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## ORIGINAL

### HANDBALL THROWING CAPACITY ACCORDING TO SPECIFIC PLAYING POSITION

### CAPACIDAD DE LANZAMIENTO EN BALONMANO EN FUNCIÓN DEL PUESTO ESPECÍFICO

Rivilla-García, J.<sup>1</sup>; Navarro Valdivielso, F.<sup>2</sup>; Grande Rodriguez, I.<sup>3</sup> y Sampedro Molinuevo, J.<sup>4</sup>

<sup>1</sup>Profesor de Balonmano, Facultad de Ciencias de la Actividad Física y del Deporte, Universidad Politécnica de Madrid. España. E-mail: [jesus.rivilla@upm.es](mailto:jesus.rivilla@upm.es)

<sup>2</sup>Laboratorio de Entrenamiento Deportivo, Facultad de Ciencias del Deporte, Universidad de Castilla – La Mancha. España. E-mail: [fernnav1@terra.es](mailto:fernnav1@terra.es)

<sup>3</sup>Profesor de Gimnasia Artística, Facultad de Ciencias de la Actividad Física y del Deporte, Universidad Politécnica de Madrid. España. E-mail: [ignacio.grande@upm.es](mailto:ignacio.grande@upm.es)

<sup>4</sup>Decano, Facultad de Ciencias de la Actividad Física y del Deporte, Universidad Politécnica de Madrid. España. E-mail: [javier.sampedro@upm.es](mailto:javier.sampedro@upm.es)

**Spanish-English translator:** Diana Schofield Smith ACIL

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#### ABSTRACT

The present study analyzed the differences in throwing capacity among the playing positions in elite and amateur male team handball players (n=48) in four throwing tests: throwing with a heavy (THMB) and light medicine ball (TLMB), throwing velocity without (TV) and with opposition (TVO).

The backs achieved the highest scores while goalkeepers had the lowest scores in the most specific tests, TLMB ( $F_{4,43}=2.886$ ;  $p<0.05$ ), TV ( $F_{4,43}=4.857$ ;  $p<0.05$ ) and TVO ( $F_{4,43}=12.828$ ;  $p<0.01$ ). The analysis of differences revealed that TV was higher than TVO ( $p<0.01$ ) in all cases.

The results suggest that the playing position is determinant in specific throws. Furthermore the influence of opposition is significant in throwing velocity, decreasing it in all positions.

**Key words:** handball, testing processes, throwing velocity, medicine ball, opposition.

## RESUMEN

Se analizaron las diferencias en la capacidad de lanzamiento en función del puesto en jugadores de balonmano ( $n=48$ ) de elite y amateurs con cuatro test: lanzamiento con balón medicinal pesado (LBP) y ligero (LBL), velocidad de lanzamiento sin (VLSO) y con oposición (VLCO).

Los laterales lograron los mejores valores mientras los porteros obtuvieron los peores en los test más específicos, LBL ( $F_{4,43}=2,886$ ;  $p<0,05$ ), VLSO ( $F_{4,43}=4,857$ ;  $p<0,05$ ) y VLCO ( $F_{4,43}=12,828$ ;  $p<0,01$ ). El análisis de diferencias reveló que VLSO era mayor que VLCO ( $p<0,01$ ) en todos los casos.

Los resultados sugieren que el puesto es determinante en los lanzamientos específicos. Igualmente, la oposición influye significativamente disminuyendo la velocidad de lanzamiento en todos los casos.

**PALABRAS CLAVE:** balonmano, procesos de evaluación, velocidad de lanzamiento, balón medicinal, oposición.

## INTRODUCTION

Handball is an Olympic contact sport (Gorostiaga et al., 2006) which requires a high level of physical fitness for performing the actions involved in the game like jumping, feinting, blocking, sprinting and throwing (Wallace and Cardinale, 1997). Of them all, throwing at the goal is considered key to success (Granados et al., 2007; Hoff and Almasbakk, 1995; Wit and Eliaz, 1998). The speed of the ball plays an important role in scoring a goal (Fleck et al., 1992; López, 2005; Van den Tillaar and Ettema, 2003). This factor of throwing velocity gains more importance the farther the distance from the goal, being a key factor in throwing from beyond the 9m line or long distance throws (Bayer and Mauvoisin, 1991).

Handball players are usually classified according to their specific playing positions when attacking: goalkeepers, located in the goal, the first line made up of backs and centre backs, and the second line made up of the pivots and wings (Marczinka, 1993; Pezarat-Correia, Valamatos, Alves and Santos, 2007; Šibila, Vuleta and Pori, 2004).

Several studies have shown differences in the actions and distances covered in the match according to the specific playing position (Cambel, 1985; Luig et al.,

2008; Manchado et al., 2007; Ziv and Lidor, 2009; Šibila et al., 2004). Differences have also been shown in their anthropomorphic characteristics (Cavala, Rogulj, Srhoj, and Katic, 2005; Chaouachi et al., 2009; Rogulj, Srhoj, Nazor, Srhoj, and Cavala, 2005; Srhoj, Marinovic, and Rogulj, 2002; Taborsky, 2007), physical capacities and motor skills (Oxyzoglou et al., 2008; Pezarat-Correia et al., 2007; Vasques et al., 2005; Zapartidis et al., 2009) and psychological characteristics (Rogulj et al., 2005). In contrast some studies found no differences in the various physiological capacities (Chaouachi et al., 2009; Manchado et al., 2007).

Several previous studies have analyzed throwing velocity (Bayios et al., 2001; Bretagne, 1980; Cardoso and González-Badillo, 2006; Fleck et al., 1992; Joris et al., 1985; Marques et al., 2007; Mikkelsen and Olensen, 1985; Prokajac, 1980; Šibila et al., 2003), and some have reported differences according to competitive level and age (Gorostiaga et al., 2005; Granados et al., 2007; Mohamed et al., 2009). However, the studies on this variable differ substantially with regard to the conditions under which the goal shots were performed and the instruments and protocol used to measure their velocity, implying that comparisons of results must be made with special caution. This variable has also been analyzed in other sports, like baseball, with an in-depth study of its relation to anthropometric characteristics (Padilla, 2010), and in water polo, where throwing velocity differences were analyzed between the right and left arm (Aragón et al., 2010)

The lack of comparative studies on general and specific throwing capacity according to the specific playing position is surprising, given that top level coaches have stated that throwing strength is more important for the first line than for the second line, and of little relevance to goalkeepers (Moreno, 2004). This opinion has been confirmed in young female handball players, with the backs throwing with greater velocity than the rest of the players, and revealing significant differences with regard to the goalkeeper (Zapartidis et al., 2009). In contrast, no significant differences were found in the throwing of a medicine ball between junior and senior female handball players, although the goalkeepers recorded the worst results (Rogulj et al., 2005). No comparative studies were found on differences in throwing velocity among the specific playing positions in elite and amateur players.

The main objective of the present study was to determine the differences in general and specific throwing capacity among the five specific playing positions into which the players have been classified. At the same time, considering that the perceptive dimension is key for throwing (Antúnez, Ureña, Velandrino and García, 2004) and that throwing velocity is not only determined by physical-technical factors (Joris et al., 1985; Van Muijen et al., 1991) and precision (Bayios and Boudolos, 1998; Van den Tillaar and Ettema, 2003; Zapartidis et al., 2007), but also by cognitive factors and the presence of opposition as confirmed in several research projects on handball (Fleck et al., 1992; López, 2005; Pardo et al., 2007; Párraga et al., 2001; Rivilla et al., 2010) or water polo (Van der Wende, 2005; Vila et al., 2009), the present study included a throwing

velocity test with opposition.

**METHOD**

**Sample**

The sample was made up of forty-eight handball players belonging to four competitive teams from two different levels: elite and amateur. The elite group (E) is representative of the highest national level as it was competing in the top Spanish handball league (Asobal) at the time of the study. The amateur group (A) was made up of three senior teams (over 18) who competed in the third and fourth category of Spanish handball, called the 1st and 2nd national division.

**Table 1. General characteristics of the sample ( X ± SD).**

PLAYING POSITION	N	AGE (years)	HEIGHT (cm)	WEIGHT (kg)	OBSERVATIONS
Backs (B)	13	26.3±5.35	197±4.12	98.3±7.1	Elite (n=5) Amateur (n=8)
Centre Backs (C)	11	24.65±3.87	186±3.88	88.15±9.2	Elite (n=3) Amateur (n=8)
Pivots (P)	10	27.83±4.32	181±4.86	95.31±4.2	Elite (n=3) Amateur (n=7)
Wings (W)	9	23.12±2.23	177±2.97	80.48±6.8	Elite (n=2) Amateur (n=7)
Goalkeepers (G)	5	28.52±4.98	1.85±2.34	83.65±5.3	Elite (n=2) Amateur (n=3)

The sample was classified into five groups according to the specific playing position: backs (B), centre backs (C), pivots (P), wings (W) and goalkeepers (G). The characteristics of each group are shown in Table 1.

**Procedure**

All the participants were evaluated in four throwing situations: 1) throwing with a heavy medicine ball (THMB), 2) throwing with a light medicine ball (TLBL), 3) throwing velocity without opposition (TV), and 4) throwing velocity with opposition (TVO). In order to minimize interference deriving from the context

and external factors, each team carried out the four throwing tests during the same day and in the same session, and each subject performed the tests in the same order.

All the participants were informed in detail about the procedure and the basic characteristics of the study as well as the possible risks related to the performance of the tests, and signed the consent form before carrying them out. The study was carried out according to the Declaration of Helsinki and was approved by the university local ethics committee.

They performed a standard 10 minute warm up which included specific movements, with special emphasis on accelerating and braking actions typical of the steps prior to a throw, specific mobility exercises and of wide throws with balls of different weights and finally throws with the balls to be used in each test. After the warm up the subjects were informed about the protocol for each of the tests and familiarized themselves with them using several throws prior to the evaluation.

For the throw with the heavy medicine ball, the participants followed these instructions: feet placed at shoulder width, body facing the direction of the throw and the ball held in both hands symmetrically below the hips. The throw consisted in lifting the medicine ball with both hands over and behind the head, extending the trunk and flexing the elbows and knees and, finally using an explosive forward movement (flexing the trunk and extending the shoulders, elbows and knees) throwing the ball as far as possible in a horizontal direction. The subjects were informed of the importance of using a long kinetic chain with the legs, trunk and arms, avoiding reducing the action to the arms only (Reina and Martínez, 2003). They were permitted to lift their heels but not to lift their feet from the floor. The thrower was not allowed to cross the throwing line.

In the throw with the light medicine ball the subjects were allowed to use resin and throw after three steps holding the ball in one hand. The participants were encouraged to perform a standing throw as used in the real situation. The players therefore stood behind the throwing line at the desired distance (three steps were allowed prior to the throw), with their feet on the floor and their bodies facing in the direction of the throw. Description of the movement: first, take three specific steps beginning and ending with the opposite foot to the throwing arm; and second, throw the ball with one hand. The throwers were not allowed to cross the throwing line.

The throwing velocity tests were performed following the following instructions: throw the ball with the greatest possible velocity, using only one hand and with the correct technique for a shot at goal; take a maximum of three prior steps and throw from behind the free throw line, 9 m from the goal. They were allowed to use resin on their hands to simulate real play actions. The subjects were instructed to carry out precise throws according to the criterion of difficulty for the intervention of the goalkeeper established by Zeier (1987), with different instructions for each test: a) In the shot at goal without the goalkeeper (TV),

unopposed, the throws had to be aimed at the corners of the goal (where the cross bar meets the side posts and where the side posts meet the floor) and b) In the case of the throws with opposition from the goalkeeper (TVO), the throwers had to aim at the points which were farthest from the goalkeeper, giving priority to the corners.

The goalkeeper was instructed to move along a line parallel to the goal line and 0.5 m away from it. Movement was only allowed in the frontal plane. An observer evaluated the performance of the goalkeeper recording each action from the side and observing them in slow motion. The coaches supervised the throwing technique to ensure that the throws were performed correctly.

Each participant, in each of the tests, performed throws until they had recorded three scores in each of the tests, the best two were verified and the highest value in each test was chosen for the final analysis. The process was as follows (Gorostiaga et al., 2005; Granados et al., 2007): each subject carried out a series of three continuous throws with a pause between them of 10-15 seconds; if it was necessary to perform more throws because three scores had not been recorded, the player performed a second series of throws with a pause of 1-2 minutes between the series, with a maximum limit of three series of throws.

In order to motivate the players they were informed about the throwing velocity immediately after the performance of each throw. Subsequently each player's best throws were analyzed. The intraclass correlation coefficient was 0.99 (THMB), 0.98 (TLMB), 0.98 (TV) and 0.97 (TVO) and the coefficient of variation was 3.1% (THMB), 4.9% (TLMB), 2.8% (TV) and 5.2% (TVO).

## **Materials**

The tests were carried out on an in-door handball court. Two "Salter" medicine balls of 3 and 0.8 kg and 72.2 and 58 cm circumference respectively were used. Distance was measured with a metric measuring tape with a standard error of 0.01m. The exact place where the medicine ball landed was measured using a black tarpaulin (20 x 3m) on which the ball left a mark on landing.

For the throwing velocity tests official regulation balls were used of 480 g and 58 cm diameter. Throwing velocity was calculated by measuring time. The time recording was carried out with a standard error of 0.001 s using a timing system (Sportmetrics, Valencia, Spain) composed of a passage sensor made up of photoelectric cells and a sound sensor. The passage sensor, located 2 m from the 6 m line was made up of eight photoelectric cells distributed vertically and uniformly with a 15 cm space between them (from 1.40 to 2.50 m from the floor). The sound sensor, with adjustable intensity, was installed in the lower central part of the goal. The chronometer began timing automatically when the ball passed across the photoelectric cells and stopped when the ball came into contact with the goal (6 m away) or the goalkeeper (5.5 m away), in the case of the throw with opposition. Given that the distance from the point at which the ball made impact to the sound sensor was never more than 2.5 m and given

that sound generates a delay of 0.001 s every 30 cm, a standard error is estimated at no more than 0.008 s. The calculation of throwing velocity was made using the following distances: when the goalkeeper was present in the goal the distance was 5.5 m if the ball was intercepted (the goalkeeper was 0.5 m from the goal), while the distance was 6 m if the ball came into contact with the goal (metal). The goalkeeper's movements in the frontal plane (TVO) were monitored with a camera located on the same line laterally to the goalkeeper.

### **Statistical Analysis**

The means and standard deviations were calculated for the variables THMB, TLMB, TV and TVO. The analysis of the differences among specific positions with regard to the dependent variables was performed with a one-way ANOVA, with a post hoc analysis using the Bonferroni method. Student's t test for related samples was used to analyze the differences between TV and TVO in the different positions. The statistical calculations were carried out with the SPSS 10.0 statistical programme.

### **RESULTS**

The results revealed that the backs were the best in the four tests while the goalkeepers obtained the lowest scores in the three most specific tests., revealing significant differences in TLMB ( $F_{4, 43}=2.886$ ;  $p<0.05$ ), TV ( $F_{4, 43}=4.857$ ;  $p<0.01$ ) and TVO ( $F_{4, 43}=12.828$ ;  $p<0.01$ ). The results of these tests also showed the same tendency, the backs scored the highest values, followed by the centre backs, then the pivots and the wings, with little difference between them in all the tests, and in last place the goalkeepers. No significant differences were found in THMB ( $F_{4, 43}=0.464$ ;  $p=0.762$ ) and the order of values obtained differed substantially from the rest of the tests (Table 2).

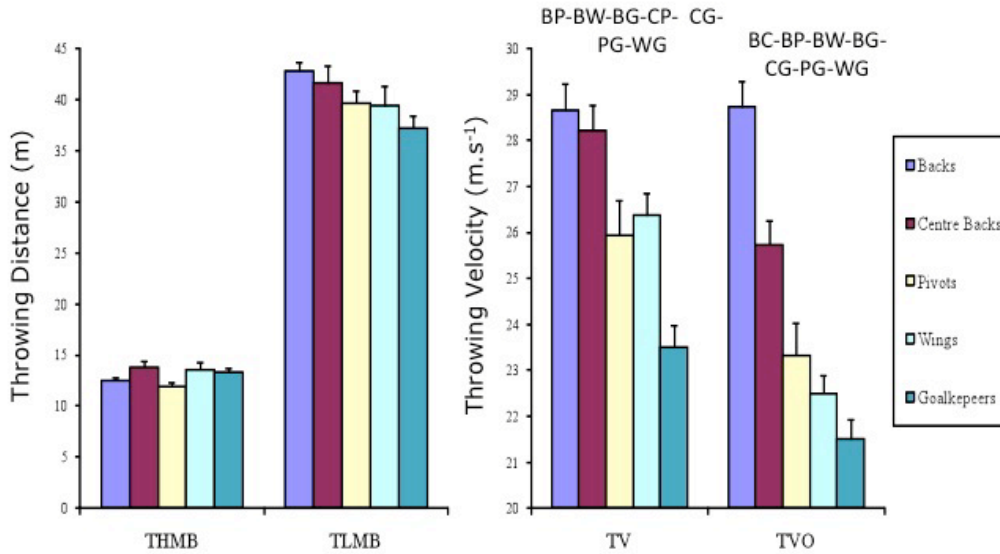
**Table 2.** Values ( $X \pm SD$ ) obtained in the throwing tests in the five groups of playing position

THROWING TESTS	Backs (n=13)	Centre backs (n=11)	Pivots (n=10)	Wings (n=9)	Goalkeepers (n=5)
THMB (m)	11.84±1.01	11.71±2.03	11.06±1.14	11.37±1.43	11.71±2.07
TLMB (m)	40.35±2.59	37.73±5.45	36.04±4.52	35.55±3.01	35.50±3.31
TV (m.s <sup>-1</sup> )	26.96±1.52 <sup>p<sub>wg</sub></sup>	25.26±2.76	24.48±1.46 <sup>b</sup>	24.07±1.73 <sup>b</sup>	23.80±0.44 <sup>b</sup>
TVO (m.s <sup>-1</sup> )	25.85±2.53 <sup>p<sub>wg</sub></sup>	23.97±1.8 <sup>g</sup>	21.8±1.75 <sup>b</sup>	21.5±0.71 <sup>bc</sup>	20.60±1.13 <sup>bc</sup>

Significantly different ( $p < 0.05$ ): <sup>b</sup>Significantly different from backs. <sup>c</sup>Significantly different from centre backs. <sup>w</sup>Significantly different from wings. <sup>p</sup>Significantly different from pivots. <sup>g</sup>Significantly different from goalkeepers.

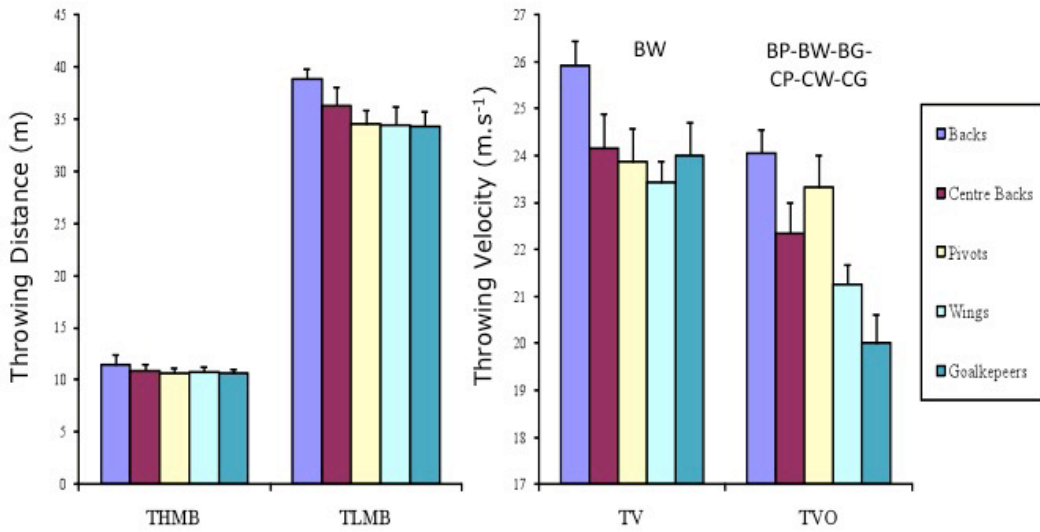
The backs were statistically superior to the goalkeepers in TV ( $p < 0.05$ ) and TVO ( $p < 0.01$ ), to the pivots in TV ( $p < 0.05$ ) and TVO ( $p < 0.01$ ), to the wings in TLMB (very near to significance:  $p = 0.078$ ), and TV ( $p < 0.01$ ) and in TVO ( $p < 0.01$ ). The centre backs were superior to the goalkeepers in TVO ( $p < 0.01$ ). There were no significant differences between the backs and the centre backs in any of the tests as among pivots, wings and goalkeepers.





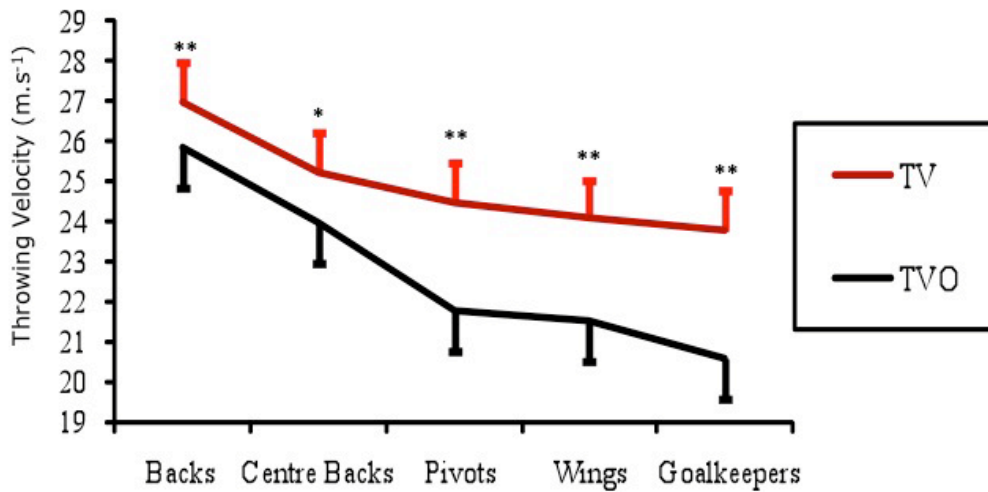
**Figure 2.** Values ( $X \pm SD$ ) obtained in the throwing tests by elite players according to the playing position. Significantly different ( $p < .05$ ) between: <sup>BC</sup>Backs-Centre Backs, <sup>BP</sup>Backs-Pivots, <sup>BW</sup>Backs-Wings, <sup>BG</sup>Backs-Goalkeepers, <sup>CP</sup>Centre Backs-Pivots, <sup>CG</sup>Centre Backs-Goalkeepers, <sup>PG</sup>Pivots-Goalkeepers, <sup>WG</sup>Wings-Goalkeepers.

A more in-depth analysis of the results obtained by the two groups shows that the elite players showed significant differences in TV ( $F_{4, 10}=23.797$ ;  $p<0.01$ ) and in TVO ( $F_{4, 10}=23.227$ ;  $p<0.01$ ), in contrast to the more general tests of THMB ( $F_{14}=1.255$ ;  $p=0.349$ ) and TLMB ( $F_{14}=2.197$ ;  $p=0.143$ ). The tendency of the values was similar to the one mentioned above (backs, centre backs, pivots, wings and goalkeepers) in TLMB and TVO, and very similar in TV. The backs were significantly superior to the goalkeepers in TV ( $p<0.01$ ) and TVO ( $p<0.01$ ), to the wings in TV ( $p<0.05$ ) and TVO ( $p<0.01$ ), and to the centre backs in TVO ( $p<0.05$ ). The centre backs obtained significantly higher values to the goalkeepers in TV ( $p<0.01$ ) and in TVO ( $p<0.01$ ) and to the pivots in TV ( $p<0.05$ ). The pivots achieved significantly higher results than the goalkeepers in TV ( $p<0.05$ ). The wings were significantly superior to the goalkeepers in TV ( $p<0.05$ ). There were no significant differences between pivots and wings (Fig. 2).



**Figure 3.** Values ( $X \pm SD$ ) obtained in the throwing tests by amateur players according to the playing position. . Significantly different ( $p < .05$ ) between: <sup>BP</sup>Backs-Pivots, <sup>BW</sup>Backs-Wings, <sup>BG</sup>Backs-Goalkeepers, <sup>CP</sup>Centre Backs-Pivots, <sup>CW</sup>Centre Backs-Wings, <sup>CG</sup>Centre Backs-Goalkeepers.

The amateur like the elite group revealed significant differences in TV ( $F_{4, 28}=3.181$ ;  $p<0.05$ ) and TVO ( $F_{4, 28}=11.324$ ;  $p<0.01$ ), in contrast to THMB ( $F_{4, 28}=0.512$ ;  $p=0.727$ ) and TLMB ( $F_{4, 28}=1.854$ ;  $p=0.147$ ). The backs were significantly superior to the goalkeepers in TVO ( $p<0.01$ ), to the pivots in TVO ( $p<0.01$ ), to the wings in TV ( $p<0.05$ ) and in TVO ( $p<0.01$ ). The centre backs were significantly superior to the goalkeepers in TVO ( $p<0.01$ ), to the pivots in TV ( $p<0.01$ ) and TVO ( $p<0.05$ ). As occurred in the overall data, there were no significant differences between the backs and the centre backs in any of the tests, or among the pivots, wings and goalkeepers (Fig. 3).



**Figure 4.** Values ( $X \pm SD$ ) obtained in the throwing velocity tests according to the playing position. \*Significantly different ( $p < .05$ ) \*\*Significantly different ( $p < .01$ ).

Furthermore, throwing velocity was significantly higher unopposed than with opposition ( $TV-TVO=1.98 \pm 1.72 \text{ m}\cdot\text{s}^{-1}$ ;  $p < 0.01$ ;  $t=8.317$ ;  $gl=47$ ). By specific position, the differences were significant in all the groups (Fig. 4), being greater in the goalkeepers ( $VLSO-VLCO=3.19 \pm 1.48 \text{ m}\cdot\text{s}^{-1}$ ;  $p < 0.01$ ;  $t=4.841$ ;  $gl=4$ ), followed by the pivots ( $VLSO-VLCO=2.68 \pm 1.66 \text{ m}\cdot\text{s}^{-1}$ ;  $p < 0.01$ ;  $t=5.098$ ;  $gl=9$ ) and wings ( $VLSO-VLCO=2.55 \pm 1.49 \text{ m}\cdot\text{s}^{-1}$ ;  $p < 0.01$ ;  $t=5.106$ ;  $gl=8$ ), and less evident in the centre backs ( $VLSO-VLCO=1.29 \pm 1.59 \text{ m}\cdot\text{s}^{-1}$ ;  $p < 0.05$ ;  $t=2.681$ ;  $gl=10$ ) and backs ( $VLSO-VLCO=1.11 \pm 1.26 \text{ m}\cdot\text{s}^{-1}$ ;  $p < 0.01$ ;  $t=3.196$ ;  $gl=12$ ).

## DISCUSSION

According to the bibliographic review there were very few studies which analyzed the differences in throwing capacity among the different playing positions in handball. It is surprising the lack of studies which have used tests with medicine balls of different weights, in spite of their common use in the training environment, and also throwing tests with opposition.

Considering the values obtained, it is worthy of mention that in the three specific throwing situations tested there was a similar tendency in the order of the results: backs, centre backs, pivots, wings and goalkeepers. The significant differences were fundamentally found between the players in the first line (backs and centre backs) and the goalkeeper, as well as between the first line players and those from the second line (wings and pivots). Both the elite group and the amateur one showed these differences in TV and TVO. These results

coincide with others obtained in young female handball players (Zapartidis et al., 2009), also supporting the opinion expressed by the coaches that throwing strength is more important for the first line than for the second and is of little relevance for the goalkeepers (Moreno, 2004).

With regard to the throws with the medicine ball the differences found were not significant in either group, and support the results achieved with elite junior and senior female handball players (Rogulj et al., 2005). These results together with the differences encountered in the more specific throwing velocity tests, could indicate that the differences in terms of playing position are to be found more in specific playing abilities rather than in general physical fitness. In this line of thought several studies have found differences in technical actions, intensity and distance covered in the game (Cambel, 1985; Luig et al., 2008; Manchado et al., 2007; Ziv and Lidor, 2009; Šibila et al., 2004). The present study has also confirmed the absence of differences in terms of specific playing position with regard to physiological tests (Chaouachi et al., 2009; Manchado et al., 2007). In contrast there are other studies, although they do not refer to throwing, which have found significant differences in other physical qualities and basic motor skills (Oxyzoglou et al., 2008; Pezarat-Correia et al., 2007; Vasques et al., 2005; Zapartidis et al., 2009) and psychological characteristics (Rogulj et al., 2005), together with the existence of differences in general physical abilities in terms of the specific defensive position (Vasques et al., 2005).

Moreover throwing velocity was significantly greater when unopposed than opposed in all playing positions. These results seem to coincide with several studies which have analyzed throwing velocity with and without opposition, both in handball (Pardo et al., 2007) and in water polo (Van der Wende, 2005; Vila et al., 2009). The same occurs with the jump shot with decision making and opposition from the goalkeeper (Párraga et al., 2001) where velocities were lower than other studies with the same type of throw carried out during a similar time period (Bayios et al., 2001; Šibila et al., 2003). However, this could be due to the fact that the analysis was two-dimensional (2D), and ignored the transversal component of velocity. In contrast to these data no significant differences were observed in throwing velocity in the jump shot with and without opposition in players from the Honour B Division (López, 2005).

A closer analysis of the differences between TV and TVO according to specific playing position shows that the greatest differences were found in the goalkeepers followed by the pivots and wings, and the smallest in the backs and centre backs. This difference in the influence of opposition in throwing velocity could be related to the specific requirements of long distance throws. Thus the players who frequently make throws which need maximum velocity, the first attack line, obtained the smallest differences; the pivots and the wings, who do not need to throw at maximum velocity as their throws are made from areas near to the goal, showed greater differences; while the influence of the opposition was greater in the goalkeepers, who hardly have to perform any type of throw.

Lastly, mean throwing velocity for the elite group was higher than that reported for other studies carried out with top level male players using a standing shot (Bayios and Boudolos, 1998; Cardoso and González-Badillo, 2006; Gorostiaga et al., 2005; Marques et al., 2007). However, this comparison should be made with caution as the studies were performed with considerable differences both in the measuring instruments used for velocity and in the protocol.

## CONCLUSIONS

The results confirm the existence of differences in specific throwing capacity among the different playing positions, but not in general throwing capacity. Thus the specific position could be determinant in this important play action and, equally, the level demonstrated in this capacity could be an important variable in the selection of the specific playing position that a player should occupy.

The fact that the greatest differences among the positions were found in the specific tests could mean that the specific requirements needed to select the players for the different positions should include specific tests with opposition. Although this hypothesis should be studied in depth in future research.

Opposition influences throwing velocity in handball goal shots, reducing it in all player positions. This influence is smaller as the need to throw from a longer distance in the game increases.

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