

ANTHROPOMETRIC AND PHYSIOLOGICAL PROFILE OF PORTUGUESE RUGBY PLAYERS - PART I: COMPARISON BETWEEN ATHLETES OF DIFFERENT POSITION GROUPS

EXERCISE AND SPORTS
MEDICINE CLINIC



ORIGINAL ARTICLE

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ABSTRACT

Introduction: In rugby, each position has very specific and unique requirements, both anthropometric and physiological. Several studies have documented the significant differences in the anthropometric and physiological characteristics of athletes in the different playing positions. However, despite being common in countries where rugby is more popular, no studies seeking to investigate the anthropometric and physiological characteristics of the Portuguese rugby players have been published yet. **Objectives:** To anthropometrically and physiologically characterize Portuguese rugby players, attempting to identify any differences between athletes of different positions and to compare the recorded results with similar studies. **Methods:** 46 rugby players from two teams competing in the senior male national championships were assessed. Athletes were grouped according to their positions on the field, as forwards ($n = 24$) and backs ($n = 22$). All athletes underwent anthropometric assessment with determination of height, body mass and nine skin folds. Out of these, forty also underwent physical abilities assessment which consisted in determination of speed, acceleration and maximal aerobic capacity. Statistical analysis was performed using the IBM® SPSS® Statistics v.19 and significance level of 5% was considered. **Results:** Forwards presented average body weight of 96.02 kg (± 13.44) and 1.80 m (± 0.06) of height, compared to 76.84 kg (± 7.28) and 1.73 m (± 0.06) height of backs. As for the physiological assessment, backs recorded better results. In the 10m test they only took 1.97 s (± 0.20), while forwards spent 2.10s (± 0.27). In the speed test, backs also spent 0.36 s less than forwards. Maximal aerobic capacities, weight dependent, recorded by backs (52.33 ± 5.41 mlO₂/min/kg) were also better than those determined for forwards (46.60 ± 5.64 mlO₂/min/kg). **Discussion and Conclusions:** In the present study forwards were significantly taller, heavier and had higher percentage of body fat than backs. They were also slower and had lower maximal aerobic capacity concerning their body mass. However, they had higher maximal aerobic capacity in absolute value and produced greater momentum. Differences between forwards and backs were consistent with the literature and related to the different roles in the game. Despite its intrinsic limitations, we believe this study is relevant and will promote further investigations about this issue. Similar but larger studies should be conducted in the future so that we can more accurately assess and characterize the Portuguese rugby players.

Keywords: football, anthropometry, physiology.

INTRODUCTION

The majority of the team sports wishes the homogeneity of the athletes involved in the practice of the modality; however, in rugby, a much wider number of individuals, with physical constitutions and characteristics, may play in the same team¹, since each position presents very specific and distinct requirements².

There are in rugby two position groups with distinct and very specific functions. Generally speaking, the forwards are considered the “ball’s conquerors”, being involved in the ball dispute situations, both static and dynamic, having the need to develop and apply physical strength in the “melées”, “rucks” and “mauls”. On their turn, the backs are considered the “ball’s users”, being more involved in running and getting rid of marking situations³.

Many papers which aim to characterize the rugby athletes concerning their anthropometric and physiological profile are available in the literature and its majority points to the existence of significant differences between forwards and backs³⁻⁵.

The specialization of each position led to the identification of specific characteristics for them and crucial ones for better sports performance⁵, and this differentiation has intensified from the introduction of its professional status in 1995³.

When compared with the backs, the forwards are taller and heavier athletes, with greater percentage of fat mass, being also more endomesomorphic than the backs^{2,3,6-8}.

Concerning performance in physical fitness tests, the forwards usually present maximum aerobic capacity (VO_{2max}) (due to their body weight), time of running at ten and 30 meters and in agility tests worse than the backs^{3,4}. When the VO_{2max} is given in absolute value, this relation becomes reverse. The differences found may reflect the specific requirements of the optimum performance of the respective positions^{2,3}.

Unfortunately, despite the massive research, it was not possible to find any investigation which tried to characterize the anthropometric and/or physiological viewpoint of Portuguese rugby athletes. Thus, the designing of this study seemed relevant.

AIMS

To characterize from the anthropometric (weight, height, skinfolds and fat mass percentage), as well as physiological (acceleration, velocity, maximum aerobic capacity and linear moment) viewpoint the Portuguese rugby athletes.

To compare the results obtained by the athletes in the distinct position groups (forwards and backs), trying to identify occasional differences between these athletes, both from the anthropometric and physiological point of view.

To compare the results obtained with the remaining papers already published.

METHODS

In this study, 46 senior male athletes of two teams which participate in the Portuguese rugby championships of the XV Honor League and the 2nd National League were assessed. The assessed athletes were grouped concerning their position on the field in forwards ($n = 24$) and backs ($n = 22$). All athletes were assessed from the anthropometric point of view; however, six athletes from the first group did not perform the physical tests for being injured.

All evaluations were carried out between December, 2010 and February, 2011, following the guidelines from the *American College of Sports Medicine*⁹. Firstly, in a room with controlled temperature, the anthropometric evaluation of the athletes was performed. Subsequently, in the game field, a set of physical tests was performed.

The anthropometric evaluation consisted of the determination

of height^{9,10}, weight^{9,10} and nine skinfolds (bicipital, tricipital, subscapular, chest, midaxillary, abdominal, suprailiac, thigh and twin)⁹ of the athletes. Based on the formulas provided by the ACSM, the fat mass percentage of the athletes was estimated⁹. The physiological evaluation consisted in the determination of the VO_{2max} by the Luc Léger test^{11,12}, of acceleration and velocity, through performance of 10 and 30 m running tests, respectively².

Statistical analysis was performed with the *IBM® SPSS® Statistics v.19 software*. Normality of the distribution of the quantitative variables was assessed with the Kolmogorov-Smirnov or Shapiro-Wilk tests. In the descriptive analysis mean and standard deviation for the samples derived from the normal distributions were calculated, while for the abnormal distributions median and interquartile amplitude were determined. In the inferential analysis, Student's *t* test for independent samples were used in the comparison of quantitative variables with normal distribution between two groups; for abnormal variables, the Mann-Whitney corresponding non-parametric test was used. Significance value of 5% was considered.

RESULTS

The obtained results are summarized in tables 1 and 2. When the forwards and backs as groups are compared, statistically significant differences concerning body mass, height, body mass index (BMI) and fat mass percentage are identified.

The forwards were in average, heavier ($96.02 \text{ kg} \pm 13.44$), taller ($1.80 \text{ m} \pm 0.06$) and presented higher BMI ($29.54 \text{ kg/m}^2 \pm 4.17$) than the backs ($76.84 \text{ kg} \pm 7.28$, $1.73 \text{ m} \pm 0.06$ and $25.45 \text{ kg/m}^2 \pm 1.94$, respectively). The mean of the sum of the nine skinfolds was equally significantly higher for the forwards ($184.92 \text{ mm} \pm 78.98$) than for the backs (129.05 ± 45.14), which translated into estimation of fat mass percentage of 21.21% (± 7.69) for the forwards and of only 15.71% (± 5.1) for the backs.

Concerning the physiological evaluation, statistically significant differences were found in all the assessed parameters.

It was verified that the backs presented better results in the acceleration, velocity and agility tests, besides in the estimation of the maximum aerobic capacity concerning body mass, but producing lower linear moment and maximum aerobic capacity.

Thus, in the 10 m acceleration test, the backs spent a median of 1.97 s (± 0.20) against 2.10 s (± 0.27) from the forwards. The 30 m

Table 1. Anthropometric characteristics of the athletes.

	Number (n)	Body mass (kg)	Stature (m)	BMI (kg/m ²)	Sum of nine skinfolds (mm)	Fat mass (%)
Forwards	24	96.02 ± 13.44	1.80 ± 0.06	29.54 ± 4.17	184.92 ± 78.98	21.21 ± 7.69
Backs	22	86.97 ± 15.82	1.75 ± 0.07	25.45 ± 1.94	129.05 ± 45.14	15.71 ± 5.51
P		0.000*	0.000*	0.000*	0.008*	0.008*

*p < 5%.

Table 2. Physiological characteristics of the athletes.

	Number (n)	VO_{2max} (LO ₂ /min)	VO_{2max} (mLO ₂ /min/kg)	Acceleration (s)	Velocity (s)	Linear moment (kg.m/s)
Forwards	21	4.31 ± 0.73	46.60 ± 5.64	2.10 ± 0.27	4.86 ± 0.39	597.92 ± 74.99
Backs	19	3.99 ± 0.70	52.33 ± 5.41	1.97 ± 0.20	4.50 ± 0.32	504.54 ± 56.10
P		0.002*	0.002*	0.030*	0.004*	0.000*

*p < 5%.

velocity test was concluded by the back athletes with mean time of 4.50 s (\pm 0.32), while the forwards spent 4.86 s (\pm 0.39).

Concerning the estimation of the VO_{2max} , it was verified that the backs presented absolute median value (3.99 LO₂/min \pm 0.70) lower than the forwards (4.31 LO₂/min \pm 0.73). However, when the body mass of the athletes was considered, inversion of this ratio was observed, and the backs presented higher mean value (52.33 mL O₂/min/kg \pm 5.41) when compared with the forwards (46.60 mL O₂/min/kg \pm 5.64).

The results of the velocity test are translated in mean linear moment of 597.92 kg.m/s (\pm 74.99) for the forwards and only 504.54 kg.m/s (\pm 56.10) for the backs.

DISCUSSION AND CONCLUSIONS

Rugby has become a very popular sport in Portugal and around the world. There is increasing attention from the media and the public which makes it more competitive and motivating for all those who are involved with it.

Considering the results obtained by the athletes of the different studied groups in the anthropometric and physiological evaluations performed, it seems clear that the classical differences presented between forwards and backs in the published papers over the last 15 years, essentially remain in the present study.

Concerning body mass and according to what has been verified in the remaining papers already published, we record that forwards presented body mass significantly higher than the backs. Nonetheless, the difference found between body mass of forwards and backs was, in the present study, lower than what was detected in the studies already published, including in the ones which involved amateur athletes^{4,5,13-15}.

Concerning the height of the rugby athletes studied, it was verified that as presented in the literature, the forwards were taller than the backs^{4,5,13-15}.

The forwards also presented significantly higher fat mass and skinfold values than the backs.

From the physiological point of view, we verified in terms of VO_{2max} that the forward athletes presented values significantly higher than the backs when these are absolute; however, when body mass is considered, an inversion in this ratio is observed, despite a significant difference kept between forwards and backs.

In this study it was verified that there were significant differences between forwards and backs concerning the results of the velocity tests, when the forwards were significantly slower. In the few studies where there was an attempt to characterize the capacity of acceleration of the rugby athletes, it was observed that the results obtained by forwards and backs were very similar⁴. In the present study, this relation was not actually verified, and the forwards presented significantly worse results in the acceleration tests.

The differences found, both on the anthropometric and physiological levels, between the forward and back athletes are connected with the different roles played by these athletes in the field. While the forwards have to apply their high body mass and strength in the ball dispute situations, the backs need to be faster to get rid of the marking and finalize the situations of territory advantage conquered

by the forwards. Thus, it becomes an advantage to the forward athletes to abandon velocity and acceleration capacity over higher body mass and fat mass percentage which translate in advantage in the man-to-man dispute of the "melées", "rucks" and "mauls". On the other hand, the backs chose to reduce their body mass and maximize their acceleration and velocity capacity to be able to gain advantage in the unmarking, dribbling and ending of plays. The differences concerning VO_{2max} are also explained by the work performed by the athletes. The higher absolute VO_{2max} value allows to the forwards an advantage in the continuous and prolonged effort situations in the ball dispute in static and dynamic phase¹⁶.

When the results of the evaluation performed with forwards and backs with other similar studies are compared separately, some important differences are found.

The forwards in this study were shorter than the ones in all the other similar studies published^{4,5,10,13-15,17}. Comparing the values obtained for body mass with the ones of amateur athletes in the studies by Quarrie *et al.*⁴ and Nicholas⁵, as well as the ones by Babic *et al.*¹³ and Elloumi *et al.*¹⁰, we verified that the Portuguese athletes were heavier. However, when the studies of populations of higher or international competitive level were compared, we verified inversion of this relation^{4,17}. Regarding body composition, and contrary to what was observed in the remaining literature, we only verified that the fat mass percentage of Argentinian and Brazilian athletes estimated by Holway and Garavaglia¹⁷ and Carteri *et al.*¹⁸, respectively, was higher than the one calculated to Portuguese athletes.

Concerning physiological evaluation, except for the maximum aerobic capacity of the forward athletes studied by Scott *et al.*¹⁴, as verified in the backs, and of velocity and linear moment calculated by Quarrie *et al.*⁴ for athletes of lower competitive level, all the result obtained by the forward group of this study were lower than the ones verified in the literature.

Speaking of the backs, we verified that these were shorter, heavier and presented higher fat mass percentage, when compared with similar populations of other studies already published^{4,5,10,13-15,17}.

In the physiological evaluation, except for maximum aerobic capacity of the backs of the study by Scott *et al.*¹⁴, all the results obtained by the group of backs of this study were lower than the ones verified in the remaining papers with similar characteristics already published. This statement is valid for the velocity, maximum aerobic capacity tests and linear moment calculation.

Despite the obvious limitations intrinsic to this first study, such as the low number of athletes evaluated and the fact that all of them belonged only to two teams, we believe this study is highly relevant and will encourage further investigation in this field.

Similar studies, but with greater dimensions, broader and with more human and material resources should be carried out in the future so that Portuguese rugby athletes can be more faithfully characterized and evaluated.

All authors have declared there is not any potential conflict of interests concerning this article.

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