ACUTE NEUROMUSCULAR AND METABOLIC RESPONSES DURING HIGH-INTENSITY INTERVAL TRAINING SESSIONS, IN TEAM SPORT PLAYERS

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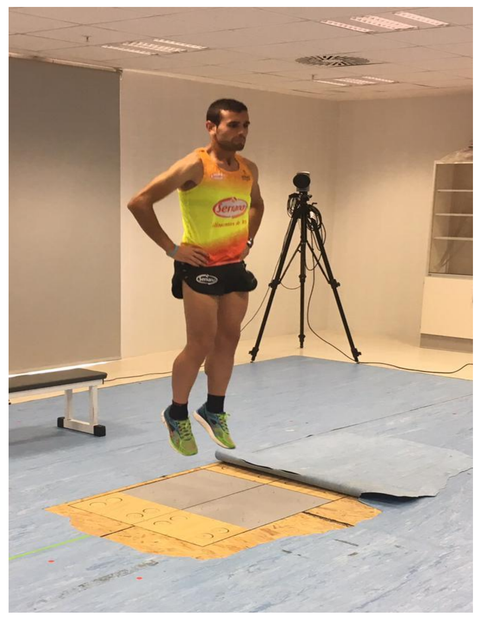
Background and Justification

Concurrent training involves the adequacy of different training contents, in order to avoid a negative interference between them [1]. In this line, previous studies have analyzed acute neuromuscular fatigue during intermittent efforts performed until exhaustion [2,3]. However, the effects of regular sessions of high intensity interval training (HIIT) on explosive strength has not been sufficiently explained.

Purpose

To analyze the mechanisms that could affect countermovement jump performance during two different HIIT sessions.



Methods

Subjects: Eleven male team-sport players (football, 3; field hockey; 3; handball, 4; volleyball, 1), who participate in regional level competitions (Table 1).

Table 1. Anthropometric and performance data

n = 11	Age (years)	Height (cm)	Mass (kg)	Body fat (%)	$VO_{2\ max}$ ($L \cdot min^{-1}$)	MAS ($km \cdot h^{-1}$)	T_{LIM} (s)
Mean	20.8	181.2	72.0	10.1	3.3	14.3	355
± sd	3.2	8.3	7.0	3.0	0.7	1.2	62

MAS, maximal aerobic speed; T_{LIM}, Time to Exhaustion test.

Procedures: Based on preliminary testing, the participants completed **two HIIT sessions**, on separated days.

- Intensity: 100 % MAS
- Series volume was equal to T_{LIM}
- Work to rest ratio was of 1:1
- A different work-interval duration was applied in each session
- Blood lactate concentration and CMJ performance were measured pre-effort, and at the end of all series

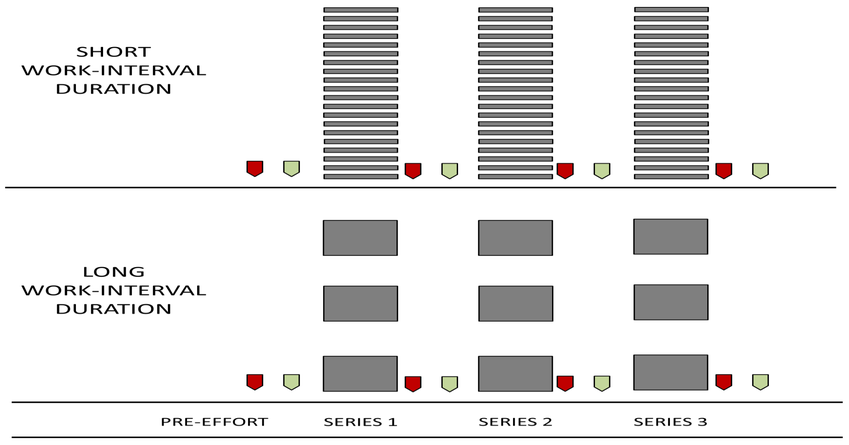


Figure 1. Schematic overview of the short and long HIIT sessions.
Grey rectangles represent work-intervals; Blood lactate measurement; CMJ Test.

Results

The repeated measures ANOVA showed:

- An **effect of** the type of **session** ($p < .001$, power = 1.00), and the **volume** ($p < .001$, power = 1.00) **on blood lactate concentration** with an **interaction** of both factors for this variable ($p < .001$, power = 1.00) (Figure 2).
- An **effect of volume** ($p = .024$, power = .738) **on CMJ** performance (Figure 3).

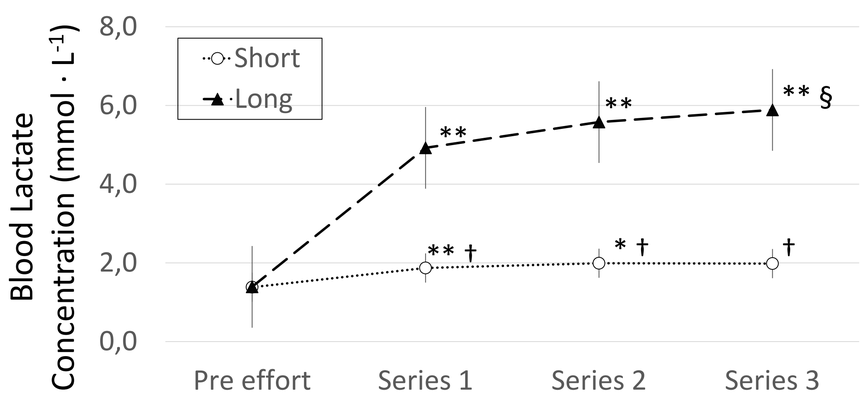


Figure 2. Mean and typical error for blood lactate concentration across series during the two HIIT sessions. *significantly different ($p < .05$) from pre-effort; ** significantly different ($p < .001$) from pre-effort; § significantly different ($p < .01$) from series 1; † significantly different ($p < .001$) from long session

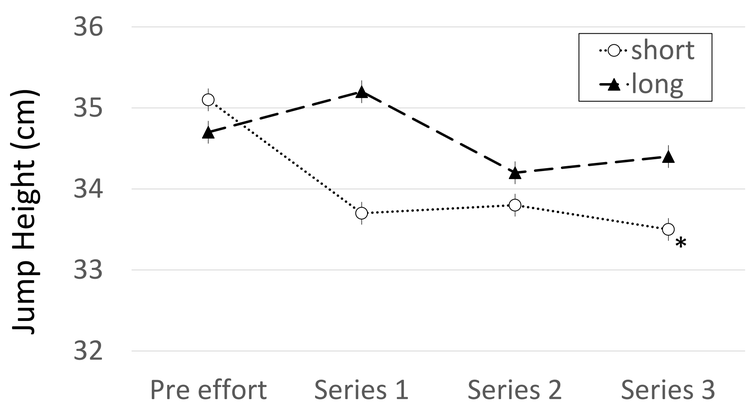


Figure 3. Mean and typical error for CMJ height across series during the two HIIT sessions.
*significantly different ($p < .05$) from pre-effort.

Conclusions and Practical Applications

- CMJ performance is not necessarily dependent of the blood lactate concentrations levels.
- The fact that a jump diminish occurred at the end of series 3 of the short protocol, in which the lactate values were extremely low, suggests that the underlying mechanisms that conditioned neuromuscular capacity may be related to the mechanical demands (i.e. repeated accelerations), rather than to the metabolic stress.
- These findings could be useful for physical trainers and coaches, as it provides specific information about the neuromuscular responses that may be observed when conducting this type of protocols.

References

1. Wilson J.M., Marin P.J., Rhea M.R., Wilson S.M., Loenneke J.P., & Anderson J.C. (2012). Concurrent training: a meta-analysis examining interference of aerobic and resistance exercises. *Journal of Strength and Conditioning Research, 26*, 2293-2307.
2. Gathercole R., Sporer B., Stellingwerff T., & Sleivert G. (2015). Alternative Countermovement-jump analysis to quantify acute neuromuscular fatigue. *International journal of sports physiology and performance, 10*, 84-92.
3. Watkins C.M., Barillas S.R., Wong M.A., Archer D.C., Dobbs I.J., Lockie R.G., et al. (2017). Determination of vertical jump as a measure of neuromuscular readiness and fatigue. *Journal of Strength and Conditioning Research, 31*, 3305-331.

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