Improving high-intensity intermittent running performance and repeated-sprint and jump ability in young elite female handball players: to lift or to play?

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Headline

High-intensity intermittent running capacity and repeated sprint and jump ability are important components of physical performance in elite Handball (1, 2). While the most efficient training methods likely involve a combination of strength, speed and metabolic conditioning (1, 3), those training objectives may have superior effects when targeted in isolation than combined (4) (known as the toothpaste theory). Nevertheless, the distinct effects of a strength/speed (aimed at improving the first sprint or jump efforts) vs. sport-specific metabolic (aimed at improving the ability to repeat those efforts) training program are unknown.

Aim. The aim of the present study was to compare the effect of supplementing usual technical/tactical handball training contents with a gym-based strength/speed (5) vs. small-sided handball games (SSG) (6) on high-intensity intermittent running capacity and repeated sprint and jump ability.

Methods

Athletes. Twelve highly-trained young female players (15.2 ± 0.9 y, 61.4±7.0 kg; 1.65±0.1 m, Tanner stage III (5), IV (6) and V (1), 10 h.week^{-1} + 1 game) representative of an elite regional center in France participated in the study. These data arose as a condition of player monitoring in which player activities are routinely measured over the course of the competitive season (7); therefore, ethics committee clearance was not required. The study conformed nevertheless to the recommendations of the Declaration of Helsinki.

Design. Pre-post parallel group trial. Players were assigned to either a gym-based strength/speed (ST; n = 6) or SSG (n = 6) training group. Groups allocation were based on coaches decisions (need for more technical awareness for some players) and players availability (i.e., while players could perform the ST training on their own between 2 classes, they had to be a minimum of 8 players + 2 goal keepers (GK) to perform SSGs). As a matter of fact, players in group ST were likely older (16.0 ± 0.5 y vs. 14.2 ± 0.4 y) than those in the SSG group, although differences in maturation levels were unclear (Tanner Stage 4.2 ± 0.4 vs. 3.2 ± 0.4). During 10 weeks, ST consisted in 4 to 6 series of 4 to 6 exercises (e.g., 60-80% 1-RM leg press, 30% body-mass split squat, counter movement jumps, depth and plyometric jumps, 5-m shuttle sprints) (5), each interspersed with at least 45 s of passive recovery; SSG consisted of 2-3 x 3 to 4-min small sided handball games (4 vs. 4 + 2 GKs) (6). Groups performed either ST or SSG twice per week and maintained similar external training programs.

Methodology. Before and after training, physical performance was assessed by 1-RM leg press (Technogym, Cenesa, Italia), a counter movement jump and a hopping test (6 repeated jumps) from which average jumping height (Hop Heihgt) and leg stifness (Hop K) (8) were assessed (CMJ, Ergojump, Globus Italia, Codogne, Italy), a 10-m sprint time (10m) (Wireless Timing-Radio Controlled, Brower Timing System, Colorado, USA), a repeated sprint and jump ability test (2) where best (RSb and CMJb) and mean (RSm and CMJm) speed and jump performance were retained (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-1 interspersed with 15 s of active recovery ran at 9 km.h-1) (9).

Analyses. Data in the figures are presented as means with 90% confidence limits (CL). All data were first log-transformed to reduce bias arising from non-uniformity error. Between-group standarized differences in the change in the different performance measures were compared to the smallest worth-

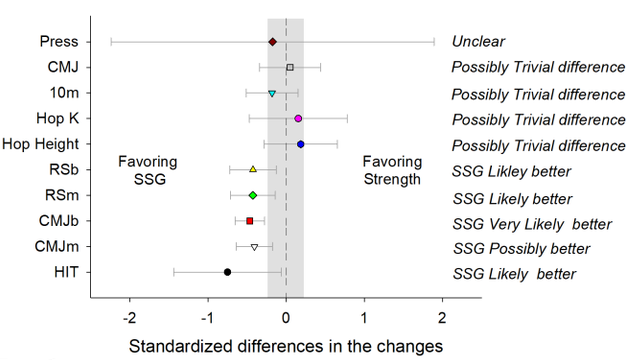

FIG. **1 –.** *Standardized difference in the changes in performance for ST vs. SSG training groups. Press: 1-RM leg-press, CMJ: isolated counter movement jump height, 10 m: 10-m sprint time, Hop K: vertical stiffness calculated during hopping, Hop Height: average hopping height, RSb: best sprint time during the repeated-sprint and jump test, RSm: average sprint time during the repeated-sprint and jump test, CMJb: best jump height during the repeated-sprint and jump test, CMJm: average jump height during the repeated-sprint and jump test and HIT: time to exhaustion during the high-intensity intermittent exercise.*

wile change (SWC, 0.2 multiplied by the pooled pre-training between-subject deviation, based on Cohens d principle) using magnitude based inferences. For all comparisons, pre-trainig performance was used as a co-variable. These probabilities were used to make a qualitative probabilistic mechanistic inference about the true effect: if the probabilities of the effect being substantially positive and negative were both >5%, the effect was reported as unclear; the effect was otherwise clear and reported as the magnitude of the observed value. Threshold values for standarized difeerences were >0.2 (small), >0.6 (moderate), >1.2 (large) and very large (>2) (10).

Results

Between-group differences in the change in Press, CMJ, 10 m, Hop K and Hop Height were unclear and trivial, respectively (Figure 1). SSG improved likely moderately more all other performance measures.

Discussion

Present results show that supplementing usual training contents with specific aerobic handball training in the form of SSGs represents a more effective means to increase high-intensity intermittent running performance and repeated sprint/jump ability in young elite female handball players than a gym-based program targeting strength and speed. The fact that handball spontaneously involves jumping, sprinting, throwing and aerobic abilities at high intensity (1) 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 (6). Nevertheless, whether well-trained adult males are likely to demonstrate similar benefits as yet to be investigated.

Practical applications

- In elite young female handball players, adding twice a week SSGs in the form of 4v4 (+2 GKs) to technical and tactical training contents has a likely greater effect on overall physical performance than a gym-based strength/speed work.
- In addition to their greater effectiveness, SSGs are generally more appealing for young players, and may help improving skills and tactical awareness under fatigue.

Limitations

- Players in the strength training group were a bit older than those in the SSG group, which may have affected the responses to the training programs - the comparisons were nevertheless adjusted on initial performance levels, which likely allowed to compensate for this potential bias.

Dataset

Dataset available on SportPerfSci.com

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