Original Article

Match and training loads of professional soccer players in relation to their tactical position

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Abstract

The aim of this study was to compare the internal and external loads of professional soccer players in relation to their tactical position during the in-season trainings and matches. 13 players from one team of the Super League 2 (2nd Greek Division), aged 26±4.6yrs, with body mass of 77.4±6.96kg, stature 181±50cm and body fat 8.7±1.51%, participated in the current study. The players' loads were recorded in three trainings per microcycle and during the team's official matches in a 6-week period by the use of a Polar Team Pro tracking system (©Polar Electro, Sports instruments, Kempele, Finland). Repeated measures analysis of variance along with the Bonferroni multiple comparisons was used for the statistical treatment of the data. Independently from their tactical position, the players spent significantly more time with low heart rate during trainings, while they spent significantly more time with high heart rate in matches. However, the fullbacks, the central midfielders and the central defenders performed with high heart rates, in comparison with the other players' positions, in both trainings and matches ($p<0.05$). The distances covered by the players with low running speeds were significantly longer in training ($p<0.05$), than in matches, while the distances covered with higher running speeds were not significantly different between training and match in all players ($p<0.05$). Moreover, the covered distances with high running speed did not significantly differ in the studied players according to their tactical positions ($p<0.05$). Regarding the number of accelerations/decelerations significant greater amounts were detected during trainings, rather than in the official matches in all recorded intensity zones while significant differences in the number of accelerations/decelerations were observed in all players' positions ($p<0.05$). This study finding suggest that the coaches must simulate the high intensities of the match during the competitive microcycles trainings adapting the physical conditioning training in relation to the players' tactical position.

Keywords: football, performance monitoring, heart rate, league.

Introduction

The performance in soccer is considered complex and multivariate and depends on various factors such as the players' technique, their physical conditioning, their psychology (Barra & Rossetti, 2014) and tactical (Weineck, 1992). These parameters should be handled both individually and as a total in order to improve the professional players' performance, according to the requirements and demands of each one (Hohmann, 1994). To identify the soccer players' physical demands during training and matches, the internal and external loads, such as their heart rate (Rampinini et al., 2007; Dellal et al., 2008), the distance covered and the amount of runs regarding their tactical position or in relation to the formation of the team must, among others, be assessed (Gatti, 2016). For this reason, simulated workouts were used nowadays during training, in order the players to receive specific stimuli and to practice simultaneously their physical condition and the various technical and/or tactical skills (Tessitore et al., 2006; Marco et al., 2012).

Furthermore, the internal and external loads during soccer training and official matches have been recorded in recent study and their differences were evaluated for a qualitative preparation of the players (Payet et al., 2016). It has been noted that, despite the attempts to simulate the match conditions during training, the players perform fewer loads with high intensity in training (Ispyrilidis et al., 2018). The internal loads during matches and training procedures were often determined by recording the heart rate of the players (Rampinini et al., 2007; Dellal et al., 2008). This physiological parameter reflects the metabolic demands in soccer (Esposito et al., 2004) and can also be used to determine the differences of the players' physical conditioning profile in relation to their tactical position (Alli & Farraly, 1999; Drust, Atkinson, & Reilly, 2007). In addition, for the proper evaluation of loads, the accelerations and decelerations must also be taken into account, because they require a great deal of effort from the players due to the eccentric type of muscular contraction (Garren, 1990; Little & Williams, 2007; Tibaudi, 2011).

Moreover, it is suggested, during the competitive microcycle, the interchange of matches with a competitive profile trainings in order to improve all the parameters of the players' physical condition

(aerobic/anaerobic capacity) and simultaneously to train according to the model and principals of the team during the matches (Sannicandro & Cofano 2015; Bordonau & Villanueva, 2019). However, to the best of our knowledge, although each one of the tactical positions has different technical and physical conditioning requirements for the players (Dellal et al., 2010), there is a lack of data regarding the internal and external loadings in relation to the tactical positions of the professional players during trainings and official matches. Thus, the aim of the current study was to compare the internal and external loadings of professional soccer players during official matches and in-season microcycle trainings, in relation to their playing position. It is hypothesized that the internal and external loadings during training and match will be identical for all players and that these loadings will be different for each tactical position.

Methods

Participants

Thirteen players (N=13) from one team of the Super League 2 (2nd Greek Division), aged 26±4.6yrs, with body mass of 77.4±6.96kg, stature 181±50cm and body fat 8.7±1.51%, participated in the current study. Three (3) of them were wingers, two (2) were fullbacks, four (4) were central midfielders, three (3) were central defenders and one (1) was attacker. The experimental protocol was approved by the institutional review board and was in accordance with the Declaration of Helsinki. All the participants provided written assent after they were informed about the possible risks, benefits, and the nature of the study.

Data collection

The internal and external loadings were evaluated during the competitive period of the Super League 2nd Division championship, in season 2018-19. In total, the loadings were recorded in 18 match-orientated trainings and 6 official matches (home & away). The loads of the starting line-up players (the Goalkeeper was excluded) during three intense trainings per weekly microcycle (Wednesday-Thursday-Friday) and during the team's official match (Sunday), which followed the trainings in a 6-week time frame were assessed. Forty seven (n=47) players were recorded with the amount of the studied players to participated in both intense trainings and in the following official matches. The team's remaining trainings during the in-season weekly microcycle (Monday, Tuesday, Saturday) were not recorded and were excluded from the study, because they contained low training loads. These trainings aimed on the players' physical and psychological discharging and on the tactical preparation for the following official match.

During the trainings and the matches, each participant wore in a personal vest a portable transmitter for the real-time recording of selected parameters. The transmitter was a Polar Team Pro tracking system (*©Polar Electro, Sports instruments, Kempele, Finland*), with high-frequency 10 Hz GPS and 200 Hz MEMS motion tracking sensor. For each participant it was recorded the time (min) in which his heart rate ranged from: 50 – 59.9, 60 – 83.9, 84 – 89.9, 90 – 94.9 & 95 – 100 %HR_{max}, along with the total distance (m) covered and the distance covered with running speed of 0 – 7.99 km.h⁻¹, 8 – 14.39 km.h⁻¹, 14.4 – 19.79 km.h⁻¹, 19.8 – 24.99 km.h⁻¹ & >25 km.h⁻¹. The number of accelerations (<1 m/sec², 1 – 1.99 m/sec², 2 – 2.99 m/sec² & >3 m/sec²) & decelerations (<-1 m/sec², from -1 to -1.99 m/sec², from -2 to -3 m/sec² & >-3 m/sec²) was also assessed.

Statistical analysis

The normal distribution of the data was verified using the Shapiro–Wilk test. Two –way repeated measures analyses of variance (ANOVA), along with the multiple comparisons Bonferroni test, were used for the statistical treatment of the data. The within factor was the “match vs training” and the between factor was the player's “tactical position”. The level of significance was set as $p < 0.05$.

Results

Loading duration in the heart rare intensity zones

Table 1 shows the loading duration (min) in the separate intensity zones according to the % HR_{max}. In the intensity zones 50-59.99 and 60-81.99 % HR_{max}, the loading duration was significantly longer in trainings, in comparison to the matches, for all tactical positions. On the other hand, in the intensity zone 50-59.99 % HR_{max} no significant differences were found between the players' positions, neither in trainings ($F_{4,40} = 0.653$; $p = 0.628$), nor in matches ($F_{4,40} = 2.227$; $p = 0.083$). In the intensity zone 60-81.99 % HR_{max}, a significant main effect of the tactical position factor was found in both trainings ($F_{4,40} = 2.809$; $p < 0.05$) and matches ($F_{4,40} = 7.352$; $p < 0.05$). However, the Bonferroni multiple comparisons test revealed that in trainings the loading duration in the intensity zone 60-81.99 % HR_{max} was longer only in the fullbacks in comparison to the central midfielders, while, in matches, it was longer only in the attackers, in comparison to the other tactical positions. As far as the intensity zone 82-89.99 % HR_{max} is concerned, neither significant differences between trainings and matches in any of the tactical positions, nor significant differences between the players' positions were found, in both trainings ($F_{4,40} = 1.219$; $p = 0.318$) and matches ($F_{4,40} = 0.412$; $p = 0.799$).

In the intensity zone 90-94.99 % HR_{max} the loading duration was shorter in trainings, in comparison with the matches, but this difference was significant only for the wingers and the central midfielders. Between the

players' positions, significant differences were found in both trainings ($F_{4,40}= 12.210$; $p< 0.05$) and matches ($F_{4,40}= 4.693$; $p< 0.05$). However, the Bonferroni multiple comparisons test revealed that in trainings the loading duration was significantly longer only in the central defenders, in comparison to the other players, while in matches, it was significantly longer in the central midfielders and the central defenders only in comparison with the attackers. Regarding the intensity zone 95-100 % HR_{max} the loading duration was shorter in trainings, in comparison to the matches, but this difference was significant only for the fullbacks, the central midfielders and the central defenders.

Between the tactical positions, no significant differences were found neither in trainings ($F_{4,40}= 2.092$; $p= 0.100$), nor in matches ($F_{4,40}= 2.399$; $p= 0.066$). However, in matches the fullbacks, the central midfielders and the central defenders showed longer durations.

Table 1. Loading duration (min) in selected intensity zones (% HR_{max}) in relation to players' position in training and matches (mean $\pm$ SD)

% HR_{max}	50-59.99			60-81.99			82-89.99			90-94.99			95-100		
	Training	Match		Training	Match		Training	Match		Training	Match		Training	Match	
Positions	Duration (min)		F-value	Duration (min)		F-value	Duration (min)		F-value	Duration (min)		F-value	Duration (min)		F-value
Wingers	39.27 $\pm$ 11.11	10.20 $\pm$ 4.49	31.355*	82.13 $\pm$ 11.9	40.30 $\pm$ 7.78	43.152*	33.30 $\pm$ 10.03	32.02 $\pm$ 6.60	0.106	9.26 $\pm$ 5.30	19.67 $\pm$ 6.76	10.435*	0.95 $\pm$ 1.17	4.35 $\pm$ 4.05	1.263
Full-backs	38.18 $\pm$ 13.41	6.13 $\pm$ 3.16	29.676*	95.96 $\pm$ 11.62	36.95 $\pm$ 12.57	66.815*	28.42 $\pm$ 7.88	29.61 $\pm$ 8.70	0.072	11.91 $\pm$ 6.90	18.72 $\pm$ 7.81	3.474	2.34 $\pm$ 1.98	14.85 $\pm$ 16.34	13.309*
Central midfielders	40.37 $\pm$ 16.29	6.43 $\pm$ 4.64	61.772*	78.38 $\pm$ 11.70	33.18 $\pm$ 8.18	72.823*	29.92 $\pm$ 9.89	32.81 $\pm$ 6.24	0.786	14.23 $\pm$ 7.15	24.21 $\pm$ 8.40	13.860*	3.16 $\pm$ 4.31	11.40 $\pm$ 9.30	10.739*
Central defenders	32.49 $\pm$ 15.99	6.73 $\pm$ 5.49	32.838*	79.87 $\pm$ 14.50	31.95 $\pm$ 10.18	75.524*	36.42 $\pm$ 9.50	30.68 $\pm$ 3.90	2.852	27.35 $\pm$ 10.50	28.69 $\pm$ 14.49	0.231	4.03 $\pm$ 3.35	10.14 $\pm$ 7.66	5.446*
Attackers	43.80 $\pm$ 17.56	12.10 $\pm$ 2.25	16.571*	88.39 $\pm$ 6.37	65.44 $\pm$ 24.53	5.775*	35.00 $\pm$ 5.71	33.24 $\pm$ 8.92	0.090	2.18 $\pm$ 0.61	5.34 $\pm$ 2.81	0.428	0.03 $\pm$ 0.06	0.39 $\pm$ 0.53	0.006

*training vs match $p< 0.05$

Distances covered with specific running speeds

Table 2 shows the covered distances (m) with specific running speeds. With a running speed of 0-7.99 $km \cdot h^{-1}$, the players of all tactical positions covered significantly longer distances in trainings, than in matches, except the attackers. On the other hand, no significant differences were found between the players' positions, neither in trainings ($F_{4,40}= 1.480$; $p= 0.226$), nor in matches ($F_{4,40}= 0.778$; $p= 0.546$). However, in trainings, the attackers covered shorter distances with a slow running speed of 0-7.99 $km \cdot h^{-1}$, in comparison with the other players. With a running speed of 8-14.39 $km \cdot h^{-1}$, only the wingers, the central defenders and the attackers covered significantly longer distances in trainings, than in matches. Although in trainings no significant differences were found between the various tactical positions ($F_{4,40}= 1.116$; $p= 0.363$), a significant simple main effect of the tactical position factor was observed ($F_{4,40}= 15.141$; $p< 0.005$) in matches and the Bonferroni multiple comparisons test revealed that only the central midfielders covered significant longer distances in comparison to the players of the other tactical positions.

With a running speed of 14.4-19.79 $km \cdot h^{-1}$, only the central defenders and the attackers covered significantly longer distances in trainings, than in matches. A significant simple main effect of the players' position factor was observed in both trainings ($F_{4,40}= 3.008$; $p< 0.05$) and matches ($F_{4,40}= 9.526$; $p< 0.05$). However, the Bonferroni multiple comparisons test revealed that in trainings, only the central midfielders and the attackers covered significantly longer distances than the others did, while in matches significant longer distances were covered only by the central midfielders in comparison with the players of the other tactical positions. With maximal running speed of 19.8-24.99 $km \cdot h^{-1}$ and over 25 $km \cdot h^{-1}$ in no one tactical position was covered significant different distances between trainings and matches.

However, with running speed of 19.8-24.99 $km \cdot h^{-1}$ a significant simple main effect of the tactical position was found in both trainings ($F_{4,40}= 4.669$; $p< 0.05$) and matches ($F_{4,40}= 4.690$; $p< 0.05$). Nevertheless, in trainings only the attackers covered significant longer distances in comparison to the central defenders, while in matches significantly longer distances were covered only by the fullbacks, in comparison to the central defenders. With running speed over 25 $km \cdot h^{-1}$, significant differences were observed between the players' positions in both trainings ($F_{4,40}= 4.536$; $p< 0.05$) and matches ($F_{4,40}= 4.714$; $p< 0.05$), where significantly longer distances were covered by the fullbacks, in comparison with the wingers, the central midfielders and the central defenders.

Table 2. Covered distances (m) with specific running speeds ($\text{km}\cdot\text{h}^{-1}$) in relation to players' position in training and matches (mean $\pm$ SD)

Speed ($\text{km}\cdot\text{h}^{-1}$)	0-7.99			8-14.39			14.4-19.79			19.8-24.99			>25		
	Training	Match		Training	Match		Training	Match		Training	Match		Training	Match	
Positions	Distance (m)		F-value	Distance (m)		F-value	Distance (m)		F-value	Distance (m)		F-value	Distance (m)		F-value
Wingers	6162.00 $\pm$ 706.22	4479.89 $\pm$ 229.30	10.897 *	4122.45 $\pm$ 684.42	3551.00 $\pm$ 396.12	4.738*	1597.00 $\pm$ 314.00	1422.45 $\pm$ 285.88	2.114	552.89 $\pm$ 105.54	561.78 $\pm$ 125.93	0.026	110.56 $\pm$ 58.40	154.45 $\pm$ 56.20	2.464
Full-backs	6443.58 $\pm$ 897.83	4383.72 $\pm$ 159.70	12.709 *	3839.29 $\pm$ 633.96	3706.43 $\pm$ 342.26	0.199	1520.86 $\pm$ 551.35	1676.72 $\pm$ 374.67	1.311	589.72 $\pm$ 164.71	654.58 $\pm$ 148.16	1.068	207.00 $\pm$ 72.05	199.29 $\pm$ 58.50	0.059
Central midfielders	6034.54 $\pm$ 762.29	4230.00 $\pm$ 148.21	18.114 *	4472.07 $\pm$ 714.73	4648.85 $\pm$ 758.80	0.655	1824.47 $\pm$ 433.93	2021.93 $\pm$ 588.74	3.908	544.85 $\pm$ 208.25	494.23 $\pm$ 233.06	1.208	111.70 $\pm$ 87.23	90.70 $\pm$ 48.79	0.815
Central defenders	6500.25 $\pm$ 1178.27	3828.13 $\pm$ 1786.16	36.664 *	4030.75 $\pm$ 877.24	3120.25 $\pm$ 413.21	16.039*	1399.34 $\pm$ 451.34	1096.67 $\pm$ 109.40	8.476*	398.84 $\pm$ 148.22	359.84 $\pm$ 113.36	0.662	97.59 $\pm$ 36.45	109.67 $\pm$ 76.26	0.249
Attackers	4818.25 $\pm$ 1283.25	4420.75 $\pm$ 128.15	0.270	4358.50 $\pm$ 299.92	3242.25 $\pm$ 294.31	8.036*	2126.50 $\pm$ 253.23	1478.50 $\pm$ 211.38	12.951 *	785.50 $\pm$ 128.10	635.75 $\pm$ 100.78	3.209	191.00 $\pm$ 40.24	161.25 $\pm$ 42.98	0.503

*training vs match $p < 0.05$

Concerning the total distance covered by the players, it was significantly longer in trainings, rather than in matches, independently from their tactical position. Between the players' positions, no significant differences were observed in trainings ($F_{4,40} = 0.476$; $p = 0.753$), while there were found in matches ($F_{4,40} = 10.179$; $p = 0.000$). However, the Bonferroni test revealed significantly longer covered total distances only for the central midfielders, in relation to the wingers, the central defenders and the attackers, and for the fullbacks in comparison to the central defenders (Table 3).

Table 3. Total covered distance (m) and total number of sprints in relation to players' position in training and matches (mean $\pm$ SD)

	Training	Match		Training	Match	
Positions	Total covered distance (m)		F-value	Number of sprints		F-value
Wingers	12584.89 $\pm$ 1544.39	10169.56 $\pm$ 541.17	17.675*	11.89 $\pm$ 5.51	9.78 $\pm$ 3.77	1.273
Full-backs	12600.43 $\pm$ 2101.48	10627.86 $\pm$ 610.40	9.169*	17.58 $\pm$ 4.16	11.58 $\pm$ 1.52	7.996*
Central midfielders	13100.16 $\pm$ 1737.35	11485.70 $\pm$ 1378.52	11.407*	10.93 $\pm$ 5.80	6.22 $\pm$ 3.60	9.083*
Central defenders	12426.25 $\pm$ 2224.89	9341.34 $\pm$ 381.04	38.445*	9.75 $\pm$ 4.25	7.33 $\pm$ 3.80	2.224
Attackers	13688.75 $\pm$ 1212.18	9938.50 $\pm$ 557.23	18.939*	18.25 $\pm$ 1.90	13.25 $\pm$ 4.12	3.173

*training vs match $p < 0.05$

As far as the total number of sprints is concerned, more sprints were performed in trainings, rather than in matches, but this difference was significant only for the fullbacks and the central midfielders. Between the tactical positions, significant differences were found in both trainings ($F_{4,40} = 4.577$; $p < 0.05$) and matches ($F_{4,40} = 5.125$; $p < 0.05$), but they were detected only in the greater number of sprints performed by the fullbacks and the attackers, in comparison with the rest positions.

Amount of decelerations and acceleration

Table 4 shows the number of decelerations performed by the players in trainings and matches, in relation to their players' position. As far as the total number of decelerations is concerned, significant more decelerations were performed by the amount of players, independently from their tactical position, during trainings, in comparison with matches, while no significant differences were found between the players' positions neither in trainings ($F_{4,40} = 0.318$; $p = 0.864$), nor in matches ($F_{4,40} = 1.607$; $p = 0.191$). Regarding the different intensities of deceleration, the amount of decelerations $> -3\text{m}/\text{sec}^2$ was greater in trainings, than in matches, in all players' positions, but this difference was significant only for the wingers, the central midfielders and the central defenders. As far as the differences between the tactical positions is concerned, a significant simple main effect was observed in both trainings ($F_{4,40} = 7.455$; $p < 0.05$) and matches ($F_{4,40} = 14.528$; $p < 0.05$).

However, significant more decelerations $> -3\text{m}/\text{sec}^2$ were performed only by the attackers, in comparison to the other players. The number of decelerations from -2.99 to $-2\text{m}/\text{sec}^2$, from -1.99 to $-1\text{m}/\text{sec}^2$ and $< -1\text{m}/\text{sec}^2$ was significantly greater in trainings, than in matches, in all tactical positions. Regarding the differences between the players' positions in the number of decelerations from -2.99 to $-2\text{m}/\text{sec}^2$, a significant simple main effect was

observed only in matches ($F_{4,40} = 5.380$; $p < 0.05$), while in trainings no significant differences were found ($F_{4,40} = 1.671$; $p < 0.05$). However, the significant differences between the tactical positions in matches were detected only in the greater number of decelerations performed by the attackers and the central midfielders, in comparison with the central defenders.

Concerning the differences between the tactical positions in the number of decelerations from -1.99 to -1 m/sec^2 , a significant simple main effect was observed, again, only in matches ($F_{4,40} = 6.926$; $p < 0.05$), while in trainings no significant differences were found ($F_{4,40} = 0.991$; $p < 0.05$). However, the significant differences, between the players' positions in matches, were found only in the greater number of decelerations performed by the central midfielders in comparison with all the others. Finally, regarding the comparison of the number of decelerations $< -1 \text{ m/sec}^2$ between the tactical positions, no significant differences was observed, neither in trainings ($F_{4,40} = 923$; $p = 0.460$), nor in matches ($F_{4,40} = 1.161$; $p = 0.342$).

Table 4. Number of decelerations in relation to players' position in training and matches (mean $\pm$ SD)

Decelerations	Total			>3m/sec ²			-2.99 to -2m/sec ²			-1.99 to -1m/sec ²			< -1 m/sec ²		
	Training	Match		Training	Match		Training	Match		Training	Match		Training	Match	
Players position	Number		F-value	Number		F-value	Number		F-value	Number		F-value	Number		F-value
Wingers	1255.76 $\pm$ 193.45	677.89 $\pm$ 59.50	78.686*	41.45 $\pm$ 10.83	30.23 $\pm$ 7.48	8.979*	119.56 $\pm$ 25.35	72.67 $\pm$ 13.14	34.035*	359.78 $\pm$ 56.62	214.15 $\pm$ 19.14	42.019*	735.12 $\pm$ 119.50	360.56 $\pm$ 33.23	87.004*
Full-backs	1295.15 $\pm$ 185.50	665.00 $\pm$ 29.60	72.769*	42.58 $\pm$ 10.05	36.72 $\pm$ 13.77	1.902	116.58 $\pm$ 31.08	75.15 $\pm$ 16.95	20.665*	381.00 $\pm$ 70.23	218.43 $\pm$ 12.36	40.894*	755.00 $\pm$ 98.33	334.72 $\pm$ 24.26	85.202*
Central midfielders	1312.85 $\pm$ 122.60	731.62 $\pm$ 95.93	114.977*	31.45 $\pm$ 9.06	20.24 $\pm$ 5.42	12.990*	122.70 $\pm$ 18.39	77.77 $\pm$ 11.02	45.126*	413.93 $\pm$ 60.19	267.62 $\pm$ 45.12	61.510*	744.77 $\pm$ 72.78	366.00 $\pm$ 59.24	128.516*
Central defenders	1351.09 $\pm$ 266.86	675.67 $\pm$ 63.60	143.316*	34.50 $\pm$ 8.46	22.34 $\pm$ 7.18	14.072*	115.92 $\pm$ 26.04	61.75 $\pm$ 7.80	60.560*	405.08 $\pm$ 87.05	223.42 $\pm$ 21.02	87.539*	795.59 $\pm$ 155.55	368.17 $\pm$ 52.31	151.060*
Attackers	1289.50 $\pm$ 174.46	676.25 $\pm$ 48.37	39.383*	58.50 $\pm$ 8.35	53.25 $\pm$ 12.26	0.873	149.75 $\pm$ 8.62	89.75 $\pm$ 9.22	24.769*	407.50 $\pm$ 58.09	207.25 $\pm$ 21.29	35.455*	673.75 $\pm$ 123.70	326.00 $\pm$ 21.76	33.332*

*training vs match $p < 0.05$

Table 5 shows the number of accelerations performed by the players in trainings and matches, in relation to the players' position. Regarding the total number of accelerations, significant more accelerations were performed by all players, independently from their tactical position, during trainings, in comparison with matches, while no significant differences were found between the players' positions neither in trainings ($F_{4,40} = 0.427$; $p = 0.788$), nor in matches ($F_{4,40} = 1.773$; $p = 0.153$). As far as the difference in the number of the various intensities of acceleration is concerned between trainings and matches, in all accelerations' intensities their amount was greater in trainings in all tactical positions. Concerning the comparison of the number of accelerations between the players' positions in trainings, in all acceleration intensities no significant differences were observed, except the acceleration $>3 \text{ m/sec}^2$ ($<1 \text{ m/sec}^2$: $F_{4,40} = 0.311$; $p = 0.869$, $1 - 1.99 \text{ m/sec}^2$: $F_{4,40} = 0.880$; $p = 0.484$, $2 - 2.99 \text{ m/sec}^2$: $F_{4,40} = 0.871$; $p = 0.490$), $>3 \text{ m/sec}^2$: $F_{4,40} = 3.959$; $p < 0.05$). In matches, no significant differences were also found, except the acceleration $1 - 1.99 \text{ m/sec}^2$ ($<1 \text{ m/sec}^2$: $F_{4,40} = 0.800$; $p = 0.532$, $1 - 1.99 \text{ m/sec}^2$: $F_{4,40} = 4.057$; $p < 0.05$, $2 - 2.99 \text{ m/sec}^2$: $F_{4,40} = 1.717$; $p = 0.165$), $>3 \text{ m/sec}^2$: $F_{4,40} = 2.194$; $p = 0.087$).

Table 5. Number of accelerations in relation to players' position in training and matches (mean $\pm$ SD)

Accelerations	Total			<1 m/sec ²			1-1.99 m/sec ²			2-2.99 m/sec ²			>3 m/sec ²		
	Training	Match		Training	Match		Training	Match		Training	Match		Training	Match	
Players position	Number		F-value	Number		F-value	Number		F-value	Number		F-value	Number		F-value
Wingers	1113.56 $\pm$ 206.03	656.12 $\pm$ 72.83	52.556*	574.45 $\pm$ 135.02	358.78 $\pm$ 50.19	31.938*	374.23 $\pm$ 65.59	219.34 $\pm$ 33.55	42.087*	135.67 $\pm$ 18.57	73.89 $\pm$ 12.08	63.941*	29.23 $\pm$ 7.57	14.12 $\pm$ 3.73	25.415*
Full-backs	1158.86 $\pm$ 188.44	655.86 $\pm$ 41.59	49.424*	593.00 $\pm$ 102.28	347.00 $\pm$ 48.42	32.320*	393.43 $\pm$ 70.92	223.72 $\pm$ 21.82	39.300*	144.43 $\pm$ 22.65	76.15 $\pm$ 14.02	60.762*	26.58 $\pm$ 6.48	13.29 $\pm$ 4.60	15.280*
Central midfielders	1176.39 $\pm$ 125.10	714.08 $\pm$ 103.53	77.537*	582.62 $\pm$ 82.30	371.70 $\pm$ 69.90	44.125*	400.08 $\pm$ 47.75	265.30 $\pm$ 43.79	46.024*	127.31 $\pm$ 21.40	68.39 $\pm$ 13.75	84.021*	28.39 $\pm$ 7.59	9.08 $\pm$ 6.24	59.932*
Central defenders	1204.92 $\pm$ 237.12	640.00 $\pm$ 59.79	106.870*	619.75 $\pm$ 128.90	339.08 $\pm$ 43.05	72.121*	422.00 $\pm$ 84.66	221.50 $\pm$ 26.30	94.031*	137.25 $\pm$ 27.96	66.34 $\pm$ 9.50	112.344*	26.00 $\pm$ 6.10	12.67 $\pm$ 4.48	26.382*
Attackers	1232.50 $\pm$ 115.53	655.50 $\pm$ 38.60	37.164*	617.00 $\pm$ 66.93	331.75 $\pm$ 26.29	24.832*	430.25 $\pm$ 41.53	227.50 $\pm$ 13.33	32.051*	144.00 $\pm$ 8.25	80.75 $\pm$ 7.09	29.789*	41.25 $\pm$ 5.50	15.50 $\pm$ 4.04	32.799*

*training vs match $p < 0.05$

Discussion

Loading duration in the heart rate intensity zones

In the current study, regarding the players' internal loading, it was found that, independently from their tactical position, they spend significantly more time with low heart rate ($50 - 81.99\% \text{ HR}_{\max}$) in trainings in comparison to the matches. On the contrary, in the majority of the tactical positions, the players spend significantly more time with high heart rate ($90 - 100\% \text{ HR}_{\max}$) in the matches, comparing to the trainings. Thus, it seems that, in all tactical positions, the trainings workouts did not simulate the required loading intensities of the professional soccer players' in an official matches. These results are in agreement with the findings of Dellal et al. (2012), where it was also observed that in matches the loading intensities were higher, in comparison with the loadings during the trainings in the corresponding weekly microcycle. This result highlights the difficulty to achieve the proper loading intensities in trainings, when only soccer-specific exercises with ball were used, as in the current study.

According to Hoff & Helgerud (2004), the effective intensity to improve endurance ranged between 90 and 95% of maximal heart rate, and thus it is essential, when small-sided games using ball are included in the training process, to adapt appropriately (to increase) the pitch dimensions in order to induce the high intensity of exercise (Hoff et al., 2002). As far as the behavior of the players of the different tactical positions is concerned, the results of the current study confirm previous findings (Bangsbo, 1999; Coelho, 2005; Di Salvo et al., 2007) that the fullbacks, the central midfielders and the central defenders spend more time with high intensity ($95 - 100\% \text{ HR}_{\max}$), in comparison with the other players' positions, not only in matches, but also in trainings. Although these differences were not statistically significant in the current study, these non-significant results would be attributed to the large inter-subjects variability and the limited number of the participants, due to the difficulty to measure many professional soccer players for a long period of time. This should be considered as a limitation of the current study. Moreover, it is interesting to note that the attackers showed significantly shorter loading durations in the intensity zone $90-94.99\% \text{ HR}_{\max}$, in comparison with the players of all the other tactical positions, in both trainings and matches. This restricted loading of the attackers with maximal internal loads should be taken into account in the training process.

Covered distances during training and match

As far as the total distance covered by the players is concerned, it was significantly longer in trainings than in matches, independently from their tactical position and without any significant difference between them, neither in trainings, nor in matches. With low intensity and running speed until $14.39\% \text{ km}\cdot\text{h}^{-1}$, the players covered longer distances in trainings, rather than in matches, in all tactical positions, and in most of the cases, these differences were statistically significant. This finding is not in line with the suggestion of Helgerud et al. (2007). According to them, exercises with long duration and low or medium intensity should be avoided in the training workouts of the competitive microcycles. Concerning the loadings with higher intensity and running speed, no significant differences were observed in the covered distances between training and match by the players. This finding, although contradicts the observation of Casamichana, Castellano & Castagna (2012), who stated that the professional players covered longer distances with running speed greater than $21 \text{ km}\cdot\text{h}^{-1}$ in official matches, in comparison with the competitive profile trainings while it is in accordance with the suggestion of Impellizzeri et al. (2006) to simulate the match requirements in the training loadings.

Moreover, in the current study, it was found that the covered distances with high running speed did not differ significantly between the various tactical positions. In training, the only exception was the longer distances covered with medium intensity, corresponding to a running speed of $14.4 - 19.97 \text{ km}\cdot\text{h}^{-1}$, by the central midfielders and the attackers and in matches the longer distances covered by the central midfielders, in comparison with the players of the other tactical positions. This observation is in partial agreement with the findings of Hoff & Helgerud (2004). According to them, the central midfielders, the fullbacks, the wingers and the attackers cover longer distances than the central defenders with the above running speeds, in both training and official matches. The fact that in the current study the central defenders covered less, but not statistically significant shorter distances than the players of the other tactical positions, could probably also be attributed to the limited number of the subjects participated in the current study.

Number of accelerated/decelerated runs

Regarding the amount of the players' accelerations and decelerations significant differences were detected between training and official matches in all recorded intensity zones. In all tactical positions, the highest values were observed in training, confirming previous findings (Varley & Aughey, 2013), where significant more accelerations and decelerations were recorded in training with small-sided games (7 vs 7), in comparison to the matches. As far as the differences between the players' positions are concerned, the attackers performed in the current study significantly more decelerations $>-3\text{m}/\text{sec}^2$, in both trainings and matches, in relation to the other players' position. Moreover, the number of decelerations from -2.99 to $-2\text{m}/\text{sec}^2$ was found to be significantly larger by the attackers and the central midfielders, in comparison with the central defenders, only in matches, while the decelerations from -1.99 to $-1\text{m}/\text{sec}^2$, were significantly lower only by the central midfielders

in relation to the other players' positions. Regarding the accelerations, in relation to their tactical position, in the majority of cases no significant differences were observed. The above results are in agreement with previous relevant findings and highlight the special demands of these tactical positions regarding the eccentric mode of their muscular contractions (Garren, 1990; Little & Williams, 2007; Tibaudi, 2011).

Conclusion

The main findings of the current study revealed greater loading duration with low heart rate during the trainings of the in-season microcycles, in comparison to the players' heart rate during the following official matches of the professional soccer team. In addition, the players' covered distances with low running speeds during trainings were longer, while no differences existed in the distances covered with medium and high running speeds in both trainings and official matches. Also, it is noticeable that the number of accelerations and decelerations of the soccer players was greater during the matches of this team. These differences between training and match loadings depended on the players' tactical position and they should be taken into account for an effective preparation before the official matches. Summarizing, this study could offer valuable information to the coaches in order to simulate the official match conditions during the trainings of the in-season competitive microcycles, organizing effectively the team's loads and avoiding the loss of quality during training.

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