BALL SPEED IN WOMEN HANDBALL PLAYERS: ANALYSIS OF DIFFERENT PLAYING POSITIONS

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Summary

The aim of this study was to describe the ball speed of different playing positions in female top-level handball players. 130 professional female players of the Spanish 1st handball league agreed to participate in this study. These data indicate that position-specific ball speed depends on the main throw that is performed most often during training and matches.

Keywords: Performance, team sport.

Introduction

From the point of view of physical performance, handball is a complex, intermittent sport game, which requires maximum intensity efforts in a short period of time, where players jump, run and throw the ball at high velocity, followed by low intensity or rest moments Jacobs, Westlin, Rasmusson and Houghton, 1982. Several studies have reported that, in handball players, in addition to the technical skills and tactics, the anthropometric characteristics, as well as highs levels of force, power and throwing velocity constitute determining factors for the competitive success (Gorostiaga, Granados, Ibanez, Gonzalez-Badillo and Izquierdo, 2006; Gorostiaga, Granados, Ibanez and Izquierdo, 2005; Hoff and Almasbakk, 1995; Wallace and Cardinale, 1997). It is deduced as a result of all these studies that the physical prevailing requirements of handball are the explosive force in the upper and lower limbs (player velocity and throwing velocity of the ball) and the maximal force and muscular power (required in contact moves against the opponents) (Chelly, Hermassi and Shephard, 2010; Wallace and Cardinale, 1997).

Throwing velocity of the ball is an important skill in handball and a very important aspect for success (Fleck, Smith, Craib, Denaham, Snow and Mitchell, 1992; Gorostiaga, Granados, Ibanez and Izquierdo, 2005; Granados, Izquierdo, Ibanez, Bonnabau and Gorostiaga, 2007; Skoufas, Kotzamanidis, Hatzikotoylas, Bebetsos and Patikas, 2003; Van den Tillaar, 2004). The velocity of a handball throw is not only dependent on the muscular strength, but others aspects like body segments coordination and technical skills (Van Muijen, Joris, Kemper and Van Ingen Schenau, 1991). This velocity is an important aspect for success, because the faster the ball is thrown at the goal, the less time defenders and goalkeeper have to save the shot.

The aim of this study was to describe the ball speed of different playing positions in female top-level handball players (centers, backs, wings, pivots and goalkeepers).

Methods

Subjects

130 professional female players of the Spanish 1st handball league (16 centre backs, 36 wings, 41 back players, 18 pivots and 19 goalkeepers) agreed to participate in this study. All of them were playing in the top Spanish professional handball league.

Assessment Procedures

The study was approved by the San Antonio Catholic University Committee for research involving human subjects. All participants received verbal and written information about the study and gave informed written consent before anthropometric and conditional assessment.

Throwing velocity test

Throwing velocity was assessed with a radar gun (StalkerPro Inc., Plano,TX,USA), with 100 Hz frequency of record and with 0.045 m•s-1 sensitivity, placed behind the goal post and in a perpendicular direction to the player. This test has been shown to have very good test-retest reliability Intraclass correlation coefficient (ICC) of 0.96 and a coefficient of variation (CV) of 2.4% (9, 29).

Prior to the throwing velocity assessment, subjects performed a 15 min warm up focused on overhead throwing. After applying resin as desired, subjects performed two different protocols of throw, one with a goalkeeper and one without. For both protocols, subjects threw a standard handball as fast as possible towards a standard goal, using a single hand and their personal technique. The position or kinds of throws were: 1. 7m penalty shot (n=1); 2. Free throw from the 9 m line in a stationary position (n=2); 3. Throw from the 9 m line with 3 previous steps (n=3); 4. Jump throw from the 9 m line with previous running (n=4), all of them in straight direction to the goal in a random order.

Only throws sent to the goal post were used for analysis. For motivational purposes, players were immediately informed of their performance. A 3-minute rest elapsed between throws in order to avoid fatigue.

Statistical analysis

Standard statistical methods were used to calculate the mean and standard deviations. All data is expressed as mean ± standard deviation (all data were checked for distribution normality and homogeneity with the Kolgomorov-Smirnov, Lilliefors and Levene tests). A one-way analysis of variance (ANOVA) together with a Tukey HSD post-hoc test was used to determine if significant differences existed among 5 playing positions (center, back, wing, pivot and goalkeeper). The $p \leq 0.05$ criterion was used for establishing statistical significance.

Results

The average velocity of each throws was: 21.44 m/s, 21.85 m/s, 23.47 m/s and 22.99 m/s for position 1, 2, 3 and 4, respectively. The players that reached the major speeds in throws 1, 2 and 3, were centre backs (22.28, 23 and 24.73 m/s respectively). In the fourth throw, the major velocity was for pivots with 23.60 m/s. Ball speeds differed significantly depending on the kind of throwing and on the player's main position. Highest values were reached either with 3 steps prior to throwing, or jumping. Pivot players reached the highest values jumping, while centre back players reached the highest values with 3 steps. Differences with (table 1) and without goalkeeper (table 2) are shown in the tables:

Table 1

Mean and standard deviations values ($\bar{x} \pm sd$) correspondent to throwing velocity with goalkeeper in m/s.					
Position	**n**	**7 m (m/s)**	**9 m (stationary) (m/s)**	**9 m (3 steps) (m/s)**	**9 m (jump) (m/s)**
Centre	16	21.1 ± 1.9	21.7 ± 1.5	23.4 ± 1.6	22.2 ± 1.3
Back	36	20.5 ± 1.4	20.9 ± 1.7	22.2 ± 1.9	22.1 ± 1.8
Wing	41	20.0 ± 1.4	20.2 ± 1.3	22.1 ± 1.4	21.5 ± 1.2
Pivot	18	19.9 ± 1.9	20.6 ± 1.6	22.0 ± 1.6	22.3 ± 1.9
Goalkeeper	19	19.4 ± 2.1	19.5 ± 1.0	20.7 ± 2.1	19.2 ± 1.5
Total (m/s)	130	20.2 ± 1.6	20.6 ± 1.6	22.2 ± 1.7	21.7 ± 1.7

Table 2

Mean and standard deviations values ($\bar{x} \pm sd$) correspondent to throwing velocity without goalkeeper in m/s.					
Position	**n**	**7 m (m/s)**	**9 m (stationary) (m/s)**	**9 m (3 steps) (m/s)**	**9 m (jump) (m/s)**
Centre	16	20.8±1.42	21.1±1.48	23.1±1.10	22.5±1.59
Backs	36	20.9±1.68	21.0±1.57	22.9±1.88	22.3±1.59
Wings	41	20.3±1.64	20.5±1.55	22.1±1.7	21.8±1.42
Pivot	18	21.0±1.84	20.8±1.87	22.5±1.77	22.0±2.00
Goalkeeper	19	19.5±0.93	20.2±1.02	21.7±1.68	20.8±1.72
Total	130	20.6±1.63	20.7±1.55	22.5±1.74	21.9±1.62

Discussion

Throwing velocity in handball is important in order to be successful in the sport because the faster the ball is thrown at the goal, the less time the defenders and the goalkeeper have to save the shot. Others studies of elite female handball players show a mean throwing velocity of 17.1 - 22.2 $m*s^{-1}$ (Granados, Izquierdo, Ibañez, Bonnabau and Gorostiaga, 2007; Hoff and Almasbakk, 1995; Joris, Van Muyen, Van Ingen Schenau and Kemper, 1985; Saeterbakken, Van den Tillaar and Seiler, 2010; Van den Tillaar, 2004; Van Muijen, Joris, Kemper and Van Ingen Schenau, 1991; Zapartidis, Gouvali, Bayios and Boudolos, 2007). The velocities reached by our female handball players are in line with the aforementioned studies. If we compare 7 m velocities reported by Granados et al, (2007), in female Spanish handball players, we notice that their players had a mean throwing velocity of 19.5 $m*s^{-1}$. Our values are similar in throwing velocities with the goalkeeper (20.24 $m*s^{-1}$), and without the goalkeeper (20.58 $m*s^{-1}$). Nevertheless, the interpretation of these comparisons should be made with care because there are few studies published and the methodologies (radar gun, photogrametry, electronic timing gates) and sample levels are also different.

The truth is that, *a priori*, it could be expected that first line players (back and center) reached higher velocities than the other players because it is a very common throw for this specific position. This issue is confirmed in our study, but only at 9 m with a three step run with a goalkeeper throw. We found statistical differences between centers and wings.

Conclusions

These data indicate that position-specific ball speed depends on the main throw that is performed most often during training and matches.

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