

The Offensive Efficiency of the High-Level Handball Players of the Front and the Rear Lines

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Abstract

Purpose: The aim of this study was to investigate the offensive efficiency of the professional handball players forming the front and rear lines.

Methods: Our investigation was carried out on four matches (final, semi-finals and classifying match) at the 19th male Handball World Championship "Tunisia 2005". Finalist teams were Tunisia, France, Croatia, and Spain. Matches were recorded using 5 digital camcorders (SONY, DCL, and TRV 130E). Number of passes and the length of the attacks were determined by software "STUDIO 9". Speed of the ball at the different shootings was calculated by REGAVI software, version 2.57, 2004. Work was dissociated according to 2 variables namely axes and lines.

Results: Players of lateral axes (A4) and front basis (L1) were shorter and thinner than those of the central axis (A3) and rear basis (L2). No differences were observed between lines and axes in age. The analysis of the total shootings to the goal shows that the players of lines and axes present very close values in each team, excepting the Croatian L2 compared to the Tunisian L2. Players of the rear Croatian basis present also a number of attacks concluded by a non-successfully cadred shooting greater than all other groups. In the Spanish group, a significant difference among number of passes concluded by a non-successfully cadred shooting between lines, and front basis vs central axis was noted. No significant difference was found between lines and axes in the Croatian team. Regarding the velocity of shooting, excepting the Croatian team, no differences were found between lines and axes of the other teams. No differences were also noted in the attack duration between lines and axes in Croatian and Tunisian teams. In the Spanish team, duration of attacks concluded by a cadred shooting was most important when finished by an L2 or an A3 player.

Conclusion: The present results demonstrate that finalist teams were found to be clearly characterized by L2 and A3 players taller and weightier than those of L1 and A4. Organized attack was generally concluded by shooting done by an L2 or an A4 player and the shooting velocity did not significantly determine the offensive efficiency.

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INTRODUCTION

Handball is a strenuous contact Olympic team sport that places emphasis on running, jumping, sprinting, arm throwing, hitting, blocking, and pushing

[1]. For these reasons, it is believed that anthropometric characteristics and physical qualities are the most important factors to improve handball performance [2]. Consequently, the importance of the morphological parameters was the origin of orientation toward the

choice of more and more big players, and it is the reason for which the majority of the trainers show a big interest in the morphological potential of the players during the period of detection and orientation [3].

However, the characteristics of the handball game are much more than a mere playing with big and strong sportsmen. It's the result of the cooperation between players within a team and the competition between teams in a complex synergistic relationship. In this way, Newell (1986) [4] considers behaviour as an emergent process emanating from the interaction between individuals, environment and task constraints. In addition to the physical characteristics, coaches need to consider and analyse the players' capacity to interact with the environment and to make the best individual and collective decisions within the game [5]. So, according to Newell (1986) [4] players' behaviours emerge as the result of 3 different constraints: individual constraints, task constraints and environmental constraints.

Conversely, when we state performance analysis, the actual approaches are centred on small parts (fundamentally on the outcomes) and don't consider the behaviour in the ecological state, i.e. the interaction between players and environment [6]. Their techniques are based on descriptive statistics and just consist of measuring the result of the handball players' performance. The majority of the specialists of the assessment stay however perplexed and unsatisfied because these measures leave aside the important portions of the process leading to the performance in the situation of the game. Therefore, to strengthen the comprehension of the game we need to focus our analysis on the relations between the different factors, which enable us to understand the dynamic of the game or the patterns of success of the teams [7]. To evaluate the later we need to understand the behaviour patterns that emerge in the offensive game situations. The success of an offensive action during a match of handball doesn't depend only on the mechanical or the physical aspects of the player, but it depends also on the ability of teams and individuals to adjust their behaviours to the changes that occur over time in the offensive context of the handball game [5,8]. However, the absence of tools that describe the emergent patterns of behaviour in different game situations and permit

the assessment of global performance (individual / collective) in handball is a problem for the majority of the trainers and one that will be solved by researchers. In order to develop a reliable characterization of the offensive process we can evaluate some offensive patterns and correlate them with the efficacy of the attack. The players' evolution according to centres or a line, the speed of shootings, the time of the preparation of the attack etc., are some examples of variables that are not considered by the researchers yet. This study, therefore, investigated the offensive efficiency of the professional handball players forming the front and rear lines. We are also specifically interested in determining the efficiency in the offensive actions composed by the front and rear lines in professional handball teams. At the end we expect verify if the team's performance depends on the capacity of the players who compose the rear basis, and if the speed of the ball, the length of the attacks and the circulation of the ball predefine the success of the offensive actions.

METHODS AND SUBJECTS

Participants:

This study was a multidimensional, homothetic and sequential observational design. The sample was formed from four matches (final, semi-finals and classifying match) at the 19th male Handball World Championship "Tunisia 2005". Finalist teams were Tunisia, France, Croatia, and Spain. Age and individual anthropometric characteristics are shown in table 1. All players were mentioned on the two match papers (semi-final and final or semi-final and placement match), and participated in playing. Before filming, the comity organization of the 19th male Handball World Championship received a verbal description of the experiment, and was required to complete a written consent for this study. The protocol was approved by the Ethical Tunisian Olympic Committee.

Materials:

Matches were recorded using 5 digital camcorders (SONY, DCL, and TRV 130E) fixed on the stadium centre, and at the 4 angles. The number of passes and

Table 1: Demographic catechistic of the four finalist teams at the 19th male Handball World Championship “Tunisia 2005”

Variables	Age (year)	Size (cm)	Weight (kg)	BMI (kg/m ²)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Spain (N=19)	27.10 (3.20)	192.85 (6.10)	88.05 (2.85)	23.60 (2.85)
Croatia (N=17)	28.65 (3.90)	190.50 (7.5)	91.50 (7.60)	25.10 (4.05)
France (N=22)	29.20 (4.10)	190.01 (6.10)	93.60 (93.60)	25.80 (1.45)
Tunisia (N=16)	27.35 (2.05)	187.35 (7.10)	90.15 (8.70)	25.65 (1.70)

BMI: body mass index/ SD: standard deviation

the length of the attacks were determined by software “STUDIO 9”. This software permits cutting the pictures shot at the time of the matches in brief sequences. These were later used to determine the attacks placed in order to be able to measure the frequency of passes and the attack duration. Speed of the ball at the different shootings was calculated by REGAVI software, version 2.57, 2004. This software is an external module of Regression intended to extract the information of BMP files, JPEG, WAV, AVI, MPEG or MOV and to send it to Regression.

Parameters:

Age and the anthropometric variables of size (cm), and body mass (kg) were measured in each participant on a leveled platform scale (An˜o Sayol, Barcelona, Spain) with an accuracy of 0.01 kg and 0.1cm, respectively. Body mass index (BMI) was calculated from body mass and body height (kg.m⁻²).

Attack Characteristics:

Four parameters were detected: i) Ball circulation (BC); ii) Shootings (SH); iii) Attack length (AL); and iv) The shooting speed (ShS). BC was calculated through the heap of the passes achieved by the team in attack on a placed defence until the moment of shooting. SH was counted following one achieved attack, and three shooting types were differentiated: shootings centred successfully, shootings centred non successfully, and shootings none centred. AL was the time spent between the beginning of the attack until the moment of shooting. Finally, ShS reflects the power of shootings; it was calculated from the vertical and horizontal speeds of the movement of the ball when it leaves the hand of the shooter and after 0.04 seconds.

Analysis:

All along our research, we were careful to dissociate work according to 2 variables namely axes and lines. According to the variable "axis" we differentiate the central axis, and the two lateral axes (right and left): the Central axis represents the zone of evolution of the play maker, pivot, and the two lateral rears, while lateral axes concerned the two wings. However, the variable “lines” splits up the players in the front basis and the rear basis: the front basis is composed of the two wings and the pivot, whereas the rear basis is formed of a play maker, and the two rears (left and right).

Statistical analysis:

The SPSS 17.0 statistical package was used to analyze all data. The comparison of the dependent variables (technical-tactical) according to the independent variables (axes and lines) was performed using ANOVA Test. All data are presented as means ± standard deviation (SD) with a p value of less than 0.05 considered as statistically significant.

RESULTS

Age and anthropometric characteristics by lines and axes are shown in table 2. The multiple comparisons showed some differences between groups namely in Height and weight. In fact, the Spanish L2 and A3 players were taller and weightier than the other two groups (L2 vs L1: P=009; L2vsA4: P=003; A3 vs L1: P=0.007; A3 vs A4: P=0.002). No differences were

Table 2: Demographic catechistic by lines and axes of the four finalist teams at the 19th male Handball World Championship “Tunisia 2005”

Country		Age (years)	Weight (kg)	Size (cm)
		Mean (SD)	Mean (SD)	Mean (SD)
SPAIN	L1	29.86 (3.13)	87.86 (11.64)	185.00 (7.44)
	L2	29.21 (4.37)	96.71 (9.98)	192.71 (5.64) *
	A3	28.93 (4.35)	96.80 (9.62) ‡	192.87 (5.46) **
	A4	30.67 (2.5)	86.17 (11.77)	183.30 (6.56)
CROATIA	L1	27.33 (2.64)	91.3 (9.03)	185.67 (7.02)
	L2	26.75 (1.83) ‡	89.5 (8.65)	189.75 (6.52) ‡
	A3	26.31 (2.02) ‡	92.62 (8.35)	189.85 (5.69) ‡
	A4	29.50 (0.58)	83.5 (5.74)	180.25 (5.50)
FRANCE	L1	28.33 (3.14)	77.67 (17.07)	192.20 (8.20)
	L2	27.36 (3.32)	93.9 (4.28) **‡	193.02 (5.00)
	A3	27.17 (3.24)	93.75 (4.11) **‡	194.02 (5.40)
	A4	29.00 (3.00)	74.80 (17.40)	190.20 (7.35) ^φ
TUNISIA	L1	29.67 (3.39)	88.00 (13.77)	185.67 (7.80)
	L2	28.15 (4.09)	93.08 (19.38)	192.69 (5.80) **‡
	A3	28.93 (4.32)	94.67 (18.43)	192.73 (5.40) **‡
	A4	27.50 (0.58)	94.67 (18.43)	182.00 (6.93)

* Differs significantly from front basis (L1) of the same team; ‡ differs significantly from lateral axes (A4) of the same team; ^φ differs significantly from A4 of Croatia / SD: standard deviation

observed between lines and axes in age. Whereas, in the Croatian team, A4 players were older and shorter than those of L2 and A3 (A4 vs L2: $P=0.02$; A4 vs A3: $P=0.001$). Players of lateral axes and front basis were also shorter and thinner than those of the central axis and rear basis, respectively in Tunisian (L2 vs L1: $P=0.026$; L2 vs A4: $P=0.004$; A3 vs L1: $P=0.02$; A3 vs A4: $P=0.004$) and French team ($p=0.003$ for L1 and $P=0.001$ for A4). The Comparison between teams showed a significant difference in height between the French and the Croatian rear bases ($P=0.046$).

Table 3 represses the data about the number of passes by attack concluded by a successfully cadred shooting, or a non-successfully cadred shooting, or a non-cadred shooting. The analysis of the total shootings to the goal shows that the players of lines and axis present very close values in each team, excepting the Croatian L2 compared to the Tunisian L2. The later present a TP and a number of passes concluded by a non-cadred shooting (NPNCS) less important ($p=0.049$ for all.). Players of the rear Croatian basis also present a number of attacks concluded by a non-successfully cadred shooting greater than all other groups (Spain: $p=0.046$; France: $P=0.041$; Tunisia: $P=0.049$).

Regarding intra-group comparisons, in the Spanish group we noted significant differences among number of passes concluded by a non-successfully cadred shooting (NPNSCS) between lines ($P=0.04$), and front basis vs central axis ($P=0.05$). No significant difference was found between lines an axes in the Croatian team. Whereas, in the French group, the number of passes in a non-successful attack were greater when shootings were done by players of L2 (L1: $P=0.02$; A4: $P=0.02$), and A3 (L1: $P=0.02$; A4: $P=0.02$). The later, in the Tunisian team, were also performing less than A4 when the attack was concluded by a non-successfully cadred shooting (L2: $P=0.03$; A3: $P=0.02$).

Table 4 summarizes the mean and standard deviation of the velocity of shooting. The results for the analyses of variance demonstrated significant differences between lines and axes in the Croatian team. In fact, in successful attacks, the shooting velocity was greater when the ball was shot by a rear basis, or a central axis player (L1 vs L2: $P=0.03$; L1 vs A3: $P=0.05$; A4 vs L2: $P=0.01$; A4 vs A3: $P=0.01$). No differences were found between lines and axes of the other teams. Substantial differences were also noted between the Spanish and Croatian L2 in velocity of the ball at a successfully cadred shooting (VSCS) ($P=0.02$),

Table 3: Number of passes by attack at the 19th male Handball World Championship “Tunisia 2005”

Country		Total passes	NPSCS	NPNSCS	NPNSCS
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
SPAIN	L1	4.86 (4.06)	8.00 (3.40)	5.70 (1.90)	6.40 (1.90)
	L2	5.50 (2.95)	9.21 (4.04)	9.93 (4.78) *‡	7.00 (2.88)
	A3	5.60 (2.87)	9.33 (3.92)	9.47 (4.94) *	6.80 (2.88)
	A4	4.50 (4.32)	7.50 (3.45)	6.17 (1.60)	6.83 (1.70)
CROATIA	L1	5.33 (2.87)	9.11 (4.70)	9.00 (5.60)	6.44 (1.51)
	L2	9.00 (5.85)	11.75 (5.06)	10.75 (5.15)	6.44 (4.37)
	A3	7.38 (5.19)	10.77 (5.08)	9.38 (4.77)	9.38 (3.82)
	A4	6.00 (3.37)	9.00 (4.69)	11.25 (7.41)	8.08 (1.83)
FRANCE	L1	7.17 (3.12)	9.00 (4.00)	6.00 (1.79)	5.67 (3.14)
	L2	5.73 (4.27)	8.18 (3.22)	9.82 (3.34) *‡	8.64 (2.73) *‡
	A3	5.67 (4.08)	8.25 (3.08)	9.58 (3.29) *‡	8.67 (2.60) *‡
	A4	7.60 (3.28)	9.00 (4.47)	5.80 (1.92)	5.00 (3.00)
TUNISIA	L1	6.33 (3.01)	11.17 (7.08)	7.50 (2.95)	7.83 (1.94)
	L2	5.23 (3.88) ‡	8.90 (4.92)	10.54 (4.01) ‡	6.69 (1.97) ‡
	A3	5.33 (3.60)	9.80 (6.04)	10.6 (3.74) ‡	6.87 (1.88)
	A4	6.50 (3.87)	9.00 (4.08)	5.75 (1.26)	7.75 (2.50)

NPSCS: number of passes concluded by a successfully cadred shooting / NPNSCS: number of passes concluded by a non-successfully cadred shooting / NPNSCS: number of passes concluded by a non-cadred shooting / SD: standard deviation

* Differs significantly from front basis (L1) of the same team; ‡ Differs significantly from lateral axes (A4) of the same team; † differs significantly from rear basis (L2) of Croatia

and velocity of the ball at a non-successfully cadred shooting (VNCS) ($P=0.03$).

Regarding the duration of attacks, analysis noted no differences between lines and axes in Croatian and Tunisian teams. Attack durations concluded by non-cadred shooting or non- successfully cadred shooting

were longer in the French team than Spanish when shooting was respectively done by an A3 ($P=0.03$) or an A4 player ($P=0.02$). In the Spanish team, duration of attacks concluded by a cadred shooting was also most important when finished by an L2 [Duration of attack concluded by a successfully cadred shooting

Table 4: Ball velocity shootings at the 19th male Handball World Championship “Tunisia 2005”

Country		VSCS	VNSCS	VNSCS
		Mean (SD)	Mean (SD)	Mean (SD)
SPAIN	L1	20.14 (5.04)	14.42 (4.42)	17.57 (2.37)
	L2	19.86 (6.42) ‡	12.29 (4.78) ‡	16.57 (3.48)
	A3	19.80 (6.19)	12.66 (4.83)	16.87 (3.54)
	A4	20.33 (5.50)	13.83 (4.54)	17.00 (2.00)
CROATIA	L1	20.67 (3.16)	15.90 (4.10)	16.30 (1.94)
	L2	24.37 (3.80) *‡	16.50 (3.74)	16.63 (2.62)
	A3	23.16 (3.64) *‡	15.69 (3.38)	16.77 (2.31)
	A4	18.50 (0.58)	17.75 (5.32)	15.50 (1.73)
FRANCE	L1	21.50 (5.47)	13.83 (4.87)	17.12 (3.18)
	L2	20.73 (2.37)	13.40 (4.06)	15.91 (1.37)
	A3	20.83 (2.29)	13.28 (3.90)	16.06 (1.20)
	A4	21.4 (6.11)	14.20 (5.36)	17.00 (3.53)
TUNISIA	L1	21.83 (4.80)	15.67 (3.88)	15.50 (2.74)
	L2	22.32 (2.50)	14.04 (3.54)	15.75 (1.56)
	A3	22.15 (2.36)	14.43 (3.52)	15.58 (1.52)
	A4	22.25 (6.40)	15.00 (4.55)	16.00 (3.37)

VSCS: Velocity of the ball at a successfully cadred shooting / VNSCS: Velocity of the ball at a non-successfully cadred shooting; VNCS: Velocity of the ball at a non- cadred shooting / SD: standard deviation

* Differs significantly from front basis (L1) of the same team; ‡ differs significantly from lateral axes (A4) of the same team; † differs significantly from rear basis (L2) of CROATIA.

Table 5: Attack durations at the 19th male Handball World Championship “Tunisia 2005”

Country		DASCS	DANSCS	DANCS
SPAIN	L1	15.70 (10.64)	13.43 (5.86)	21.14 (3.18)
	L2	25.07 (11.93) ‡	17.59 (6.66) ‡	19.64 (6.36)
	A3	25.60 (11.68) ‡	18.02 (6.63) ‡	19.27 (6.30)
	A4	12.83 (8.13)	11.67 (3.88)	22.33 (0.52)
CROATIA	L1	23.72 (9.37)	19.9 (11.98)	21.39 (2.20)
	L2	25.25 (8.08)	16.13 (10.42)	21.27 (9.10)
	A3	24.42 (7.00)	17.54 (11.36)	21.09 (6.90)
	A4	24.5 (12.63)	20.00 (11.58)	22.12 (2.95)
FRANCE	L1	19.80 (8.56)	8.83 (3.43)	19.50 (8.09)
	L2	20.90 (11.14)	19.18 (7.30) **‡	23.90 (2.03) ‡
	A3	20.67 (10.65)	18.42 (7.48) **‡	23.83 (1.94) ‡
	A4	20.20 (9.52)	8.60 (3.78)	18.80 (8.84)
TUNISIA	L1	24.33 (8.62)	15.00 (7.24)	21.00 (6.00)
	L2	22.38 (14.76)	17.31 (8.66)	21.08 (4.80)
	A3	22.87 (14.05)	17.40 (8.58)	21.67 (4.81)
	A4	23.50 (8.85) †	13.50 (5.97)	18.75 (5.97)

DASCS: Duration of attack concluded by a successfully cadred shooting; DANSCS: Duration of attack concluded by a non-successfully cadred shooting; DANCS: Duration of attack concluded by a Non-cadred shooting / SD: standard deviation

* differs significantly from front basis (L1) of the same team; ‡ differs significantly from lateral axes (A4) of the same team; † differs significantly from lateral axes (A4) of SPAIN

(DASCS): $P=0.03$ for A4] or an A3 player [DASCS: $P=0.02$ for A4; duration of attack concluded by a non-successfully cadred shooting (DANSCS): $P=0.04$ for A4]. There were no differences between lines and axes when shooting was non cadred. In The French team, Duration of attack concluded by a Non-cadred shooting (DANCS) was most important in L2 and A3 than the other two groups (L2 vs L1: $P=0.004$; L2 vs A4: $P=0.005$; A3 vs L1: $P=0.006$; A3 vs A4: $P=0.008$).

DISCUSSION

Previous reports have noted the importance of the morphological parameters as a criterion of success that can encourage the access to handball practice [9]. In fact, anthropometric characteristics are very relevant for handball players because the game entails physical contact in which specific physiques with a high level of strength and power may provide an advantage [10]. The physical characteristics of handballers are considered in the choice of players to implement the game plan.

The most striking comparison of anthropometric make-up of handball players in the present study was the difference in height and weight between lines and axes. On average, rear basis and central axis players were the tallest and the weightiest, possibly because most teams use the backs to score from outside the 9-m area; no differences were noted between teams in this area. This may be due to the anthropometric diagnostic procedures which become very important during the selection of athletes, for the sake of which the sport-specific morphological models or profiles have been created. In fact, the “model” somatic patterns are primarily based on those initial anthropological dimensions at the youngest possible age, and that are genetically strongly determined [11]. Further, the findings regarding the anthropometric status of players are indispensable in the training process, the modeling and the management. To be effective, the training process must consider both the current and the targeted anthropometric status of players, on the one hand, and the game specific demands and desirable results, on the other [12].

In comparison with the study of Hasan et al. (2007) [10] involving the 12th Asian Games in Hiroshima, the

mean height (1.832 ± 0.073 m) and body mass (82.2 ± 9.6 kg) values were lower in the Asian players than those found in the present study. The authors noted also that values were higher in successful players (medaled team) than the unsuccessful players (non medaled team), demonstrating that anthropometric characteristics did play a role in successful performance in handball games. However, success in the later needs much more than a game with big players [11]. Numerous studies have demonstrated the role of particular motor ([11], functional [10], and psychological [13] characteristics of the players in their situational efficiency. Tactical activity is a crucial feature of sport games, which is manifest in the situational-competitive conditions and that can be defined as a planned and premeditated management of all system dimensions to reach the goal.

The essence of tactical activity is to usefully employ the potentials available in a way that is spatially and temporally least favorable for the opposed team. This implies optimal utilization of the specific features of each individual through allocation of the tasks compatible to his abilities and at an appropriate spatial-temporal moment, depending on the activity of the opposed team players (Rogulj et al., 2004). Undoubtedly, the efficiency of the implementation of tactical elements in the attack greatly depend on the preparation of a shooting that we called "the length of attack", a condition of the success of shooting. The middle values of the length of the attacks concluded by the different shootings show that the most important middle length of shootings centred successfully are by the Spanish and Croatian teams, this is observed among the handball players of L2 and A3. In fact, the evolution of the defence as well as its modern technical means permit the neutralization of shooting. While fighting against this defence, the attacker uses a circulation until being in adequate position of shooting [12]. The attack of the L2 evolves far from the line of the opposing goal. This rear basis is formed of the two or three players according to the chosen optics. We think that it is essentially the capacity of the players composing the rear basis to organize themselves which determines the result of the handball match [10]. As far as this "rear line" succeeds in making an uncertainty hover on the defence, either by its intrinsic action, or

with the help of the pivot who allows the wings to keep a lateral position. Players composing "the rear basis" are therefore, mainly, responsible for the occupation of the land, the circulation of the ball, and the fundamental manoeuvres.

Results of the study showed also a significant difference in ball velocity between lines and axes of the same team. This may be due to anthropometric characteristics which were positively correlated to the throwing ball velocity [14]. In fact, according to studies, when an athlete has increased segmental body length measurements, he can throw the ball with higher velocity. The combination of a longer humerus and a higher angular velocity results in higher linear ball velocity [15]. Mechanically, an increase of a rotation radius should cause a proportional increase in the force applied to the ball, and consequently an increase of the ball's linear velocity [14].

However, the inter-teams comparison noted a significant difference between Spain's L2 and Croatia's L2 ball velocities in favor of the later indicating the L2 score efficiency to be not realized by the ball velocity. This is in discordance with previous studies considering throwing velocity as one of the most important technical skills in competitive team hand ball as it is a major determinant of all actions taken by the players [14], whereas, it can be attributed to the Spanish capacities at destabilizing the defense. The high efficiency of Spanish attack is quite understandable, as it is an attack against unorganized defense, which is to be completed at close range, usually without the presence of defenders. The forward possesses thereby a great kinetic potential as well as a favorable shooting angle, thus ensuring a considerable advantage over the goalkeeper. That is why this type of closing prevails in achieving high score differences in the games of two teams of a varying quality, and reliably polarizes handball teams into efficient and inefficient in terms of game results.

Some aspects of the present study need to be put into perspective, namely differences in the utilization of particular collective tactical elements in attack activities between the winning and losing teams. This study was restricted to determining the speed of the ball, the length of the attacks and the circulation of the ball and did not include continuity, system,

organization and spatial direction of attacks. The use of individual scores on a single technical measure can also explain the attack efficiency. Technique is a complex characteristic in ball games and consequently the use of a composite technique score based on individual scores on several reliable and relevant skills would be useful ^[16]. The determination of factors influencing ball velocity such as the team's role distribution, playing post, muscular strength and anthropometric characteristics would also be most interesting ^[14].

CONCLUSION

The present results demonstrate that finalist teams were found to be clearly characterized by L2 and A3 players

taller and weightier than those of L1 and A4. Organized attack was generally concluded by shooting done by an L2 or an A4 player and the shooting velocity did not significantly determine the offensive efficiency.

ACKNOWLEDGMENTS

Before filming, the organizing comity of the 19th male Handball World Championship received a verbal description of the experiment, and was required to complete a written consent for this study. The protocol was approved by the Ethical Tunisian Olympic Committee.

Conflict of interests: None

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