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Comparison of the Anaerobic Power of Brazilian Professional Football Players Grouped by Tactical Position

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A B S T R A C T

Football is characterized as a predominately aerobic modality, however, during a match; the most important actions performed by the players are in short duration and high intensity. In addition, this sport presents to have some particularities, such as, highlights differences of each tactical position. Thus, this study aimed to compare the anaerobic power of professional football players grouped by different tactical positions. Thirty professional football players separated in three groups, goalkeepers+fullbacks, sideways+DMF (defensive middlefields) and OMF (offensive middlefields)+forwards, performed two anaerobic power tests, Running anaerobic sprint test and Sargent jump test Goalkeepers+fullbacks showed higher values of body mass index and absolute anaerobic power (w), using Sargent jump test than the others, but when analyzed the RAST results, this same group presented lower values ($p<0.05$) of relative AP (w·kg-1). OMF+forwards showed to have the best Pmed and Pmax values ($p<0.05$), when compared with defensive players. These results suggest the use of running anaerobic sprint test and sargent jump test together when is proposed to measure the anaerobic power of football players, and also a anthropometric evaluation, so the training can be more specific e efficient to each tactical position and athlete.

Key words: *Anaerobic power, Sprint test, Football, Tactical position.*

Introduction

Football is one of the most popular sports practiced in the world and moves in their matches, televised or not, millions of fans who enrich this sport. This way, with the growing of the communication vehicles and the high investment from the soccer clubs for the formation and preparation of athletes, some researchers passed to pursue better understanding about this modality with the goal to improve performance of those individuals. This sport is characterized as a predominantly aerobic modality being 80-90% of the energy used coming from the oxidative system (Santos & Soares, 2001). However, during an official football match, the athletes also realize another physical actions of short duration and high intensity (sprints, jumps, spins), being predominant, in this cases, the anaerobic-glycolytic system. Souza (1999) examined that, in a football match, a player performs one sprint every 90 seconds. Besides, some studies (Di Salvo, Tschan, Calderon Montero, Bachl and Pigozzi, 2007; Di Salvo, Gregson, Atkinson, Tordoff and Drust, 2009) pointed that, is executed 17 sprints of 20 meters per match by each player. This way, the decisive moments of a football match seem to depend these actions, independent of the player's position in the tactical formation, so, is justified the need to monitor the anaerobic power for a better performance in these athletes (Asano, Oliveira and Bartolomeu, 2009).

Anaerobic Power (AP) is defined by Franchini (2002) as the maximal liberated energy for time unit by the anaerobic-glycolytic system, being evaluated using several methods: Wingate (Franchini, 2002), Continous Jump (Bosco, 1999), Squat and Countermovement Jump Test (Markovic, Dizdar, Jukic and Cardinale, 2004), Sargent Jump Test (SJT) (Salles, Mello, Vasconcellos, Júnior and Dantas, 2010), Running-bases Aerobic Sprint Test (RAST) (Zacharogiannis, Paradisis and Tziortis, 2004) and yo-yo test (Bangsbo, Laia and Krustrup, 2008). However, according to Kiss (2003), the greater the similarity of the mechanical test mode in question, the greater the practical usefulness of the training. Nevertheless, the RAST stands out, by maybe being the test that is more related to the actions of football.

In addition, football presents to be a complex sport with some particularities, among which, highlights differences of each tactical position, such as, traveled distance per match (Santos et al., 2001; Zagatto, Miyagi, Sakugawa and Papoti, 2013), anaerobic threshold (Santos et al., 2001; Zagatto et al., 2013) VO_2max (Santos et al., 1999), body composition (dos Santos, 1999), and especially the quantity of actions in high intensity that each player executes.

On the other hand, there's a lack of studies that investigate the AP of professional football players grouped by tactical position, in a way that, studies such as Santos, Coledam and dos Santos. (2009), Dal Pupo, Almeida, Detanico, Silva, Guglielmo and Santos (2010), Asano et al. (2009) and, Asano, Bartholomeu-Neto, Ribeiro, Barbosa and Sousa (2009), made use of the sample distribution and different methodologies of analysis from those employed in the present study, using overall average as in indicative of data central tendency, not showing the

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possible tendencies of different physiological demands and consequent adaptations between each position that the sport may have.

Thus, in order to contribute to a better physical preparation of football athletes, the present study aimed to compare the AP values of professional players grouped by different tactical positions.

Methods

Sample

The sample consisted in thirty professional football players with 25,1±4,4 years old from a professional soccer club registered in the Brazilian Football Confederation. All volunteers signed an informed consent and were informed about the risks and procedures adopted. The experimental protocol followed the legal resolution 466 of the National Health and were approved by the ethics committee of the university research center UNIRG (process number 0001/2008).

Protocols

Was evaluate the values of maximal AP (Pmax), medium AP (Pmed) and minimal AP (Pmin) through the Running Aerobic Sprint Test (RAST) validated by Zacharogiannis et al (2004), which consisted in six sprints of 35 meters with 10 seconds of interval between then. Were also used the Sargent Jump Test (SJT), following the protocol previously described by Matsudo (2005), in order to verify the vertical jumping as well as to estimate the anaerobic power. All calculations to obtain the AP values were obtained by using the Lewis equations as suggested by Asano, Oliveira and Bartolomeu (2009).

Statistical Treatment

The normality and homogeneity of data were assessed by the Shapiro-Wilk and Levene tests, respectively. Only the variables Pmax, Pmed e Pmin RAST absolute (W) of the attackers (n=5) didn't showed normal distribution, being p=0.009, p=0.007, p=0.034, respectively. This way, the results referring to those variables were expressed in median and confidence intervals of 95% (CI=95%). Some of the tactical positions had just a few players, therefore, the subjects were grouped according to his physiological need during the match: goalkeepers+fullbacks (n=9), sideways+defensive middlefields (DMF) (n=11) and offensive middlefield (OMF)+forwards (n=10). To compare all variables between groups were applied the One Way ANOVA followed by Tukey's Post-hoc . The significance level were fixed in 5% ($p<0.05$). All procedures were realized with support of the software Statistical Package for the Social Sciences 20.0 for Windows.

Results

Table 1 contains values relating to characterize the sample, as well as the absolute values of absolute AP (w) and relative AP ($w \cdot kg^{-1}$) separated according to playing position.

Table 1. Comparison of age, anthropometric variables (BM, Height, BMI, BF), anaerobic power - SJT (cm, w, $w \cdot kg^{-1}$), RAST Pmax, Pmed, Pmin (w, $w \cdot kg^{-1}$) - between the groups (goalkeepers+fullbacks, sideways+DMF, OMF+forwards).

	Groups		
	Goalkeepers+Fullbacks (n=9)	Sideways+DMF (n=11)	OMF+Forwards (n=10)
Age (y)	26.9±6.0	24.1±3.8	24.5±3.3
BM (kg)	85.1±8.2*	71.5±6.3	72.9±7.0
Height (cm)	186.6±4.4*	177.6±4.2	175.4±5.5
BMI ($kg \cdot m^{-2}$)	24.4±1.4†	22.6±1.6	23.7±1.3
BF (%)	11.4±1.2	10.9±1.5	11.2±2.3
SJT (cm)	42.3±2.9	42.2±6.1	46.2±3.6
SJT (w)	1200.1±112.0*	1005.4±102.9	1074.3±92.2
SJT ($w \cdot kg^{-1}$)	14.1±0.5	14.1±1.0	14.8±0.6
Pmáx RAST (w)	903.1±108.2	862.3±102.9	976.7±124.5
Pméd RAST (w)	743.9±85.1	712.1±92.4	771.5±89.5
Pmin RAST (w)	595.6±82.3	584.9±91.4	626.5±79.0
Pmáx RAST ($w \cdot kg^{-1}$)	10.7±1.5‡	12.1±1.4	13.4±1.4
Pméd RAST ($w \cdot kg^{-1}$)	8.8±1.3‡	10.0±1.1	10.6±1.0
Pmin RAST ($w \cdot kg^{-1}$)	7.0±1.1*	8.2±1.0	8.6±1.2

*- Significant difference (p<0,05) from the others; †- Significant difference (p<0,05) from the sideway+MDF group; ‡- Significant difference (p<0,05) from the OMF+forwards group.

Table 2 presents the results grouped by tactical position with similar physical requirements for a football match. Thus, when analysed the anthropometric variables was observed that the group formed by goalkeepers+fullbacks had higher values ($p<0.05$) of body mass (BM) and height in relation to the other groups, as well as higher BMI values ($p<0.05$) compared to the sideway+DMF group. In regarding to the SJT, goalkeepers+fullbacks also showed higher values ($p<0.05$) of absolute AP (w) than the other groups. However, the relative AP ($w \cdot kg^{-1}$) values showed no significant difference ($p>0.05$).

When analyzed the RAST results, goalkeepers+fullbacks had lower values ($p<0.05$) of relative Pmin ($w \cdot kg^{-1}$) in relation to the other groups (Table 2). The same players, also showed lower values ($p<0.05$) of relative Pmed and Pmax ($w \cdot kg^{-1}$) when compared to the OMF+forwards group. No statistical differences were founded in the remaining variables ($p<0.05$).

With regard the associations between the tests, absolute values of AP (w) from the SJT and RAST, the results indicated a weak ($r=0.432$), but significant correlation ($p = 0.017$). On the other hand, when analyzed the same association, but, in relative values to BM ($w \cdot kg^{-1}$), the results showed a moderate ($r=0.517$) and significant ($p=0.003$) association.

Table 2. General characteristics of the sample (n = 30). Data expressed as mean (±) standard deviation, and median and their respective 95% confidence intervals (95% CI).

	Tactical Position						
	Goalkeepers (n=3)	Sideways (n=4)	Fullbacks (n=6)	DMF (n=7)	OMF (n=5)	Forwards (n=5)	Total (n=30)
Age (y)	29.8±6.8	23.6±2.7	25.4±5.5	24.3±4.5	25.1±4.2	23.9±2.6	25.1±4.4
BM (kg)	87.8±13.9	70.1±9.5	83.8±4.8	72.3±4.3	71.3±5.1	74.5±8.8	76.1±9.2
Height (cm)	187.7±7.2	178.0±4.2	186.0±3.0	177.4±4.5	173.4±5.6	177.4±5.3	179.6±6.6
BMI ($kg \cdot m^{-2}$)	24.8±2.1	22.0±2.0	24.2±1.1	23.0±1.3	23.7±1.0	23.6±1.6	23.5±1.6
BF (%)	11.2±1.4	10.8±2.0	11.5±1.2	10.9±1.3	11.4±1.9	11.1±2.9	8.0±1.2
SJT (cm)	40.7±3.2	45.5±7.7	43.0±2.6	40.3±4.6	45.6±3.4	46.8±4.1	43.6±4.8
SJT (W)	1213.8±169.9	1021.4±135.9	1193.2±91.5	996.3±90.3	1044.6±58.1	1104.0±116.5	1086.2±129.9
SJT ($W \cdot .kg^{-1}$)	13.9±0.5	14.6±1.2	14.2±0.4	13.8±0.8	14.7±0.5	14.8±0.6	14.3±0.7
Pmáx RAST (W)	871.0±95.0	919.3±102.3	919.3±119.1	829.7±94.9	922.2±141.8	1079.0 (924.7-1137.7)	912.7±118.7
Pméd RAST (W)	706.7±88..2	728.5±70.0	762.5±85.0	702.7±107.3	739.2±89.9	803.8 (697.3-910.3)	741.4±89.9
Pmin RAST (W)	557.3±114.0	591.3±67.2	614.7±65.8	581.3±107.8	589.0±48.2	664.0 (551.7-776.3)	602.0±83.8
Pmáx RAST ($W \cdot kg^{-1}$)	10.4±1.6	13.2±1.4	11.0±1.5	11.5±1.0	12.9±1.7	13.9±1.1	12.1±1.8
Pméd RAST ($W \cdot kg^{-1}$)	8.1±1.4	10.5±0.7	9.1±1.2	9.7±1.2	10.4±1.1	10.8±1.0	9.8±1.3
Pmin RAST ($W \cdot kg^{-1}$)	6.4±1.1	8.5±0.4	7.4±1.1	8.0±1.2	8.3±0.8	8.9±0.9	8.0±1.2

Discusion

The present study proposed to compare AP values in professional football players grouped by tactical position with similar physical demand. This way, the obtained results contributes with the evaluation and monitoring of the variable in question. Since Santos et al. (2009) suggest that, due the every tactical position specificity and the bioenergetic source of each test, some methods should be more specific to each athlete, taking into account his tactical position and/or his anthropometric characteristics.

The findings referring to RAST diverge of the present literature that used similar samples to this study. Cetolin, Foza, Silva, Guglielmo, Siqueira, Cardoso and Crescente (2009) applied the RAST in adult football players and Sideways showed the better results in Pmax and Pmed values, whereas, our study, OMF+forwards has the best Pmax and Pmed. Furthermore, it was also observed that, goalkeepers+fullbacks group showed worse results than the OMF+forwards group in all relative AP values and a Pmed relative value worse than the sideways+DMF group.

Which may be partly explained due to the metabolic demand of RAST and the specific adaptive response to training of each tactical positions investigated. So, means that, the sideways+DMF and OMF+forwards groups had stimulus during his training and matches that required more anaerobic actions, generating better results in his RAST values.

Moreover, the results obtained in SJT showed no statistical difference between the groups when using the relative values of AP ($w \cdot kg^{-1}$), on that account, we suggest that this test has a higher anaerobic demand than the RAST, being so, a more adequate test for fullbacks and goalkeepers. About the significant differences in SJT absolute values, the results can be justified by the anthropometric profile of each group, such as goalkeepers+fullbacks that have higher values of height and body mass, therefore, showed much higher values of absolute AP than the other groups, but, this difference is diluted and inexistent in AP relative values ($w \cdot kg^{-1}$).

Another studies used similar methodologies, such as Coelho et al. (2010) that made a comparison between a Sprint Test and SJT and didn't find any significant difference when comparing the values between tactical positions. On the other hand, the players' anaerobic power were evaluated only in absolute values, not taking in account the body composition of each athlete, what may explain the results.

Cruz (2005) evaluated the AP of 279 Portuguese professional football players, since 1996 to 2006, by using RAST and found that forwards has the better results than the other positions. Cruz explain that, this may happen because forwards perform a higher volume of high intensity actions during the match. Corroborating with Cruz (2005) and the present study, Mohr, Krustrup, Nybo, Nielsen and Bangsbo (2003) pointed that offensive middlefileds and forwards travels more distance and in a higher speed during a football match when compared with the other tactical positions.

Therefore, football athletes that play in a more forward tactical position performs much more anaerobic actions such as jumps, sprints, spins and goal kicks, so forwards tend to express great glycolytic capacity and a higher anaerobic efficiency, being more tolerant to acidosis, enabling then to perform much more movements in a high intensity with less reduction of mechanical efficiency (Rienzi, Drust, Reilly, Carter and Martin, 2000).

Nevertheless, football is very a complex sport and is played all around the world by many different countries, creating different "football cultures". All these cultures, has his on methods of training in each stratum, such as infant, base category, amateur and professional, creating a lot of different players profiles to all tactical positions. So, there is not a universal method of physical training for football players that will work with his high efficiency in all football cultures, generating a need of monitoring and study every one of those to understanding his better capacities and potentials.

Therefore, the association of the values of maximal AP from different tests point that these tests should be used together with a monitoring and evaluation process of the athletes, in a way that the physiological demand of each test can extract the maximal capacity of the player, resulting a more accurate value of anaerobic power, and if is to be compared with another player, their anthropometric measures should be taken in account.

Conclusion

Given the exposed, we conclude that offensive middlefields and forwards have better relative AP values ($w \cdot kg^{-1}$) of Pmax and Pmed using RAST when compared to other tactical positions. Goalkeepers and fullbacks had the worst values of AP when using RAST values, but not when used SJT. Moreover, we suggest the use of SJT and RAST together when is proposed measure the anaerobic power of football players, and also a anthropometric evaluation, so the training can be more specific e efficient to each tactical position and athlete.

REFERENCES

Santos, P. J. & Soares, J. M (2001). Capacidade aeróbia em futebolistas de elite em função da posição específica no jogo. Revista Portuguesa de Ciências do Desporto. 1(2), 7-12.

Campeiz, J. M., Oliveira, P. R. (2006). Análise comparativa de variáveis antropométricas e anaeróbias de futebolistas profissionais, juniores e juvenis. Movimento e Percepção. 6(8).

Asano, R. Y., Oliveira, H. P., Bartolomeu, J. (2009). Avaliação das potências aeróbia e anaeróbia em jogadores de futebol da. Revista Cereus. 1(4).

Souza, J. (1999). Variáveis antropométricas, metabólicas e neuromotoras de jogadores de futebol das categorias mirim, infantil, juvenil e junior em relação a posição de jogo: um estudo comparativo. Revista de Treinamento Desportivo. 4(3), 43-8.

Di Salvo, V., Baron, R., Tschan, H., Calderon Montero, F. J., Bachl, N., Pigozzi, F. (2007). Performance characteristics according to playing position in elite soccer. International Journal of Sports Medicine, 28(3), 222-227.

Di Salvo V., Gregson W., Atkinson G., Tordoff P., Drust B. (2009). Analysis of high intensity activity in premier league soccer. International Journal of Sports Medicine, 30, 205-12.

Franchini, E. (2002). Teste anaeróbio de Wingate: conceitos e aplicação. Revista Mackenzie de Educação Física e Esporte. 1(1), 11-27.

Bosco C. (1999). Strength assessment with the Bosco's test. Italian Society of Sport Science.

Markovic, G., Dizdar, D., Jukic, I., Cardinale, M. (2004). Reliability and factorial validity of squat and countermovement jump tests. Journal of Strength and Conditioning Research. 18(3), 551-555.

Salles, P. G., Mello D.B., Vasconcellos, F.V., Júnior, A.A., Dantas, E.H. (2010). Validity and reliabilty of the Sargent Jump Test in assessing the explosive strength of soccer players. Revista Brasileira de Ciências da Saúde. 14(1), 21-6.

Zacharogiannis, E. Paradisis, G. Tziortzis, S. (2004). An evaluation of tests of anaerobic power and capacity. Medicine and Science in Sports and Exercise. 36, 116.

Bangsbo J., Laia F. M., Krustrup P. (2008). The yo-yo intermittent recovery test: a useful tool for evaluation of physical performance in intermittent sports. Medicine and Science in Sports and Exercise. 38, 37-51.

Kiss, M. A. (2003). Esporte e exercício: avaliação e prescrição. São Paulo: Roca.

Barros, R., Misuta, M. S., Menezes R. P., Figueroa P. J., Moura F. A., Cunha S. A., Leite N. J. (2007). Analysis of the distances covered by first division brazilian soccer players obtained with an automatic tracking method. Journal of Sports Science and Medicine. 6, 233-42.

Rampinini, E., Coutts, A. J., Castagna C., Sassi R., Impellizzeri F. M. (2007). Variation in top level soccer match performance. International Journal Sports Medicine. 28(12), 1018-24.

Zagatto A. M., Miyagi W. E., Sakugawa R. L., Papoti, M. (2013). Utilização da distância total percorrida no teste específico de HOFF como preditor da velocidade de limiar anaeróbio no futebol. Revista Brasileira de Medicina do Esporte. (19), 266-69.

dos Santos, J. A. R. (1999). Estudo comparativo, fisiológico, antropométrico e motor entre futebolistas de diferente nível competitivo. *Rev. paul. Educ. Fís., São Paulo*, *13*(2), 146-59.

De Barros, T. L., & Guerra, I. (2004). *Ciência do futebol*. Editora Manole Ltda.

Mohr, M., Krustrup, P., Nybo, L., Nielsen, J. J., & Bangsbo, J. (2004). Muscle temperature and sprint performance during soccer matches–beneficial effect of re-warm-up at half-time. *Scandinavian journal of medicine & science in sports, 14(3)*, 156-162.

Santos, D., Coledam, D. C., & dos-Santos, J. (2009). Alterações na potência anaeróbia após a pré-temporada em atletas profissionais de futebol. *Movimento e Percepção*, *10*(15).

Dal Pupo, J., Almeida, C. M. P., Detanico, D., Silva, J. F. D., Guglielmo, L. G. A., & Santos, S. G. D. (2010). Potência muscular e capacidade de sprints repetidos em jogadores de futebol. *Rev Bras Cineantropom Desempenho Hum*, *12*(4), 255-61.

Asano, R. Y., Bartholomeu-Neto, J., Ribeiro, D., Barbosa, A., & Sousa, M. (2009). Potência anaeróbia em jogadores jovens de futebol: Comparação entre três categorias de base de um clube competitivo. *Brazilian Journal of biomotricity*, *3*(1), 76-82.

Matsudo, V. K. R. (Ed.). (1987). *Testes em ciências do esporte*. Centro de estudos do laboratorio de aptidao fisica.

Cetolin, T., Foza, V., Silva, J. F. D., Guglielmo, L. G. A., Siqueira, O. D., Cardoso, M. F. D. S., & Crescente, L. A. B. (2013). Comparison of anaerobic power between tactical positions in soccer players: a retrospective study. *Revista Brasileira de Cineantropometria & Desempenho Humano*, *15*(4), 507-516.

Coelho, D. B., Coelho, L. G. M., Braga, M. L., Paolucci, A., Cabido, C. E. T., Junior, J. B. F., ... & Garcia, E. S. (2011). Correlação entre o desempenho de jogadores de futebol no teste de sprint de 30m e no teste de salto vertical. *Motriz*, *17*, 63-70.

Cruz, S. (2005). Avaliação da capacidade física em futebolistas profissionais: análise em função da posição específica.

Rienzi, E., Drust, B., Reilly, T., Carter, J. E., & Martin, A. (2000). Investigation of anthropometric and work-rate profiles of elite South American international soccer players. *The Journal of sports medicine and physical fitness*, *40*(2), 162-169.

Frykman, P. N., Harman, E. A., Kraemer, W. J., Rosenstein, R. M., & Rosenstein, M. T. (1988). Estimation of Human Power Output from Maximal Vertical Jump and Body Mass.

Ekblom, B. (1986). Applied physiology of soccer. *Sports Medicine*, *3*(1), 50-60.

Helgerud, J., Engen, L. C., Wisloff, U., & Hoff, J. (2001). Aerobic endurance training improves soccer performance. *Medicine and Science in Sports and Exercise*, *33*(11), 1925-1931.

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