

The quantification of within week session intensity, duration and intensity distribution across a season in Australian Football using the session RPE method

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Running head: Quantification of session intensity and duration

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Abstract

Purpose: Team-sports training requires the daily manipulation of intensity, duration and frequency with pre-season focusing on meeting the demands of in-season competition and in-season on **maintaining fitness**. To provide information about daily training in Australian Football (AF), this study aimed to quantify session **intensity, duration**, and intensity distribution across **different stages of an entire** season.

Methods: Intensity (**session** Ratings of Perceived Exertion [s-RPE]; **CR-10 scale**) and duration were collected from forty-five professional male AF for every training session and game. Each s-RPE was categorized into the corresponding intensity zone; Low (<4.0 AU), Moderate (≥ 4.0 and <7.0), and High (≥ 7.0) to categorize session intensity. Linear mixed models were constructed to estimate session duration, intensity and distribution between **the** 3 pre-season and 4 in-season periods. Effects were assessed using linear mixed models, and magnitude-based inferences.

Results: The distribution of the mean session intensity across the season was 29% low-, 57% moderate- and 14% high-intensity. While 96% of games were high-intensity, 44% and 49% of skills training sessions were low- and moderate-intensity, respectively. Running had the highest proportion of high-intensity training sessions (27%). Pre-season displayed higher training session intensity (**ES = 0.29-0.91**) and duration (**ES = 0.33-1.44**), while in-season game intensity (**ES = 0.31-0.51**) and duration (**ES = 0.51-0.82**) were higher.

Conclusion: By using a cost-effective monitoring tool, this study provides information about the intensity, duration and **intensity distribution** of all training types across different phases of a season, thus allowing a greater understanding of the training and competition demands of Australian Footballers.

Keywords: Training load, periodization, team sports, ratings of perceived exertion

1 Introduction

2 Australian Football (AF) training integrates a number of training modalities into its weekly
3 cycles so as to prepare and recover sufficiently. However, accurately quantifying the session
4 intensity of varying modalities represents a challenge to practitioners, owing to the different
5 physiological and mechanical properties of each training mode, the varying technologies
6 required, **the issue of not being able to use some technologies indoors (i.e., GPS)**, the cost, and
7 the time to monitor multiple athletes within the same session. One monitoring tool that
8 circumvents some of these issues are **session** ratings of perceived exertion (**s-RPE**).
9

10 **The RPE scale was designed as a psychophysical self-report scale with varying psychometric**
11 **properties, which encompasses a psychological aspect to the level of physical exertion¹. Indeed,**
12 **it is suggested that RPE is sensory-discriminative, motivational-affective, and cognitive-**
13 **evaluative. Moreover, research suggests that RPE can be used as a measure of intensity owing**
14 **to its relationship with power, heart rate, lactate, and percent maximal oxygen uptake and**
15 **respiration rate.^{2,3} As such, the RPE method is regarded as “the single best indicator of the**
16 **degree of physical strain”¹. Given this backdrop, the RPE method can be applied to all training**
17 **modes, be easily administered, and is cost- and time-effective⁴. Existing evidence broadly**
18 **documents the intensity of training and competition in AF (using s-RPE)⁵; however, expanding**
19 **our knowledge of this important programming variable across varying phases of a season will**
20 **permit a greater understanding of the demands placed on AF athletes.**
21

22 Practitioners often multiply the **athlete’s s-RPE** by **session** duration to form a **total load score**
23 **measured in arbitrary units (AU)**, which provides information on the **total internal load** for
24 training sessions, weeks and phases (e.g., microcycles, pre-season, and in-season). Load scores
25 are monitored⁶⁻⁹ to assess fitness and fatigue over time, **which may also identify** periods where
26 athletes are exposed to an increased injury risk and/or overtraining^{9,10}. While this approach is
27 beneficial for quantifying weekly and training phase load, the specific breakdown of load is
28 unclear. As a composite measure of duration and intensity, it neglects the quantification of the
29 true intensity and duration of a given session, both of which are significant for effective training
30 program design. Furthermore, as various training modes are used in AF across varying days of
31 the week to ‘off load legs’, protect against increased running-induced injury risk, and to provide
32 additional training stimuli, it would be useful to know more about the day-to-day intensities
33 and durations AF athletes complete. Given the cost and time required to monitor multiple
34 athletes using varying technologies **and the issue of not being able to utilize GPS indoors,**
35 **obtaining just the RPE and duration of each session partially alleviates the limitations imposed**
36 **by limited human resources.¹¹ As such, it represents a simple and effective means to better**
37 **understanding the demands of all components of AF training and complements current**
38 **understanding of the weekly load distribution. Accordingly, the aim of the current study was to**
39 **quantify the session intensity, duration and intensity distribution of Australian Rules football**
40 **across various stages of a season using the s-RPE method.**
41
42

43 Methods

44 Subjects

45 Forty-five professional male AF players (mean \pm SD: age, 24.7 ± 4.3 y; height, 187.2 ± 7.5 cm;
46 body mass, 85.5 ± 8.9 kg), from the same AF club during the 2015 season participated in the
47 study. The participating athletes competed in the Australian Football League (AFL) and when
48 not selected for the AFL side, played in the Victorian Football League (VFL). All participants
49 provided written consent to participate prior to commencement of the study. The study was
50 approved by the Victoria University Human Research Ethics Committee.
51

52 Design

53 A total of 15,502 individual observations were recorded during the 2014-15 season, spanning
54 a total of 45 weeks. To consider for the effects of injury, player’s data whilst in an injured state
55 was accounted for in the analysis and subsequently excluded. The period excluded for a player

56 was deemed as the day the injury transpired to the point of return to full training with the squad.
57 Injury was classified by the senior physiotherapist of the club and recorded on the club's
58 database. **There were a total of 34 players impacted resulting in a median loss of 34 (range: 5-**
59 **145) observations to injury.** As such, a total of 14,101 individual observations remained. To
60 determine session volume, intensity and distribution across a season, we adopted a similar
61 approach to previous research⁷. The season was divided into seven blocks such that pre-season
62 was subdivided into pre-season 1 (PS1), pre-season 2 (PS2) (divided by the Christmas break),
63 and pre-season 3 (PS3). This latter period of pre-season incorporated 3 practice matches. The
64 competition phase was subdivided into four blocks; in-season 1 (IS1) and in-season 3 (IS3) -
65 each containing 10 and 11 games, respectively, which were divided by a single bye week (in-
66 season 2, (IS2)). In-season 4 (IS4) included finals period and for this season for this club
67 amounted to one week. **A schematic representation of the season overview can be seen in Figure**
68 **1.** It has been reported that there is an increase in high-intensity activity during AF finals¹²; thus,
69 we aimed to quantify the session volume and intensity of training during this period, in the
70 context of the regular home and away season. The session volume and intensity presented in
71 each block and for each mode represent the mean duration and intensity for a given session of
72 a given modality for that block. This also accounts for the slight variation in number of weeks
73 per block.

74 75 **Methodology**

76 This study adopted an approach used previously in AF in order to quantify session intensity⁵.
77 Each **individual athlete was presented with the Borg CR-10 scale¹³ and asked in isolation and**
78 **face-to-face** to rate their perceived exertion (RPE). Their RPE was recorded on a pre-made
79 collection sheet. **Timing of RPE collection has been shown to not interfere with ratings of**
80 **perceived exertion in team sport athletes¹⁴ or steady state and interval exercise.¹⁵ Therefore, for**
81 **practicality, s-RPE was collected within 10 min after cessation of training and 30 min after**
82 **cessation of competition.** All the athletes were well versed and educated in the use of the s-RPE
83 CR-10 scale. Following collection of the s-RPE, scores were divided into three separate
84 intensity zones, Low (<4.0 AU), Moderate (≥ 4.0 and <7.0), and High (≥ 7.0 -10.0), as used
85 previously in endurance cross-country skiers¹⁶, rugby league players¹⁷ and AF players⁵. Whilst
86 it should be noted that comparing modes by intensity using s-RPE has its limitations¹⁸, in team
87 sports with a squad of players up to 45, the s-RPE method is a valid, reliable, time- and cost-
88 efficient way to obtain information on each session⁴. Session duration was recorded to quantify
89 the session volume and for each seasonal block, the mean session duration for each modality
90 in each block was calculated.

91
92 Similar to previous studies in AF^{5,7}, training modes were categorized into games (all matches
93 players competed in), skills (skill focused training sessions), UB weights (upper-body gym
94 sessions), LB weights (lower-body gym sessions), 'other' (cycling, boxing, swimming, cross-
95 training) and running (conditioning focus field-based running sessions). Individual extras and
96 recovery sessions were not included in the analysis. Training intensity and duration was also
97 quantified according to day type; recovery skills day, main training day, captains run day and
98 game day. Captains run was performed the day prior to game day, whilst recovery skills was
99 performed either 24 or 48 h post-game. Main training day was classified as per Tuesday and
100 Thursdays. **Irrespective of whether participants competed in the AFL or VFL competition, their**
101 **planned weekly schedule in relation to training day type was the same.**

102 103 **Statistical Analysis**

104 Linear mixed models were constructed to estimate session volume, intensity and distribution
105 across the season. Random effects were specified to adjust for different between-player
106 standard deviations between season-phase, and also different within-player standard deviations
107 between season-phases. **Fixed effects** were included in these models to adjust for the athletes
108 injury state (un-injured or injured), playing position (**forward, midfield, defender**) and
109 **professional status** training age (**1st year, 2-3 years, 4-7 years and 8+ years**). Pairwise
110 comparisons between season-phase, playing position and training age were evaluated using the

111 Least Squares Mean test, and were further assessed using a non-clinical magnitude based
 112 inference network¹⁹. Effects were assessed using non-clinical magnitude-based inferences,
 113 using standardized **effect sizes (ES)**, classified as; ≤ 0.2 trivial, < 0.6 small, < 1.2 moderate, < 2.0
 114 large, < 4.0 very large and > 4.0 as very large²⁰. Each effect was expressed as 90% confidence
 115 limits (CL) and as probabilities that the true effect was substantially positive or negative, with
 116 effects declared clear **only** at the 75% **likelihood** level. **Statistical analyses were performed**
 117 **using R Studio statistical software (v 1.0.136)**.
 118

119

120 **Results**

121 *Overall session intensity and distribution*

122 The session intensity distribution between low, moderate and high are shown in Table 1 and
 123 Figure 1. When all sessions are pooled across the season, 29% were low-intensity, 57%
 124 moderate-intensity and 14% high-intensity. Game intensity was higher compared to all training
 125 modes (**Skills, ES = 1.43; $\pm 90\%$ CL 0.60; running, 1.02; ± 0.43 ; 'other', 1.15; ± 0.48 ; upper-**
 126 **body weights, 1.02; ± 0.43 ; lower-body weights, 1.32; ± 0.56**). Conversely, skills training
 127 intensity was lower compared to running (ES = 0.30; ± 0.13), and upper-body weights (ES =
 128 0.51; ± 0.22). Upper-body weights intensity was higher compared to lower-body weights (ES =
 129 0.48; ± 0.20), and lower compared to 'other' training (ES = 0.26; ± 0.11). Lower-body weights
 130 intensity was lower than running (ES = 0.33; ± 0.14) (Table 1).
 131

132

132 *Session intensity and duration by season period*

133 The pooled mean session intensity **and breakdown of intensity and duration** for each season
 134 block is shown in Table 2. **Pooled session intensity** during PS3 was lower compared to PS1
 135 (ES = 0.44; ± 0.19) and PS2 (ES = 0.45; ± 0.19), **but compared to in-season periods were unclear**
 136 **to trivial**. **Pooled** session intensity during PS1 was higher compared to IS1 (ES = 0.69; ± 0.29),
 137 IS2 (ES = 0.30; ± 0.12), IS3 (ES = 0.82; ± 0.34), and IS4 (ES = 0.37; ± 0.16). Similarly, PS2 was
 138 higher compared to IS1 (ES = 0.69 ± 0.29), IS2 (ES = 0.31; ± 0.13), IS3 (ES = 0.82; ± 0.35), and
 139 IS4 (ES = 0.39; ± 0.17).
 140

141

141 Game intensity in PS3 was lower compared to all in-season periods (ES = IS1 = 0.48; ± 0.20 ,
 142 IS3 = 0.51; ± 0.21 and IS4 = 0.31; ± 0.13). Similarly, game duration in PS3 was lower compared
 143 to all in-season periods (ES = IS1 = 0.80; ± 0.40 , IS3 = 0.82; ± 0.41 and IS4 = 0.51; ± 0.25).
 144

145

145 Skills intensity during PS1 was lower compared to PS2 (ES = 0.25; ± 0.10), but higher than PS3
 146 (ES = 0.31; ± 0.13), IS1 (ES = 0.52; ± 0.22), IS2 (ES = 0.29; ± 0.12), IS3 (ES = 0.54; ± 0.23), and
 147 IS4 (ES = 0.33; ± 0.14). Comparatively, PS2 was higher than PS3 (ES = 0.59; ± 0.25), IS1 (ES
 148 = 0.89; ± 0.37), IS2 (ES = 0.42; ± 0.18), IS3 (ES = 0.91; ± 0.38), and IS4 (ES = 0.48; ± 0.20).
 149 Skills duration during PS1 was higher than PS3 (ES = 0.45; ± 0.19), IS1 (ES = 0.73; ± 0.31), IS2
 150 (ES = 0.41; ± 0.17), IS3 (ES = 0.79; ± 0.33), and IS4 (ES = 0.42; ± 0.18). Likewise, PS2 was
 151 higher than PS3 (ES = 0.74; ± 0.31), IS1 (ES = 1.10; ± 0.47), IS2 (ES = 0.54; ± 0.23), IS3 (ES =
 152 1.18; ± 0.50), and IS4 (ES = 0.56; ± 0.24).
 153

154

154 Upper-body weights intensity during PS1 was higher than IS3 (ES = 0.26; ± 0.11), and PS2 was
 155 higher than IS1 and IS3 (ES = 0.24; ± 0.10 , and 0.27; ± 0.12 , respectively). In contrast, upper-
 156 body weights duration during PS3 was higher than PS1 (ES = 0.25; ± 0.11), PS2 (ES = 0.30;
 157 ± 0.12), IS1 (ES = 0.38; ± 0.16), IS2 (ES = 0.42; ± 0.18), and IS3 (ES = 0.60; ± 0.25). IS4 duration
 158 was higher than IS2 (ES = 0.35; ± 0.15) and IS3 (ES = 0.34; ± 0.14). IS2 upper-body weights
 159 duration was lower than PS1 (ES = 0.29; ± 0.12) and PS2 (ES = 0.27; ± 0.11), while IS3 was
 160 also lower than PS1 (ES = 0.33; ± 0.14) and PS2 (ES = 0.30; ± 0.12).
 161

162

162 Lower-body weights intensity during PS1 was higher than IS1 (ES = 0.90; ± 0.45), IS2 (ES =
 163 0.39; ± 0.19), IS3 (ES = 1.29; ± 0.65), and IS4 (ES = 0.63; ± 0.32). Similarly, PS2 was higher
 164 than IS1 (ES = 1.04; ± 0.52), IS2 (ES = 0.46; ± 0.23), IS3 (ES = 1.44; ± 0.72), and IS4 (ES =
 165 0.68; ± 0.34). Furthermore, lower-body weights intensity during PS3 was higher compared to

166 IS3 (ES = 0.36; ± 0.18) and IS4 (ES = 0.28; ± 0.14). Lower-body weights duration was higher
167 during PS1 than PS2 (ES = 0.38; ± 0.16), PS3 (ES = 0.27; ± 0.11), IS1 (ES = 0.30; ± 0.12), IS2
168 (ES = 0.33; ± 0.14), IS3 (ES = 0.52; ± 0.22), and IS4 (ES = 0.29; ± 0.12).

169
170 'Other' training intensity during PS1 was higher than PS2 (ES = 0.25; ± 0.10), IS1 (ES = 0.53;
171 ± 0.22), and IS3 (ES = 0.73; ± 0.31). Comparatively, PS2 'other' intensity was higher than IS1
172 (ES = 0.35; ± 0.15) and IS3 (ES = 0.53; ± 0.23). 'Other' training duration during PS1 was higher
173 than IS1 (ES = 0.85; ± 0.36) and IS3 (ES = 0.87; ± 0.37). Similarly, PS2 was higher than IS1
174 (ES = 0.74; ± 0.31) and IS3 (ES = 0.74; ± 0.31). However, PS3 was lower than PS1 (ES = 0.44;
175 ± 0.19) and PS2 (ES = 0.35; ± 0.15).

176
177 Where running intensity during PS1 was higher than PS2 (ES = 0.33; ± 0.14), PS1 and PS2
178 running intensity was together higher compared to all in-season periods (ES = 0.57-1.68). PS3
179 was higher compared to IS1 (ES = 0.37; ± 0.16), IS3 (ES = 0.52; ± 0.22) and IS4 (ES = 0.42;
180 ± 0.18) but trivial compared to IS2. Running intensity during IS2 was higher than IS3 (ES =
181 0.34; ± 0.14) and IS4 (ES = 0.25; ± 0.11). Running duration during PS1 was higher than PS2
182 (ES = 0.36; ± 0.15), IS1 (ES = 0.31; ± 0.13), IS3 (ES = 0.52; ± 0.22), and IS4 (ES = 0.29; ± 0.12).
183 IS2 running duration was higher than PS2 (ES = 0.25; ± 0.10), IS3 (ES = 0.34; ± 0.15) and IS4
184 (ES = 0.26; ± 0.11).

185
186 *Comparison of session duration and intensity by day type*

187 Overall, game day duration was longer than main training (ES = 1.32; ± 0.56), captains run (ES
188 = 1.34; ± 0.57) and recovery (ES = 1.53; ± 0.64) days, and higher intensity than main training
189 (ES = 2.48; ± 0.84), captains run (ES = 4.52; ± 1.52) and recovery (ES = 3.31; ± 1.11) days.
190 Comparatively, main training day was longer than captains run (ES = 0.43; ± 0.18) and recovery
191 (ES = 0.45; ± 0.19) days and higher intensity than captains run (ES = 1.42; ± 0.48) and recovery
192 (ES = 0.70; ± 0.23) days.

193
194

195 **Discussion**

196 The aim of the current study was to quantify the session duration, intensity and distribution of
197 AF across various phases of a season. Although the weekly demands of training and
198 competition are relatively well documented, information about the session duration and
199 intensity of AF is lacking. This study reports that only 14% of total sessions across a season are
200 rated high-intensity, 57% as moderate-intensity and 29% as low-intensity. This study also
201 reports novel data on all training modes across a season, showing that pre-season training
202 contains higher durations and intensities of skills, weights, running and 'other' training sessions,
203 while in-season, game days contribute the greatest duration and intensity of any mode type.
204 Together, these data provide a level of detail about the specific daily training practices of
205 Australian Rules Footballers across a season, which further enhances the overall appreciation
206 of the demands of Australian Football.

207

208 Training design in team sports involves the manipulation of volume, intensity and frequency,
209 and is often depicted by the stage of the season, with pre-season focused on meeting the
210 demands of in-season competition and in-season training focusing on recovery from
211 competition and maintenance of fitness levels. This study extends current knowledge of AF by
212 showing that intensity for all training modes (skills, weights, other and running) is higher during
213 pre-season than in-season. Conversely, game intensity is higher during in-season than it is
214 during pre-season. These patterns are consistent with previous data in AF⁷, where it was
215 reported that weekly training volume is higher during the pre-season, and weekly game volume
216 is higher during the in-season. Of note in the current study, skills, running and 'other' duration
217 were also higher in the pre-season (i.e., before onset of games), than any time in-season. While
218 the patterns of loading between mode types during pre-season and in-season are likely
219 unsurprising, when taken together with previous data in AF, it is apparent that load intensity
220 and volume are closely aligned. Indeed, it has been difficult to ascertain from empirical

221 evidence the difference in intensity and duration of training during the pre-season and in-season
222 phases. This study has attempted to address this gap by demonstrating that different loading
223 patterns occur between pre-season and in-season due to the manipulation of intensity and
224 duration, not just the change of one variable over the other. Indeed, when there are no games
225 (i.e., pre-season) training is maximized for intensity and volume, while during the in-season,
226 games possess the greatest intensity and volume, indicating the need for reduced training
227 intensity and an emphasis on recovery during the in-season phase.

228
229 In assessing the recovery element of training in AF, this study demonstrates that recovery skills
230 days, which are performed 24-48 h post-match, are lower intensity and duration than main
231 training days and game days. Additionally, this study shows that captains run day, sometimes
232 referred to as match day -1 in other field based sports⁸, is the lowest stimulus of the week, thus
233 potentially representing a form of taper. This is consistent with recent data in professional
234 soccer²¹, where running volume and intensity is reduced on the day prior to competition.
235 Despite these emerging data, what is currently not well understood, and therefore warranting
236 further investigation, is whether this observed reduction in volume and intensity the day before
237 competition in both the present study and previous studies results in more optimal performance.
238 Consistent with weekly loading patterns in AF⁷, whereby weekly training loads equate to
239 approximately 50% of total weekly load, this study also reports that on main training days,
240 intensity and duration is just below half of that of competition duration and intensity. This
241 possibly reflects a greater emphasis on technical and tactical training while concomitantly
242 protecting against load-induced injury. When taken together, it is becoming increasingly clear
243 that training and recovery is periodised within each micro-cycle (i.e., per week), with the belief
244 that it enhances recovery and preparation for subsequent competition.

245
246 The distribution of training intensity is an important factor to consider in relation to
247 understanding training design. It has been reported that approximately 75% of elite endurance
248 runners' training sessions are performed at 'low' intensity as determined by the CR-10 RPE
249 scale (<4 RPE), with 7% of the remaining 25% performed at moderate intensity and 18% at
250 high-intensity¹⁶. While this depicts a polarized approach to training, it may be speculated that
251 this approach is not suitable for field-based team sport athletes, due to their requirement to
252 perform repeated high-intensity intermittent running. The present study shows that AF athletes
253 perform 29% of training at low intensity, 57% at moderate intensity and 14% at high intensity.
254 This is consistent with Moreira et al.⁵, where a similar intensity distribution was observed
255 during the pre-season (26.7%, 55.2% and 18.1% at low, moderate and high intensity,
256 respectively). Other team sports, such as soccer²² and rugby league¹⁷ have also reported training
257 intensity distribution is non-polarized suggesting that compared to endurance athletes, team
258 sport athletes perform a larger percentage of training at moderate intensities. Putting this into
259 context, it is important to consider the composition of a given skills training session. Indeed, a
260 session is often made up of varying drills targeting various energetic pathways, while
261 concomitantly focusing on the individual's and teams technical and tactical requirements. As
262 such, retrospective s-RPE is limited in that it only provides a snapshot of the mean of the session.
263 Circumventing this issue, practitioners now have the capability to also monitor; the external
264 load of training through GPS allowing accurate quantification of both the intermittent nature of
265 training and specific running speeds.

266
267 In further understanding the impact of seasonal periods on training, this study also examined
268 the effect of playing finals football on training intensity. Indeed, it has been reported that AF
269 finals games have increased high-intensity running activity compared to the regular home and
270 away in-season period¹². From an applied perspective, this may also follow true for training,
271 such is the importance of finals football and the increased focus and preparation of these games.
272 Nevertheless, this study shows no difference in training intensity during finals preparation
273 compared to that of during the regular in-season periods. While the coaching philosophy on
274 training may have been a factor it also demonstrates the importance for practitioners to
275 recognize the varying training and competition demands across phases of the season.

276
277 Although this study presents novel findings, there are also some limitations that should be
278 acknowledged. Despite a dataset comprising >14,000 observations, this study is only of one
279 professional AF team during the course of a single AF season. Therefore, the observed volume,
280 intensity and distribution may only be relevant to the players and coaching philosophy of the
281 club. In addition, it is acknowledged that the only method to capture intensity was using RPE.
282 Although this method has been shown to be valid, reliable and effective to use within team
283 sports^{4,17,23}, it not only describes internal response to exercise, but it also uses the same scale to
284 quantify intensity of different training modes. This may be problematic in terms of the different
285 physiological and mechanical components of the adopted training modes. One way to possibly
286 circumvent this issue is to adopt the differential RPE (dRPE) method, which discriminates
287 between discrete sensory inputs, i.e., central and peripheral exertion signals, allowing specific
288 quantification of intensity pertaining to the legs and/or breathlessness²⁴.

289 290 **Practical applications:**

- 291 • The s-RPE method represents a time- and cost-effective approach to **quantifying**
- 292 **session intensity for** all types of training performed in Australian Football.
- 293 • **Coaches and practitioners should use a range of monitoring approaches to quantify the**
- 294 **intensity, volume and distribution of team sport athlete's training and competition so**
- 295 **to accurately determine all aspects of load, and inform future training plans.**
- 296 • Within-week training design undergoes periodization such that early in the week (i.e.,
- 297 recovery) and late in the week (i.e., day before a game) is focused towards low intensity
- 298 work and low durations, while the main training stimulus is performed in the middle
- 299 part of the week (i.e., furthest point away from competition).

300 301 **Conclusions:**

302 **This study demonstrates that intensity distribution is non-polarized in professional AF. Similar**

303 **to previous studies that show training volume in professional AF are highest in the pre-season,**

304 **this study shows that pre-season contains higher intensity of all training modes than in-season,**

305 **whereas, in-season competition is of higher intensity than any training mode type and pre-**

306 **season competition. Finally, this study shows that the during the in-season phase the middle**

307 **part of the week contains the highest intensity and duration of any training with lower intensities**

308 **and durations at the start (recovery) and end (taper) of the week - indicating weekly micro-**

309 **cycle periodization.**

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Figure 1. A schematic representation of the study overview and seasonal periods

Figure 2. The intensity distribution of all pooled training modes for the season

Table 1. Total number of observations and intensity (measured by RPE) distribution by mode type. Intensity data is shown as mean \pm SD

Table 2. Quantification of session intensity (measured by RPE) and duration (min) throughout each seasonal period for games, skills, UB weights, LB weights, running and other. Standardized differences are denoted by letters and expressed by effect size. Data is shown as mean \pm SD

Table 3. Quantification of session intensity (measured by RPE) and duration (min) by day type for games, skills, UB weights, LB weights, running and other. Standardized differences are denoted by letters and expressed by effect size. Data is shown as mean \pm SD

Table 1. Total number of observations and intensity (measured by RPE) distribution by mode type. Intensity data is shown as mean \pm SD.

Mode	RPE Intensity	# of observations	Low			Moderate			High		
			RPE Intensity	#	%	RPE Intensity	#	%	RPE Intensity	#	%
Games	9.5 \pm 0.9 ^{M-L}	926	-	0	0	6.4 \pm 0.9	41	4	9.6 \pm 0.6	885	96
Skills	4.0 \pm 2.1 ^S	5054	2.0 \pm 0.8	2246	44	5.2 \pm 1.0	2455	49	8.3 \pm 0.5	353	7
Running	5.4 \pm 2.5 ^S	1408	2.6 \pm 0.6	461	33	5.5 \pm 1.2	571	41	8.7 \pm 0.7	376	27
Other	5.4 \pm 2.2 ^S	1982	2.1 \pm 0.8	457	23	5.9 \pm 1.0	1261	64	8.4 \pm 0.6	264	13
LB weights	4.2 \pm 1.8 ^S	1787	2.3 \pm 0.7	695	39	5.4 \pm 1.0	1072	60	8.2 \pm 0.4	20	1
UB weights	5.1 \pm 1.1	2944	2.7 \pm 0.6	211	7	5.3 \pm 0.9	2703	92	8.1 \pm 0.3	30	1

Superscripts indicate small (S), moderate (M) or large (L) effects for mean RPE as follows:

Games M vs. Other, Running, and UB weights. L vs. LB weights and skills.

Skills S vs. Running and UB weights.

Running S vs. LB weights

Other S vs. UB weights

LB weights S vs. Running and UB weights

Table 2. Quantification of session intensity (measured by RPE) and duration (min) throughout each seasonal period for games, skills, UB weights, LB weights, running and other. Standardised differences are denoted by letters and expressed by effect size. Data is shown as mean \pm SD.

	Pooled		Games		Skills		UB Weights		LB Weights		Other		Running	
	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration
Pre-season 1 (PS-1)	5.8 \pm 1.8 _{S-M}	41 \pm 21 _S	-	-	5.3 \pm 1.8 ^S	63 \pm 18 _{S-M}	5.6 \pm 1.0 ^S	40 \pm 10 ^S	5.5 \pm 1.2 _{S-M-L}	24 \pm 10 ^S	6.2 \pm 2.0 _{S-M}	39 \pm 13 _M	7.2 \pm 1.9 _{S-M-L}	27 \pm 27 ^S
Pre-season 2 (PS-2)	6.1 \pm 1.9 _{S-M}	44 \pm 28 _S	-	-	5.9 \pm 2.2 ^{S-M}	72 \pm 29 _{S-M}	5.7 \pm 1.0 ^S	39 \pm 7 ^S	5.9 \pm 1.0 _{S-M-L}	20 \pm 2	5.7 \pm 2.1 _S	37 \pm 14 _M	7.8 \pm 1.5 _{M-L}	16 \pm 16
Pre-season 3 (PS-3)	4.7 \pm 2.1 _S	43 \pm 20	8.5 \pm 1.2 ^S	80 \pm 19	3.7 \pm 1.8	46 \pm 16 _{S-M}	5.3 \pm 1.1	44 \pm 6 ^S	3.4 \pm 1.4	20 \pm 5	5.6 \pm 1.7 ^S	29 \pm 16 ^S	5.9 \pm 1.8 ^S	20 \pm 16
In-season 1 (IS-1)	4.4 \pm 2.5	41 \pm 27	9.6 \pm 0.8	101 \pm 18 _M	3.2 \pm 1.7	39 \pm 16	4.9 \pm 1.1	38 \pm 9	3.5 \pm 1.5 ^S	21 \pm 10	4.0 \pm 1.9	20 \pm 8	3.9 \pm 1.6	17 \pm 16
In-season 2 (IS-2)	3.8 \pm 1.8	29 \pm 12	-	-	2.6 \pm 1.5	32 \pm 9	4.4 \pm 1.2	32 \pm 7	3.4 \pm 1.8 ^S	17 \pm 4	5.0 \pm 1.3	32 \pm 11	4.5 \pm 1.6	29 \pm 17 ^S
In-season 3 (IS-3)	4.2 \pm 2.5	38 \pm 28	9.6 \pm 0.8	100 \pm 16 _M	3.1 \pm 1.7	37 \pm 17	4.6 \pm 1.0	35 \pm 10	2.6 \pm 1.1	17 \pm 5	3.3 \pm 1.6	19 \pm 7	3.2 \pm 1.1	13 \pm 8
In-season 4 (IS-4)	4.0 \pm 2.6	40 \pm 28	10.0 \pm 0.0	103 \pm 16 _S	2.7 \pm 1.5	35 \pm 15	4.8 \pm 0.9	45 \pm 0 ^S	2.0 \pm 0.8	15 \pm 0	4.6 \pm 1.5	34 \pm 2	2.8 \pm 0.9	11 \pm 6

Superscripts indicate small (S), moderate (M) or large (L) differences between periods within mode type as follows:

Pooled intensity: PS-1 S vs. IS-2 and IS-4. PS-1 M vs. IS-1. PS-2 S vs. IS-2 and IS-4. PS-2 M vs. IS-1. PS-3 S vs. PS-1 and PS-2.

Pooled duration: PS-1 S vs. IS-3. PS-2 S vs. IS-1 and IS-3.

Games intensity: PS-3 S vs. IS-1, IS-3 and IS-4.

Games duration: PS-3 M vs. IS-1 and IS-3. PS-3 S vs IS-4.

Skills intensity: PS-1 S vs. PS-2 and PS-3, and all IS periods. PS-2 S vs. PS-3, IS-2 and IS-4. PS-2 M vs. IS-1 and IS-3.

Skills duration: PS-1 S vs. IS-2 and IS-4. PS-1 M vs. IS-1 and IS-3. PS-2 S vs. IS-2 and IS-4. PS-2 M vs. IS-1 and IS-3. PS-3 S vs. PS-1 and IS-3. PS-3 M vs PS-2.

UB Weights intensity: PS-1 S vs. IS-3. PS-2 S vs. IS-1 and IS-3.

UB Weights duration: PS-1 S vs. IS-2 and IS-3. PS-2 S vs IS-2 and IS-3. PS-3 S vs. PS-1, PS-2, IS-1 and IS-2. PS-3 M vs. IS-3. IS-4 S vs. IS-2 and IS-3.

LB Weights intensity: PS-1 S vs. IS-2. PS-1 M vs. PS-3, IS-1 and IS-4. PS-1 L vs. IS-3. PS-2 S vs IS-2. PS-2 M vs. PS-3, IS-1, and IS-4. PS-2 L vs. IS-3. IS-1 S vs. IS-3 and IS-4. IS-2 S vs. IS-3 and IS-4.

LB Weights duration: PS-1 S vs. all PS and IS periods.

Other intensity: PS-1 S vs. PS-2 and IS-1. PS-1 M vs. IS-3. PS-2 S vs. IS-1, IS-3. PS-3 S vs. IS-3.

Other duration: PS-1 M vs. IS-1, and IS-3. PS-2 M vs. IS-1, and IS-3. PS-3 S vs. PS-1 and PS-2.

Running intensity: PS-1 S vs. PS-3 and IS-2. PS-1 M vs. IS-1 and IS-4. PS-1 L vs. IS-3. PS-2 M vs. PS-3, IS-2 and IS-4. PS-2 L vs. IS-1, IS-3 and IS-4. PS-3 S vs. IS-1 and IS-3. IS-2 S vs. IS-3 and IS-4.

Running duration: PS-1 S vs PS-2, IS-1, IS-3 and IS-4. IS-2 S vs. PS-2, IS-3 and IS-4

Table 3. Quantification of session intensity (measured by RPE) and duration (min) by day type for games, skills, UB weights, LB weights, running and other. Standardised differences are denoted by letters and expressed by effect size. Data is shown as mean \pm SD

	Pooled		Games		Skills		UB Weights		LB Weights		Other		Running	
	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration	Intensity	Duration
Recovery skills day	4.0 \pm 1.9 ^M	32 \pm 14	-	-	2.5 \pm 1.3 ^S	35 \pm 13 ^S	4.9 \pm 1.1	40 \pm 10	3.7 \pm 1.8	17 \pm 6 ^S	5.0 \pm 2.2	32 \pm 13	3.8 \pm 1.6 ^S	17 \pm 14
Main training day	5.4 \pm 1.8 ^L	42 \pm 24 ^S	-	-	5.5 \pm 1.6 ^{L-VL}	64 \pm 20 ^L	5.3 \pm 1.1 ^S	38 \pm 9	4.4 \pm 1.8 ^S	21 \pm 8	6.3 \pm 1.9 ^L	38 \pm 18	6.5 \pm 2.4 ^M	18 \pm 19
Captains run day	2.4 \pm 1.4	23 \pm 10	-	-	2.1 \pm 1.0	22 \pm 9	4.6 \pm 0.9	33 \pm 8	-	-	5.1 \pm 1.9	26 \pm 12	4.8 \pm 2.4	32 \pm 24
Game day	9.5 \pm 0.9 ^{VL}	98 \pm 18 ^L	9.5 \pm 0.9	98 \pm 18	-	-	-	-	-	-	-	-	-	-

Superscripts indicate small (S), moderate (M) or large (L) differences between periods within mode type as follows:

Pooled intensity: VL vs. recovery skills day, main training day and captains run day. M vs. main training day and captains run day. L vs. captains run day.

Pooled duration: L vs. recovery skills day, main training day and captains run day. S vs. recovery skills day and captains run day.

Skills intensity: L vs. recovery skills day. VL vs captains run day. S vs. captains run day.

Skills duration: L vs. recovery skills day and captains run day. S vs. captains run day.

UB Weights intensity: S vs. captains run day and recovery skills day.

LB Weights intensity: S vs. recovery skills day.

LB Weights duration: S vs. main training day.

Other intensity: L vs. recovery skills day

Running intensity: M vs. captains run day and recovery skills day. S vs. captains run day.