

# Effect of complex vs. specific Handball training in young elite female players



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## Introduction

Repeated sprint ability (RSA) is known to be related to first sprint performance (i.e., maximal speed)<sup>1</sup>, neuromuscular activation<sup>2</sup>, but also on other metabolic and oxidative factors that are involved when repeating the sprints (e.g., PCr recovery, H<sup>+</sup> buffering)<sup>1</sup>. Nevertheless, the distinct impacts on RSA of a strength/speed (aimed at improving the first sprint) vs. aerobic (aimed at improving the ability to repeat sprints) training program are unknown. The aim of the present study was to compare the effect of strength/speed (i.e., complex training<sup>3</sup>) vs. high intensity aerobic (i.e., specific aerobic handball exercises<sup>4</sup>) training on athletic performance and RSA in young elite female handball players.

## Methods

Twelve highly-trained young female (15.2 ± 0.9 y, Tanner stage III (5), IV (6) and V (5)) were randomly assigned to either complex (C; n = 6) or small-sided handball games (HBT; n = 6) training groups. Groups were matched for initial physical performance, training history, age and maturation status. During 10 weeks, C consisted in 4 to 6 series of 4 to 6 exercises (e.g., leg press, one-legged half squat (Fig 1.A.), counter movement jumps, depth and pliometric jumps, 5-m shuttle sprints...)<sup>3</sup>, each interspersed with at least 45 s of passive recovery; HBT consisted of 2-3 x 3 to 4-min small sided handball games (4 vs. 4, Fig 1.B.)<sup>4</sup>. Groups performed either C or HBT twice per week and maintained similar external training programs. Before and after training, performance was assessed by 1-RM leg press, counter movement jump (CMJ), leg stiffness (Stiffness, hopping test<sup>5</sup>), 10 m sprint time (10 m), best (RS<sub>b</sub> and CMJ<sub>b</sub>), mean (RS<sub>m</sub> and CMJ<sub>m</sub>) and percentage of speed and height decrement (%DecRS and %DecCMJ) on a repeated shuttle-sprint/jump ability test (6 x (2x15m), interspersed with 20 s of recovery; a CMJ being performed during the recovery period) and time to exhaustion during a high-intensity intermittent exercise (HIT, 15 s ran at 19 km.h<sup>-1</sup> interspersed with 15 s of active recovery ran at 9 km.h<sup>-1</sup>).

## Results

After training, except for 10 m and CMJ, all performances were significantly improved in both groups (all  $p < 0.05$ ). CMJ was only increased for C ( $p < 0.05$ , Fig. 2). Nevertheless, relative changes for RA<sub>b</sub>, Ra<sub>m</sub>, CMJ<sub>b</sub> (Fig. 2) and HIT (93.6 ± 80.8 vs. 20.0 ± 17.4 %,  $p < 0.05$ ) were higher for HBT compared to C. Changes in %DecRS (+26.6 ± 22.7 vs. 19.8 ± 15.6% for HBT vs. C, respectively,  $p = 0.40$ ) and %DecCMJ (-22.3 ± 57.5 vs. -13.8 ± 78.4% for HBT vs. C, respectively,  $p = 0.44$ ) were not different between groups. When pooling all players together, changes in 10m were significantly correlated with changes in CMJ ( $r = -0.66$ ,  $p < 0.05$ ).

## Conclusions

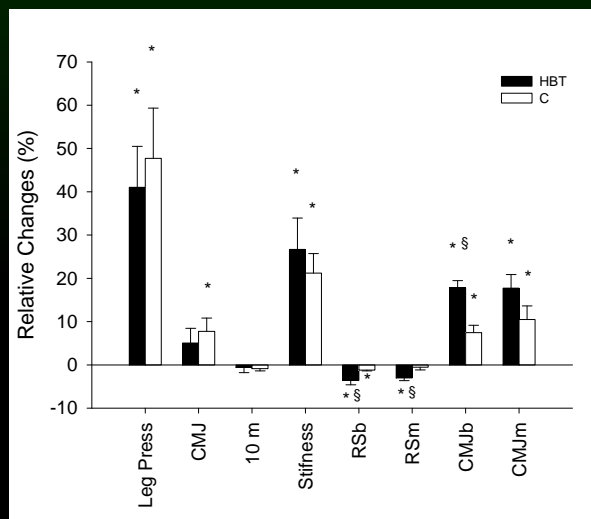
Present results show that, in addition to usual training contents, both complex and specific aerobic handball training represent effective means to increase physical performance and repeated sprint/jump ability in young elite female handball players. Nevertheless, in such '(pre)pubertal' players (Tanner Stage 3 and 4, n = 11), small-sided handball games had a greater impact on repeated sprint/jump ability than complex training. The fact that handball spontaneously involves jumping, sprinting, throwing and aerobic abilities at high intensity might explain its remarkable efficiency at improving at the same time cardiorespiratory and muscular-related determinants of handball performance and repeated sprint/jump ability. Because of its specificity and high efficiency, specific handball training should be considered as the preferred training method in young female players. Nevertheless, whether well-trained adult males are likely to demonstrate similar benefits as yet to be investigated.

## References

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**Fig 1.** Illustration of the two training modalities. A: one-legged half squat (complex training). B: Small-sided Handball games (specific handball training, 4 vs .4).



**Fig 2.** Relative changes in 1-RM Leg press, counter movement jump (CMJ), 10 meter sprint time (10 m), leg stiffness (Stiffness), 10 meter sprint time (10 m), best (RS<sub>b</sub> and CMJ<sub>b</sub>) and mean time (RS<sub>m</sub>) and height (CMJ<sub>m</sub>) on a repeated sprint/jump ability test ( $p < 0.05$ ). \*: significant training effect. §: significant vs. C ( $p < 0.05$ ).