power, etc.).

However, it is interesting to note that despite the limitations presented, our study had positive effects on the specific agility and power of the lower limbs. Thus, it is valid that the application of the methodology used could be an interesting strategy for the initial phases of training for athletes not adapted to resistance training, in addition to being feasible for use by amateur teams that mostly have low financial conditions.

In summary, our results indicate a large improvement in the specific agility test and moderate in lower limb power, mainly in the squat jump test (ES=moderate), followed by a small effect in the countermovement jump. However, no effects were observed in the speed tests, aerobic capacity, and body composition after the intervention period. Thus, resistance training with self-selected load using RPE can be recommended for amateur athletes who seek greater control in the adaptation phase and who aim to improve the agility and power of lower limbs for competitive performance in acyclic sports.

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