

THE COMBINED TRAINING METHOD CONTRIBUTION TO THE VERTICAL JUMP IN HIGH-LEVEL HANDBALL PLAYER DEVELOPMENT



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SUMMARY

Vertical jump ability is of considerable importance in numerous handball events. To improve this quality, 39 players from the Canadian men's junior and senior national team were tested with a new vertical jump close to the handball jump shot and leg strength test following twelve weeks of power training practice. Coaches and trainers are greatly interested in developing training techniques designed to improve power performance of the legs, and vertical jump ability, and are less concerned with developing strength (Blattner, Stuart 1980).

Repeated measures taken for the analysis of variance comparisons have revealed significant differences between the vertical jump and power programme training in the three experiment groups and a very significant difference ($p < 0.01$) between the combined programme and the two other programmes (concentric and plyometric).

Results from this investigation support the use of the combined programme (plyometric with weight training and concentric) to improve the vertical jump in handball players. The results that were obtained after twelve weeks can influence the practice to improve the vertical jump and to prevent mechanical damage and some occurrence of tendonitis (Aoki, Tsukahara, and Yabe 1989).

INTRODUCTION:

There is no doubt that high-level handball practice and the vertical jump is very important for the

shooters or defence actions. In the handball player physical preparation phase, we observe two power expressive shapes: General power, regarding all strength muscular groups, and specific power to use technically in particular handball situations.

Our goal in this study is specifically concentrated on the explosive strength training and the plyometric's compounded.

MATERIAL AND METHOD:

This research has been done on 39 elite handball players who age between 18 - 28 years divided into three groups (N=13) Seven goalkeepers, 8 line players, 9 wings, 15 back courtplayers. They come from three development areas (Alberta, Winnipeg, Quebec) 39 Canadian junior and senior national handball team players have followed a 12 week specific strength training programme of two days a week, 2 hours in each unit.

Concentric group:

This group practice was on classical power machines, 6 series and 10 repetitions in each exercise, with 90° knee flexion, leg presses, leg extension, legs curls and half squats.

Plyometric's group:

Jump ¼ squat (with 60 kg weight and the legs stretched vertical jump), leg presses, scissor jump (with weights) jumping jacks (with weights) and side leg to the front in 6 series and 10 repetitions.

Combined group:

This group practice was, half of concentric and

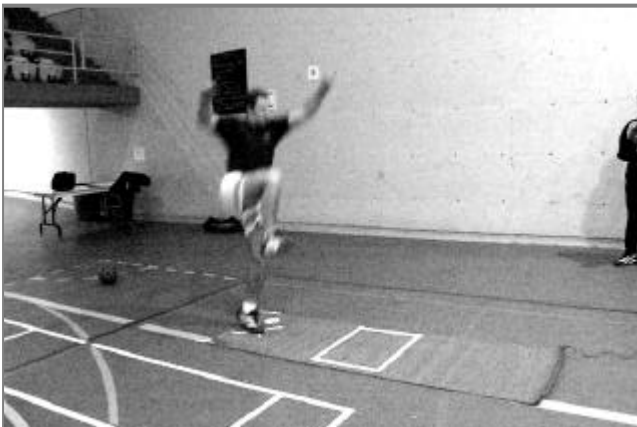
plyometric's programme volume training, in 3 series and 10 repetitions of each exercise.

THE TESTS USED:

Two tests were used in this experiment, before and three days after the last power practice. The two tests give us the liberty to measure the muscular power and the high jump (University of Quebec in Montreal test) in order to follow the three groups and evolution during the specific power programme. The tests used in this experiment were:

- The UQAM jump test, in the same shoot condition in handball on trigonometric Bosco carpet with a run-up of two steps. The first step out of the carpet, the second on the carpet to realise the impetus and the reception in the high jump action. The objective was to jump as high as possible.

L'UQAM test on Bosco carpet realised by Mohamed Benkreira.



The muscular power was measured by strength tests:

- The leg presses test at 90° feet flexion.
- The leg extension and leg curl test on the classical machines.

The descriptive statistic analysis was used in this experiment to identify the difference between the measured parameters. Following players position, the comparison between groups used by Anova test.

RESULTS:

The statistic analysis clearly revealed significant differences between pre- and post-test results in the three practice groups, however, the practice group

E3T2 is very different compared to the two other practice groups E2T2 and E1T2 (Table 1).

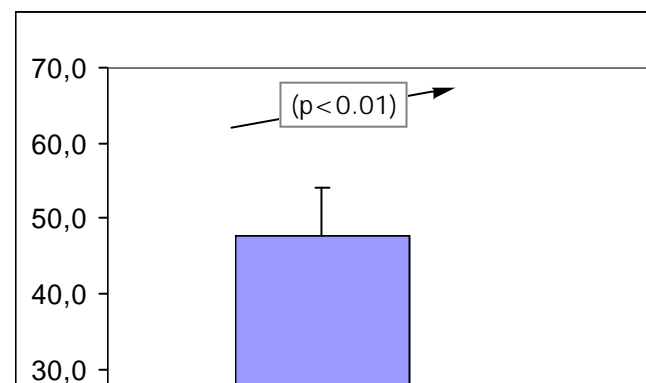
Table 1: Jump tests (T1 and T2) result in cm compared with practice group (E) with standard deviation
· $p < 0.01$

Statistics Descriptions (groups x tests)

	T1	T2
E1 mean	47,8	50,4
SD	5,9	7,2
E2 mean	47,5	51,6
SD.	7,9	8,3
E3 mean	47,7	56,3*
SD	5,4	5,4

The third practice group E3 shows clear progress in the high jump between the pre-test T1 and post-test T2 compared to practice groups E2 and E1.

Fig 1: Jump gain pre-test T1 and the post-test T2 for three practice groups.



DISCUSSION:

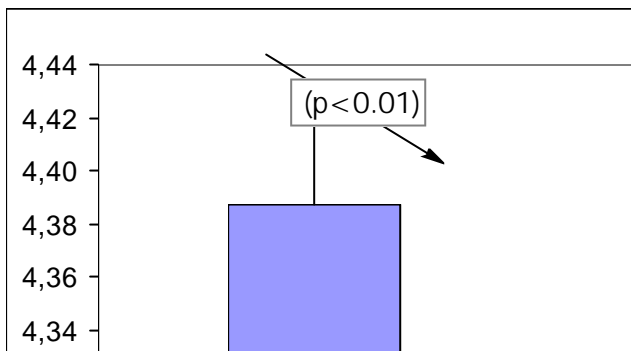
The most important finding in this study is that after 12 weeks practice the players achieve a high performance in the vertical jump.

As shown in Figure 3, the positive result in this experiment is the significantly high vertical jump produced by handball players who have undertaken the combined power programme training.

As a test during the experimentation, the combined programme was not only very efficient to strengthen the muscles in the foot and to develop the vertical jump but also to avoid mechanical damage and some occurrence of tendonitis.

- Our result also revealed a good progress in speed (the speed was tested over 30 metres on a handball court), even the repeated ANOVA measures revealed no significant differences between the three practice groups E1,E2 and E3, post-test data showed that most of players get better results over 30 metres. (Figure 2)

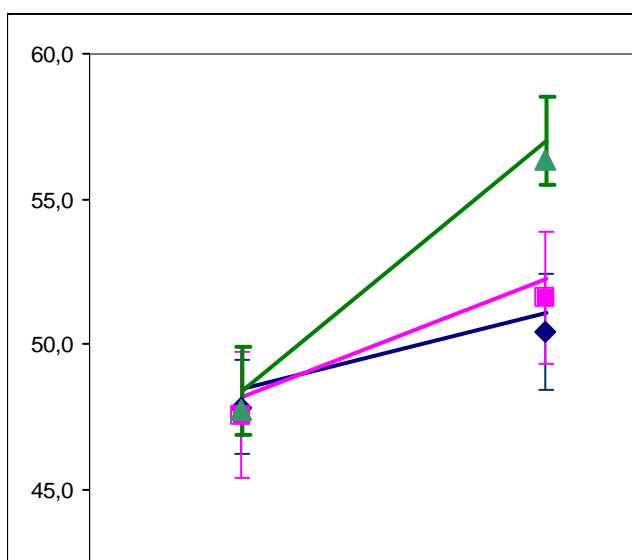
Fig 2 : Speed-30m test (s) T1 and T2 results average with standard deviation.



- The power press test , leg extension test and the leg curl test revealed in important progress between the pre-test and post-test in the three practice group.

As showed in Figure 3, the three groups E1, E2 and E3 effect practice between the pre and the post-test but also the very significant E3 difference compared with E2 and E1 in the post-test.

Fig 3 : Three progression practice group E1,E2,E3 in a jump between the two tests T1 et T2.

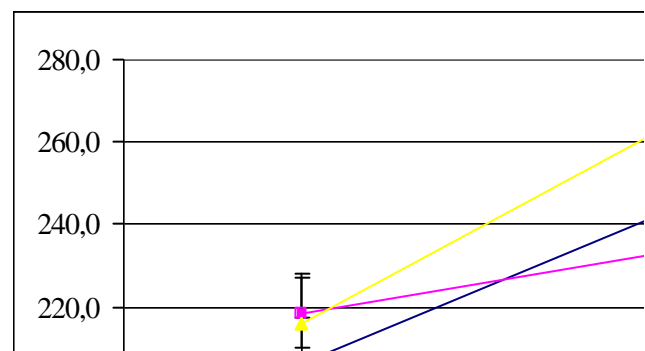


An analysis of variance (ANOVA) with repeated measures confirms that the combined training programme makes the greatest vertical jump gains in high-level handball players.

It also indicates no significant interaction in the 30 metres speed test. There is no difference between practice groups, this is justified by the training specificity (oriented to the jump power development) and the tests specificity (here we measured other factors than the jump power).

As show in Figure 4, the combination between the concentric and the plyometric's training programme on the leg extension test make greatest gains in jump capacity.

Fig. 4: Three practice strength group progress E1, E2, E3 in leg extension between the pre-test T1 and the post-tests T2.



The analysis of variance (table 2), show training significant differences between pre and post-test. However there is no interaction between them. This showed no difference between practice groups. But there is pre-test post-test gain and significant differences in the inter-training programme.

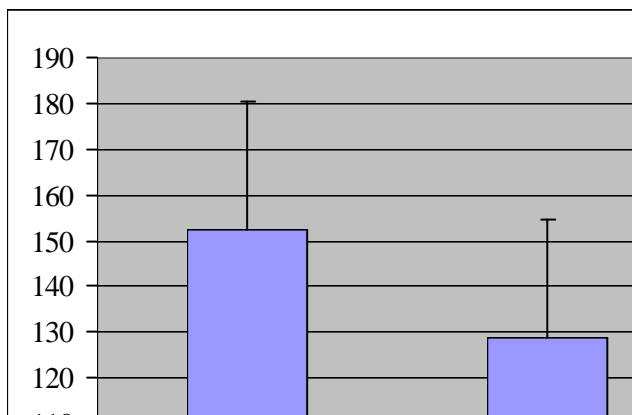
Table 2: Average value and ecart-type compared with the two power test on the press machine and three practice groups E1, E2 et E3.

Mean	T1	T2
E1	272,6	349,7
E2	258,8	365,4
E3	233,2	316,7
Err.T.	T1	T2
E1	13,3	13,2
E2	10,8	10,0
E3	9,2	10,0

This test was on the press machine, so in concentric side test, hence training specificity. This result should be expected when we test on the concentric power machine.

As shown in *Figure 6*, the curl leg test was on the classical concentric machine. The result confirms no significant difference between groups. However, power gains was observed after 12 weeks training but not specific to the groups.

Figure 6: Power (kg) average value between the three practice group on the leg curls machine.



CONCLUSION:

Finally, the results of this study lead us to confirm that combined E3 practice group, showed a greatest vertical high jump performance than experimental practice groups E2 and E1 after 12 weeks of with handball training.

RECOMMENDATION:

Finally our muscular tests results show the training effect between pre-test T1 and post-test T2. This advantage was not only for E3 practice combined group and this is due of training and test specificity. For future research, we suggest to make test in the same training and specific condition.

The concentric practice group power results were better than the combined and plyometric, practice group because the test used was in concentric conditions on a classical machine.

The real value in this study was not transmitted by the power test used.

To measure the value of the explosive strength training in the real condition we suggest finding a new power test in plyometric.

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