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Characterizing different loads with the same velocity loss percentage in the bench press throw exercise
Caracterización de diferentes cargas con el mismo porcentaje de pérdida de velocidad en el ejercicio de lanzamiento en press de banca

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Abstract. Velocity loss has been recognized as an effective fatigue index in resistance training. However, the physiological consequences of this fatigue should be described. Traditionally, researchers have debated the hormonal response to non-failure resistance training. Cortisol on salivary concentration was one of the hormones under study, which is linked to the inflammatory process from exercise. The present work will assess the acute salivary cortisol (Sal-C) response for various 1RM percentages, with a 10% velocity loss standardized fatigue level. A randomized, counterbalanced experimental design was implemented. Fifteen males took part, having fasted for 12 hours prior to the test, who then completed 6 sets of bench press throws at varying 1RM intensities (30% - 90% 1RM). Salivary cortisol samples were collected prior to and following each session, and velocity loss was monitored using a linear encoder. ANOVA and effect size analyses were conducted. Sal-C significantly dropped at every 1RM percentage, with larger effect sizes happening at lower loads (1.61, high) not at higher loads (0.95-1, moderate). Peak power was dramatically higher, 40-70% of 1RM compared to other intensities (30-80% 1RM). These results indicate that velocity-based training assists in maintaining a dynamic balance inside the body, independently of the intensity level applied. Additionally, subjects without former training were able to perform efficiently up to six sets at all percentages albeit with fewer repetitions at higher intensities. This study indicates that untrained subjects suffer 10% velocity loss under four repetitions.
Keywords: Salivary Cortisol; Velocity-based resistance training; Fatigue; Bench press. Caracterización de diferentes cargas con el mismo porcentaje de pérdida de velocidad en el ejercicio de lanzamiento de press de banca.

Resumen. La pérdida de velocidad ha sido reconocida como un eficaz índice de fatiga en el entrenamiento de fuerza. Sin embargo, debe describirse la consecuencia fisiológica de esta fatiga. Tradicionalmente, la respuesta hormonal ha sido objeto de debate entre los investigadores en relación con el entrenamiento de fuerza sin fatiga. Una de las hormonas estudiadas ha sido el cortisol, una hormona relacionada con el proceso inflamatorio del ejercicio, en la concentración salival. Este estudio pretendía comparar la respuesta aguda del cortisol salival (Sal-C) a diferentes porcentajes de 1RM con fatiga estandarizada por una pérdida de velocidad del 10%. Se diseñó un estudio experimental, aleatorizado y contrabalanceado. Quince hombres participaron en el estudio (ayunaron 12 horas antes de realizar la prueba), realizando 6 series de lanzamiento de press de banca con diferentes porcentajes de 1RM (30% - 90% 1RM), Se recogió cortisol salival antes y después de cada prueba. La pérdida de velocidad se midió con un codificador lineal. Se realizaron ANOVA y tamaño del efecto. El Sal-C mostró una disminución significativa en todos los porcentajes y el tamaño del efecto fue mayor con carga baja (1,61 alta) que con carga alta (0,95-1 moderada). La potencia máxima fue significativamente mayor entre el 40-70% de 1RM en comparación con otros porcentajes (30-80% de 1RM). Los resultados de esta investigación apoyan la idea de que el entrenamiento basado en la velocidad mantiene el equilibrio dinámico de los organismos independientemente del entrenamiento de intensidad. Además, los sujetos no entrenados podían realizar eficazmente hasta seis series en todos los porcentajes, pero realizando menos repeticiones a intensidades más elevadas, ya que este estudio muestra que los sujetos no entrenados alcanzaron una pérdida de velocidad del 10% en cuatro repeticiones.
Palabras clave: Cortisol Salival; Entrenamiento de fuerza basado en la velocidad; Fatiga, Press de banca

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Introduction

Velocity-based resistance training (VBRT) is a fundamental approach to improve strength performance and assess the athlete's fatigue state (Pareja-Blanco et al., 2017). As far as fatigue is concerned, this may be caused through various mechanisms; still, their particular contribution and the extent of their influence remain uncertain, which the nature of the effort exerted (Allen et al., 2008). Notwithstanding, said mechanisms ultimately result in an execution velocity decrease (Jones, 2010). Sanchez-Medina and Gonzalez-Badillo (2011) specifically reported that as effort increases, mean propulsive velocity (MPV) decreases. This loss in velocity is associated with poorer performance and higher concentrations of metabolic byproducts like lactic acid and ammonia. In addition, other variables, such as optimal load (OL), optimal repetition number (OR) and time under tension (TUT), should be considered (Sarabia et al., 2017) since they can influence fatigue states and, consequently, the physiological response to resistance training (Burd et al., 2012). Thus, OL makes reference to the loads at which people reach their peak acceleration for a precise movement, optimizing the dose-response connection in strength training (Soriano et al., 2015). In a similar manner, OR, understood as the total number of repetitions prior to a predetermined velocity loss threshold, and TUT, 10% of the maximum duration, might influence hormonal responses (Mangine et al., 2015) and, by extension, overall performance (Crewther et al., 2018). Thus, knowing how the OR and TUT behave depending on loads could facilitate the optimization of prescription in resistance training.

The hormonal response has been widely assessed to explain acute performance loss (Crewther et al., 2006) since hormonal changes could impair strength output (Hamdi &

Mutungi, 2010). It has been proven that cortisol has inhibitory effects on a number of immune responses, including relevant suppression of phagocytic cell functions. Its capacity to constrain not only acquired but also innate immune functions makes cortisol highly effective when tackling different acute inflammatory episodes derived from physical activity (Azizbeigi et al., 2015; Rhen & Cidlowski, 2005). In this regard, increments in cortisol concentration occur after a stressful situation, regularly 4 minutes after (Hall & Hall, 2020). Therefore, cortisol is considered a good indicator of psychobiological stress (Hellhammer et al., 2009), despite the wide variability in hormonal concentration among individuals (Crewther et al., 2013; Papacosta & Nassis, 2011). Compared to vein puncture (Gatti & De Palo, 2011), The marker of free cortisol called Salivary cortisol (Sal-C) may be an alternative to serum-based measurements because of the way it is collected, non-invasively, which preserves hormonal concentration.

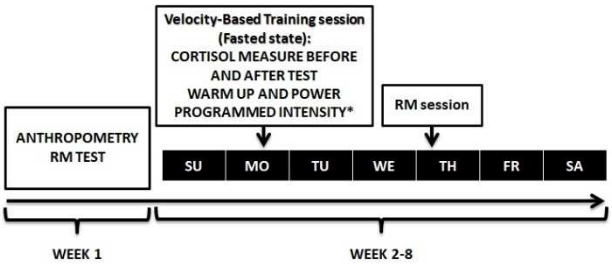
Specifically, Sal-C responses in high-intensity resistance training have been compared with the responses obtained after a low-intensity one. In said comparison, the former showed the greatest increase in cortisol concentration (McGuigan et al., 2004). Likewise, several authors have reported differences in Sal-C response after failure or non-failure training obtaining cortisol concentration rises at different intensities, volumes, and types of exercise (Becker et al., 2021; Cairns et al., 2005; McCaulley et al., 2009; Stokes et al., 2013). The explication to the present results lies in the lacking standardization of training prescriptions, measurement protocols, and exercise choice (Crewther et al., 2009; Viru et al., 2001). In this sense, knowing the timing the cortisol response will optimise collecting (Hall & Hall, 2020). The same happens with the implementation of an easily replicable, standardised exercise, and transferring it to sports abilities such as bench press throw, which has been used by other authors (Baker et al., 2001; Sánchez-Medina et al., 2014; Stokes et al., 2013). Furthermore, as fatigue progresses continuously until muscle failure occurs (Sánchez-Medina & González-Badillo, 2011), homogenizing effort levels is of the essence so as to gain clearer insights into the relation between fatigue and its hormonal effects. Consequently, individualized training is relevant, since an individual may reach similar fatigue levels through OL and OR, instead of resorting to traditional performance criteria such as executing only half of the repetitions at a given one-repetition/maximum percentage (1RM) (Legaz-Arrese et al., 2007).

Yet, the acute Sal-C response to velocity loss induced by resistance training has not been delved into sufficiently. Thus, the present study's goal was to address two primary objectives: i) to characterize 7 different loads, related to the 1RM, with the same velocity loss criteria in the bench press throw exercise and ii) to compare acute Sal-C response at different percentages of 1RM. In this context, higher loads may necessitate longer TUT, leading to increased Sal-C.

Method

Experimental approach

A randomized, counterbalanced design was implemented (Figure 1). The participants we subjected to two weekly sessions over a seven-week period, resting for 72 hours before the next. One session consisted in 1RM bench press testing, whereas the following (experimental session) focused on assessing velocity and velocity loss in all repetitions along the bench press throw. Sal-C concentrations were evaluated right before and after the experimental sessions, which used intensities of 30% 1RM, 60% 1RM, and 90% 1RM. Participants were allocated to one of two groups at random. Sessions opened with a short dynamic warm-up (15 seconds of joint mobility practice for each joint involved, and three 10-repetition sets at 5%, 10%, and 20% of 1RM) before the main training session (Borgenvik et al., 2012; McMillian et al., 2006). The experimental sessions encompassed six sets of bench press throws, until identifying a 10% loss in mean propulsive velocity (MPV) after two consecutive repetitions, with a five-minute rest interval between sets (Ahtiainen et al., 2005). Intensity varied each week (30% 1RM to 90% 1RM). The VBRT session was conducted in a fasted state. All sessions and measurements took place at the same time each day (between 8:00 and 9:00 a.m.) for every individual.



*PROGRAMMED INTENSITY							
GROUP	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8
A	30%RM	40%RM	50%RM	60%RM	70%RM	80%RM	90%RM
B	90%RM	80%RM	70%RM	60%RM	50%RM	40%RM	30%RM
	Sal-C			Sal-C			Sal-C

Figure 1. Experimental design.

Participants

Fifteen healthy and active males (26.4 ± 4.3 years; 178.6 ± 6.2 cm; 76.7 ± 10.7 kg) voluntarily accepted to participate in this study. Subjects were randomized into each group using a dice roll until achieving a similar number of participants in both groups. In addition, subjects needed to demonstrate a minimum of one year of experience in resistance training, which made bench press throw part of their regular routine. Participants abstained from any other training or supplement intake for all seven weeks. They were also requested to follow their habitual eating patterns. Subjects with endocrine disruption, heart disease, or injuries to the shoulder, wrist, or elbow were excluded from the research. Each subject provided written informed consent before participation, after being fully informed about its aims, potential benefits, and associated risks. The study received approval from the University Ethics Committee (DPS.MMR.01.18) and was conducted in accordance with the principles outlined in the Declaration of Helsinki.

Procedures

Bench press throw

Participants performed the bench press throw exercise on a Smith Machine (Multipower M953; Technogym, Italy). They lay on their backs on the bench, holding the bar keeping their arms fully extended. They lowered the bar until it gently touched their chest, about 3 cm above the xiphoid process, and then pressed it upward by extending their elbows. Proper form was maintained throughout the movement, ensuring the head and hips stayed in contact with the bench and the feet remained flat on the floor. To avoid injury and ensure accurate performance, bouncing the bar off the chest or arching the back was not allowed.

1RM Assessments

To determine the 1RM value, an incremental load test was conducted following the methodology of Sánchez-Medina and González-Badillo (2011). All participants began with an initial load of 20 kg, which was increased by 10 kg per set until a mean propulsive velocity (MPV) of 0.5 m/s was achieved. After reaching this point, the load was adjusted in smaller increments of 5 to 2.5 kg until the participant could no longer lift the bar. A rest period of at least 5 minutes was provided between sets. The same researcher supervised the 1RM session to ensure consistency, and all conditions were carefully controlled according to standard.

Velocity loss measure

Mechanical data were collected using an iso-inertial dynamometer (T-Force Dynamic Measurement System, Ergotech, Murcia, Spain), which includes a linear velocity transducer linked to specialized software. The system recorded vertical instantaneous velocity at a rate of 1000 Hz. A single researcher oversaw the VBRT session to ensure consistency, with all conditions standardized. The analysis focused on maximum mean propulsive velocity (MPV max), peak power, optimal repetition (OR), and time under tension (TUT).

Salivary hormonal response

Salivary samples were obtained immediately before the exercise and following the final set. Participants were instructed to avoid eating, drinking, or using toothpaste for at least two hours prior to the assessment. To establish baseline values, they rested quietly for 15 minutes before the samples were collected. A 5-10 ml saliva sample was gathered in a sterilized plastic tube (Salivette®, Sarstedt, France) and stored at -20 °C until analysis (Sarabia et al., 2015). Each analysis was performed in duplicate using the Cortisol Enzyme-Linked Immunoassay Kit (Salimetrics, State College, PA), which has a sensitivity of 0.007 μg/dL and a 4% coefficient of variation. Calibration followed the manufacturer's instructions.

Statistical analysis

The data are expressed as mean ± standard error of the mean (SEM). The Kolmogorov-Smirnov test was applied to evaluate the normality of the data distribution, and ANOVA was performed to examine the relationship between OL and 1RM load. As no significant influence was detected, the assumptions of normality and independence were satisfied. Additionally, Levene's test confirmed homogeneity of variance. After checking, an ANOVA of repeated measures was performed because of its ability to compare means across multiple conditions within the same subjects. A Bonferroni post hoc test was performed whenever variations were present. Mechanical and hormonal variables were analyzed as within-subject factors, with the mechanical variable comprising seven levels corresponding to RM percentages (30%, 40%, 50%, 60%, 70%, 80%, and 90%) and the hormonal variable including three levels (30%, 60%, and 90% RM). A bivariate correlation was conducted to evaluate the relationship between the percentage change in Sal-C and TUT, but no significant correlation was observed. Effect sizes were calculated using Hedges' g (Freeman et al., 1986; Hedges & Pigott, 2004) and interpreted according to Rhea's (2004) criteria: trivial (<0.35), small (0.35–0.80), moderate (0.80–1.50), and large (>1.50). Statistical significance was set at $p < 0.05$. All data analyses were conducted using PASW Statistics 18 software (Chicago, IL, USA).

Results

The analysis examining the independence between the initial load (OL) lifted and the one-repetition maximum (1RM) revealed no significant influence ($F(1,14) = 0.546$; $p = 0.473$). This finding indicates that the initial load lifted by participants did not have a statistically significant effect on the percentage of 1RM at which they reached their peak performance. In other words, the starting weight used by participants did not bias or alter the outcome related to the percentage of 1RM at which they ultimately performed best. Therefore, it was deemed appropriate to proceed with repeated ANOVA measurements for subsequent analyses, as this statistical method is suitable when the same subjects are measured under different conditions.

The ANOVA results demonstrated significant differences across intensities for key performance metrics, including velocity ($F(6, 84) = 410.89$; $p < 0.001$), TUT ($F(6, 84) = 2.248$; $p = 0.045$), peak power ($F(6, 84) = 11.627$; $p < 0.001$), and OR ($F(6, 84) = 22.185$; $p < 0.001$). Specifically, velocity showed a remarkable variation across all tested intensities, highlighting how performance speed changes significantly depending on the percentage of 1RM used. In contrast, TUT, which measures how long the muscles are under strain during the lift, did not show differences in post-hoc analysis, and remained consistent across different 1RM percentages, suggesting that the time spent under tension did not vary much despite changes in load intensity. Peak power shows differences between moderate intensity and light and high intensities.OR, which reflects the repetition number where velocity loss criteria were achieved, revealed significant differences among the various intensities. However, these differences were not observed between adjacent intensity levels, particularly between 50% and 70% 1RM, indicating a certain range where OR remains relatively stable. Descriptive statistics and comparisons across the different training loads are presented in Table 1.

Table 1.
Descriptive data (mean ± SEM; [95%CI]) and comparison among loads.

Load	MPV max (m/s)	OR (n)	Peak Power (W)	TUT (s)
30% 1RM	1.09 + 0.01 * [1.07; 1.11]	4.58 ± 0.20 [bcdefg] [4.19; 4.97]	505.6 ± 30.35 [445.5; 564.4]	21.16 ± 1.35 [18.48; 23.75]
40% 1RM	0.97 + 0.01 * [0.96; 0.98]	3.67 ± 0.14 [acdefg] [3.40; 3.94]	547.9 ± 30.10 [a] [488.0; 606.0]	23.08 + 1.02 [21.00; 25.00]
50% 1RM	0.84 + 0.01 * [0.83; 0.85]	3.39 ± 0.16 [aefg] [3.08; 3.70]	562.7 ± 28.64 [a] [505.9; 618.1]	24.04 + 1.19 [21.67; 26.33]
60% 1RM	0.69 + 0.01 * [0.68; 0.70]	2.86 ± 0.16 [abfg] [2.55; 3.17]	558.8 ± 25.98 [a] [507.1; 608.8]	25.02 ± 1.52 [22.02; 27.98]
70% 1RM	0.58 + 0.01 * [0.56; 0.60]	2.57 ± 0.13 [abcg] [2.32; 2.82]	543.9 ± 33.40 [477.5; 608.5]	25.14 + 1.28 [22.59; 27.67]
80% 1RM	0.43 + 0.01 * [0.41; 0.45]	2.18 ± 0.12 [abcdg] [1.94; 2.42]	475.2 ± 23.16 [bcde] [429.6; 520.3]	25.26 +1.56 [24.10; 26.30]
90% 1RM	0.32 + 0.01 * [0.29; 0.35]	1.53 ± 0.09 [abcdef] [1.35; 1.71]	417.1 ± 22.82 [cde] [372.3; 461.7]	25.37 ± 1.96 [21.46; 29.14]

Notes: MPV max = maximum of mean propulsive velocity; OR = optimal repetitions; TUT = Time under tension; * = p < 0.05 compared with all percentages; [a] = p < 0.05 compared with 30% 1RM; [b] = p < 0.05 compared with 40% 1RM; [c] = p < 0.05 compared with 50% 1RM; [d] = p < 0.05 compared with 60% 1RM; [e] = p < 0.05 compared with 70% 1RM; [f] = p < 0.05 compared with 80% 1RM; [g] = p < 0.05 compared with 90% 1RM.

Regarding the analysis of Sal-C, no significant correlation was found between hormonal levels and the different training loads (d = 0.16; p = 0.281). This lack of correlation suggests that the amount of weight lifted did not directly influence the baseline hormonal response. However, Sal-C levels did demonstrate substantial changes following the intervention across all load intensities ($F(1, 14)$ = 45.071; $p < 0.001$), as detailed in Table 2. Specifically, Sal-C levels showed a significant reduction across all tested percentages of 1RM, with a more dramatic effect size observed at lower loads (30% 1RM) compared to higher loads (90% 1RM). This indicates that lighter loads had a greater impact on reducing Sal-C levels post-exercise. Despite these overall reductions, no significant differences were observed between the individual 1RM percentages ($F(2, 28)$ = 1.258; p = 0.300), meaning that while Sal-C levels dropped across the board, the degree of reduction did not vary significantly between the different load levels.

The effect size analysis provided further insight into the changes in Sal-C levels (Δ% Sal-C) across different load comparisons. A trivial effect was observed when comparing the changes between 30% vs. 60% 1RM (ES = 0.35) and 60% vs. 90% 1RM (ES = 0.24), suggesting that the magnitude of Sal-C reduction was minimal between these specific comparisons. However, a small effect was noted when comparing 30% vs. 90% 1RM (ES = 0.63), indicating a slightly more noticeable reduction in Sal-C levels when contrasting the lightest and heaviest loads. These findings highlight the nuanced impact of load intensity on hormonal responses, with lower intensities leading to more substantial reductions in Sal-C levels.

Table 2.
Changes in Sal-C concentration (mean ± SEM; [95%CI]) after intervention in each load.

Load	Pre (µg/dL)	Post (µg/dL)	Δ% Sal-C	ES	p
30% 1RM	0.58 ± 0.04 [0.50; 0.66]	0.37 ± 0.03 [0.31; 0.43]	-21.14%	1.61 (high)	0.000
60% 1RM	0.52 ± 0.05 [043; 0.63]	0.37 ± 0.03 [0.31; 043]	-16.02%	0.95 (moderate)	0.001
90% 1RM	0.48 ± 0.03 [0.42; 0.54]	0.35 ± 0.03 [0.29; 0.41]	-12.83%	1.00 (moderate)	0.001

Notes: Sal-C = Salivary Cortisol; Δ% Sal-C = percentage change of Salivary Cortisol.

Discussion

The aim of this study was two-fold: a) to characterize 7 different loads, related to the 1RM, with the same velocity loss percentage in the bench press throw exercise and b) to compare acute Sal-C response at different percentages of 1RM. This is the first study that compares the changes in Sal-C after a protocol based on the press bench exercise in 3 different percentages of 1RM.

The main results showed that the MPV max was different between percentages although the time under tension to achieve10% of velocity loss was kept on among loads. Besides, there were differences in optimal repetitions that could be achieved in each percentage and the peak power was found at around 50% of 1RM. In addition, Sal-C concentration decreased in all loads, while higher changes in Sal-C after intervention were found in the lower load (30% 1RM). The MPV max found in this study diverges from the data provided by other authors at moderate and light intensities (García-Ramos, Pestaña-Melero, et al., 2018; Loturco et al., 2017). These differences could be due to the participants' training level since these authors included participants with higher training backgrounds (at least one additional year). Another possible explanation may be the use of a specific Smith machine, as the assisted rolling bearing on this equipment might have influenced results in velocity.

Besides, contrary to what was expected, TUT was similar among the intensities, thus velocity loss could have a non-linear behavior related to the intensity in training and directly related to effort time (Trybulski et al., 2022). In this sense, velocity loss could be regarded a good index of volume training (García-Ramos, Torrejón, et al., 2018; Guez-Rosell et al., 2020) since participants showed the same time of effort and stress across intensities when only one velocity loss criterion was applied. Therefore, velocity loss could be used for individualised training (González-Badillo et al., 2011; Pareja-Blanco et al., 2017), because it allows to establish the same level of fatigue during the resistance training regardless of the exercise's intensity.

The present work delved into the acute effects of training on Sal-C as well as into velocity loss at different 1RM percentages. Despite the fact that research has already looked into the hormonal response to resistance training, their conclusions seem to be inconsistent, possibly due to inconsistencies in the timing of sample collection (McCaulley et al., 2009; McGuigan et al., 2004; Stokes et al., 2013) without considering the hormonal trigger response time (Hall & Hall, 2020). In addition, research on Sal-C response has not yet addressed the question on how to guarantee equal fatigue levels among subjects across participants (Cairns et al., 2005; McCaulley et al., 2009; Stokes et al., 2013).

In this study, where an exercise and timing sample was standardized, Sal-C decreased in all percentages compared to the first samples collected in each measure and no difference among intensities was found. However, previous literature such as Kraemer & Mazzetti (2003) reported that cortisol increased when high-intensity exercise was done. Subsequently, the presence of higher cortisol concentrations promotes a higher muscle protein degradation (Wing & Goldberg, 1993). Therefore, it could be suggested that velocity-based training regardless of intensity is an ideal training method to improve the strength-conserving muscle protein as Pareja-Blanco et al. (2017) has shown when low-velocity loss criteria are applied.

At no 1RM percentage was there any perceptible variation in Sal-C, and still, a high effect was observed as soon as participants tackled the 1RM exercise at 30%, as compared to higher percentages. However, the variation in Sal-C (Δ% Sal-C) showed no striking differences between the 1RM percentages, although there was a smaller drop in Sal-C when participants trained at higher intensities. It was found that the effect sizes for these comparisons were too small to be considered. Therefore, this study follows Walker et al. (2022) results since they revealed that VBRT had a low physiological impact on cortisol concentration. Thus, for the aforementioned reasons, it could be hypothesized that lower intensities might have slightly stronger conservative effects than higher intensities. What is more, this study seems to indicate that subjects with no prior training could do up to six sets at all percentages. Peak power decreased during exercise, and yet there were no statistically relevant differences to be identified among the six sets. Additionally, optimal repetitions (ORs) stayed consistent along sessions at all 1RM percentages. Therefore, ORs might be a reliable parameter to establish training volume. It has been suggested that in order to make power training optimal, the number of repetitions should be half of the total repetitions possible.(Legaz-Arrese et al., 2007). This does not seem to be the case at percentages lower than 80%, where subjects required only a few repetitions (four or fewer) to meet the criteria.

Furthermore, the present results showed that repetitions appear less in the peak power load than in a lower percentage of 1RM (Allen et al., 2008; Sánchez-Medina et al., 2014). This evidence is supported by effort character (González-Badillo & Gorostiaga-Ayestarán, 2002), since the higher the intensity the fewer repetitions, thus assuming that the velocity is characteristic of an exercise and intensity (González-Badillo & Sánchez-Medina, 2010), the velocity loss by repetition might be higher in percentages closer to 1RM. Moreover, this work comes to prove that peak power is reached at 1RM intensities which lie between 40% and 70%, which follows the results obtained by other authors (Baker et al., 2001; Cronin et al., 2001; Stock et al., 2010) who have similarly observed that peak power occurs at moderate intensity levels. This consistency across studies reinforces the notion that medium intensities are optimal for maximizing power output during resistance training exercises. Nevertheless, several limitations could be identified in this research. (i) Hormonal determination should be sampled a few minutes after performing the exercise, since the main findings have been detected even 30 minutes after training. Additionally, (ii) Sal-C should have been measured at all percentages which would have allowed to establish a regression between intensities and cortisol modulation. (iii) Future design will need to implement a blinding procedure, higher sample size and to include a control group to improve the quality of research.

Perspective

This study provides valuable insights into the acute salivary cortisol response and velocity-based resistance training (VBRT) across different percentages of 1RM in the bench press throw exercise. The findings underscore the importance of understanding the physiological implications of fatigue induced by resistance training, particularly about hormonal responses (Bermejo et al., 2022). The decrease observed in salivary cortisol concentration across all intensities suggests that VBRT may not significantly influence cortisol levels, indicating a potential dissociation between intensity and hormonal response. This challenges conventional notions regarding the impact of resistance training on cortisol modulation and highlights the need for further investigation into the complex interplay between training variables and hormonal dynamics. Moreover, the maintenance of time under tension at various intensities highlights the potential of velocity loss criteria as a reliable index for monitoring training volume and fatigue. This reinforces the utility of velocity-based metrics in optimizing resistance training protocols and individualizing training prescriptions. While this study provides valuable insights, it also points to avenues for future research. Further exploration into the temporal dynamics of cortisol response post-exercise and its relationship with velocity-based training volume could elucidate the nuanced effects of resistance training on hormonal regulation. Additionally, quantifying optimal training volume based on power loss in each set could enhance training efficiency and performance outcomes.

Conclusion

This study found that maximum propulsive velocity and optimal repetitions decreased as intensity increased, while time under tension remained consistent across all intensity levels. The results also indicate that salivary cortisol (Sal-C) may not be relevantly impacted by intensity while performing velocity-based resistance training (VBRT), as reductions were similar (25-35%) across all 1RM percentages. However, training volume might affect Sal-C, given the consistent time under tension across intensities. To better understand these dynamics, further research examining the salivary cortisol response under varying training volumes is recommended. Additionally, quantifying the optimal training volume could help mitigate power loss observed in each set, enabling athletes to train effectively while avoiding excessive fatigue.

Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions

According to the CRediT taxonomy, the contributions of each author are as follows: Conceptualization: M.M.-R. & A.G.-V.; Data curation: A.G.-V. & D.P.; Formal analysis: A.G.-V. & M.M.-R.; Funding acquisition: M.M.-R.; Investigation: A.G.-V.; Methodology: M.M.-R. & A.G.-V.; Project administration: M.M.-R.; Resources: M.M.-R. & D.P.; Supervision: M.M.-R.; Validation: D.P. & M.M.-R.; Visualization: A.G.-V.; Writing – original draft: A.G.-V.; Writing – review & editing: M.M.-R & J.R.-G.

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