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Original article

COMPARISON OF SPRINT, REPEATED SPRINT AND JUMPING PARAMETERS OF DIFFERENT LEVELS HANDBALL PLAYERS

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Abstract

The aim of this study was to examine sprint, repeated sprint and jumping parameters of handball players at different levels.

Methods. The study included 16 male senior handball players aged 22.6±3.8 and 13 male junior handball players aged 16.1±0.8. Age, height, body weight, 20m sprint test, repeated sprint test and counter movement jump (CMJ) test data were obtained. Sigma Plot 12.0 (Systat Software Inc.) software was used for data analysis.

Results. One-Way Anova Repeated Measures of Variance and non-parametric Holm Sidak test were used for intragroup comparison of senior and junior male handball players. Mann Whitney U test was used for intergroup comparisons. Jumping parameters of senior athletes were evaluated.

CMJ after repeated sprint (43.0±4.8 cm), and 20 m sprint test (46.9±4.2 cm) of senior athletes were found to be significantly lower than CMJ values after warm up (45.8±6.0 cm) ($p<0.05$). There was a significant difference between CMJ of junior handball players after 20 m sprint (49.5±3.9 cm) and repeated sprint test (46.2±3.8 cm). Comparison of jumping heights of the subjects between the groups showed no statistically significant difference. It was found that the last two performances of both groups (Senior: 5.41±0.25, 5.42±0.24 sec and junior; 5.43±0.17, 5.56±0.20 sec), were significantly higher than their first sprint performances (Senior: 5.63±0.16, 5.60±0.20 sec and junior; 5.66±0.29, 5.65±0.29 sec) after repeated sprint.

Conclusion. Sprint and jumping are known to be important for handball game. However, experience and game tactics should support combination of these important abilities with repeated sprint and jumping performance during the game.

Keywords: Counter movement jump, Repeated sprint, Handball.

Introduction

Sprints are necessary 1/3 to effective game time in team sports. Handball consists of successfully defensing opposing team's shootings at the goal by sprint and various elements of sprint, exit speed, running towards the pass or reaction speed (Akan et al., 2002:17-22).

Repeated sprint skill, on the other hand, is defined as ability supported by short resting periods and provides production of maximum sprint effort (Girard et al., 2011:673-694).

Handball players can be active or passive according to varying degrees of running performance during the match.

Thus, the most important requirement for the score is the ability to recover in the shortest time between repeated sprints (Cherif et al., 2012:21-28).

Motoric, physiologic and anthropometric parameters are the factors affecting the development of this skill (Soydan, 2012:45-68). Although sprint is a congenital skill, especially repeated sprint can be improved by training.

Jumping ability is one of the most important components where jumping height and repeatability can affect the score in a sport like handball (Hutchinson et al., 1998:1543-1547).

The shootings of the athletes to the goal by horizontal of vertical jumping play an important role to win the game (Buchheit et al., 2010:3-17).

Jumping height is also considered as a performance index in team sports and can be regarded as a distinctive variable of different competitive standard. Game characteristics of handball require extra combined training such as sprint and jumping.

Including combined workouts with repeated sprints in training programs can have benefits for especially jumping and ball speed (Cherif et al., 2012:21-28).

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A review has shown that sprint and jumping parameters and different combinations of these gradually gain prominence to achieve a success in team sports.

Cherif et al. (2012:21-28), examined the effect of drop jump performed after repeated sprint training and found that repeated sprint and drop jump training applied for 12 weeks positively affected vertical jump and sprint performance (Cherif et al., 2012:21-28).

Buchheit et al., (2012:555-562) analyzed repeated sprint performances from different aspects and evaluated the relationship between lactate, heart rate, time parameters and angles. They found that repeated sprint time showed variations according to angles and that sprint time extended as the angles increased.

Comparison of sprint times revealed significant differences between sprints and repeated sprint times and the first and the last performance of repeated sprint (6.72%).

Buchheit and Ufland (2011:293-301) examined the effect of endurance training program on repeated sprint performance and muscle reoxygenation ratio.

They applied an endurance program including 8-week 10 km running and 2-15 repeated sprint running. Infrared spectroscopy was used to evaluate muscle reoxygenation ratio between the sprints before and after the 8-week program.

Results have shown that 8-week program enhanced maximal aerobic speed and endurance capacity of trained males.

Furthermore, the program improved repeated sprint performance. It was concluded that the improvement in repeated sprint ability was correlated with acceleration in muscle reoxygenation ratio after the sprint (Bucheit and Ufland, 2011:293-301).

Marques et al., (2011) attempted to examine the relationship between short sprint time (5m) and countermovement jumping strength of 25 amateur athletes in football, futsal and handball branches using a group of linear transformers. They emphasized a positive relationship between 5m sprint and maximal lower body strength (Marques et al., 2011:115-122).

Buchheit found a large body of research on repeated sprint. However, sport scientists and trainers aim to reach the most ideal recovery time by making considerable changes in frequency, duration, degree and number of repeated sprint for game success especially in team sports (Buchheit et al., 2012:555-562).

This study aimed to examine sprint, repeated sprint and jumping performances of handball players at different levels and evaluated 20 m run, 6 repeated 2x15 sprint and CMJ performances after both sprints of male senior and junior handball players.

Method. Subjects

The study included 16 male super league handball players. Age, body height, body weight and sport age of super league players were 22.6±3.8 years; 18.4±8.2cm; 83.7±8.9 kg and 10.4±5.1 years respectively.

The study also included 13 male junior league handball players with an age of 16.1±0.8 years, body height of 179.4±5.5 cm, body weight of 69.9±8.5 kg and sport age of 6.3±1.2 years. Participation to the study was voluntary.

Inclusion criteria were being super league or junior league players and not having experienced any injury in the last six months.

All the subjects signed an informed consent form prior to testing, detailing the contents of the study. They were free to withdraw from the study at any time without giving any reason.

Measurements

20 m sprint performances of subjects were measured on rubber floor in multi-purpose sport hall. Photocell (Newtest Power Timer, 2000) was used to record 20 m sprint and repeated sprint times in seconds. Sensorized Free Jump (Rome, Italy) was used to determine jumping performances of subjects by CMJ test.

General and special warm up was done for approximately 20 minutes before the tests (Mendez Villanueva et al., 2011). CMJ test started when the subjects were in standing position with their hands in their waists and feet open at shoulder length.

The subjects took squat position after the signal (maintaining knee joint at 90^{o}) and completed jumping. The subjects were asked to keep their hands on their waists during jumping time. After 5 min. resting, 20 m sprint and CMJ was applied. Repeated sprint performances after 5 min resting included 6 repeated 2x15 m sprints running in 20 seconds (Buchheit, 2005:42-47; Cherif et al., 2012:21-28).

The subjects did passive relaxation in approximately 14 second resting period between the sprints. The subjects were warned to get ready 3 seconds before the start of each sprint. Measuring CMJ immediately after repeated sprint test completed the protocol.

Statistical analysis

Descriptive statistics and hypothesis tests and Sigma Plot 12.0 (Systat Software Inc.) software were used for data analysis. One-Way Anova Repeated Measures of Variance, non-parametric Holm Sidak tests were used for intragroup comparisons of senior and junior male

athletes. Mann Whitney U test was used for intergroup comparisons *(p<0.05)*.

Findings

20 m sprint and repeated sprint times of senior handball players were found to be 3.18±0.10 sec and 32.93±0.20 sec respectively. CMJ were found to be 45.8±6.0 cm after warm-up, 49.9±4.2 cm after 20m sprint and 43.0±4.8 cm after repeated sprint. 20 m sprint and repeated sprint times were found to be 3.15±0.15 sec, and 33.26±0.22 sec for junior athletes.

CMJ of junior handball players were found to be 48.5±4.3 cm after warm up, 49.5±3.9 cm after 20 m sprint and 46.2±3.8 cm after repeated sprint.

CMJ of senior handball players were found to be significantly lower after repeated sprint when compared to CMJ after warm up and 20 m sprint ($p<0.05$).

As for junior handball players, there was a significant difference between CMJ after 20m sprint and CMJ after repeated sprint test. The highest CMJ in both test groups was obtained after 20 m sprint test. Comparison of CMJ of subjects between the groups revealed no statistically significant difference.

An examination of repeated sprint times showed that the last two sprint performances (Senior: 5.41±0.25, 5.42±0.24 and Junior; 5.43±0.17, 5.56±0.20 sec) of both groups were significantly higher than their first sprint performances (Senior: 5.63±0.16, 5.60±0.20 and Junior; 5.66±0.29, 5.65±0.29 sec).

Discussion

The study evaluated 20 m sprint, 6 repeated 2x15 sprint and CMJ performances after both sprints of senior and junior male handball players. The highest CMJ performance was obtained after 20 m sprint in both groups. We found no difference between the groups.

However, 20 m sprint times of junior handball players were better than those of senior. The highest CMJ were obtained after 20 m sprint, warm up and repeated sprint in descending order in both groups.

An analysis of repeated sprint times in both groups revealed a significant decrease between the first two sprint performances and the last two sprint performances. We found no difference between the groups.

However, 20 m sprint times of junior athletes (junior: 3.18±0.10 sec, senior: 3.15±0.15 sec) and repeated sprint times of senior students were found to be better (Total sprint time for junior: 33.26±0.22 Total sprint time for senior: 32.93±0.20). The researchers reported 20 m sprint performances of handball players as 3.09±0.11 sec.

This sprint time is lower than we obtained in the present study. In another study, 30 m speed of 24 handball players with a mean age of 12.0±0.6 who did regular exercises for three years was reported to be 4.65±0.48 sec.

The fact that sprint in this study are higher than the previous studies is believed to be associated with the age of the subjects (Koç et al., 2010:227-231)

Although junior male handball players showed a similar speed performance similar to those of senior male handball players indicate their good condition status, success in handball game is determined by a combination of characteristics such as endurance, skill, coordination and mobility instead of only conditional characteristics such as speed and conditional status.

An examination of CMJ performances of male handball players after 20 m sprint and 6 repeated 2x15 sprint showed that the highest CMJ was obtained after 20 m sprint in both groups. A similar result was reported by Buchheit et al. (2005), in a study on 122 handball players.

The researchers measured CMJ of handball players after warm up and after 6×(2×12.5-m) repeated sprint performance with 25 sec intervals.

They found that the best sprint time (100.1 ±1.8%) and jumping height (98.9 ± 2.2 %) during the test were obtained after warm up performance. However, there was no significant difference between the measurements.

Similar results were obtained in another study that evaluated research on different team sports and on elite female football players.

Haugen et al., (2012:340-349) examined sprint and CMJ characteristics of elite female football team players.

The researchers conducted 40 m sprint test after standard warm up. CMJ was found to be 28.1-±4.1 cm. CMJ after repeated sprint test were found to be 27.9-±3.1 cm (Haugen et al., 2012:340-349).

CMJ measured after sprint, repeated sprint and after both of them of junior and senior male handball players showed no significant difference between the groups. Gabbet, (2002:334-339) examined 159 athletes (88 junior and 71 senior athletes) playing rugby, which is another team sport.

The study analyzed 10m, 20m and 40m sprint performance, vertical jump, agility and maximum VO_2 of junior and senior athletes.

Evaluation of results found no significant difference between the groups in vertical jumping and agility.

Senior athletes were found to have higher muscle strength, agility, speed and max VO_2 parameters than junior athletes. However, there was no statistically significant difference (Gabbet, 2002:334-339).

In another study, squat jumping of male elite handball athletes were found to be higher than those of non-elite athletes elite: 23.8±4.4cm, non-elite: 18.1±3.1cm (Atabek et al., 2010:36-45).

Conclusion

In conclusion, sprint and jumping are known to be important for handball game. However, experience and game tactics should support combination of these important abilities with repeated sprint and jumping performance during the game.

Practical Application

Sprint is one of the most important requirements for handball game. Based on an evaluation of sprint, repeated sprint and jumping performances, it can be stated that both junior and senior athletes reached the best performance after 20 m sprint and that fatigue had a negative impact on CMJ performance in both groups.

It can be stated that endurance is the most significant difference between senior and junior athletes.

It was observed that repeated sprint and CMJ after repeated sprint of senior athletes were better than those of junior athletes. However, the difference was not statistically significant.

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TABLES

Table 1: Characteristics of subjects

	Senior players	Junior players
Age (years)	22.6±3.8	16.1±0.8
Body height (cm)	184.4±8.2	179.4±5.5
Body weight (kg)	83.7±8.9	69.9±8.5
Body Mass Index (kg.m^{-2})	24.6±1.9	21.9±2.1
Fat %	12.6±3.9	12.8±4.1
Years of experience (years)	10.4±5.1	6.3±1.2

Table 2: Sprint, repeated sprint and jumping performance of the subjects

	Senior players	Junior players
Warm up after CMJ (cm)	45.8±6.0	48.5±4.3
CMJ after 20 m sprint test (cm)	46.9±4.2	49.5±3.9
CMJ after RS (cm)	43.0±4.8	46.2±3.8
20 m sprint test (sec)	3.18±0.10	3.15±0.15
RS1 (sec)	5.41±0.25	5.37±0.16
RS2 (sec)	5.42±0.24	5.43±0.17
RS3 (sec)	5.40±0.18	5.56±0.20
RS4 (sec)	5.47±0.17	5.59±0.22
RS5 (sec)	5.63±0.16	5.66±0.29
RS6 (sec)	5.60±0.20	5.65±0.29
Total RS Time (sec)	32.93±0.20	33.26±0.22

CMJ: Counter movement jump, **RS:** Repeated sprint test.

Table 3: Jumping

	Senior players	p	t	Junior players	p	t
[a] CMJ (cm)	45.8±6.0 [c]	0.002	3.851	48.5±4.3		
[b] CMJ after 20 m sprint test (cm)	46.9±4.2 [c]	0.018	2.795	49.5±3.9 [c]	0.008	3.345
[c] CMJ after Repeated Sprint test (cm)	43.0±4.8 [a,b]			46.2±3.8 [b]		

Significant difference among groups ($p<0.05$). CMJ: Counter movement jump. **[a]:** Counter movement jump after warm-up, **[b]:** Counter movement jump after 20 m sprint test, **[c]:** Counter movement jump after repeated sprint test.

Table 4: Repeated sprint test

	Senior players	Junior players
[a] RS1 (sec)	5.41±0.25 [e,f]	5.37±0.16 [c,d,e,f]
[b] RS2 (sec)	5.42±0.24 [e,f]	5.43±0.17
[c] RS3 (sec)	5.40±0.18 [e,f]	5.56±0.20 [a]
[d] RS4 (sec)	5.47±0.17	5.59±0.22 [a]
[e] RS5 (sec)	5.63±0.16 [a, b, c]	5.66±0.29 [a,b]
[f] RS6 (sec)	5.60±0.20 [a, b, c]	5.65±0.29 [a,b]

Significant difference among groups ($p<0.05$). RS: Repeated sprint test. **[a]:** First repeated sprint, **[b]:** Second repeated sprint, **[c]:** Third repeated sprint, **[d]:** Fourth repeated sprint, **[e]:** Fifht repeated sprint, **[f]:** Sixth repeated sprint.