

## KINANTHROPOMETRIC PROFILE OF PORTUGUESE WATER POLO PLAYERS

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Our purpose was to describe physical and training background characteristics of Water Polo players and compare them according to their specialized playing positions. The International Working Group of Kinanthropometry guidelines were followed. A one-way unvaried measure ANOVA with Bonferroni post hoc was used to develop a multiple comparisons procedure between the specialized playing positions ( $\alpha=0.05$ ). It was concluded that the center players presented tendency for the highest values in 8 of the 10 parameters studied. Center backs are older than the drivers and center forwards have a higher BMI than the wingers and the goalkeepers. The somatotype is balanced mesomorph. Center forwards and Drivers tend to get closer endomorphy when compared with the remaining positions.

**KEY WORDS:** Anthropometry, specialized playing position.

**INTRODUCTION:** Water Polo is a high-intensity intermittent team sport with complex movements (Lozovina et al., 2009). The Water Polo players perform several actions and play a specific role in the game (Lozovina et al., 2009) with specific tasks requiring different physical characteristics (Platanou & Nikolopoulos, 2003). Furthermore, the years of sport experience, frequency and intensity of training, induce morphological adaptations, meaning that the players characteristics differ depending on the role performed in the field (Lozovina & Pavičić, 2004). However, researchers continue refer to the lack of scientific investigation of this topic (Lozovina et al., 2009). In addition, the Kinanthropometric profile of Portuguese Water Polo players is still unknown.

It is commonly accepted that the knowledge about morphological characteristics of Water Polo players, particularly their general physical and training background characteristics, can help coaches and the Water Polo community to better understand their performance (Platanou & Nikolopoulos, 2003; Tsekouras et al., 2005). Therefore, the purpose of the present study was to describe the general physical and training background characteristics of Portuguese national level Water Polo players, in overall sample and according to their specialized playing positions. Also, to assess the anthropometric somatotype, in all sample, and by specialized playing position.

**METHODS:** Thirty Portuguese male national level Water Polo players were studied. Subjects were grouped according to their specialized playing positions: five goal keepers, six center back, seven center forwards, six drivers and six wingers. The experimental protocol was developed and approved by the Institutional Review Committee of the local institution.

The general physical and training background parameters were chosen according with the literature as being important for Water Polo (Carter & Ackland, 1994; Lozovina et al., 2009; Tsekouras, 2005), and the anthropometrical parameters were chosen according to the proposal by Carter (2002) for determining the Heath-Carter anthropometric somatotype, as well, considered determinant for Water Polo (Carter & Ackland, 1994; Lozovina et al., 2009). Their assessment followed the International Working Group of Kinanthropometry proposal (Ross & Marfell-Jones, 1991). The anthropometrical parameters were accurately measured with specific instruments as a scale and a stadiometer (Seca, Germany), a paquimeter (Holtain Ltd., United Kingdom) an inextensible fibber glass tape measure (Holtain Ltd., United Kingdom), and a skinfold caliper (Holtain Ltd., United Kingdom). In addition, were

calculated the muscle mass percentage (Martin et al., 1990), the fat percentage (Yuhasz, 1974), the body mass index (BMI) and the three somatotype components (Carter, 2002) that lead to determination of the somatochart axes and design, which was developed with the support of software *somatotype 1.1, calculation and analysis* (sweat technologies, metacard corporation., USA). Maximal hand grip strength was also assessed with the use of a dynamometer (Takei Scientific Inst. Co. Ltd, Japan). The players performed a maximal contraction, with their arm extended while gripping on the dynamometer. The best result out of two efforts was recorded for all tests.

Mean  $\pm$  SD computations for descriptive analysis were obtained for all variables and the Shapiro–Wilk’s test was applied to verify the normal distribution of the data. A one-way unvaried measure ANOVA with Bonferroni post hoc was used to develop a multiple comparisons between the specialized playing positions. A significance level of 5% was accepted.

**RESULTS:** The physical characteristics and training background of Portuguese Water Polo players according to their playing position are shown in Table 1.

**Table 1**  
**Mean  $\pm$  SD values of the general physical and training background characteristics of Water Polo players in general and by specialized playing position.**

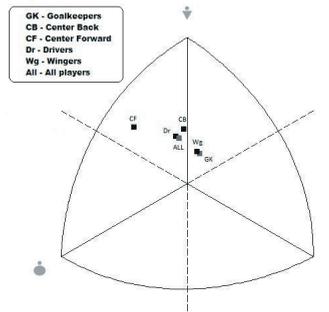
	Goalkeepers (n=5)	Center back (n=6)	Center forward (n=7)	Drivers (n=6)	Wingers (n=6)	All players (n=30)
Age (yrs)	24.4 $\pm$ 4.6	32.3 $\pm$ 6.9*	25.0 $\pm$ 3.4	23.3 $\pm$ 4.7*	24.5 $\pm$ 4.7	25.9 $\pm$ 5.7
Experience (yrs)	11.2 $\pm$ 3.3	17.3 $\pm$ 7.6	13.1 $\pm$ 4.6	11.3 $\pm$ 3.5	11.5 $\pm$ 3.5	13.0 $\pm$ 5.0
Training (hrs/wk)	11.5 $\pm$ 2.6	12.5 $\pm$ 5.2	13.6 $\pm$ 5.6	10.8 $\pm$ 2.4	13.3 $\pm$ 9.9	12.4 $\pm$ 5.6
Height (cm)	182.4 $\pm$ 6.1	183.1 $\pm$ 3.2	180.2 $\pm$ 7.2	176.7 $\pm$ 3.0	180.6 $\pm$ 5.5	180.5 $\pm$ 5.4
Weight (kg)	75.8 $\pm$ 7.0	80.8 $\pm$ 6.7	88.7 $\pm$ 16.7	74.9 $\pm$ 9.1	75.6 $\pm$ 6.0	79.6 $\pm$ 11.1
Arm span (cm)	186.2 $\pm$ 8.1	184.8 $\pm$ 6.0	187.2 $\pm$ 11.0	180.8 $\pm$ 4.4	189.8 $\pm$ 9.1	185.8 $\pm$ 8.2
Fat (%)	9.9 $\pm$ 1.1	10.9 $\pm$ 2.5	13.1 $\pm$ 2.9	9.9 $\pm$ 2.7	9.7 $\pm$ 1.5	10.8 $\pm$ 2.5
Muscle Mass (%)	46.2 $\pm$ 4.4	49.5 $\pm$ 3.6	52.3 $\pm$ 11.5	46.5 $\pm$ 4.7	47.9 $\pm$ 4.3	48.7 $\pm$ 6.7
Body mass index	22.8 $\pm$ 1.3*	24.1 $\pm$ 1.5	27.1 $\pm$ 3.3*	24.0 $\pm$ 2.7	23.2 $\pm$ 1.8*	24.4 $\pm$ 2.7
Maximal grip	48.5 $\pm$ 7.6	47.7 $\pm$ 6.4	51.5 $\pm$ 8.2	49.6 $\pm$ 5.2	52.6 $\pm$ 8.7	50.1 $\pm$ 7.1

Note. \*, † Significant differences between groups ( $p \leq 0.05$ ).

It can be observed higher values of age to the center backs when compared with the drivers, as well as higher values of BMI to the center forwards compared with the wings and goalkeepers. In addition, endomorphy, mesomorphy and ectomorphy somatotype components of Water Polo players by specialized playing position are described in Table 2 and in the Figure 1.

**Table 2**  
**Mean  $\pm$  SD values of somatotype components of Water Polo players by specialized playing position**

	Endomorphy	Mesomorphy	Ectomorphy
All players (n=30)	2.8 $\pm$ 1.0	4.5 $\pm$ 1.2	2.3 $\pm$ 0.9
Goalkeepers (n=5)	2.5 $\pm$ 0.4	4.1 $\pm$ 1.0	3.0 $\pm$ 0.6
Center back (n=6)	2.6 $\pm$ 0.6	4.8 $\pm$ 0.7	2.4 $\pm$ 0.6
Center forward (n=7)	3.8 $\pm$ 1.1	5.0 $\pm$ 1.8	1.3 $\pm$ 0.7
Drivers (n=6)	2.8 $\pm$ 1.3	4.4 $\pm$ 0.7	2.2 $\pm$ 1.0
Wingers (n=6)	2.3 $\pm$ 0.7	3.9 $\pm$ 1.3	2.7 $\pm$ 1.0



**Figure 1: Somatochart of Water Polo players by specialized playing position.**

When referring to all the sample, the somatotype of Water Polo players is classified as balanced mesomorph; regarding to the specific positions, center forwards and drivers are more endomorph (classified as endo - mesomorphs) than the remaining positions, which are more balanced mesomorphs.

**DISCUSSION:** The height and weight values found in our study tend to be lower than those observed by Carter & Ackland (1994) in players of 15 different countries and by Tsekouras et al. (2005). In the research carried out by Lozovina & Pavičić (2004), the players exceed 185 cm and 85 kg, values that are above of those found in our sample. Furthermore, this difference was also observed in the study of Platanou & Nikolopoulos, (2003) with a sample of younger players from Water Polo national level. The players taking part in present study are also from national level, and their sport experience is similar to that observed by Vila et al. (2010) in senior players. It would be important to have more data about this parameter as well as the number of hours of training per week, since they may induce morphological adaptations (Lozovina & Pavičić, 2004) and could be pointed as reasons for lower height and weight, of the players in our sample.

In the arm span, the values obtained in the present study tend to be lower than those observed by Vila et al. (2010) to senior and junior players. The same tendency is noticed for the body fat % and muscle mass %, comparing with the values mentioned by Tsekouras et al. (2005) and Carter & Ackland (1994) respectively. Likewise, the BMI obtained in the present study tends to settle under the values observed by Vila et al. (2010).

Regarding the hand grip, some researches (Lozovina et al., 2009; Vila et al., 2010) present positive correlation of this variable with anthropometrical parameters. However, the respective values of hand grip of their studies are not directly reported, so we could not compare them with the values found in the present study. Since the overhand throw accounts in large percentage of all passes and shots during a game, it will be important to gather more data about the strength of upper extremities (Tsekouras et al., 2005).

Regarding the specialized positions, the goalkeeper value of arm span does not show a tendency to be the highest between specialized playing positions, subject of interest, since that parameter and tallness are crucial to its success (Kacic, 2007).

In the present study, center backs show tendency for higher values in age, experience in sport and height. For its part, center forwards boast tendency for higher values in training hrs /wk, weight, fat %, muscle mass % and BMI. However, the height and weight of center back and center forward players remain under the values mentioned by the authors cited above.

Although it is considered that the wingers do not need a high stature to perform their tasks during the game (Lozovina et al., 2009), in our study this players show tendency for higher values of arm span and maximal grip. This can be due to their specialization in the task of shooting on goal (Lozovina et al., 2009) or in performing defensive blocks.

Regarding the significant differences found in the present study, between specialized positions, higher age of the center backs can be explained by the nature of the role played in that position. The center backs are core elements in game organization, and have the

responsibility to defend the center forward (Lozovina et al., 2009). In the current study, they present higher values for experience in the sport. For its part, the higher values of BMI reported for the center forward can be due to the frequent physical contact and intense wrestling (Platanou, 2004) so they are heavier and bulkier (Lozovina et al., 2009). On the other hand, the wingers show a BMI significantly lower than the center forward, followed by the goalkeepers. Like the driver, the winger is considered a contact-free playing position where the players seek to release the counterattack (Lozovina et al., 2009). In what concerns to the goalkeepers, they need agility, ability to react, speed of movement and having a high stature (Kacic, 2007).

Concerning the somatotype (Table 2 and Figure 1), in our study players can be classified as balanced-mesomorphs (Carter, 2002), in opposition with the endo-mesomorph classification presented by Platanou & Nikolopoulos, (2003) and Vila et al. (2010). Only the center forwards and drivers tend to get closer endomorphy (classified as endo-mesomorphs). Center forwards and center backs present a tendency for higher values of mesomorphy than the other positions, stating a greater volume and muscle-skeletal development, which is in accordance with the characteristics of constant wrestling of these particular positions (Lozovina et al., 2009). The goalkeepers and wingers, besides the dominance of mesomorphy, present higher values to the ectomorph component than the endomorph one. However, their classification is balanced mesomorph (Carter, 2002), located on the left quadrant of somatochart, showing the tendency for greater linearity.

**CONCLUSIONS:** Center players presented tendency for the highest values in 8 of the 10 parameters studied. The center backs are significantly older than the drivers and center forwards have a higher BMI than the wings and the goalkeepers. The somatotype is balanced mesomorph and center forwards and drivers tend to get closer endomorphy. Since the kinanthropometric values obtained in the present study turn out to be lower than what is presented by the literature, it would be important, for the development of the sport, better study this issue in greater depth.

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