

Physical commitment and specific work for each role in an elite soccer team

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Abstract:

The aim of this study is to detect the differences in physical commitment required for professional footballers and if there are significant effects between the preseason period and season of the championship (Second Division Italian); in order to, eventually there are not significant differences, to schedule specific work sessions for work groups (distinguished by role). The following quantitative variables have been detected: distance covered, energy cost, metabolic power, distance travelled in high acceleration and in high deceleration. The team was divided by roles into 5 groups (n=5) and each group included four players. The activities of the players were monitored using GPS technology with a sampling rate of 10 Hz and in relation to five different game positions: (CD) Central Defenders, (FB) Full-Backs, (M) Midfielders, (AM) Advanced Midfielders and (A) Attackers. It has been used the following descriptive statistic (average values, standard deviation, minimum and maximum values) and checking the normality of distribution (KS test, skewness and kurtosis), and 2x5 ANOVA. The results obtained during season were compared with that acquired at the beginning of the year (pre-season) and significant effects there aren't between the different groups.

Key words: GPS technology, inter-positional differences, 2x5 ANOVA, personalized training

Introduction

Physical demands during a soccer game differ by game position and these have been widely documented in recent years (Bradley et al., 2009; Dellal et al., 2011). GPS technology has become a very useful tool to monitor training workloads in team sports (Larsson, 2003), contributing to a more accurate vision of physical commitment. The results of a previous study (Altavilla et al, 2017, Raiola, D'Isanto 2016ab) have demonstrated that physical needs are influenced by player gaming positions. Soccer is an high-situational sport with an high agonistic engagement such to require the development of all the conditional capacities (Gaetano & Rago, 2014) and acquisition of the general and specific motor skills (Tiziana et al., 2017, Di Tore et al, 2016). It is important to know the specific work to be done for each role and at various times of the year, in order to achieve significant team improvements.

To achieve this, it is necessary to establish what are the physical demands of soccer players in reference to the role of play (Rampinini et al., 2007). Coaches and anyone involved in the training of the football players should take these positional variations into account, in order to design specific physical drills (Rago et al., 2016, 2017). Among the different physical qualities needed in the soccer, there are the ability to perform straight-line sprint and positive and negative acceleration with rapid changes of directions (Gunnar & Pettersen, 2015). Physical commitment is influenced by the role of soccer players; for example, central midfielders generally perform the longer distances during the game, while the advanced midfielders cover the higher intensity distances (Di Salvo et al., 2007, 2009).

In this study were detected the total distance covered, the energetic cost, the metabolic power, the distances travelled in high acceleration and in high deceleration, in order to compare the initial data (pre-season) and final (season) of the variables detected in the various roles. The aim of this study is to detect the differences in physical commitment required for professional footballers (League B), if there are significant effect between the different groups and the possibly relative percentages increasing for each role. In case of no significant effect, to schedule specific training exercises for team-works, in order to improve the final performance of each group and of consequently of the team.

Material and methods

The setting of the work was established in relation to the data collected from a series of friendly matches of a professional Italian soccer team (League B). The data was collected during 10 pre-season friendly matches and 10 friendly matches during the season in the championship 2016-17. The team was divided by roles into 5 working groups (n=5) and each group included four players. The groups divided by roles were: 1° group - central defenders (CD), 2° group - full-backs (FB), 3° group - midfielders (M), 4° group - advanced midfielders (AM) and 5° group - attackers (A). The goalkeepers were not included in the research because they follow a specific type of work with the goalkeeper's trainer.

Group mean	Age (years)	Body mass (kg)	Stature (cm)	BMI (kg/m ²)
1° (CD)	26,9	77,5	187,1	22,13
2° (FB)	30,6	72,9	182,6	21,86
3° (M)	28,4	75,4	179,6	23,37
4° (AM)	27,3	73,8	177,3	23,47
5° (A)	25,8	70,7	176,5	22,69

BMI: its values are in a intervall of normality

Procedures

To detect data, GPS was used, which is widely used in football, as it provides a valid and reliable method for estimating physical workloads (McLellan et al., 2011). The data collected was acquired during the friendly matches. The activities of the players were monitored using the K-Sport GPS technology with a sampling rate of 10 Hz. At the end of the friendly matches, all data was downloaded to a Sony Vaio VPCSA laptop. The validity and reliability of GPS are attested in numerous studies including Randers et al., 2010.

Statistical analysis

The analysis refers to the following variables: Covered total distance (mt), Energetic cost, Distance covered in high acceleration ($> 2 \text{ m/s}^2$), Distance covered in high deceleration ($< -2 \text{ m/s}^2$) and Power metabolic. The values and relative percentages were grouped according to the following game positions: Central Defenders (CD), Full-Backs (FB), Midfielders (M), Advanced Midfielders (AM), Attackers (A). The data was collected in two different moments: pre-season phase and agonistic phase (tab.1). The analysis concerned the descriptive statistic (average values, standard deviation, minimum and maximum values) and checking the normality of distribution (KS test, skewness and kurtosis), and 2x5 ANOVA. All statistical analyses were conducted using Dell's statistical software 13.2.

Results

The data emerged confirmed a difference in physical commitment between the roles of players in football. ANOVA 2x5 showed an insignificant effect between the groups in the two pre-season and season phases, while in diagram 1 the minimum percentage variations were shown, in one case negative (M), in the different roles. These results suggest that the need to develop specific training programs in relation to the role played by the players, in order to improve the physical characteristics required by the type of the game and results in the performances. The average total distance covered by the 5 groups of players tested during the pre-season phase was 9263.4 ± 728 meters, with the FB, M and AM that have covered a greater distance than the CD and A, particularly the medians (M) also produced the highest metabolic potency (both in pre-season and season).

On the other hand, the total distance covered by the 5 groups of players tested during the competitive phase was 9956.8 ± 775.3 mt, with the FB, M and AM covering more and more distance compared to CD and F. In diagr. 1 it is reassumed the increasing percentage of the total distance travelled in the 5 different groups (CD, FB, M, AM, A). The initial and final values of the energy cost in the various groups were summarized and compared, which increased in all the groups, of which three groups (FB, M and AM) exceeded the average value of the energy cost in the championship of League B.

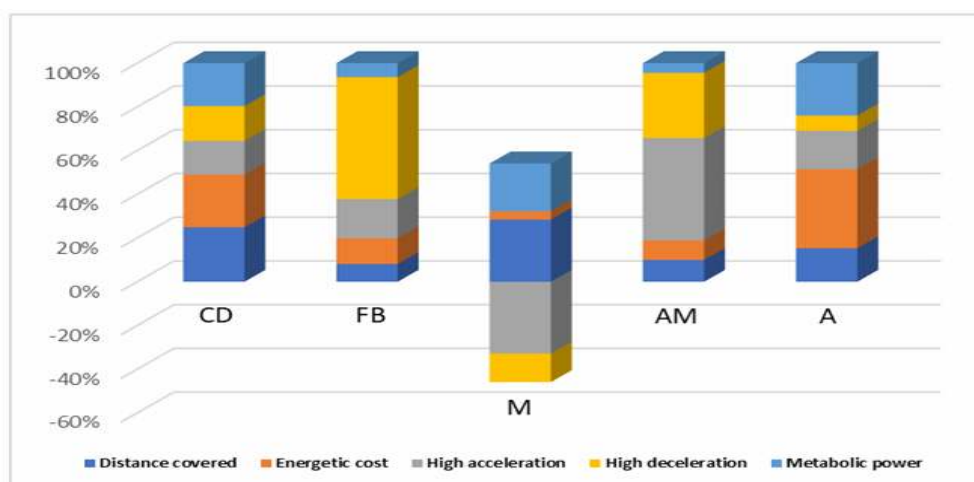
The initial and final values of the distance covered in high acceleration and in high deceleration expressed by the different groups have been summarized and compared. The values at the end of the study have undergone minimal and diversified variations in the 5 groups, with the exception of the group of the midfielders (M), who have expressed more work of quantity than quality, thus developing less actions in acceleration and high deceleration compared to the other roles.

Table .1 Data detected in pre-season and in season and descriptive statistic

Role of players	Central Defenders (CD)	Full-Backs (FB)	Midfielders (M)	Advanced Midfielders (AM)	Attackers (A)	Average values	SD	Min values	Max values	K Test	Sk Test
Distance covered	8997,16	10073,9	9588,9	9676,51	7980,51	9263,40	728,04	7980,5	10074	7,21	- 2,60
Energetic cost	50,7	56,19	59,87	55,55	40,92	52,65	6,55	40,92	59,87	4,80	- 2,08
Distance covered in high acceleration	566,79	548,36	553,29	505,36	516,62	538,08	23,21	505,36	566,8	8,51	- 2,89
Distance covered in high deceleration	458,34	447,56	460,92	464,46	434,35	453,13	10,95	434,46	464,5	8,84	- 2,96
Metabolic power	9,09	10,08	10,74	9,92	7,77	9,52	1,02	7,77	10,08	6,10	- 2,36
Role of players	Central Defenders (CD)	Full-Backs (FB)	Midfielders (M)	Advanced Midfielders (AM)	Attackers (A)	Average values	SD	Min values	Max values	KS Test	Sk Test
Distance covered	9510,8	10735,2	10586,6	10294,2	8656,8	9956,7	775,28	8656,8	10735	7,33	- 2,63
Energetic cost	53,5	61,5	60,7	58,7	49,1	56,7	4,71	49,1	61,5	7,14	- 2,59
Distance covered in high acceleration	586,9	628,2	486,9	656,5	566,8	585,06	58,20	486,9	656,5	6,22	- 2,37
Distance covered in high deceleration	475,02	648,9	438,9	552,8	451,1	513,34	78,51	438,9	648,9	3,96	- 1,64
Metabolic power	9,5	10,6	11,6	10,2	8,8	10,14	0,95	8,8	11,6	6,57	- 2,42

Tab. 2 – ANOVA 2x5

		Sum of Squares	df	Mean Square	F	Sig.
Distance covered	Between Groups	1201745,422	1	1201745,422	1,700	,229
	Within Groups	5655520,190	8	706940,024		
	Total	6857265,612	9			
Energetic cost	Between Groups	41,087	1	41,087	1,010	,344
	Within Groups	325,505	8	40,688		
	Total	366,593	9			
Distance covered in high acceleration	Between Groups	5516,861	1	5516,861	2,248	,172
	Within Groups	19629,349	8	2453,669		
	Total	25146,210	9			
Distance covered in high deceleration	Between Groups	9065,519	1	9065,519	2,308	,167
	Within Groups	31417,069	8	3927,134		
	Total	40482,588	9			
Metabolic power	Between Groups	,961	1	,961	,788	,401
	Within Groups	9,761	8	1,220		
	Total	10,722	9			



Diagr. 1. Relative percentages variation for each role

Discussion

The distance covered in friendly matches by Italian professional players monitored with GPS devices was on average about 10 km. Positional differences were detected in the total distance covered, as AM, M and FB exceeded the average 10 KM threshold. This is a feature of other studies conducted on European professional footballers (Italian, Spanish and English), where midfielders have covered more distances, while central defenders (CD) cover smaller distances (Bradley et al., 2009; Dellal et al., 2011).

Accelerating and decelerating skills play a key role in professional football, as they represent highly challenging energy activities. The sampling frequency of the GPS (10 Hz) compared to 1 Hz allows to increase the accuracy of the measurements, especially with regard to the effort to high speed (Cummins et al., 2013).

The high intensity covered distance has traditionally been identified as a key indicator of the physical performance during the matches (Mohr et al., 2003) and was related to the state of training (Krustrup et al., 2003). The huge request for acceleration and deceleration phases in football with many variations of trajectory leads to think on the uselessness of using the row run. This led to the need of redefining the concept of high intensity exercise (di Prampero et al, 2005) at the base of current metabolic power rather than of speed (Osgnach et al., 2010).

Therefore, it's right that the development of strength and endurance in team sports must always be linked to the coordination of the gesture to be performed and the repetition of these actions with short intervals of time so that the metabolic task is always high.

Conclusions

There were no significant effects between the data collected in the pre-season and the data collected during the season, therefore it can be assumed that the physical work performed during this period was not effective in terms of performance. In relation to what has been detected it would be necessary, in a subsequent study, to verify after a period of work (six months), if the improvements were significant.

The results of this study show that physical commitment is influenced by the players' playing position and these knowledges must be used to program specific workouts based on their role, in order to enhance the physical and technical characteristics of different players in the different roles. It is important to know about the specific work to be done for the different roles and at different times of the year in order to achieve significant individual and, consequently, team improvements.

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