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Original Research

Variations of High-Intensity GPS Derived Measures between Playing Status during a Full Soccer Season in a Professional Male Team

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Abstract

Background: This study's aim was twofold: (i) to compare starters and non-starters on a professional soccer team in terms of variations in training intensity indexes across a season, calculated through total distance, sprint distance, accelerations (Acc), and decelerations (Dec) and (ii) to analyse the relationship between the intensity indexes for each playing status. **Methods**: Nineteen players (age, 29.4 ± 4.4 years; height, 1.8 ± 0.1 m; body mass, 74.8 ± 2.3 kg) were divided into starters and non-starters and followed for 43 weeks using global positioning systems. **Results**: Training intensity measures (acute:chronic workload ratio [ACWR], coupled and uncoupled) were higher during the latter stage of the season. Total distance peaked during the mid-season, whereas the highest value for exponentially weighted moving average (EWMA) was recorded later in the season. Interestingly, the EMWA of total distance showed little variation during the season for players of both playing statuses. The EWMA of total distance showed a significant higher value for starters than non-starters (p = 0.036; g = 1.27 [0.31, 2.32]). The interruption in games between week 34 and week 35 due to COVID-19 moved some measures into the injury risk zone — namely, the ACWR coupled of sprint distance and Dec; the ACWR uncoupled of total distance, sprint distance, Acc, Dec; and the EWMA of sprint distance, Acc and Dec. **Conclusions**: The highest training intensity measures were reported late in the season and were similar between starters and non-starters. Across the season, only one difference between starters and non-starters occurred, revealing that training intensity was properly managed throughout the season regardless of the status of the players.

Keywords: ACWR; EWMA; coupled; uncoupled; GPS; sprint; acceleration; deceleration; player status

1. Introduction

The quantification of external training intensity/load in soccer has been shown to help analyse intra- and inter-week variations in a player's training schedule [1], thus providing relevant information to coaches so they can better periodise training sessions and matches across the season [2,3]. Previously, the term "load" was used to describe the intensity of training sessions and matches, but it was recently suggested to use the term "intensity" instead [4]. For clarity, this paper uses the term "intensity" instead of "load" or "workload", except when they are part of another term, such as "acute:chronic load/workload".

Intra- and inter-week variations could be analysed through some indexes such as the coupled or uncoupled acute:chronic workload ratio (ACWR) [5] and the exponentially weighted moving average (EWMA) [6]. For instance, coupled ACWR expresses the relationship of the intensity of the previous and current seven-day periods (acute load) with the load of the last four weeks (28 days, chronic load) [7,8], while the uncoupled ACWR does not consider the most recent week of chronic load [5]. In addition, EWMA provides greater emphasis on the most recent training by assigning a decreasing weighting for each older training value across the different weeks.

One of the intentions for calculating the ACWR was to identify individuals at risk of injury but there has been considerable debate about the limitations of such methods [9,10].

In this sense, external intensity could be associated with measures collected by video-based systems, inertial measurements units, and global positioning systems (GPSs). For instance, GPSs can measure total distance (TD) and different running distance thresholds, accelerations (Acc), and decelerations (Dec) [5], which can be used to calculate ACWR or EWMA.

Recently, some of these indexes have been shown to be influenced by contextual factors, such as playing status (i.e., whether a player is a starter or non-starter). For example, recent studies found greater values for starters than non-starters early in the season according to calculations of ACWR based on GPS-derived body load [11,12]. Contrary to this, Oliveira *et al*. [13] did not find any significant differences between playing status across 10 mesocycles of the in-season period according to ACWR data calculated based on session-RPE, (TD and high-speed running distance. In young soccer players, one study found higher ACWR of session-RPE values in the early than the mid-season and higher values in the mid-season than the end-season [14]. Another study found similar values between starters and non-starters across 10 months/mesocycles during the in-season period [15].

Moreover, recent research analysed the differences between playing statuses based on several metrics, such as monotony, strain, and accumulated intensity of specific periods of the season; they all found higher values in starters than non-starters [16–18]. However, one study did not confirm such differences between playing statuses, finding values for starters and non-starters across the season [13].

Moreover, we could not find any studies that analysed playing statuses while considering EWMA, coupled ACWR, and uncoupled ACWR calculated using GPSs based on the measures of TD, sprint distance, Acc and Dec. Furthermore, the relationships between different indexes calculated by the several high-intensity measures could improve training and match soccer data interpretations, which, in turn, would aid coaches' periodisation of practice intensity throughout the season, helping players avoid fatigue and improve performance for competitions.

Based on the above discussion, the aims of this study were: (i) to compare the variations of ACWR coupled, ACWR uncoupled, and EWMA based on TD, sprint distance, Acc and Dec across different periods of a professional soccer season (pre-, early-, mid-, and end-season) between playing statuses (starters and non-starters) and (ii) to analyse the relationships among the aforementioned measures across the entire season for both playing statuses. We hypothesised that the weekly variations in starters would be greater than in non-starters and that starters would withstand more acute and chronic intensities than non-starters in all periods of the season.

2. Materials and Methods

2.1 Participants

Nineteen professional soccer players from the First League of Iran (Asian) were analysed. They were divided into two groups: starters (n = 10, age 28.5 $\pm$ 4.2 years, 1.83 $\pm$ 0.05 m, and 74.8 $\pm$ 3.6 kg) and non-starters (n = 9, age 26.4 $\pm$ 5.1 years, 1.7 $\pm$ 0.06 m, and 74.2 $\pm$ 4.1 kg). The inclusion criteria consisted of participating in at least 80% of the weekly training sessions as previously outlined in the literature [19]. Per the exclusion criteria, players with injuries or who missed training sessions during two or more consecutive weeks were removed from the analysis. In addition, goalkeepers were excluded due to the positional differences with other field players.

Players needed to have competed for at least 60 minutes in three consecutive matches to be considered a starter; all other players were defined as non-starters [20].

2.2 Design

A descriptive longitudinal design was considered for this study that included the analysis of 43 consecutive weeks (229 main training sessions). No rehabilitation or recovery sessions were considered for analysis. Training protocols were developed and applied by the coach and staff, while the researchers controlled only the 30 minutes before and after each training session.

The study period began on June 17, 2019, and lasted until April 12, 2020. The present season was organised as follows: pre-season (Weeks 1–4); early-season (Weeks 5–17); mid-season (Weeks 18–30); and end-season (Weeks 31–43) (Table 1). It should be highlighted that the league matches were cancelled on Weeks 34 and 35 due to the outbreak of the COVID-19 pandemic.

Information about the weeks, sessions, duration, and matches in the present study is provided in Table 1.

2.3 External Intensity Monitoring

During the season, all sessions were monitored using GPSs (GPSports Systems Pty Ltd, Model: SPI High-Performance Unit (HPU); Australia). This system includes the following features: 15 Hz location GPS, distance, and speed measurement; acceleration: 100 Hz, acceleration and deceleration, data source BL; Mag: 50 Hz, TriAxial; dimensions: the smallest device on the market (74 mm $\times$ 42 mm $\times$ 16 mm); robust SPI HPU based on mining/industrial strength electronic design; waterproof and data transfer; infrared; weight 56 g [21]. This GPS was previously shown to be valid and reliable [21]. In addition, this GPS model presented high reliability with a low coefficient of variation (1.87–2.21%) for acceleration-based variables [22].

Before all sessions, belts were placed on the players, and after the sessions, all belts were taken off and put in the dock system. This procedure allowed the data to be downloaded and analysed with Team Aggregated Multiservices Solutions software. The SPI IQ Absolutes were adjusted the for GPS default zone. Each player used the same GPS to avoid possible data variability. After the data collection period, TD, sprint distance ($>$23 km$\cdot$h^{-1}), accelerations (Acc, $>$4 m/s^2) and decelerations (Dec, $<$–4 m/s^2) were considered for analysis. Acc and Dec zones were defined according to the previous research [23].

Table 1. Description of the study.

Phases of the season	Pre-season	Early-season	Mid-season	End-season
Number of weeks	4	13	13	13
Training sessions (n)	23	50	46	62
Training duration, average minutes, ST	81.5	67.5	61.0	64.0
Training duration, average minutes, NST	81.6	69.4	69.4	64.5
Training duration, total minutes, ST	485.3	307.1	255.6	290.0
Training duration, total minutes, NST	510.5	305.5	248.6	280.3
Number of matches (N)	3*	16	17	12

Abbreviations: *, friendly matches; ST, starters; NST, non-starters.

2.4 Calculations of Training Indexes

Based on TD, sprint distance, Acc and Dec, the following indexes were calculated: (i) ACWR, using the coupled formula by dividing the acute workload (i.e., the one-week rolling workload data) by the chronic workload (i.e., the rolling four-week average workload data) [24–28]; (ii) ACWR using the uncoupled formula by dividing the weekly acute workload (i.e., the accumulated daily loads during one week) by the weekly chronic load (i.e., the average of the three preceding weeks) [6]; and (iii) EWMA [8]. The EWMA for any given day was calculated as follows:

$$EWMA_{\text{today}} = \text{Load}_{\text{today}} \times \lambda_a + ((1 - \lambda_a) \times EWMA_{\text{yesterday}})$$

where λ_a is a value between 0 and 1 that represents the degree of decay, with higher values indicating older observations in the model at a faster rate. The variable λ_a is calculated as:

$$\lambda_a = 2/(N + 1)$$

here N is the chosen time decay constant, typically 7 and 28 days for acute (‘fatigue’) and chronic (‘fitness’) loads, respectively [8,29].

2.5 Statistical Analysis

All statistical procedures were performed using IBM SPSS Statistics (version 22, IBM Corporation, SPSS Inc., Chicago, IL, USA). The sample was characterized through descriptive statistics (mean ± standard deviation (SD)). Then, a Shapiro-Wilk test was run to evaluate the normality of data. After confirming normality, the relationship between all variables was tested using the Pearson product-moment correlation coefficient (r) [30]. The effect sizes of the correlations were defined as follows: <0.1 = trivial; 0.1–0.3 = small; >0.3–0.5 = moderate; >0.5–0.7 = large; >0.7–0.9 = very large; and >0.9 = nearly perfect [27].

In addition, we used a repeated-measures ANOVA test and Bonferroni post-hoc test to compare variables for all in-season periods and both playing status groups. The significance level was set to $p \leq 0.05$. Finally, Hedge’s g effect size was also determined based on the following criteria: $g \leq 0.2$, trivial; $0.2 < g \leq 0.6$, small; $0.6 < g \leq 1.2$, moderate; $1.2 < g \leq 2.0$, large; $2.0 < g \leq 4.0$, very large; and $g > 4.0$, nearly perfect [31].

3. Results

Figs. 1,2,3,4 show an overview of the weekly averages for ACWR coupled, ACWR uncoupled, and EWMA calculated based on TD, sprint distance, Acc, and Dec for different periods of a professional soccer season (pre-season, early-season, mid-season, and end-season).

Table 2 presents differences between the two playing statuses during all periods of the season for all variables. The only significant difference was found in EWMA based on TD. The value of this variable was significantly higher for starters than non-starters (p = 0.036; g = 1.27 [0.31, 2.32]).

Table 3 shows the correlation coefficients of all measures considered in the study for starters.

Table 4 shows the correlation coefficients of all measures in the study for non-starters.

4. Discussion

The primary aim of the present study was to compare starters and non-starters in terms of variations in training intensity indexes calculated throughout a soccer season according to TD, sprint distance, Acc, and Dec. The secondary aim was to analyse the relationship between the training indexes for starters and non-starters. The results revealed significant differences between starters and non-starters, supporting the first hypothesis. In line with the second hypothesis, there were correlations between the variables measured in different periods.

According to Figs. 1,2,3, most of the increases in the ACWR of the parameters under consideration (TD, sprint distance, Acc, Dec) occurred during the end-season. However, although the largest number of matches were played in the mid-season, most training sessions occurred in the end-season; thus, the volume and model of training were likely adjusted reflecting an increase in these measures (TD, sprint distance, Acc, Dec). Furthermore, the two-week break that took place due to the outbreak of the COVID-19 pandemic occurred in the end-season, which affected the type and vol-

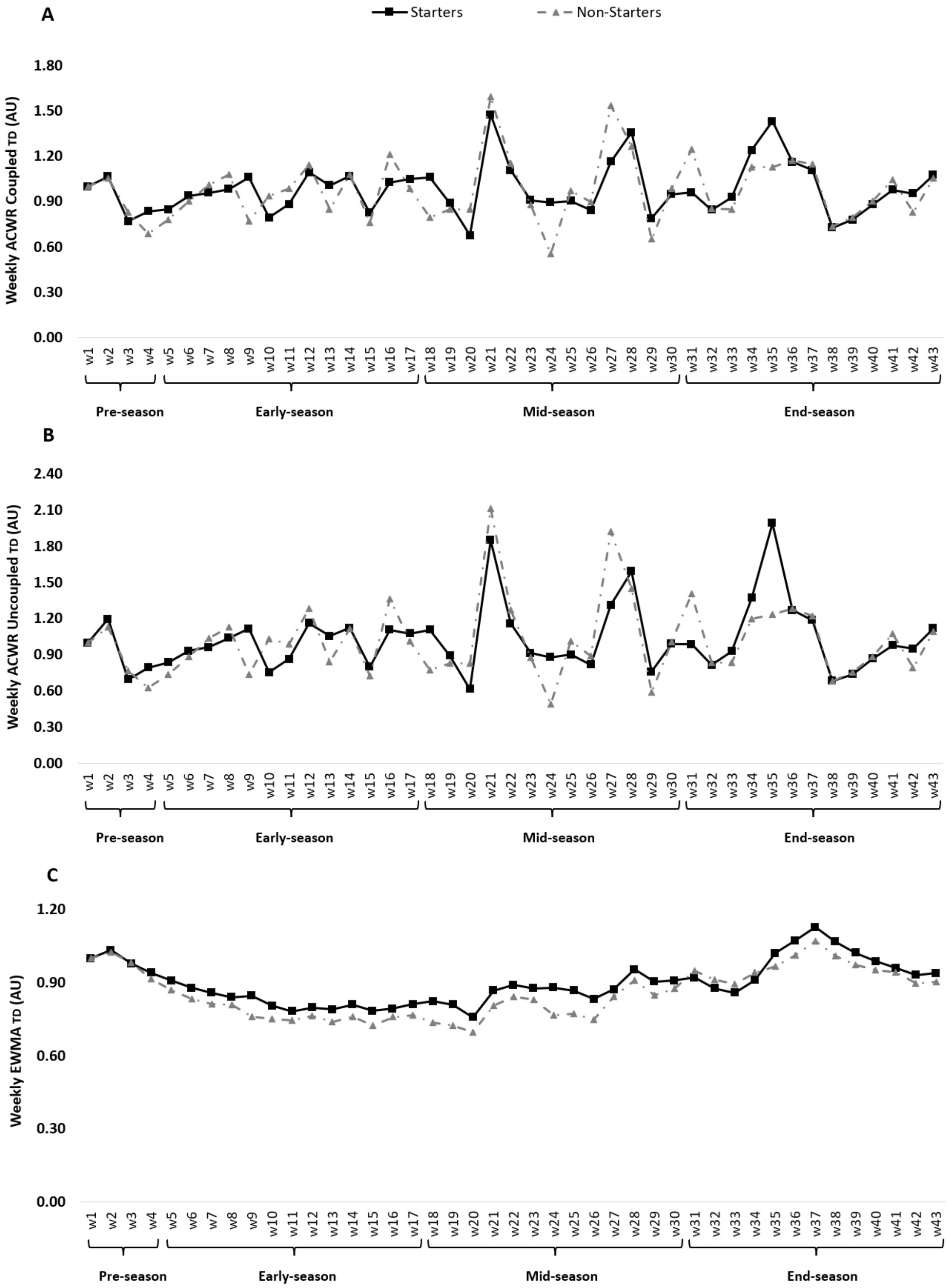

Fig. 1. ACWR coupled (A), ACWR uncoupled (B), and EWMA (C) variations calculated based on TD across 43 weeks for starters and non-starters.

ume of players' training to prevent their performance from declining. Although, in theory, the ACWR may not be able to detect higher injury risk, it can be useful to check an individual's progress with their training prescription. It will be very useful to check the ACWR in the settings of an individual training program during a season to determine and control the training intensity parameters, such as players' wellness, as doing so can affect perceived intensity and injury [19,32,33], running rate, and other parameters, thereby preventing non-contact injuries and get better results during dense training periods [15,34].

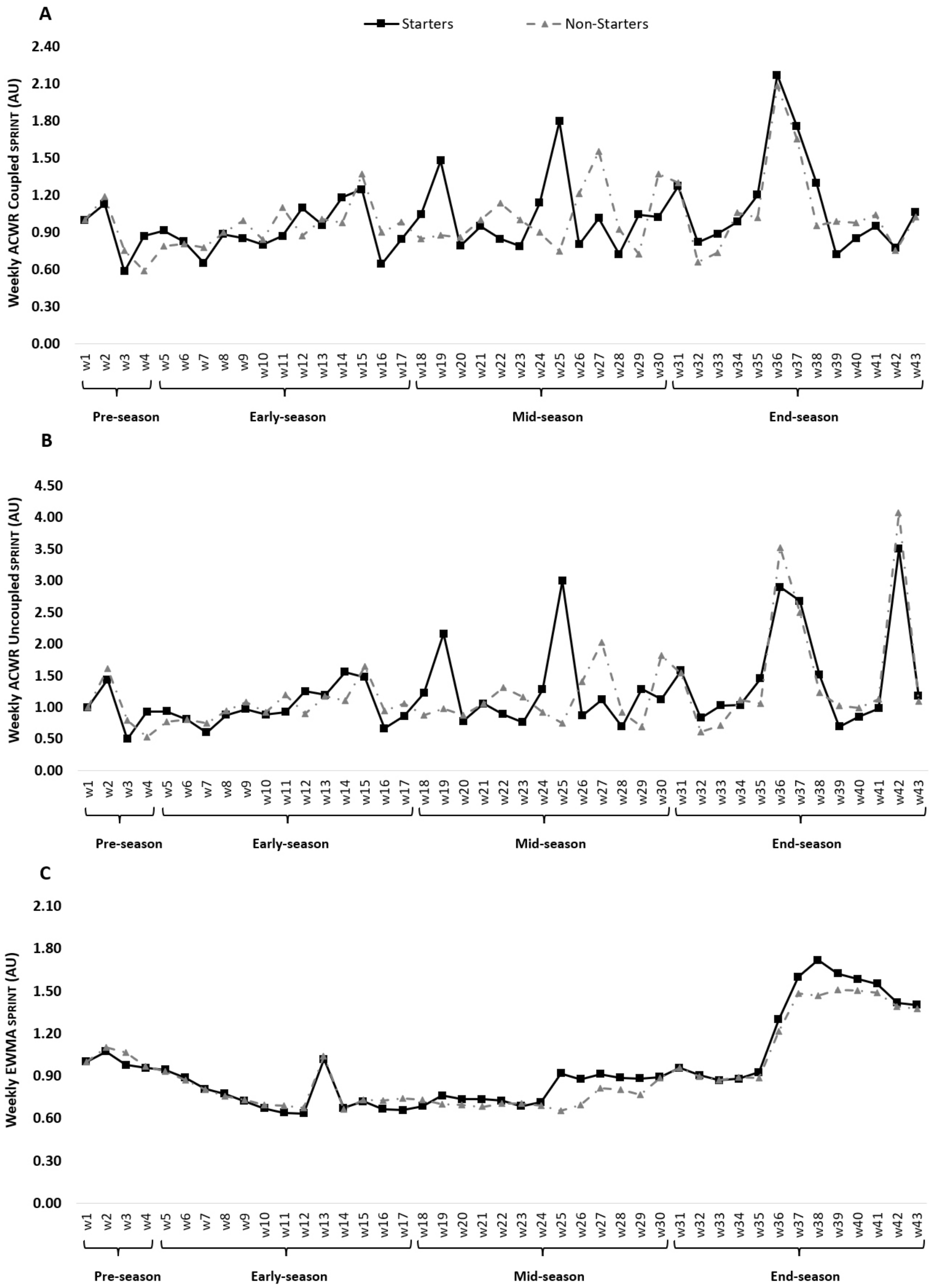

Fig. 2. ACWR coupled (A), ACWR uncoupled (B), and EWMA (C) variations calculated based on sprint distance across 43 weeks for starters and non-starters.

As soccer involves different energy systems and a combination of complex tactical/technical characteristics, there is a benefit for constant intensity monitoring particularly during training and intense competition [35]. Regularly monitoring intensity allows coaches to monitor players' progress, training trajectory, and competition status, as well as to improve the design of training regimens based on tactical demands and team needs [34,35].

According to Fig. 2, ACWR coupled, ACWR uncoupled, and EWMA values based on sprint distance were

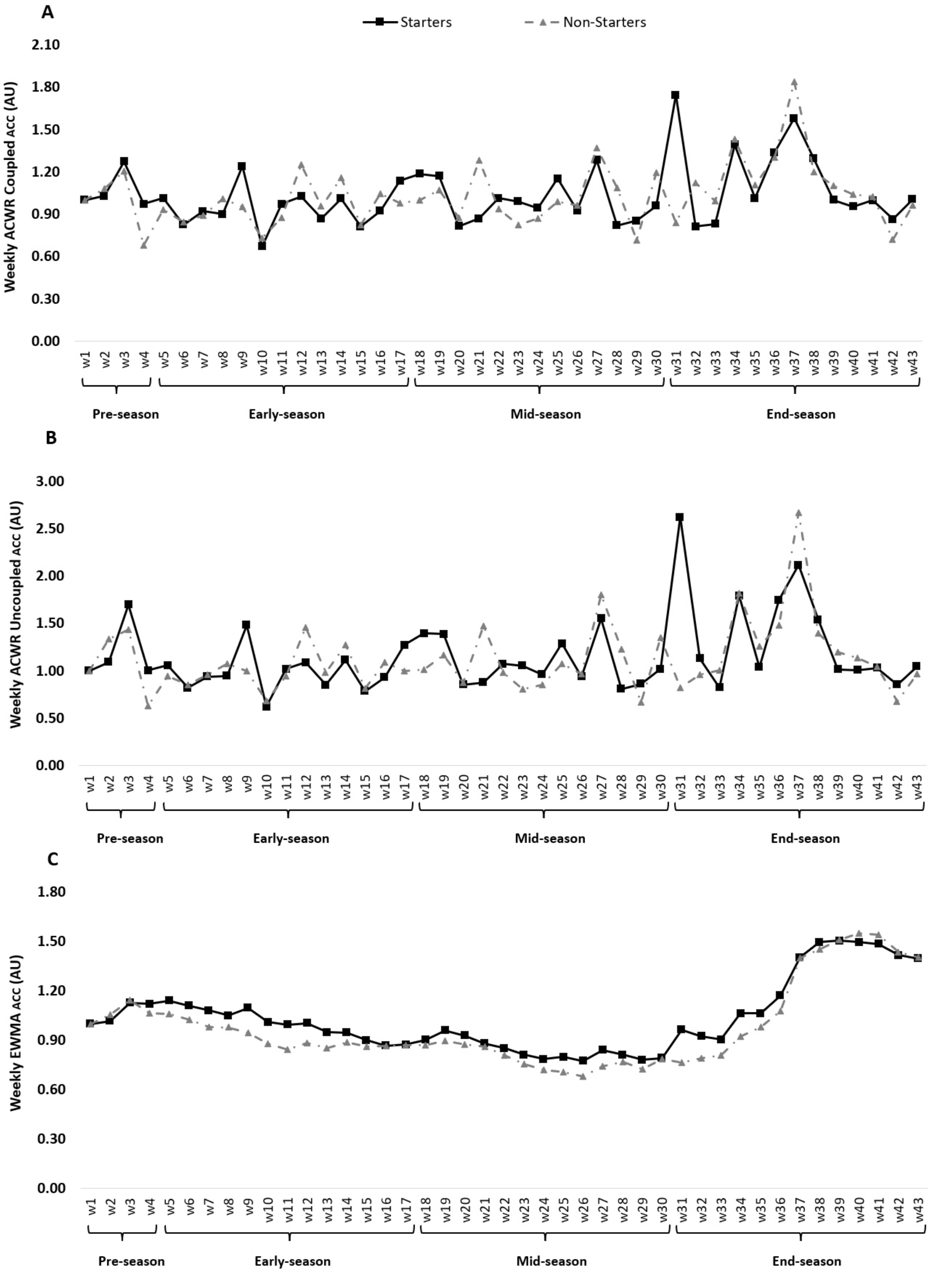

Fig. 3. ACWR coupled (A), ACWR uncoupled (B), and EWMA (C) variations calculated based on Acc across 43 weeks for starters and non-starters.

higher at the end-season after the outbreak of the COVID-19 pandemic than at any other time of the season. A probable reason for this finding is that the players experienced less fatigue, possessed high readiness after the training intensity had been reduced for two weeks; the high intensity of the exercises they experienced in the mid-season as a result of high speeds in sprints and changes or duration of ball possession may have played a role [36].

Considering the effect sizes and significance levels shown in Table 2, EWMA in TD throughout the season showed a significantly higher value for starters than non-starters. Since the highest number of matches occurred dur-

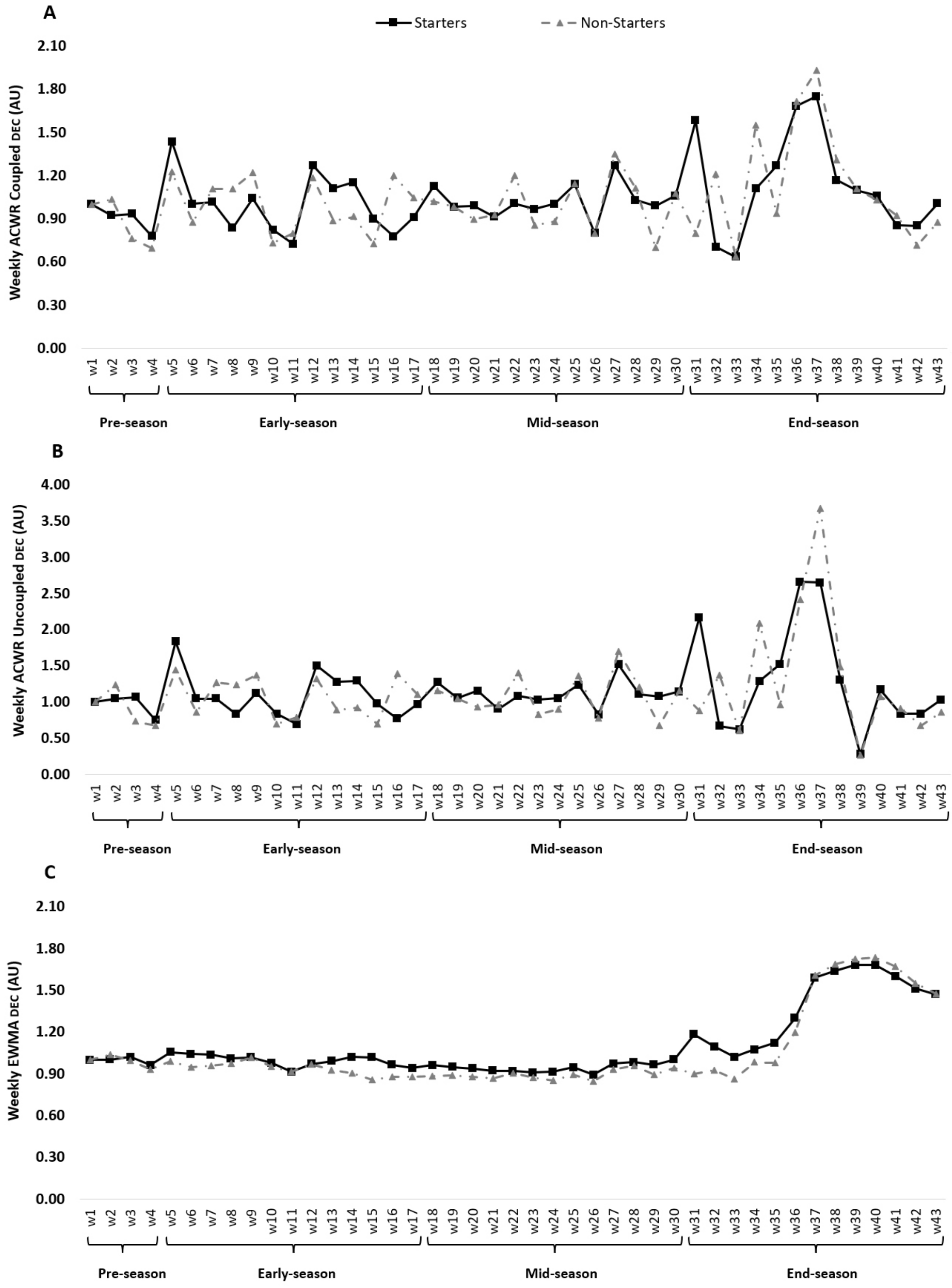

Fig. 4. ACWR coupled (A), ACWR uncoupled (B), and EWMA (C) variations calculated based on Dec across 43 weeks for starters and non-starters.

ing the mid-season, starters experienced more pressure than non-starters, which could explain this difference in TD.

According to the information in Tables 3 and 4, a weak and (in most cases) negative correlation between ACWR coupled, ACWR uncoupled, and EWMA of the parameters under consideration (TD, sprint distance, Acc, and Dec) was recorded for starters in all periods. For non-starters, a large and mostly positive correlation was recorded between the ACWR coupled, ACWR uncoupled, and EWMA values of the parameters under consideration (TD, sprint distance, Acc, and Dec) in all periods.

In a previous study, it was found that both coupled and uncoupled ACWRs produce the same likelihood of injury [37]. ACWR coupled and uncoupled should not be

Table 2. Differences between starters and non-starters during different periods of the season.

Measure	Pre-season (Mean ± SD)	Early-season (Mean ± SD)	Mid-season (Mean ± SD)	End-season (Mean ± SD)	Total-Season (Mean ± SD)
ACWR CP TD (AU), ST	0.92 ± 0.04	0.96 ± 0.02	1.00 ± 0.03	1.00 ± 0.04	0.97 ± 0.01
ACWR CP TD (AU), NST	0.89 ± 0.05	0.96 ± 0.03	0.99 ± 0.03	0.99 ± 0.04	0.96 ± 0.01
ACWR UCP TD (AU), ST	0.92 ± 0.09	0.97 ± 0.04	1.06 ± 0.04	1.07 ± 0.09	1.00 ± 0.03
ACWR UCP TD (AU), NST	0.88 ± 0.08	0.99 ± 0.03	1.08 ± 0.06	1.02 ± 0.06	0.99 ± 0.03
EWMA TD (AU), ST	0.99 ± 0.05	0.82 ± 0.72	**0.87 ± 0.05#**	0.98 ± 0.10	0.91 ± 0.06
EWMA TD (AU), NST	0.98 ± 0.03	0.78 ± 0.06	**0.79 ± 0.07**	0.96 ± 0.09	0.88 ± 0.05
ACWR CP SPRINT (AU), ST	0.89 ± 0.09	0.91 ± 0.06	1.03 ± 0.07	1.13 ± 0.09	0.99 ± 0.03
ACWR CP SPRINT (AU), NST	0.88 ± 0.09	0.94 ± 0.08	1.01 ± 0.08	1.09 ± 0.07	0.98 ± 0.03
ACWR UCP SPRINT (AU), ST	0.97 ± 0.17	1.00 ± 0.09	1.25 ± 0.19	1.47 ± 0.26	1.17 ± 0.08
ACWR UCP SPRINT (AU), NST	0.98 ± 0.28	1.02 ± 0.12	1.14 ± 0.15	1.32 ± 0.09	1.12 ± 0.08
EWMA SPRINT (AU), ST	1.00 ± 0.72	0.73 ± 0.12	0.80 ± 0.09	1.29 ± 0.08	0.95 ± 0.08
EWMA SPRINT (AU), NST	1.03 ± 0.13	0.74 ± 0.16	0.73 ± 0.16	1.23 ± 0.16	0.93 ± 0.12
ACWR CP Acc (AU), ST	1.07 ± 0.09	0.95 ± 0.04	1.01 ± 0.04	1.14 ± 0.07	1.04 ± 0.04
ACWR CP Acc (AU), NST	0.99 ± 0.12	0.96 ± 0.02	1.02 ± 0.04	1.13 ± 0.04	1.02 ± 0.03
ACWR UCP Acc (AU), ST	1.20 ± 0.24	0.99 ± 0.06	1.11 ± 0.08	1.34 ± 0.13	1.16 ± 0.07
ACWR UCP Acc (AU), NST	1.10 ± 0.27	1.00 ± 0.03	1.10 ± 0.08	1.29 ± 0.08	1.12 ± 0.07
EWMA Acc AU), ST	1.07 ± 0.07	1.00 ± 0.17	0.84 ± 0.11	1.25 ± 0.13	1.04 ± 0.07
EWMA Acc (AU), NST	1.07 ± 0.12	0.92 ± 0.15	0.79 ± 0.12	1.20 ± 0.19	0.99 ± 0.09
ACWR CP Dec (AU), ST	0.91 ± 0.17	1.00 ± 0.07	1.02 ± 0.04	1.14 ± 0.09	1.02 ± 0.04
ACWR CP Dec (AU), NST	0.87 ± 0.14	1.00 ± 0.05	0.99 ± 0.07	1.14 ± 0.07	1.00 ± 0.04
ACWR UCP Dec (AU), ST	0.96 ± 0.32	1.09 ± 0.10	1.11 ± 0.05	1.38 ± 0.18	1.14 ± 0.08
ACWR UCP Dec (AU), NST	0.91 ± 0.27	1.07 ± 0.09	1.08 ± 0.10	1.40 ± 0.18	1.12 ± 0.08
EWMA Dec (AU), ST	1.00 ± 0.15	1.00 ± 0.17	0.94 ± 0.09	1.38 ± 0.15	1.08 ± 0.09
EWMA Dec (AU), NST	0.99 ± 0.13	0.94 ± 0.25	0.89 ± 0.17	1.33 ± 0.18	1.04 ± 0.14

Significant differences between starters and non-starters are highlighted in bold ($p \leq 0.05$). Abbreviations: ACWR, acute:chronic workload ratio; EWMA, exponentially weighted moving averages; CP, coupled; UCP, uncoupled; ST, starters; NST, non-starters; TD, total distance; SPRINT, sprint distance; Acc, accelerations; Dec, decelerations; #, large effect.

Table 3. Correlation analysis between measures during the season for starters.

Measure	β0	β1	β2	β3	β4	β5	β6	β7	β8	β9	β10	β11
ACWR CP TD (β0)	1.00											
ACWR UCP TD (β1)	**0.818§**	1.00										
EWMA TD (β2)	**0.649#**	**0.669#**	1.00									
ACWR CP SPRINT (β3)	0.037	–0.329	–0.505	1.00								
ACWR UCP SPRINT (β4)	–0.147	–0.210	**–0.671#**	0.509	1.00							
EWMA SPRINT (β5)	–0.313	–0.617	**–0.679#**	**0.755§**	0.506	1.00						
ACWR CP Acc (β6)	0.217	0.169	–0.384	0.371	0.627	0.223	1.00					
ACWR UCP Acc (β7)	0.248	0.238	–0.261	0.362	0.442	0.044	**0.927£**	1.00				
EWMA Acc (β8)	–0.186	–0.179	–0.521	0.377	0.348	0.441	**0.779§**	**0.753§**	1.00			
ACWR CP Dec (β9)	0.436	0.299	0.489	0.034	–0.351	0.106	–0.005	0.001	0.093	1.00		
ACWR UCP Dec (β10)	0.548	0.532	0.492	–0.100	–0.193	0.001	0.201	0.145	0.177	**0.919£**	1.00	
EWMA Dec (β11)	0.300	0.153	0.438	0.117	–0.459	0.526	–0.155	–0.168	0.125	**0.869§**	**0.756§**	1.00

Significant correlations ($p \leq 0.05$) are highlighted in bold. Abbreviations: ACWR, acute: chronic workload ratio; EWMA, exponentially weighted moving averages; CP, coupled; UCP, uncoupled; ST, starters; NST, non-starters; TD, total distance; SPRINT, sprint distance; Acc, accelerations; Dec, decelerations; *, moderate effect; #, large effect.; §, very large effect; £, nearly perfect effect.

used separately to prescribe training intensity for players. Interpretations of ACWR information should consider factors related to each player's responses to intensity, such as their readiness, well-being, health, and fitness measures [19,32,33].

Table 4. Correlation coefficient of all measures for the non-starter's status.

Measure	β0	β1	β2	β3	β4	β5	β6	β7	β8	β9	β10	β11
ACWR CP TD (β0)	1.00											
ACWR UCP TD (β1)	**0.942£**	1.00										
EWMA TD (β2)	**0.814§**	**0.789§**	1.00									
ACWR CP SPRINT (β3)	–0.035	–0.034	0.441	1.00								
ACWR UCP SPRINT (β4)	–0.053	0.003	0.470	**0.918£**	1.00							
EWMA SPRINT (β5)	0.287	0.268	**0.756§**	**0.823§**	**0.857§**	1.00						
ACWR CP Acc (β6)	**0.698#**	0.645	**0.695#**	0.102	0..132	0.297	1.00					
ACWR UCP Acc (β7)	0.644	0.612	0.607	–0.098	–0.004	0.264	**0.865§**	1.00				
EWMA Acc (β8)	0.548	0.586	**0.785§**	0.312	0.329	0.556	**0.790§**	**0.760§**	1.00			
ACWR CP Dec (β9)	**0.673#**	0.567	**0.830§**	0.434	0.464	**0.667#**	**0.795§**	**0.758§**	**0.710**	1.00		
ACWR UCP Dec (β10)	0.426	0.382	**0.709§**	0.582	**0.682**	**0.687#**	0.605	0.503	0.572	**0.892§**	1.00	
EWMA Dec (β11)	0.510	0.426	**0.790§**	0.548	0.588	**0.781§**	**0.747§**	**0.748§**	**0.757§**	**0.949£**	**0.834§**	1.00

Correlations ($p \leq 0.05$) are highlighted in bold. Abbreviations: ACWR, acute: chronic workload ratio; EWMA, exponentially weighted moving averages; CP, coupled; UCP, uncoupled; ST, starters; NST, non-starters; TD, total distance; SPRINT, sprint distance; Acc, accelerations; Dec, decelerations; *, moderate effect; #, large effect.; §, very large effect; £, nearly perfect effect.

The present study has some limitations that need to be addressed. This study included a small sample of players from a single professional team; such a limitation is commonly reported in longitudinal studies conducted over a full professional sports season. Also, differences between playing positions were not analysed, even though in tactics and game systems, players in wing positions and wide defenders exert more effort and run more than other players [32]. Future studies should consider the amount of sleep and the quality of nutrition of players during each week to see if these factors impact the quality of training.

5. Conclusions

It seems that using ACWR coupled, ACWR uncoupled, and EWMA based on TD, sprint distance, Acc, and Dec across different periods of a professional soccer season is a useful way to monitor training and evaluate its effectiveness for different players. According to the results, starters experienced more intensity than non-starters during the end-season, but only one significant difference was found in mid-season where higher values were showed for starters in EWMA of TD. This study revealed that intensity between starters and non-starters was balanced across the season which could be an example for other coaches and future studies. It seems possible to reduce the usual pressure imposed on non-starters and create balance in the intensity imposed on starter and non-starter players for better training design and consequently use of more non-starter players across the season.

Author Contributions

Conceptualization—ADM, RO and HN; methodology—ADM, RO and HN; software—ADM, RO and HN; validation—RO and HN; formal analysis—ADM, RO; investigation—HN, RG, ADM, RDLV and RO; resources—HN, RG, ADM, RDLV and RO; data curation—ADM, RO and HN; writing—original draft preparation—HN, RG, ADM, RDLV and RO; writing—review and editing—HN, RG, ADM, RDLV and RO; visualization—ADM, RO and HN; supervision—RO and HN; project administration—HN; funding acquisition—HN. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

Players received a clear explanation of the study. Experimental procedures were approved by the Ethics Committee of the Ardabil University of Medical Sciences. The recommendations of Human Ethics in Research were followed according to the Helsinki Declaration. Written informed consent was obtained from both the players and team staff coach before beginning the investigation (IR.ARUMS.REC.1399.545).

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Conflict of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results. HN is serving as one of the Guest editors of this journal. We declare that HN had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to AT.

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