



Medical Aspects in Handball

Preparation and the Game

(SCIENTIFIC AND PRACTICAL APPROACHES)

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**Effect of in-season explosive strength training
on maximal leg strength. jumping. sprinting.
and intermittent aerobic performance
in elite handball players.**

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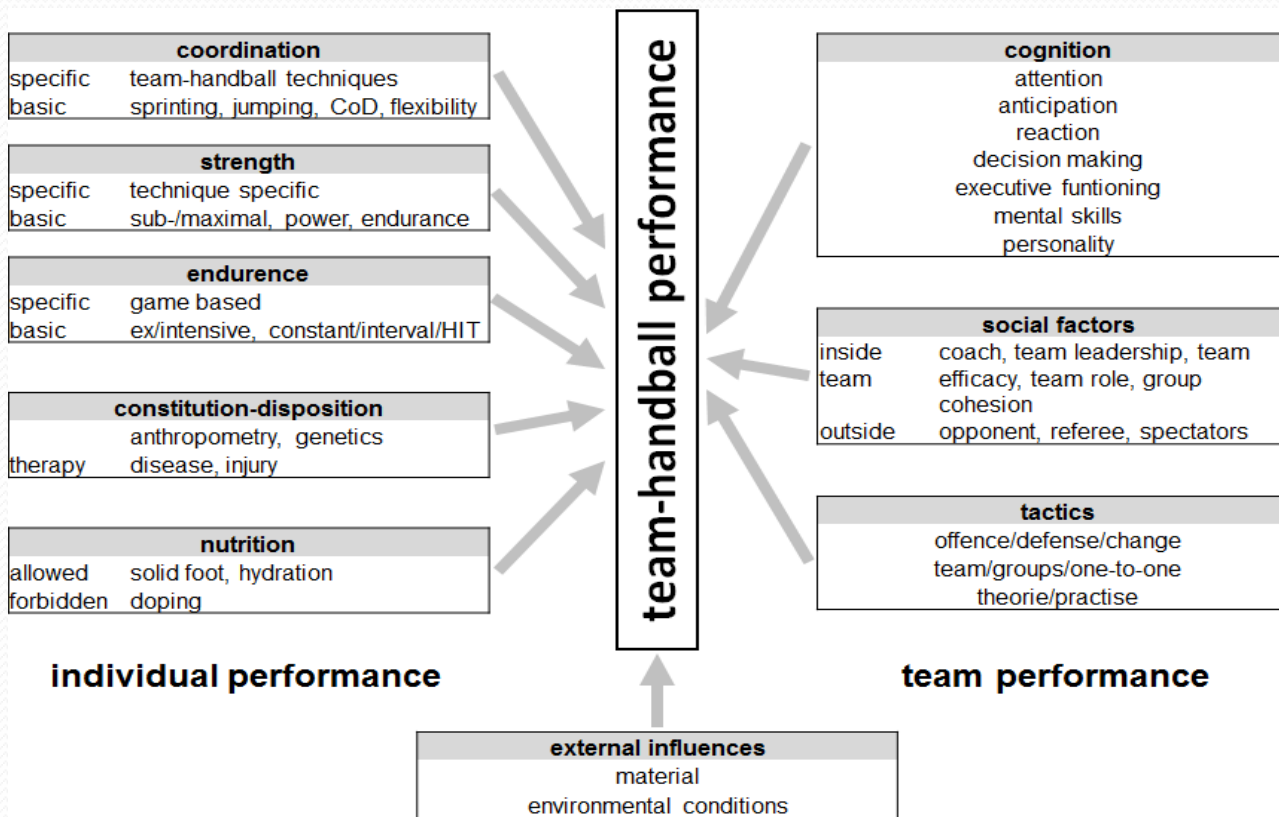




Introduction

Determinants of Team-Handball Performance

Wagner et al. 2014





Modern male elite Team Handball is a physically demanding

- **Body anthropometry** appear to have an **important influence on playing performance** and related to playing positions (Michalsik et al. 2014).
- **High explosive actions** performed at **high velocities**; depends well-developed **muscular strength** (Gorostiaga et al. 2006; Marques et al. 2007).
- **High number** and a **great variety** of short-term, **high-intense playing technical actions** (Emphasis on the anaerobic metabolism) Michalsik et al. 2014



Clear need to use high intense and specific external loads (i.e., explosive strength) to benefit from considerable muscular adaptations.

The effects of specific strength training programs on vertical jump, muscular strength and repeated sprint can help coaches select the best training stimulus in order to improve the performance of their players.

10-week in-season strength high-intensity (heavy load) training on physical performance in elite handball players during competition.





Handball players who supplemented their normal in-season handball training 10-week (i.e., 90-RM%) biweekly resistance for the lower limbs would enhance their muscular strength without compromising other factors critical to handball performance





METHODS

Elite Experimental Players Characteristics

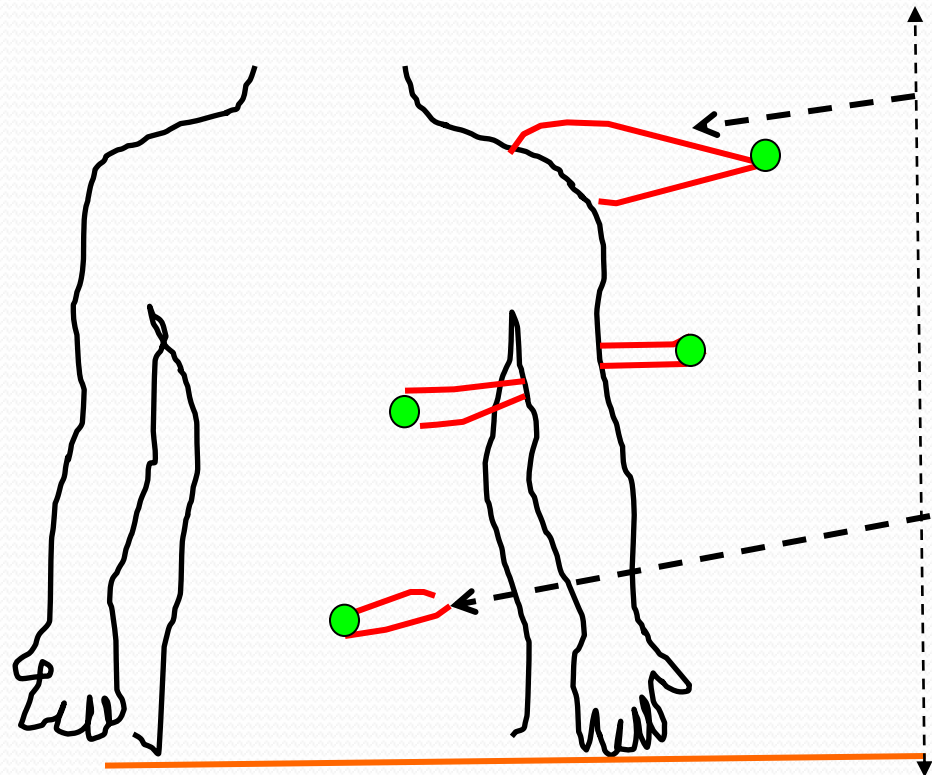
	Age (Years)	Height (cm)	Body Mass (kg)	BMI (kg/m ²)
EXG Players (n=12)	18.1 ±0.6	190 ±4.2	89.2 ±8.7	23.23 ±3.2
CG Players (n=10)	18.6 ±0.4	188 ±7.1	90.5 ±9.2	23.11 ±4.4





Anthropometry Measurement.

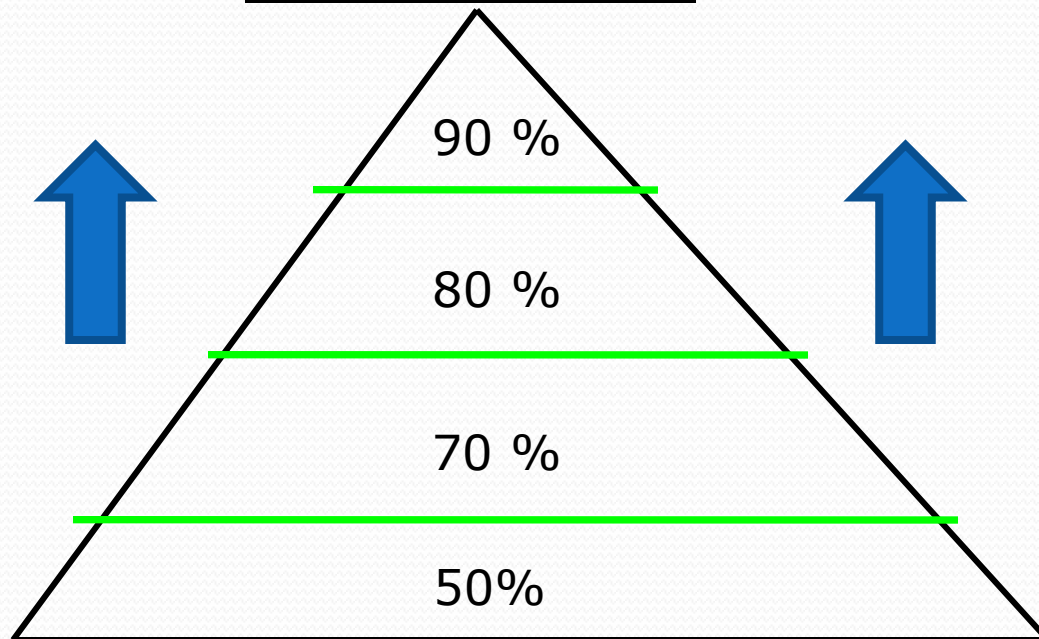
Percentage body fat, (Womersley and Durnin, 1973)





1-Repetition Maximum half back-squat

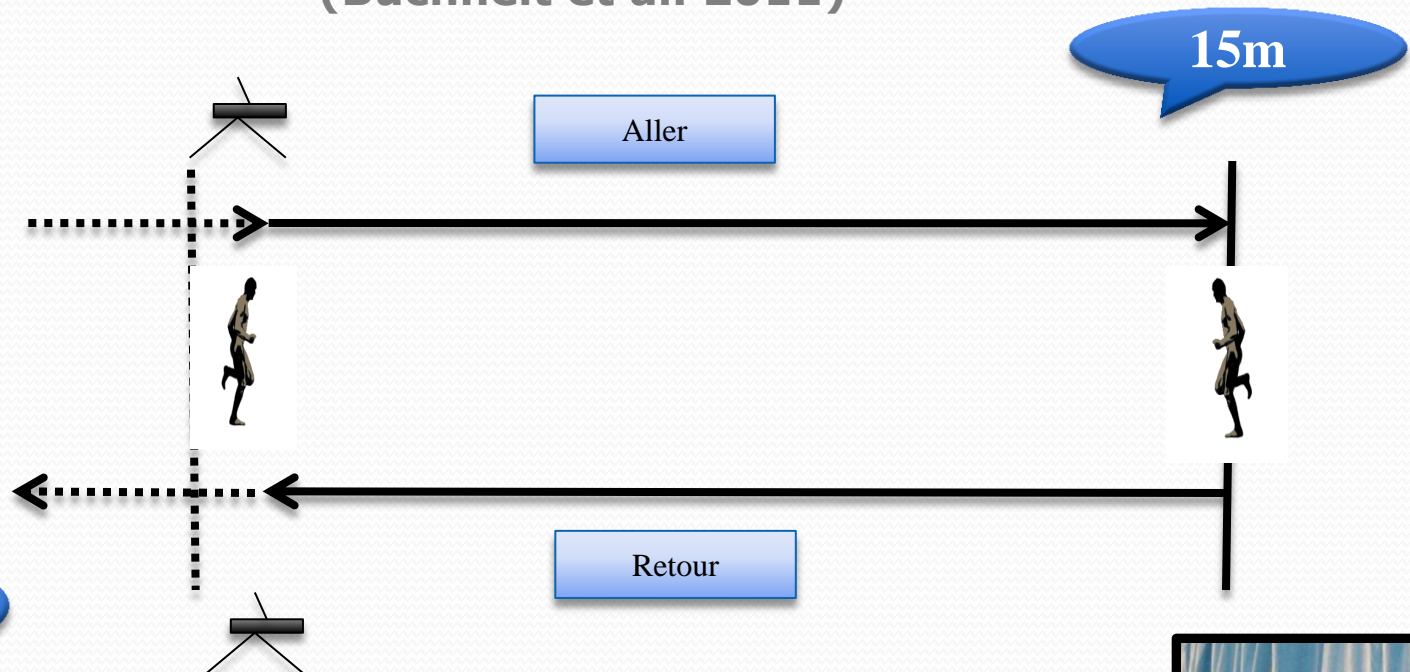
« National Strength and Conditionning Association »
(Baker et al. 1999)





Repeated Shuttle-Sprint Ability (RSA) test

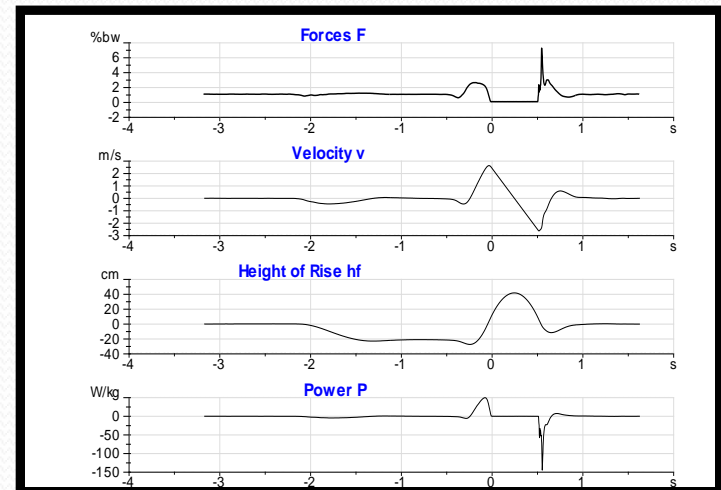
(Buchheit et al. 2011)





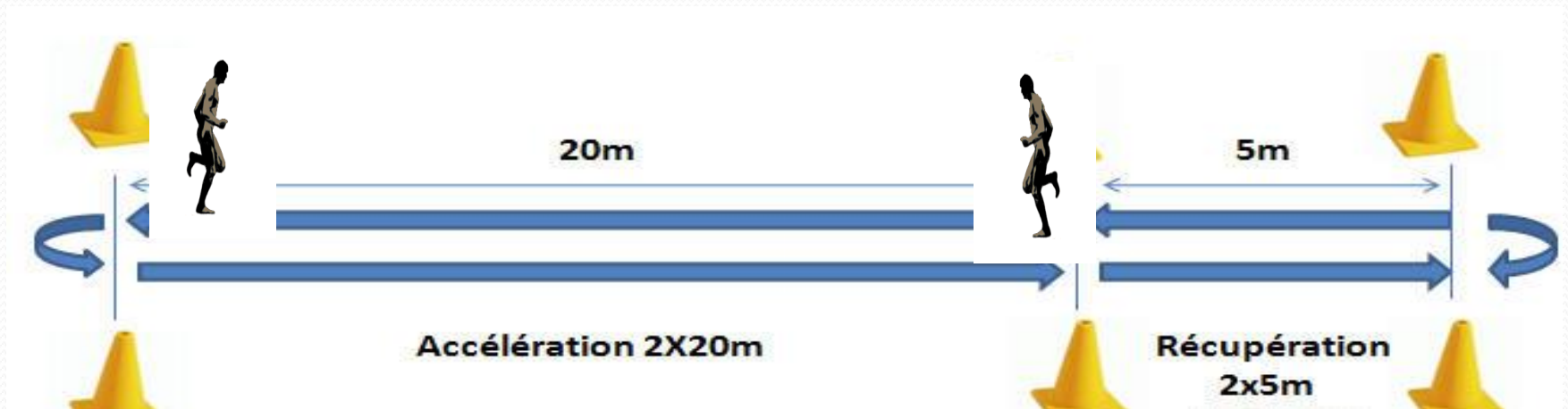
Squat (SJ) and countermovement jump (CMJ) tests

Quattro Jump, KISTLER





The Yo-Yo Intermittent Recovery Test Level 1





Measurement performance of Yo Yo IR1 test

(Bangesbo, 1996)

Speed (km/h ⁻¹)					
5	1 38,8sec 40				
9	1 64,8sec 80				
11	1 87,89sec 120	2 110,98sec 160			
12	1 132,98sec 200	2 154,98sec 240	3 176,98sec 280		
13	1 198,06sec 320	2 219,14sec 360	3 240,21sec 400		
14	1 281,58sc 480	2 301,86sc 520	3 322,15sc 560	4 342,43sc 600	5 362,72sc 640



Heavy resistance training program

10 consecutive weeks

Exercise	Session1	Session2	Session3	Session4
	70: 3x5	70: 3x5	70: 3x6	70: 3x 6
	Session5	Session6	Session7	Session8
	75: 3x5	75: 3x5	75: 3x6	75: 3x6
	Session9	Session10	Session11	Session 12
Half-Squat	80: 3x3	80: 3x3	80: 3x4	80: 3x4
	Session13	Session14	Session15	Session16
	85: 3x3	85: 3x3	85: 3x4	85: 3x4
	Session17	Session18	Session19	Session20
	90: 2x3	90: 3x3	90:3x3	90: 3x4
	% percent of RM		Sets reps	

*RM = repetition maximum.



Training sessions in the week

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
EXG Players	T	S+T	T	S+T	T	R
CG Players	T	T	T	T	T	R



Periodization of resistance training

10-week period from January to March

in the middle of the playing season (from the 22th to the 29th week),



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45



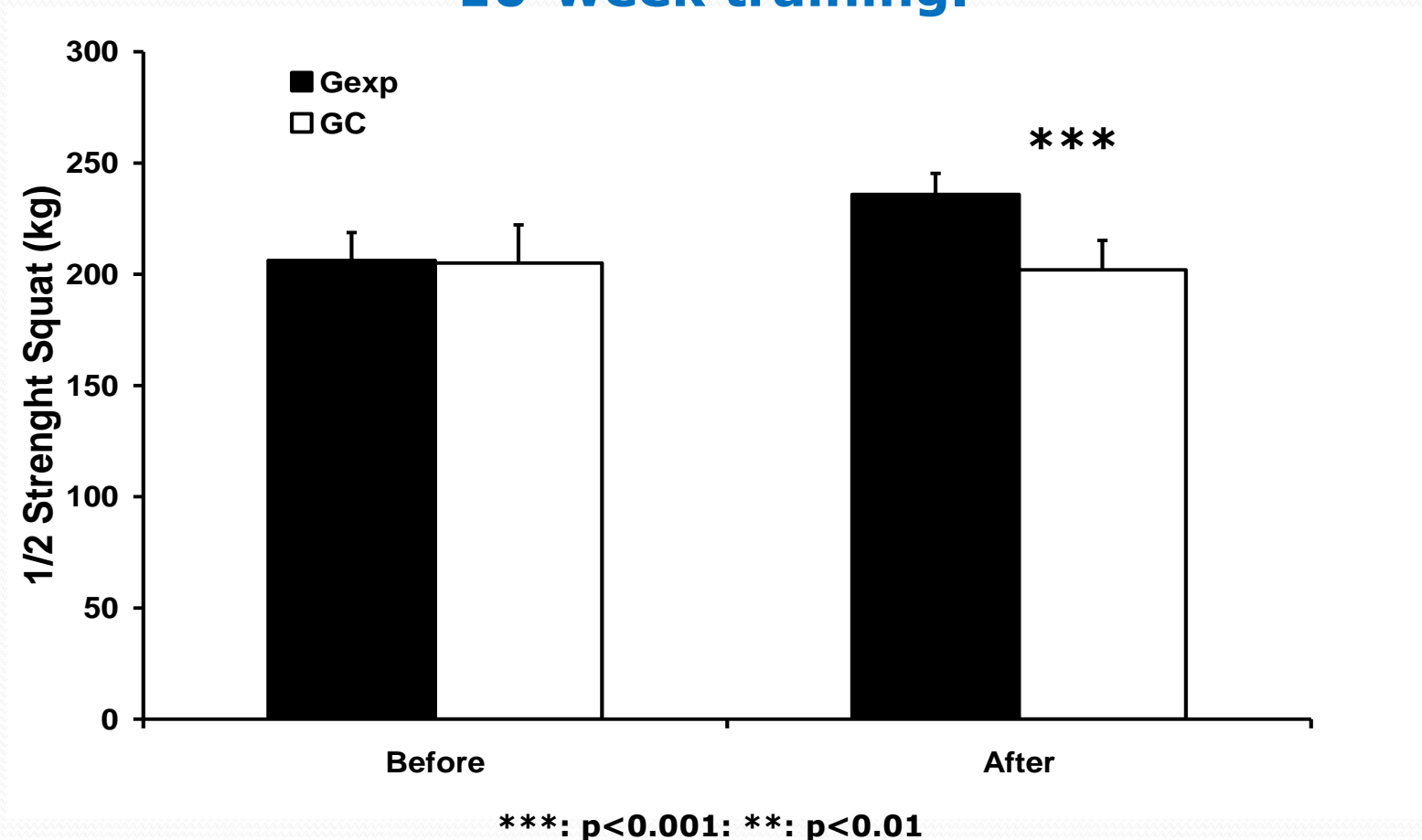
RESULTS

Reliability of various measurements

	ICC	95%CI	%CV
1-RM Max Strength			
1-RM half-Squat	0.92	0.82-0.96	3.2
Jumping tests			
Squt Jump	0.96	0.92-0.98	2.7
Contermouvement jump	0.95	0.93.0.99	2.4
Yo Yo intermittent Test			
Distance covred	0.93	0.91-0.96	3.1

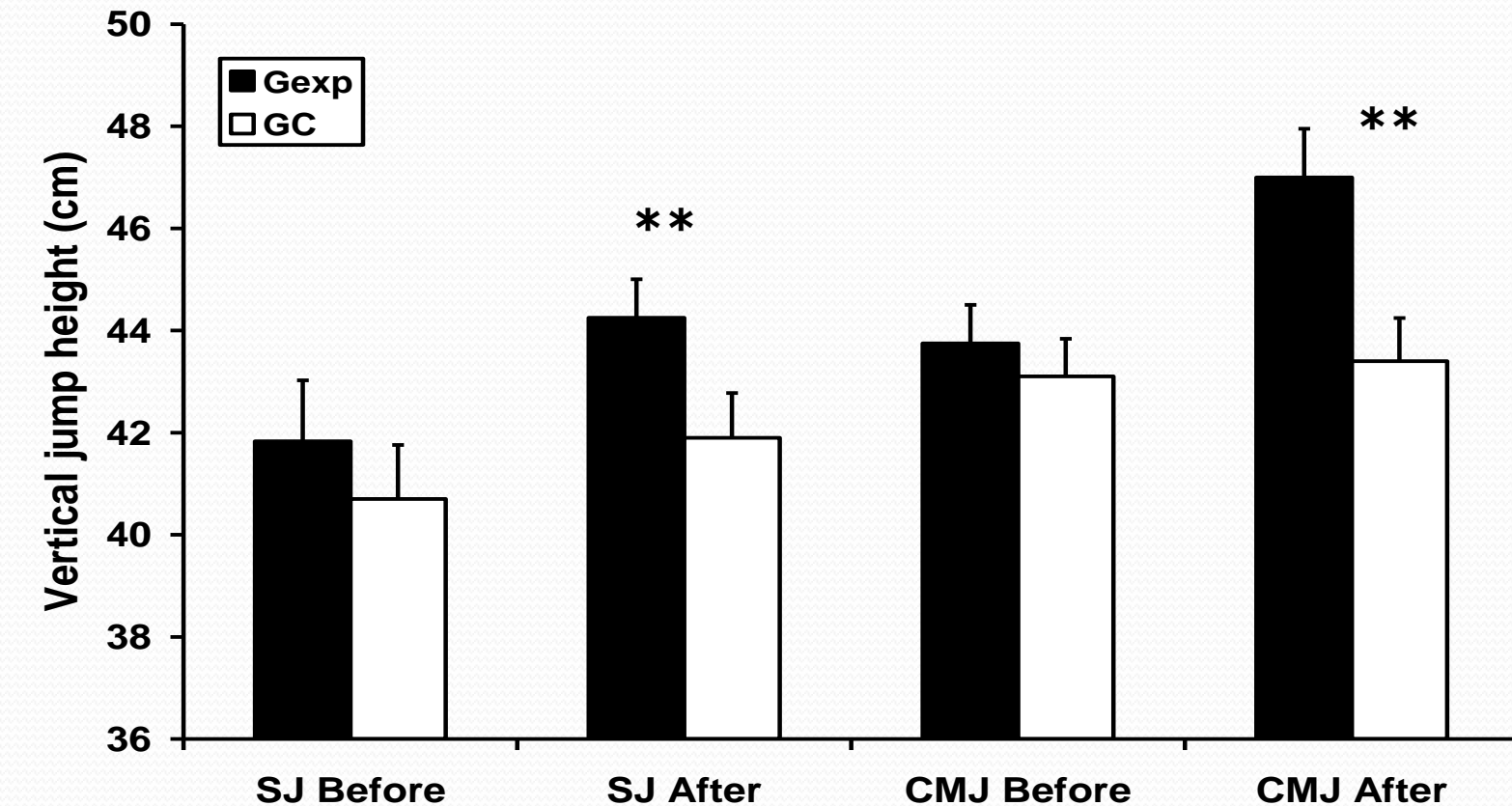


Comparison of maximal strength of lower limb between heavy resistance group and control group before and after 10-week training.





Comparison of vertical jump between heavy resistance group and control group before and after 10-week training.



** : $p < 0.01$

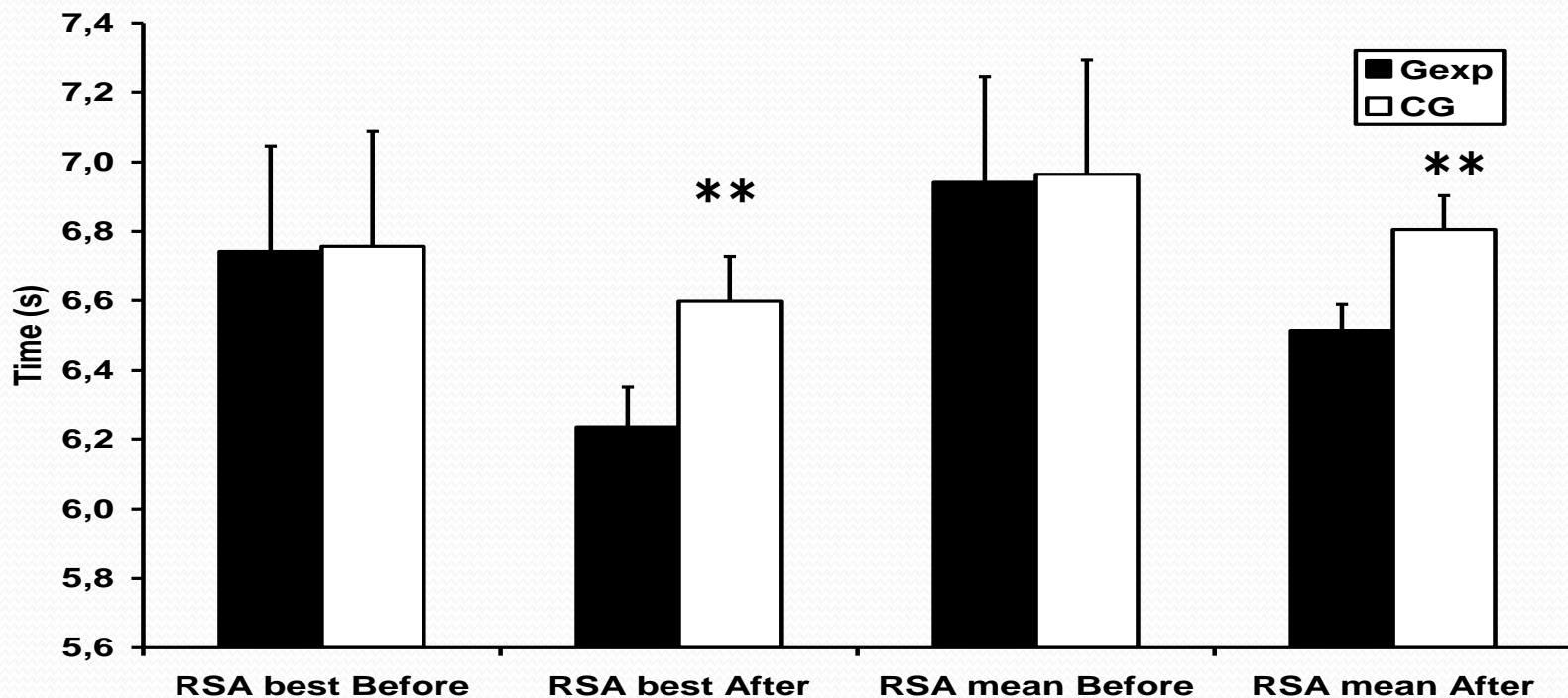


Percent improvement in vertical jump

	CMJ	SJ
Heavy resistance group	12 ⁰ %	14 ⁰ %



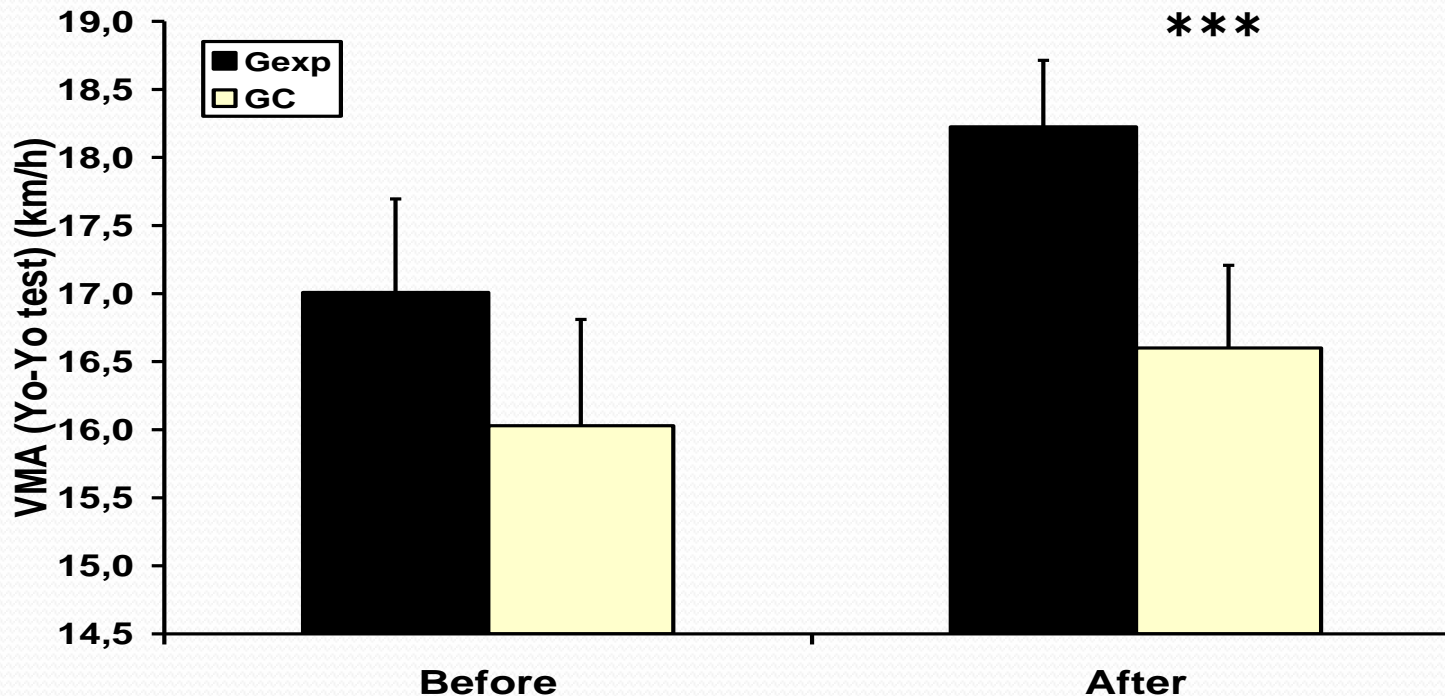
Comparison of RSA performance between heavy resistance group and control group before and after 10-weeksof training.





Le Préparateur Physique
SOUHAIL HERMASSI

Comparison of Yo-Yo Intermittent recovery test between heavy resistance group and control group before and after 10-weeksof training.





Muscular strength adaptations

In the present study, longer contraction durations were associated with heavier loads; such a prescription seems best suited to maximizing strength with a percentage improvement 22% ; $p < 0.001$

Gorostiaga et al. (2005) specific resistance training (12 weeks with 90% 1-RM) improves the strength of the leg extensors (12.2%; $p < 0.01$)

Marques et al. (2007) Heavy resistance training (16 weeks with 80-90% 1-RM improves the maximal strength of lower limb (11.2%; $p < 0.05$)



Vertical Jump Performance

The high loading (90% of 1-RM), which presumably led not only to muscle strength but also to vertical jump, with an increase in the high jump.

This study showed gains in vertical jump height (12 and 14% for CMJ and SJ, respectively) similar to those seen during training of junior handball players (Chelly et al. 2011) (11 and 12% respectively).

Gorostiaga et al. (1999) They reported significant increases in a group that had previously engaged only in team practice (6%; $p < 0.001$), but no changes of CMJ in either resistance training or control groups.



Repeated sprint Ability performance

The increases in muscle strength. our subjects showed **increases rather than decreases in RSAbest ($p < 0.01$), RSATT ($p < 0.001$) and RSAdec ($p < 0.01$)** for the experimental training group compared with the control group **in agreement with a recent study of junior soccer players (Kotzamanidis et al. 2005).**

To date, only three studies have reported that resistance training (2–5 sets of 10–15 repetitions maximal with 70% 1-RM) produces similar increases in mean work during a repeated-sprint test ($\sim 12\%$) (Robinson et al. 1995; Edge et al. 2004)



Yo Yo Intermittent Recovery Test level 1

To the best of our knowledge, no previous study has investigated the effect of maximal strength training, in **addition to regular handball training**, on intermittent endurance performance.

We found a significant improvement in aerobic intermittent endurance performance for the experimental group as the **maximal aerobic speed** was significantly **increased (16%, $p < 0.001$)** compared to control Group .



Conclusion

The performance improvements shown in the present study are of great interest for handball coaches, because the performance of this sport relies greatly on the specific maximal strength, jump, and repeated sprint ability that were enhanced by the high resistance training regimen.



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**Thanks
for your
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