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Quantification of External Training Load among Elite-Level Goalkeepers within Competitive Microcycle

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Abstract: This study aimed to evaluate the external training load (ETL) of elite-level goalkeepers considering days before match day (MD minus) and playing status in subsequent matches. The ETL of three goalkeepers from the Croatian highest national football competition were analyzed, quantifying goalkeeping-specific physical performance variables (i.e., distances covered, acceleration frequencies, dives, jumps). Data were collected using a 10 Hz global-positioning system and 100 Hz accelerometer technology (Vector G7, Catapult Sports Ltd., Melbourne, Australia) from 67 training sessions. Significant daily differences for almost all physical performance variables were found (all small-to-medium effect sizes (ESs)). Specifically, total distance, total and high-intensity dives, high-intensity accelerations and decelerations, and explosive efforts were greatest on MD-3 and lowest on MD-2 and MD-1. Nonstarters performed more medium jumps on MD-4 (large ES); low jumps on MD-3 (medium ES); total, right-, and left-side dives and low jumps on MD-2 (all small-to-medium ESs); and left-side dives and low and medium jumps on MD-1 (all small-to-medium ESs) compared to the starters. These findings demonstrated that (i) elite-level goalkeepers experienced the greatest ETL on MD-3 and the lowest on MD-2 and MD-1 and that (ii) starters' and nonstarters' ETLs were similar on MD-4 and MD-3, while nonstarters compared to the starters presented slightly greater ETLs on MD-2 and MD-1. This study highlighted the differing daily training demands placed on elite-level goalkeepers, offering valuable insights for their preparation.

Keywords: physical performance; training demands; playing status; soccer

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1. Introduction

Football is a complex and high physically demanding sport [1–3]. Analyses of physical demands in football are usually conducted through the quantification of physical performance, such as total distance, distance covered in different speed zones, and acceleration frequencies [4–6]. Research has shown that outfield players can cover 9–14 km during a match, covering from 5 to 15% of that distance at higher speeds [7–9]. Although physical demands in football have been extensively studied over the last two decades [10,11], the majority of research investigating physical demands in football has not included goalkeepers [12,13].

One of the main reasons for this is the notable differences found in physical demands compared to the other playing positions (i.e., outfield players) [14,15]. Specifically, football goalkeepers on average cover ~50% of the total distance and ~10% of the high-intensity distance of outfield players [16,17]. Furthermore, the analyses of physical demands for goalkeepers and outfield players differ remarkably [18]. Due to their specific match tasks (i.e., saves, dealing with high crosses, explosive positioning, etc.) [19–21], goalkeepers must perform explosive actions, such as jumping, striking, diving, catching, and/or accelerating and decelerating over short distances [22]. Therefore, analysis of goalkeepers' physical demands usually requires additional quantification of dives, jumps, acceleration frequencies, and explosive efforts [21].

For successful dealing with high physical demands of contemporary football [23], an appropriate distribution of external training load (ETL) is essential [24–27]. Previous research investigating ETLs of football players has mostly involved the outfield players [28,29], while studies analyzing goalkeepers' ETL are scarce. Briefly, White et al. and Jara et al. analyzed the ETL of goalkeepers according to the differing training types without information on daily/weekly demands in the English Premier League and the German fifth league, respectively [21,30]. On the other hand, Abbot et al. and Moreno et al. gave information on weekly demands by comparing ETLs of starter and nonstarter goalkeepers from the U23 English Premier League and the Spanish second division, respectively [22,31]. Furthermore, Grimson et al. and Malone et al. examined the relationship between ETL and subjective wellness in the English Premier League and top Dutch league, respectively [32,33].

Although these studies provide valuable information on goalkeepers' ETL, daily demands of training within a weekly microcycle are rarely presented [22]. Furthermore, studies have mostly investigated subelite goalkeepers and/or have not utilized goalkeeping-specific indicators of ETL [21,22,32] or considered goalkeepers' loads during specific actions. In addition, no studies thus far have investigated differences in goalkeepers' daily demands utilizing multivariate techniques, which can be particularly helpful in the better understanding of ETL [34]. As a consequence, comprehensive knowledge on daily physical demands placed on elite-level goalkeepers is currently limited, and additional research is warranted [22]. The findings from such research could serve football practitioners in goalkeeping-specific training prescription processes. Therefore, this study aimed to evaluate the ETL of elite-level goalkeepers during the competitive microcycle. As empirical evidence suggests that goalkeepers' ETLs may vary considering their playing status in subsequent matches [32], ETL was additionally evaluated for starting and nonstarting goalkeepers (i.e., starters and nonstarters).

2. Materials and Methods

2.1. Sample and Design

The participants were three adult male football goalkeepers (mean ± standard deviation, age: 30.33 ± 7.07; body mass: 90.33 ± 7.29 kg; height: 195 ± 4.32 cm) from one team that competed in the highest-level soccer competition in Croatia in the 2021/2022 season. Two of them represented national seniors, while one of them represented the national U-21 team, which characterized them as elite-level goalkeepers. Goalkeepers were observed over training sessions (n = 67) from competitive microcycles, including one match per week during one competitive half season. Only goalkeepers who had the capacity to train without any physical restriction and who were injury-free were eligible.

To evaluate ETL, goalkeepers' physical performances were collected using global-positioning system (GPS) during the in-season training sessions. The final analysis included only weeks that consisted of a minimum of four training days in the week, with six days between the matches and only one match. Based on the amount of days until the game, training sessions were divided into different categories [35,36]. Thus, MD-2 referred to the session that was conducted two days until the match day.

As the data analyzed in this study were derived from routinely measured activities through the in-season, obtaining written informed consent was not required [37]. However, verbal consent was obtained from the players if anonymity was ensured. To guarantee player anonymity, all data were deidentified in compliance with the Declaration of Helsinki. The investigation was approved by the Faculty of Kinesiology, University of Split.

2.2. Procedures

During each training session, physical performance was measured using a Vector G7 device (Catapult Sports Ltd., Melbourne, Australia) containing a GPS system (10 Hz) and an accelerometer (100 Hz). The validity and reliability of this system were recently described [38]. For each training session, the goalkeepers wore the same device to prevent interunit error. In accordance with the manufacturer's instructions, all devices were consistently activated ~30 minutes before the training sessions to allow the acquisition of satellite signals. Raw data files were exported after the conclusion of each training session using system-specific software (OpenField, Catapult Sports Ltd., Melbourne, Australia). Individual player files were trimmed to ensure that only information relating to the training time was kept for analysis.

2.3. Variables

The ETL was evaluated using general and goalkeeping-specific physical performance variables. General physical performance variables included total and high-intensity running distance covered (>5.5 m/s) and the number of high-intensity accelerations (>3 m/s^2) and high-intensity decelerations (–3 m/s^2) [39,40].

Goalkeeping-specific physical performance variables included number of explosive efforts (i.e., combined number of high-speed changes in direction, high jumps, and instances in which a dive was followed by a goalkeeper returning to standing within 1 s [21]); number of total and high-intensity dives (i.e., dive load intensity greater than 9 arbitrary units specified by analyzing system) performed for right side, left side, and to the center (i.e., forward action when the ball is traveling toward the center of the body); number of high (i.e., jump height > 0.4 m), medium (i.e., jump height of 0.2–0.4 m), and low (i.e., jump height < 0.2 m) jumps [21].

2.4. Statistical Analyses

The Kolmogorov–Smirnov test was used to evaluate the normality of distributions, while homoscedasticity was tested using Levene's test. All variables were normally distributed, so descriptive statistics included means and standard deviations. The univariate differences in physical performance were analyzed via one-way analysis of variance (ANOVA). Scheffe's post hoc analysis was calculated to identify the differences among specific training days. Afterward, effect size (ES) differences were established using ANOVA-derived partial eta-squared (>0.02, small; >0.13, medium; >0.26, large). Multivariate differences in physical performance were analyzed via canonical discriminant analysis. Statistica (version 14; TIBCO Software, Palo Alto, CA, USA) was used for all analyses. The significance level was set at 0.05.

3. Results

Tables 1 and 2 present descriptive statistics and differences in daily physical performance. Significant daily differences were found for total distance (medium ES), total and high-intensity dives (both medium ES), total and high-intensity left- and right-side dives (all medium ES), high-intensity accelerations and decelerations (both small ES), and explosive efforts (small ES). Specifically, on MD-3, goalkeepers covered the greatest total distance and attempted the highest numbers of total and high-intensity dives (significant post hoc differences when compared to MD-1, MD-2, and MD-4). Also, the greatest numbers of total and high-intensity left-side dives (significant post hoc differences when compared to MD-1 and MD-4) and total and high-intensity right-side dives (significant post hoc differences when compared to MD-1 and MD-2) were noted on MD-3. Additionally, goalkeepers on MD-3 executed the greatest number of high-intensity accelerations and decelerations (significantly different from MD-1), as well as explosive efforts (significantly different from MD-1)

Table 1. Descriptive statistics for daily physical performance (data are given as mean ± SD).

	MD-4	MD-3	MD-2	MD-1
Total distance (m)	2607.1 ± 937.4	3629.4 ± 1524.4	2669.5 ± 761.3	2569.4 ± 486.7
High-intensity running (m)	0.9 ± 2.2	8.5 ± 20.7	4.2 ± 14.7	2.6 ± 4.7
Total dives (N)	26.4 ± 14.9	41.6 ± 20.3	30.2 ± 12.6	25.9 ± 8.4
High-intensity dives (N)	13.5 ± 7.8	21.2 ± 11.5	14.0 ± 7.6	12.7 ± 5.0
Left-side dives (N)	10.9 ± 7.5	18.0 ± 10.2	13.6 ± 6.3	10.9 ± 4.9
High-intensity left-side dives (N)	5.2 ± 4.0	9.9 ± 6.2	6.9 ± 4.0	5.8 ± 3.1
Center dives (N)	6.2 ± 4.3	5.4 ± 4.7	4.4 ± 3.4	4.5 ± 3.4
High-intensity center dives (N)	2.4 ± 2.6	2.3 ± 3.1	1.9 ± 1.8	1.6 ± 1.5
Right-side dives (N)	9.4 ± 6.0	18.2 ± 8.8	12.2 ± 6.5	10.5 ± 4.0
High-intensity right-side dives (N)	5.9 ± 3.3	9.0 ± 4.8	5.2 ± 4.1	5.3 ± 2.8
Low jumps (N)	11.0 ± 7.9	11.6 ± 9.0	10.3 ± 12.7	9.6 ± 6.9
Medium jumps (N)	6.0 ± 4.7	8.5 ± 6.3	8.9 ± 7.3	11.4 ± 6.8
High jumps (N)	1.9 ± 2.1	2.6 ± 3.6	4.9 ± 6.6	5.1 ± 4.2
High-intensity accelerations (N)	4.0 ± 3.6	6.1 ± 5.4	3.3 ± 3.9	3.4 ± 2.7
High-intensity decelerations (N)	2.5 ± 2.1	4.1 ± 3.7	2.5 ± 2.7	2.0 ± 1.9
Explosive efforts (N)	27.9 ± 14.5	44.7 ± 23.3	35.5 ± 27.1	28.9 ± 10.9

Table 2. Differences in daily physical performance.

	ANOVA		Effect Size	MD-4	MD-3	MD-2	MD-1
	f	*p*	μ	Post Hoc			
Total distance	**7.28**	**0.01**	0.17	MD−3	MD−4, MD−2, MD−1	MD−3	MD−3
High-intensity running	1.30	0.28	0.04	-	-	-	-
Total dives	**6.78**	**0.01**	0.16	MD−3	MD−4, MD−2, MD−1	MD−3	MD−3
High-intensity dives	**6.08**	**0.01**	0.15	MD−3	MD−4, MD−2, MD−1	MD−3	MD−3
Left-side dives	**5.35**	**0.01**	0.13	MD−3	MD−4, MD−1	-	MD−3
High-intensity left-side dives	**5.15**	**0.01**	0.13	MD−3	MD−4, MD−1	-	MD−3
Center dives	0.97	0.41	0.03	-	-	-	-
High-intensity center dives	0.74	0.53	0.03	-	-	-	-
Right-side dives	**8.43**	**0.01**	0.19	MD−3	MD−4, MD−2, MD−1	MD−3	MD−3
High-intensity right-side dives	**5.94**	**0.01**	0.14		MD−2, MD−1	MD−3	MD−3
Low jumps	0.22	0.88	0.00	-	-	-	-
Medium jumps	2.48	0.06	0.06	-	-	-	-
High jumps	2.43	0.07	0.06	-	-	-	-
High-intensity accelerations	**3.02**	**0.03**	0.08	-	-	-	-
High-intensity decelerations	**3.32**	**0.02**	0.09	-	MD−1	-	MD−3
Explosive efforts	**3.28**	**0.02**	0.09	-	MD−1	-	MD−3

f = f-test value; p = level of significance. Bold text denotes statistical significance at $p < 0.05$. μ—partial eta-squared. Superscripted letters indicate significant post hoc differences when compared to the specific training day.

Table 3 presents a discriminant canonical analysis of multivariate differences in daily physical performance. One discriminant root reached statistical significance (Can R = 0.54, $p = 0.01$), showing significant differentiation between MD-3 and MD-1. Total distance and total dives (correlations with the discriminant function of r = 0.68 and 0.66, respectively) most greatly contributed to the differentiation, with greater occurrence on MD-3.

Table 4 presents descriptive statistics and differences in daily physical performance between starters and nonstarters. Compared to the starters, nonstarters performed more medium jumps on MD-4 (large ES); more low jumps on MD-3 (medium ES); more total dives (medium ES), left-side dives (medium ES), right-side dives (small ES), and low jumps (medium ES) on MD-2; and more left-side dives (small ES) and low (medium ES) and medium jumps (small ES) on MD-1.

Table 3. Multivariate differences in daily physical performance defined by discriminant canonical analysis.

	Root 1	Root 2	Root 3
Total distance	0.68	−0.37	−0.08
High-intensity running	0.26	−0.24	0.16
Total dives	0.66	−0.31	0.22
High-intensity dives	0.63	−0.28	−0.02
High-intensity accelerations	0.12	0.07	−0.01
High-intensity decelerations	−0.23	−0.63	−0.05
Low jumps	−0.31	−0.34	0.40
Medium jumps	0.43	−0.15	−0.25
High jumps	0.48	−0.08	0.01
Explosive efforts	0.43	−0.23	0.35
Can R	0.54	0.33	0.30
Wilks' Lambda	0.58	0.81	0.91
p-value	0.01	0.28	0.32
C: MD-4	0.04	0.80	−0.42
C: MD-3	1.14	−0.22	−0.09
C: MD-2	−0.13	0.13	0.41
C: MD-1	−0.59	−0.27	−0.20

Can R—canonical correlation; root—structure of the discriminant function/root; C—centroid.

Table 5 presents a discriminant canonical analysis of multivariate differences in daily physical performance between starters and nonstarters. None of discriminant roots reached statistical significance, showing no significant differentiation between starters and non-starters in physical performance on MD-4, MD-3, MD-2, and MD-1.

Table 4. Descriptive statistics and differences in daily physical performance between starters and nonstarters.

	MD-4		MD-3		MD-2		MD-1	
	Starters	**Non Starters**	**Starters**	**Non Starters**	**Starters**	**Non Starters**	**Starters**	**Non Starters**
Total distance (m)	2340.6 ± 911.1	3034.7 ± 902.2	3346.5 ± 1312.8	3939.2 ± 1737.3	2437.8 ± 855.2	2854.2 ± 638.6	2555.3 ± 551.5	2586.2 ± 414.1
High-intensity running (m)	1.1 ± 2.8	0.6 ± 0.9	5.1 ± 7.2	12.3 ± 29.2	1.3 ± 3.0	6.5 ± 19.5	2.8 ± 5.0	2.5 ± 4.4
Total dives (N)	22.4 ± 16.4	32.8 ± 10.3	35.2 ± 13.9	48.6 ± 24.2	**24.9 ± 9.9**	**34.4 ± 13.2** **	25.3 ± 6.7	26.6 ± 10.1
High-intensity dives (N)	10.6 ± 7.0	18.0 ± 7.4	18.6 ± 8.7	24.1 ± 13.8	11.7 ± 4.8	15.9 ± 9.0	12.3 ± 3.9	13.3 ± 6.2
Left-side dives (N)	9.0 ± 8.4	13.8 ± 5.3	14.5 ± 7.1	21.8 ± 12.0	**10.5 ± 5.1**	**16.1 ± 6.2** **	**9.4 ± 3.3**	**12.7 ± 5.8** *
High-intensity left-side dives (N)	4.0 ± 3.7	7.2 ± 3.8	8.3 ± 3.8	11.7 ± 7.8	5.6 ± 3.1	8.1 ± 4.4	5.0 ± 2.4	6.9 ± 3.6
Center dives (N)	5.3 ± 3.0	7.6 ± 6.0	4.2 ± 2.7	6.8 ± 6.1	4.7 ± 2.9	4.2 ± 3.7	5.5 ± 3.8	3.3 ± 2.4
High-intensity center dives (N)	1.9 ± 1.8	3.2 ± 3.6	1.8 ± 2.1	2.8 ± 3.9	1.9 ± 1.8	1.9 ± 1.8	1.7 ± 1.7	1.4 ± 1.3
Right-side dives (N)	8.1 ± 6.5	11.4 ± 5.0	16.5 ± 6.9	20.0 ± 10.5	**9.8 ± 5.0**	**14.2 ± 7.1** *	10.5 ± 3.3	10.6 ± 4.8
High-intensity right-side dives (N)	4.8 ± 3.2	7.6 ± 3.0	8.6 ± 4.6	9.5 ± 5.1	4.2 ± 2.1	6.0 ± 5.0	5.6 ± 2.5	5.0 ± 3.2
Low jumps (N)	7.9 ± 7.0	16.0 ± 7.2	**7.8 ± 6.0**	**15.8 ± 10.0** **	**5.1 ± 4.2**	**14.6 ± 15.5** **	**6.8 ± 4.1**	**12.9 ± 7.9** **
Medium jumps (N)	**4.0 ± 3.0**	**9.2 ± 5.5** ***	6.5 ± 3.0	10.7 ± 8.1	6.3 ± 4.6	10.9 ± 8.4	**9.3 ± 4.8**	**13.9 ± 8.0** *
High jumps (N)	1.1 ± 1.6	3.2 ± 2.3	1.8 ± 3.6	3.5 ± 3.4	3.7 ± 5.0	6.0 ± 7.6	3.9 ± 3.3	6.5 ± 4.9
High-intensity accelerations (N)	4.0 ± 4.1	4.0 ± 3.1	6.1 ± 4.4	6.2 ± 6.4	2.8 ± 3.0	3.8 ± 4.5	4.0 ± 2.8	2.7 ± 2.4
High-intensity decelerations (N)	2.9 ± 2.5	2.0 ± 1.0	4.4 ± 3.6	3.8 ± 3.9	2.1 ± 2.5	2.8 ± 2.8	2.4 ± 2.2	1.5 ± 1.2
Explosive efforts (N)	26.0 ± 17.1	30.8 ± 10.1	44.0 ± 18.7	45.5 ± 28.4	31.0 ± 10.1	39.2 ± 35.2	30.6 ± 8.9	27.0 ± 12.8

Bold text denotes significant differences between starters and nonstarters at $p < 0.05$; * denotes small effect size, ** denotes medium effect size, and *** denotes large effect size.

Table 5. Multivariate differences in daily physical performance between starters and nonstarters for different training days defined by discriminant canonical analysis.

	MD-4 Root 1	**MD-3 Root 1**	**MD-2 Root 1**	**MD-1 Root 1**
Total distance	−0.36	−0.22	−0.37	−0.04
High-intensity running	0.11	−0.19	−0.23	0.04
Total dives	−0.34	−0.39	−0.52	−0.11
High-intensity dives	−0.49	−0.27	−0.37	−0.14
High-intensity accelerations	−0.55	−0.56	−0.52	−0.66
High-intensity decelerations	−0.60	−0.39	−0.43	−0.47
Low jumps	−0.53	−0.29	−0.22	−0.44
Medium jumps	−0.15	−0.03	−0.20	0.22
High jumps	−0.36	−0.22	−0.37	−0.04
Explosive efforts	0.11	−0.19	−0.23	0.04
Can R	0.74	0.68	0.62	0.61
Wilks' Lambda	0.45	0.54	0.62	0.62
p-value	0.69	0.22	0.07	0.07
C: Starters	0.81	0.85	0.85	0.69
C: Nonstarters	−1.29	−0.93	−0.68	−0.87

Can R—canonical correlation; root—structure of the discriminant function/root; C—centroid.

4. Discussion

This is one of the first studies to evaluate the ETL of elite-level goalkeepers during a competitive microcycle quantifying goalkeeping-specific physical performance. The main findings show that (i) goalkeepers experienced the greatest ETL on MD-3 and the lowest on MD-2 and MD-1 and that (ii) starters' and nonstarters' ETLs were similar on MD-4 and MD-3, while nonstarters compared to starters presented a slightly greater ETL on MD-2 and MD-1.

Comprehensive knowledge of daily physical demands placed on elite-level goalkeepers is currently limited [18,32]. To address the relevant literature gaps, this study analyzed the daily physical performance of elite-level football goalkeepers during competitive microcycles (i.e., including one match per week). The results showed significant daily differences for almost all physical performance variables. Specifically, goalkeepers experienced the greatest ETL on MD-3, which was most likely the consequence of implementing high-volume (i.e., defined by total distance and total dives) and high-intensity (i.e., defined by high-intensity dives, high-intensity accelerations and decelerations, and explosive efforts) drills to meet the high physical demands of the game [25,31,33,35]. Considering the current literature, which mostly shows similar results for both goalkeepers and outfield players [12,33], these findings are expected to some extent. However, some studies have shown that both outfield players and goalkeepers experience the greatest ETL on MD-4 [31,36]. These differences in findings are probably caused by the use of different training methods in various countries. [35]. Possibly, some coaches do not prefer the greatest training load for the first training session of the microcycle (i.e., after a 2-day recovery period on MD-4); therefore, they implement high-volume and -intensity drills for the second training session of the microcycle (i.e., MD-3). On the other hand, coaches seeking more time for recovery before a match day most likely implement high-volume and -intensity drills for the first training session of the microcycle (i.e., MD-4).

Evidently, the training methodology can differ in the loading period (i.e., MD-4 and MD-3) [35,36]. However, the majority of the research exploring the training load of both outfield players or goalkeepers has consistently evidenced a decrease in ETL in the final period of the microcycle (i.e., tapering period: MD-2 and MD-1) [12,13,31,33,36]. This strategy enables sufficient recovery from the high physically demanding sessions during the loading period, which consequently ensures optimal match performance on the match day [31,33,41]. Given the descriptive analysis in the current study indicating the lowest values for almost all physical performance variables on MD-2 and MD-1, our results are fully in the line with these considerations. Collectively, there is no doubt that the elite-level goalkeepers experienced the greatest ETL on MD-3 and the lowest on MD-2 and MD-1. However, it is noteworthy that training volume (i.e., defined by total distance and total dives) most greatly contributed to this differentiation. This is most likely the consequence of the tapering strategy application, which aims to reduce the training volume while maintaining the training intensity prior to the match [28].

The most robust findings of this study are related to goalkeeping-specific physical performance variables, which have been insufficiently investigated so far [21,22]. Firstly, we evidenced greater total and high-intensity dives performed on both left and right sides on MD-3 than on MD-1, while the numbers of center dives, both total and high-intensity, were similar in all training sessions. This suggests that the coaches, when structuring the high-volume and -intensity drills (i.e., on MD-3; please see previous discussion for details), are more focused on saves to the sides, possibly because players during a match typically shoot to the sides of the goal [42]. Further, no significant daily differences for low, medium, and high jumps were found, indicating that goalkeepers performed similar numbers of jumps in all training sessions. Given the tapering theory that underlines decreased ETL toward the end of the week [12,13,28], such a finding may look surprising. However, the descriptive analysis indicated a relatively low jump frequency during a single training day (i.e., ~20 to 25 jumps in total). Considering that such frequencies were constant through all training sessions in the week, it seems that elite-level goalkeepers were more oriented toward maintenance rather than toward the development of specific jumping capacities during competitive microcycles.

When analyzing the ETL of goalkeepers who started (i.e., starters) and did not start (i.e., nonstarters) the match, studies have revealed conflicting findings [21,22,31]. White el al. and Abbott et al. found greater ETLs for nonstarters compared to starters [21,22], while Moreno-Pérez et al. indicated that starters completed greater ETLs compared to non-starters [31]. In the current study, a similar ETL was found on MD-4 and MD-3 for both starters and nonstarters. Specifically, compared to starters, nonstarters achieved only a greater number of medium jumps on MD-4 and more low jumps on MD-3, while no differences in all other physical performances were found. Additionally, this suggests that a similar training methodology during the loading period was applied for elite-level goalkeepers, irrespective of their playing status in subsequent matches, which is standard procedure, as evidenced in subelite or youth competitions [22,31]. Interestingly, considering some differences in physical performance between starters and nonstarters found that, on MD-2 and MD-1, it seemed that training methodology in the final part of the microcycle (i.e., tapering period) depended on goalkeepers' playing status. In detail, nonstarters performed more (i) total, right-, and left-side dives and low jumps on MD-2 and more (ii) left-side dives and low and medium jumps on MD-1 compared to the starters. This clearly indicates that nonstarters compared to the starters experienced a slightly greater ETL in the final part of the microcycle. The reason for this may be the fact that starters are often excluded from the shooting practices that occur more often in the final part of the microcycle [22].

4.1. Limitations and Strengths

The current study has some limitations that should be taken into account. Firstly, the sample size was limited, including only three observed subjects. However, this is a very common issue in studies involving goalkeepers who compete in elite soccer [22,33]. Secondly, the study included goalkeepers from one club; therefore, the results can only be applied to similar samples of subjects and levels of competition. Third, as only one-game microcycles were analyzed, the findings are not applicable to elite-level teams playing more than one game per week. However, this study also offers several strengths. Thus, this is one of the first studies to evaluate ETL among elite-level goalkeepers in competitive microcycles using goalkeeper-specific measures. Also, to the best of our knowledge, goalkeepers' loads during the specific actions are described for the first time in the current study. Finally, this study is the first to utilize multivariate techniques to assess differences in goalkeepers' daily demands. Future studies should analyze a larger sample of goalkeepers from multiple elite-level clubs, including microcycles consisting more than one game per week.

4.2. Practical Applications

These findings can serve football practitioners in goalkeeping-specific training prescription processes. Specifically, based on the current results, situational drills involving a high number of dives, jumps, and explosive reactions can be implemented up to three days prior to the match. For one and two days prior to the match, involvement of such drills should be reduced to allow goalkeepers to achieve the optimal performance on the match day. Finally, it should be emphasized that increased ETLs of nonstarters before a match may cause their inferior recovery on match day. Therefore, if it is needed for a nonstarter to start or enter a match, football practitioners should be aware of their possible impaired match performance.

5. Conclusions

The ETL of elite-level football goalkeepers was the greatest on MD-3, most likely due to the implementing of high-volume and -intensity drills to meet the high physical demands of the match. On the other hand, the goalkeepers experienced the lowest ETL on MD-2 and MD-1, which is almost certainly the consequence of tapering strategies aiming to ensure optimal performance on match day. Similar ETLs of the starters and nonstarters on MD-3 and MD-4 indicated that the elite-level goalkeepers' match preparation in the first part of the microcycle was equal, irrespective of their playing status on match day. However, the slightly greater ETL of nonstarters compared to starters on MD-2 and MD-1 suggested that elite-level goalkeepers' match preparation was determined by their playing status in the subsequent match.

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Informed Consent Statement: As the data analyzed in this study were derived from routinely measured activities over the course of the competitive season, obtaining written informed consent was not required; therefore, informed consent was waived by the Ethical Board of the University of Split, Faculty of Kinesiology.

Data Availability Statement: The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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