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# PERCEIVED WELLNESS ASSOCIATED WITH PRACTICE AND COMPETITION IN NCAA DIVISION I FOOTBALL PLAYERS

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## ABSTRACT

The present study assessed the influence of movement demands resulting from weekly practice sessions and games, on perceived wellness measurements taken post-game (Sunday) and 48 hours pre-game (Thursday) throughout the in-season period in National Collegiate Athletic Association (NCAA) division I football players. Thirty players were monitored using GPS receivers (Catapult Innovations OptimEye S5, Melbourne, Australia) during 12 games and 24 in-season practices. Movement variables included low-intensity distance, medium-intensity distance, high-intensity distance, sprint distance, total distance, player load, and acceleration and deceleration

distance. Perceived wellness, including fatigue, soreness, sleep quality and quantity, stress, and mood, was examined using a questionnaire on a 1-5 Likert scale. Multilevel mixed linear regressions determined the differential effects of movement metrics on perceived wellness. Post-hoc tests were conducted to evaluate the pair-wise differentials of movement and significance for wellness ratings. Notable findings included significantly (p<0.05) less player load, low-intensity distance, medium-intensity distance, high-intensity distance, total distance, and acceleration and deceleration distance at all intensities, in those reporting more favorable (4-5) ratings of perceived fatigue and soreness on Sunday. Conversely, individuals reporting more favorable Sunday perceived stress ratings demonstrated significantly (p<0.05) higher player load, low-intensity and medium-intensity distance, total distance, low-intensity and mediumintensity deceleration distance, and acceleration distance at all intensities than individuals reporting less favorable (1-2) perceived stress ratings. Data from the present study provide a novel investigation of perceived wellness associated with college football practice and competition. Results support the use of wellness questionnaires for monitoring perceived wellness in NCAA division I college football players.

Key Words: GPS, Monitoring, Questionnaire, American football

1

## 2 INTRODUCTION

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American football is a full-contact team sport associated with intense physical demands, 4 characterized by frequent collisions and blunt force trauma associated with repeated 5 6 contact with opponents and the ground during blocking, tackling, and ball-carrying activities, in addition to high-speed running and frequent accelerations, decelerations, 7 and change of direction specific impacts (29,33,34). Global positioning systems (GPS) 8 technology with integrated triaxial accelerometers (IA) have provided a means of 9 guantifying the physical demands of training and competition in NCAA division I football 10 (33,34) and similar contact team sport (9,23). Recent studies (33,34) have provided 11 novel insight into the positional movement demands associated with NCAA division I 12 football, including the quantification of sprint distances and high-intensity accelerations 13 14 and decelerations, and the frequency and intensity of positional impacts and rapid changes of direction associated with competition. 15

16

The intense nature of competition in NCAA division I football necessitates the prudent programming of in-season practice loads that maintain position-specific physical demands and minimize excessive fatigue that may be associated with maladaptation and underperformance. Consequently, the judicious monitoring of the individual physiological and psychological response, commonly referred to as internal load, to exercise loads encountered in practice and competition is vital for maximizing competitive performance (1,12). Investigations in contact team sport, including
American football, have examined potential measures of an athlete's internal load,
including subjective or perceived wellness, and biochemical and neuromuscular
responses to training and competition (8,20,32), however ambiguity exists as to which
methods are most pertinent (12).

28

29 Perceived measures of wellness are efficient, inexpensive and non-invasive to the athlete (18). Additionally, wellness measures have demonstrated sensitivity to training 30 stress, exhibiting a dose-response relationship with exercise load (28), and may be 31 more efficacious than objective measures in identifying internal load (28). While 32 subjective measures have demonstrated accuracy in assessing athletes' internal 33 34 response to training and competition loads, the comprehensive nature of some forms presents substantial logistical challenges in many applied settings (31). A survey of the 35 current trends in fatigue monitoring among high-performance sport revealed 84% of the 36 respondents used subjective questionnaires, 80% of which utilized custom designed 37 forms consisting of 4-12 items (30). Based upon current practices and previous 38 39 recommendations for athlete monitoring (14), the implementation of brief, customized 40 questionnaires to quantify the internal response of individuals participating in teamsports is supported. 41

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Previous research (8,33) has provided an increased understanding of the positional 45 movement demands and the time-course of perceived recovery resulting from practice 46 and competition NCAA division I football players. Currently, the impact of GPS-derived 47 movement variables associated with practice and game demands on perceived 48 wellness during the in-season competitive period remain ambiguous. A more 49 comprehensive understanding of the perceived psychological response to the 50 movement demands of practice and competition, will provide performance staff a model 51 from which to plan post-game recovery modalities and program subsequent training 52 sessions. Further, evaluating the impact of weekly in-season practice loads on 53 54 perceived wellness will provide novel insight for coaches seeking to manage the deleterious effects of fatigue and optimize subsequent game-day performance. 55

56

The aims of the present study were to (a) assess post-game (Sunday) recovery to 57 determine which GPS-derived game day variables influence post-game perceived 58 wellness in NCAA division I football players (b) to determine which GPS-derived 59 movement variables accumulated during in-season weekly practice sessions influence 60 perceived wellness two days prior to NCAA division I football games (Thursday). We 61 hypothesized that there will be significant differences in GPS-derived movement 62 variables in NCAA division I football players who reported differential ratings of 63 perceived wellness on both Sunday and Thursday. 64

65

#### 67 **METHODS**

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# 69 EXPERIMENTAL APPROACH TO THE PROBLEM

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Two statistical models were utilized to accomplish the aims of the present study. A 71 'Sunday' model examined GPS and IA derived workloads resulting from Saturday 72 games and the subsequent perceived wellness on Sunday. The 'Thursday model' 73 examined the impact of GPS and IA derived workloads accumulated Tuesday and 74 Wednesday, on Thursday perceived wellness. Researchers examined GPS and IA 75 technology data collected from players during 24 regular season practices and 12 76 competitions completed throughout the in-season period of an NCAA division I football 77 season. Data in the present study were grouped at the individual level and included the 78 following positional observations: Wide Receiver (WR): 100 (52 Sunday, 42 Thursday), 79 Offensive Linemen (OL): 98 (51 Sunday, 47 Thursday), Running Back (RB): 70 (36 80 Sunday, 34 Thursday), Quarterback (QB): 24 (12 Sunday, 12 Thursday), Tight End 81 (TE): 69 (36 Sunday, 33 Thursday), Defensive Tackle (DT): 48 (26 Sunday, 22 82 83 Thursday), Defensive End (DE): 50 (26 Sunday, 24 Thursday), Linebacker (LB): 85 (39 Sunday, 46 Thursday), and Defensive Back (DB):112 (54 Sunday, 58 Thursday). 84 85

To assess perceived wellness associated with in-season practice and competition, a custom-designed questionnaire (Figure 1) was completed by participants every day following a game (Sunday), as well as Thursday morning prior to any physical activity. A total of 656 observations (332 Sunday and 324 Thursday) were included in the present examination. For the purposes of examining perceived wellness associated with games, only GPS and IA data where a survey was completed the following day were included in the analysis. To determine the impact of in-season weekly practice sessions on subjective markers of perceived wellness on Thursday, only movement data where an individual completed a survey on Thursday and participated in Tuesday and Wednesday practice sessions, were included for analysis.

96

#### 97 SUBJECTS

98

Thirty NCAA Division I Football Bowl Subdivision (FBS) football players (age 20.5 ± 1.1 99 years; age range 18.6 - 22.9; height  $187.8 \pm 6.2$  cm; and mass  $107.4 \pm 18.6$  kg) 100 participated in the present study. All subjects were collegiate athletes whom had been 101 selected to participate in the football program prior to the commencement of the study. 102 All participants in the present study completed an 8-week summer off-season physical 103 development training program that included a full-body strength and power training 104 105 program and specific skills and conditioning sessions designed to simulate the demands of NCAA division I college football practice. The present study comprises the statistical 106 analysis of data collected as part of the day to day student athlete monitoring and 107 testing procedures within the university's football program. Ethical approval was 108 obtained from the university's Institutional Review Board and all subjects signed an 109 institutionally approved informed consent document prior to participating in the study. 110

111

## 112 **PROCEDURES**

113

Global Positioning System Units. Positional movement data were collected from 24 in-114 season practice sessions and 12 games using commercially available microtechnology 115 116 units (OptimEye S5; Catapult Innovations, Melbourne, Australia) operating at a frequency of 10 Hz. The units included a triaxial accelerometer (IA) which operated at 117 100 Hz and assessed the frequency and magnitude of full-body acceleration (m-second 118 <sup>2</sup>) in three dimensions, namely, anterior-posterior, mediolateral, and vertical (16,22). 119 Prior to the commencement of each practice and game, GPS receivers were placed 120 outside for 15 minutes to acquire a satellite signal, after which, receivers were placed in 121 a custom designed pocket attached to the shoulder pads of the subjects. Shoulder 122 pads were custom-fit for each individual, thereby minimizing movement of the pads 123 during practice and competition. The GPS and IA receivers used in the present study 124 were positioned in the center of the upper back, slightly superior to the scapulae. 125 Subjects were outfitted with the same GPS receiver for each practice and game. 126 Following the completion of practices and games, GPS receivers were removed from 127 the shoulder pads, and subsequently downloaded to a computer for analysis utilizing 128 commercially available software (Catapult Sprint 5.1, Catapult Innovations, Melbourne, 129 Australia). Combined tri-axial accelerometer data were represented as PlayerLoad<sup>TM</sup> 130 (PL), which is a modified vector magnitude expressed as the square root of the sum of 131 the squared instantaneous rates of change in acceleration in each of the three planes 132 and divided by 100 (3). Boyd and colleagues (3) have demonstrated the laboratory 133

intra-unit (0.91-1.05 % coefficient of variation [CV]) and inter-unit (1.02-1.10 % CV) 134 reliability of PL and determined its inter-unit reliability in Australian Rules Football 135 matches (1.90% CV). Findings from other team sports including basketball, netball, and 136 Australian football have demonstrated the ability of accelerometer derived PL to 137 differentiate between competitive games, scrimmage games, practice drills, positional 138 demands, and levels of competition (2,5,24). Improvements in technology and sampling 139 methodologies have increased the accuracy of data recorded via portable GPS for 140 applied research purposes (15), and have provided a valid and reliable means of 141 assessing activity profiles in team sports (6). Previous research (6) has demonstrated 142 the validity of GPS, with GPS-derived distance measures within 5% of a criterion 143 distance, and intra-unit reliability of distance measures, within 4.5 m (90% CI: 3.5-6.6 m) 144 (6). Additionally, IA have demonstrated reliability (3) as a means of measuring physical 145 146 activity across multiple players in team sports, with strong inter-unit relationships (r=0.996-0.999) demonstrated during high-intensity contact team sport activity. 147

148

Movement Classification System. Movement profile classifications have been described 149 150 for game analysis in American football (33) and similar contact team sports (21). The classification profile utilized in the present study was selected by the researchers to 151 more accurately reflect the demands of American football (33). Each movement 152 classification was coded as one of four speeds of locomotion. Low-intensity 153 movements, such as standing, walking and jogging, were considered to be 0 - 12.9 154 km·h<sup>-1</sup>, medium-intensity movements, such as striding and running, were considered to 155 be  $13.0 - 19.3 \text{ km} \cdot h^{-1}$ , high-intensity movements, such as fast running for some 156

positional groups, and sprinting for others, were classified as  $19.4 - 25.8 \text{ km} \cdot \text{h}^{-1}$ , and sprinting movements were classified as exceeding 25.8 km · h<sup>-1</sup>. Short duration highintensity movements, or measures of acceleration and deceleration, were classified as four groups, specifically low-intensity (0 – 1.0 m·s<sup>-2</sup>), medium-intensity (1.1 – 2.0 m·s<sup>-2</sup>), high-intensity (2.1 – 3.0 m·s<sup>-2</sup>), and maximal-intensity (> 3.0 m·s<sup>-2</sup>).

162

163 Perceived Wellness. Players were instructed to complete a customized self-report wellness questionnaire utilizing a commercially available web-based application 164 (CoachMePlus, Buffalo, NY) on their smartphone device, every Sunday and Thursday 165 throughout the in-season period. No physical activity took place on Sundays, however 166 players were required to participate in medical evaluations, and were instructed to 167 complete the questionnaire prior to the commencement of the evaluations. On 168 Thursdays, players were instructed to complete questionnaires prior to the morning 169 training session. The custom designed wellness guestionnaire, based upon earlier 170 recommendations by Hooper et. al. (14) and previous implementation in Rugby League 171 (20) evaluated six subscales, including fatigue, soreness, stress, sleep quality, sleep 172 quantity, and mood, on a 1-5 Likert scale (Figure 1). Players were instructed to respond 173 as to how they were currently feeling. 174

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#### 179 STATISTICAL ANALYSES

180

The perceived wellness ratings and movement metrics selected for categorization in the present study, were used to perform two statistical models to achieve the two main aims. All models were assessed using movement metrics as the outcome variable.

Sunday Model: A series of multi-level mixed linear regressions were used to determine 185 the differential effect of specific game day movement metrics on perceived wellness 186 ratings the following day (Sunday). Categorical outcomes were used to determine less 187 favorable responses (1 and 2), neutral responses (3), and more favorable (4 and 5) 188 responses to account for the possibility of non-linear relationships with varying 189 outcomes. Each movement metric was associated with wellness ratings in each of the 190 six subscales. Following the regression analyses, post-hoc tests were conducted to 191 evaluate the pair-wise differentials of movement and their significance for each wellness 192 rating (Tables 1-2). Significance in all tests was measured at three levels; p<0.001, 193 p<0.01, and p<0.05. Adjusted predictions at the means were reported with their 194 195 respective 95% confidence intervals. All statistical analyses were performed using Stata Statistical/Data Analysis Software (Stata 14 for Windows, version 14.1; StataCorp, 196 College Station, TX, USA). 197

198

200	Thursday Model: A series of multi-level mixed linear regressions were used to
201	determine the differential cumulative effects of specific movement metrics associated
202	with Tuesday and Wednesday practice sessions on Thursday perceived wellness.
203	Categorical outcomes were used to determine less favorable responses (1 and 2),
204	neutral responses (3), and more favorable (4 and 5) responses to account for the
205	possibility of non-linear relationships with varying outcomes. Each movement metric
206	was used to examine the relationship between an individual's Thursday perceived
207	wellness rating relative to their Sunday perceived wellness rating. Following the
208	regression analyses, post-hoc tests were conducted to evaluate the pair-wise
209	differentials of each movement metric and its significance for each individual's Thursday
210	wellness rating compared to Sunday (Tables 3-6). Significance in all tests was
211	measured at three levels; p<0.001, p<0.01, and p<0.05. Adjusted predictions at the
212	means are reported with their respective 95% confidence intervals. All statistical
213	analyses were performed using Stata Statistical/Data Analysis Software (Stata 14 for
214	Windows, version 14.1; StataCorp, College Station, TX, USA).

- 215
- 216 **RESULTS**
- 217

Sunday Perceived Wellness: Significant (p<0.05) differences in PL, low-, medium-, high-</li>
intensity distance and total distance, including acceleration and deceleration distance at
all intensities resulting from competitive games on the preceding day, were
demonstrated in players who rated their level of fatigue and soreness a 1 or 2,

222	compared to those who rated it a 3, and those who rated it a 4 or 5. Significant (p<0.05)
223	differences in sprint distance were also demonstrated in those who rated fatigue a 4 or
224	5 compared to those who rated fatigue a 1 or 2 (Table 1).
225	
226	Individuals who reported a 3, 4, or 5 for perceived stress the day following competition
227	demonstrated significantly (p<0.05) greater PL, low-, medium-intensity, and total
228	distance, low- and medium-intensity deceleration distance, and medium- and high-
229	intensity-acceleration distance than those who rated perceived stress a 1 or 2 (Table 2).
230	
231	The only significant (p<0.05) findings for the subscale of sleep quality were for maximal-
232	intensity deceleration distance between those whose ratings were a 1 or 2 vs a 3, and
233	those who rated sleep quality a 1 or 2 vs. a 4 or 5 (Table 2). No significant differences
234	in movement variables were demonstrated for subscales of mood and sleep quantity.
235	
236	**Insert Tables 1 and 2 here**
237	
238	Thursday Perceived Wellness: Individuals who rated their perceived fatigue a 4 or 5 on
239	both Sunday and Thursday accumulated significantly (p<0.05) less high-intensity
240	deceleration and maximal-intensity acceleration distance on Tuesday and Wednesday
241	practices than those who rated fatigue a 1 or 2 on Sunday and improved to a 3 on

Thursday, and those who reported a 1, 2, or 3 on Sunday and improved to 4 or 5 on
Thursday (Table 3).

244

When comparing players whose rating of perceived soreness improved from Sunday to 245 Thursday, those who rated soreness a 4 or 5 on Thursday, accumulated significantly 246 (p<0.05) more PL on Tuesday and Wednesday than those who rated soreness a 3 on 247 Thursday. Individuals whose perceived soreness was a 3 on Thursday and the same or 248 higher score on Sunday achieved significantly (p<0.05) less PL than those whose 249 perceived rating of soreness was a 3 on Thursday but lower (1 or 2) on Sunday. 250 Players who rated soreness a 4 or 5 on both Sunday and Thursday had significantly 251 (p<0.05) higher cumulative PL resulting from Tuesday and Wednesday practices than 252 253 those who rated soreness a 4 or 5 on Thursday and a 1, 2, or 3 on Sunday. Significantly (p<0.05) more total-, maximal- and high-intensity acceleration and 254 deceleration distance was accumulated on Tuesday and Wednesday by those who 255 rated soreness a 4 or 5 on both Sunday and Thursday, compared to those whose rating 256 was a 3 on Thursday and the same or higher on Sunday (Table 4). 257

258

Players who rated perceived stress a 4 or 5 on both Sunday and Thursday accumulated
significantly (p<0.05) greater PL, total-, sprint- and maximal-acceleration and</li>
deceleration distance on Tuesday and Wednesday than those who rated stress a 1, 2,
or 3 on Sunday and improved to a 4 or 5 on Thursday, and those who rated stress a 3,
4, or 5 on Sunday and increased to a 3 on Thursday. Individuals who rated perceived

264	stress a 4 or 5 on both Sunday and Thursday achieved significantly (p<0.05) less total
265	distance on Tuesday and Wednesday than those whose perceived stress was a 1 or 2
266	on Thursday and the same or higher on Sunday (Table 5). Players who rated sleep
267	quality a 4 or 5 on both Sunday and Thursday accrued significantly (p<0.05) more sprint
268	distance on Tuesday and Wednesday practice sessions than those who rated sleep
269	quality a 3 on Thursday and a 1 or 2 on Sunday (Table 6).
270	
271	**Insert Tables 3-6 here**
272	
273	DISCUSSION
274	
275	The aims of the present study were to assess recovery, utilizing a custom
276	questionnaire, to determine which GPS-derived game-day variables influenced
277	perceived wellness the following day, and to determine the impact of in-season weekly
278	practice sessions on subjective markers of perceived wellness two days prior to games.
279	The results of the present study contribute novel insight into the perceived wellness
280	associated with practice and competitive loads experienced by NCAA division I college
281	football players throughout in-season period and the implementation of wellness
282	questionnaires within an applied, high-performance setting. The results confirm our
283	hypothesis that differences in perceived wellness were associated with significant
284	differences in individual movement characteristics attributed to practice and competition.
285	The most notable findings were significantly (p<0.05) less PL, low-intensity, medium-

intensity, high-intensity, and total distance, and acceleration and deceleration distance 286 at all intensities, associated with competition, in those with more favorable ratings of 287 perceived fatigue and soreness the day following games. Additionally, individuals who 288 reported more favorable perceived stress the day following competition demonstrated 289 significantly (p<0.05) greater PL, low-intensity, medium-intensity, and total distance, 290 low-intensity and medium-intensity deceleration distance, and acceleration distance at 291 292 all intensities than individuals who reported the least favorable ratings of perceived stress. Data from the present study provide an increased understanding of the impact 293 of specific game-day movement variables on post-game perceptual wellness, and 294 support the implementation of a perceived wellness questionnaire to quantify perceptual 295 recovery following NCAA division I football games. 296

297

Individuals who accrued significantly (p<0.05) less PL, running distance at all intensities, 298 and deceleration and acceleration distance at all intensities during NCAA division I 299 football games, reported more favorable ratings of perceived fatigue the day following 300 the game. Similar findings with respect to perceived soreness the day following games 301 were demonstrated by significantly (p<0.05) less PL, running distance at all intensities, 302 303 except for sprint distance, and acceleration and deceleration at all intensities in individuals who reported more favorable ratings. Individuals who reported more 304 favorable perceived stress responses the day following games demonstrated 305 306 significantly (p<0.05) greater movement demands associated with competition than those who rated perceived stress less favorably. The results of the present study 307 suggest that increased movement demands resulting from competition may be directly 308

associated with a less favorable perceived fatigue and soreness response the day
following games. The perceived stress response appears to differ from both the fatigue
and soreness response, resulting in more favorable perceived stress responses
associated with increased movement demands. These data illustrate that movement
characteristics associated with NCAA division I football games reflect individual
perceptions of fatigue, soreness, and stress, and support the integration of perceived
wellness measures as part of a comprehensive athlete monitoring program.

316

The high-intensity movement demands, and the frequency and intensity of positional 317 impacts and rapid changes of direction that characterize participation in NCAA division I 318 football games have been reported, are associated with substantial physical demands, 319 320 and may contribute to increased fatigue and soreness following games (33,34). Comparing the results of the present study with previous examinations is problematic 321 due to the paucity of similar investigations in NCAA division I football. An examination 322 by Fullagar et.al. (8) of the time course of perceptual recovery following NCAA division I 323 football games demonstrated less favorable ratings of perceived soreness and overall 324 wellness that persisted for up to four days following competition. While the results of 325 326 Fullagar et. al. (8) shed new light on perceptions of wellness associated with NCAA division I football seasons, it did not examine perceived wellness the day following 327 competition or quantify the game day movement demands associated with the wellness 328 329 response.

Similar findings of increased perceived soreness and fatigue one day following contact 331 team-sport competition have been demonstrated by researchers (20.32) who utilized a 332 questionnaire similar to the one in the present study, and reported significant (p<0.01) 333 increases in fatigue and soreness ratings one day following Rugby League competition, 334 when compared to pre-competition values. The scope of these studies, however, did 335 not include the utilization of microtechnology to assess competitive movement demands 336 to determine which GPS-derived movement variables may influence the differential 337 ratings of perceived wellness the following day. While fatigue and soreness following 338 intense team-sport competition may be expected, the present study represents a novel 339 340 investigation into which GPS-derived gameday movement variables influence perceived wellness the following day. As part of a judicious athlete monitoring program, the 341 objective quantification of external loads associated with practice and competition, 342 343 alongside a subjective quantification of the athlete's physiological and psychological response to these loads, appears prudent (12). Clear guidelines on the modification of 344 training loads in response to unfavorable perceptual responses do not exist (17), and as 345 such performance coaches should judiciously monitor the perceptual responses of 346 athletes following competition and take appropriate measures including the 347 348 implementation of recovery protocols and the modification of subsequent practice 349 session when deemed prudent.

350

In the present study, several GPS-derived variables were able to differentiate
individuals whose rating of perceptual stress was a 4 or 5 vs. a 1 or 2, and those who
rated stress a 3 vs. a 1 or 2. Data indicated more favorable perceived stress responses

with increases in game-day exercise demands. These findings are in agreement with 354 the results reported by Hartwig et. al. (13) which demonstrated an inverse relationship 355 between training volumes and perceptual stress ratings in Rugby Union players during 356 the in-season period, but are in contrast with pre-season research (4) in Australian rules 357 football which demonstrated a negative effect of increased training loads on perceived 358 stress ratings the following day. These data may indicate a directional relationship 359 between the perceptual stress response and movement demands associated with 360 intensified pre-season training camps in contact team-sport athletes, and an inverse 361 relationship for competitive games, perhaps due to psychological factors unaccounted 362 for, including self-satisfaction (13). In division I college football players, both physical 363 and psychological stress have been associated with injury occurrence (19,25), and 364 consequently, the inclusion of the stress subscale as part of the athlete wellness 365 366 monitoring program may be advantageous in decreasing the likelihood of maladaptation resulting from all sources of stress accompanying participation in division I college 367 football. 368

#### 369

The present study also investigated perceptual wellness two days prior to games to evaluate the time-course of perceived recovery and to assess the impact of in-season weekly practice sessions on subjective markers of perceived wellness preceding competition. While several significant unidirectional relationships were demonstrated between GPS-derived movement demands of competition and perceived fatigue on Sunday, similar significant unidirectional relationships were not established when examining the impact of Tuesday and Wednesday practice sessions on Thursday

perceived fatigue. Individuals who accumulated significantly (p<0.05) greater medium-377 intensity and high-intensity deceleration and medium-intensity and maximal-intensity 378 acceleration distance on Tuesday and Wednesday practice sessions experienced an 379 improvement, indicated by higher scores, in perceived fatigue on Thursday. These 380 improvements were seen in individuals who rated perceived fatigue a 1 or 2 on Sunday 381 and improved to a 3 on Thursday, and those who were a 1, 2 or 3 on Sunday and 382 improved to a 4 or 5 on Thursday, when compared to individuals who rated perceived 383 fatigue a 4 or 5 on both Sunday and Thursday. The results of Thursday assessments of 384 perceived fatigue in the present study are supported by previous research (13) in Rugby 385 386 Union players which demonstrated more favorable recovery scores in players who had the highest training and physical activity volumes during the in-season period. Data 387 from the present study suggest that individuals with more unfavorable, or lower, ratings 388 389 of perceived fatigue on Sundays are not hindered by increased practice loads on Tuesday and Wednesday, but may actually experience improvements in perceived 390 fatigue ratings on Thursday. It is also plausible to assume that individuals who 391 experienced increased perceived fatigue on Sundays following games may have 392 engaged in recovery modalities in conjunction with programmed physical activities, 393 resulting in more favorable perceived fatigue ratings on Thursday. 394

395

A lack of unidirectional findings of Thursday perceived wellness was demonstrated for the subscales of perceived soreness and stress. Individuals who rated perceived soreness a 4 or 5 on both Sunday and Thursday accumulated significantly (p<0.05) greater PL, high-intensity deceleration distance and maximal-acceleration distance in 400 Tuesday and Wednesday practice sessions than those whose soreness rating improved from Sunday to Thursday, and those whose rating was the same or became worse from 401 Sunday to Thursday. Similar to soreness, the subscale of stress demonstrated 402 significantly (p<0.05) greater PL, total, high-intensity, and sprint distance, and maximal-403 and high-intensity acceleration and deceleration distance for individuals rating perceived 404 stress a 4 or 5 on both Sunday and Thursday than those whose perceived stress 405 improved from Sunday to Thursday, and those whose rating was the same or became 406 worse from Sunday to Thursday. Limited research (8) in NCAA division I college 407 football players makes comparison of the present study with previous investigations 408 409 problematic. It is unclear whether differences in practice loads in the present study were responsible for improvements demonstrated in some wellness subscales, or if 410 other factors including days until competition and under-reporting unfavorable 411 412 responses (7) in attempt to appear better or more well-adjusted, played a role. An examination (10) of in-season perceptual wellness in Australian football players has 413 indicated that days-to-game was a significant coefficient for wellness. Similar results 414 have been demonstrated in Rugby League players (20) with shorter micro-cycles 415 between competition being associated with improved wellness, suggesting that players' 416 perception of wellness is related to days-to-game. Psychological factors, including 417 418 motivation and focus of an athlete on the impending game, may override negative physiological symptoms, resulting in players perceiving themselves as recovered and 419 physically prepared for competition (11). The possibility of these results being 420 confounded via conscious bias associated with Thursday questionnaires cannot be 421 422 underestimated. This is often the result of an individual responding in a socially

desirable manner, typically over-reporting positive responses and under-reporting 423 negative or unfavorable responses (27). In a college football player, this may manifest 424 as overrating wellness on Thursday in attempt present their physical state more 425 favorably to the coaching staff, despite possible negative physical symptoms associated 426 with the cumulative loading of the Tuesday and Wednesday practice sessions. It is 427 plausible that these factors may have contributed to the lack of unidirectional findings 428 associated with the Thursday questionnaires, however similar investigations have not 429 been undertaken in NCAA division I college football players. 430

431

The results of the present study provide novel insight to the physical and psychological 432 responses associated with participation in NCAA division I football games and in-433 434 season practice sessions. Significant differences in volumes and intensities of GPS and IA movement variables were reported in athletes who responded more or less favorably 435 on perceived wellness measures. The use of a customized wellness questionnaire may 436 provide sport and performance coaches with an improved understanding of the 437 individual response to practice and competition, and contribute to the design of training 438 439 and recovery protocols to enhance subsequent competitive performance. The ease of 440 administration and cost effectiveness associated with individual athlete monitoring via wellness questionnaires, permits football teams, at every level, to implement these 441 strategies throughout the in-season period. 442

444	Future studies should examine how coaches seeking to enhance competitive
445	performance, can manipulate individual and position-specific practice volumes and
446	intensities to mitigate fatigue, enhance recovery, and optimize subsequent competitive
447	performance. Although it was beyond the scope of the present study, future
448	investigations should also examine the impact of perceived wellness ratings on
449	competitive performance and injury risk in NCAA division I football players.

450

## 451 **PRACTICAL APPLICATIONS**

452

The present study provided a novel analysis of the physiological and psychological 453 response to competitive movement demands and training loads associated with in-454 season weekly practice sessions. Results support the implementation of a 455 questionnaire consisting of 4 subscales, including fatigue, soreness, stress, and sleep 456 quality. A Likert scale with five response choices, or alternatively, having individuals 457 compare their current well-being to normal (worse than normal, normal, better than 458 normal) offering three response choices, similar to the DALDA (26) may be employed. 459 460 Consideration as to the number of questions and potential responses which ease the time burden on the athlete, while simultaneously obtaining valuable data, is critically 461 important. 462

463

Due to weekly competition associated with an NCAA football season, performance 465 coaches should monitor individual perceived wellness on a weekly basis. Recovery 466 modalities should be implemented for individuals reporting less than favorable ratings of 467 fatigue and soreness one day following games. Additionally, an assessment of 468 perceived wellness should be undertaken within 48 hours prior to subsequent 469 competition, to examine the impact of weekly practice sessions on the well-being of 470 college football players. Results of the present study do not support practice load 471 reductions on Tuesday and Wednesday in attempts to improve well-being on Thursday, 472 even for players who reported less than favorable ratings of wellness on Sunday. 473 474 However, coaches should evaluate individual wellness scores prior to games, and initiate communication with athletes who report unfavorable wellness scores on 475 Thursdays. Interpersonal communication conveys a sense of concern for the player, 476 477 ensuring the athlete that wellness scores are being monitored and their input is meaningful, and provides coaches increased information from which to program training 478 loads and recovery modalities for individuals who report less than favorable wellness 479 ratings on Thursdays. Minimizing the deleterious effects of fatigue while simultaneously 480 improving the position-specific technical, tactical, and physical demands associated with 481 athlete preparation in division I college football players requires a collaborative effort 482 between members of the coaching staff, medical staff, performance staff, and most 483 importantly, the athletes themselves. The ease of administration, cost-effectiveness, 484 and the minimal time investment required to collect perceived wellness data, makes it a 485 practical tool for monitoring team sport athletes. 486

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489

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- 493 Association.

494

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# Table 1. Sunday Ratings of Perceived Fatigue and Soreness: Line 1: Adjusted Predictions at the Means

Line 2: Lower and Upper limits of 95% Confidence Interval

<sup>A</sup> Significantly different (p < 0.05) for 1 or 2. <sup>B</sup>Significantly different (p < 0.05) for 3.

	Per	ceived Fatigue	Perceived Soreness			
Movement Variables	1 or 2	3	4 or 5	1 or 2	3	4 or 5
Total Distance	3839.6	3554.9 <sup>A</sup>	3114.1 <sup>AB</sup>	3817.9	3441.1 <sup>A</sup>	3064.7 <sup>AB</sup>
	(3686.1, 3993.1)	(3426.2, 3683.5)	(2816.2, 3412.0)	(3694.1, 3941.8)	(3426.2, 3683.5)	(2816.2, 3412.0)
Low-Intensity	3221.4	2988.8 <sup>A</sup>	2665.2 <sup>AB</sup>	3201.6	2908.5 <sup>A</sup>	2594.2 <sup>AB</sup>
Distance	(3103.5, 3339.3)	(2890.0, 3087.6)	(2436.4, 2894.0)	(3106.7, 3296.6)	(2789.1, 3027.8)	(2333.1, 2855.4)
Medium-Intensity	391.7	361.4	293.0 <sup>AB</sup>	387.2	347.4 <sup>A</sup>	304.3 <sup>A</sup>
Distance	(364.8, 418.6)	(338.9 <i>,</i> 383.9)	(240.8, 345.2)	(365.4, 409.1)	(319.9, 374.9)	(244.1, 364.4)
High-Intensity	162.7	149.8	114.0 <sup>AB</sup>	167.2	134.2 <sup>A</sup>	115.3 <sup>A</sup>
Distance	(146.5, 178.9)	(136.2, 163.4)	(82.5, 145.5)	(154.1, 180.3)	(117.7, 150.6)	(79.3, 151.3)
Sprinting	60.2	50.8	34.5 <sup>A</sup>	58.1	46.5	44.1
Distance	(50.9, 69.5)	(42.9, 58.6)	(16.4, 52.6)	(50.5, 65.6)	(37.0, 56.1)	(23.3, 65.0)
Player Load	441.3	411.8 <sup>~</sup>	365.5 AB	441.0	398.2 ^	355.2 <sup>AB</sup>
	(425.7, 456.9)	(398.8, 424.9)	(335.2, 395.7)	(428.5, 453.5)	(382.5, 414.0)	(320.8, 389.6)
Low-Intensity	1740.5	1610.7 ^^	1395.3 <sup>7,8</sup>	1727.4	1567.7 <sup>~~</sup>	1351.7 <sup>1,0</sup>
Accel. Distance	(1668.3, 1812.7)	(1550.2, 1671.2)	(1255.1, 1535.4)	(1669.2, 1785.7)	(1494.4, 1640.9)	(1191.4, 1511.9)
Medium-Intensity	101.7	91.8 ^	73.8 <sup>Ao</sup>	100.8	87.4 <sup>A</sup>	73.9 <sup>A6</sup>
Accel. Distance	(96.1, 107.3)	(87.1, 96.5)	(63.0, 84.6)	(96.3, 105.3)	(81.7, 93.1)	(61.5, 86.4)
High-Intensity	52.4	48.2	39.5 <sup>AB</sup>	52.5	45.3 <sup>A</sup>	40.7 <sup>A</sup>
Accel. Distance	(49.4, 55.3)	(45.8, 50.7)	(33.8, 45.2)	(50.1, 54.9)	(42.3, 48.3)	(34,2, 47.3)
Max-Intensity	74.8	69.2	59.3 <sup>AB</sup>	75.2	65.0 <sup>A</sup>	61.0 <sup>A</sup>
Accel. Distance	(70.6, 78.9)	(65.7, 72.7)	(51.2, 67.3)	(71.8, 78.5)	(60.8, 69.2)	(51.8, 70.2)
Low-Intensity	1102.6	1014.5 <sup>A</sup>	879.6 <sup>AB</sup>	1093.2	984.9 <sup>A</sup>	859.2 <sup>AB</sup>
Decel. Distance	(1054.8, 1150.5)	(974.3, 1054.6)	(786.7, 972.6)	(1054.5, 1131.9)	(936.2, 1033.5)	(752.8, 965.6)
Medium-Intensity	72.5	65.6 <sup>°A</sup>	52.2 <sup>AB</sup>	72.3	61.7 <sup>A</sup>	53.0 <sup>AB</sup>
Decel. Distance	(67.9, 77.0)	(61.8, 69.4)	(43.4, 61.0)	(68.6, 76.9)	(57.1, 66.3)	(42.9, 63.1)
High-Intensity	27.4	24.5 <sup>A</sup>	19.5 <sup>AB</sup>	27.5	22.6 <sup>A</sup>	19.8 <sup>A</sup>
Decel. Distance	(25.4, 29.5)	(22.8, 26.1)	(15.6, 23.4)	(25.9, 29.1)	(20.6, 24.7)	(15.3, 24.2)
Max-Intensity	28.1	24.6 <sup>A</sup>	19.3 <sup>AB</sup>	27.9	22.7 <sup>A</sup>	20.8 <sup>A</sup>
Decel. Distance	(25.9, 30.3)	(22.7, 26.5)	(15.0, 23.7)	(26.0, 29.7)	(20.5, 25.0)	(15.8, 25.7)

# Table 2. Sunday Ratings of Perceived Stress and Sleep Quality: Line 1: Adjusted Predictions at the Means

Line 2: Lower and Upper limits of 95% Confidence Interval

<sup>A</sup> Significantly different (p < 0.05) for 1 or 2. <sup>B</sup>Significantly different (p < 0.05) for 3.

	Ре	rceived Stress	Perceived Sleep Quality			
Movement Variables	1 or 2	3	4 or 5	1 or 2	3	4 or 5
Total Distance	3314.8	3647.9 <sup>^</sup>	3729.9 <sup>A</sup>	3761.0	3628.6	3552.1
	(3055.4, 3574.3)	(3512.5, 3783.3)	(3551.3, 3908.6)	(3540.6, 3981.4)	(3443.4, 3813.7)	(3405.8, 3698.3)
Low-Intensity	2812.7	3070.1 <sup>A</sup>	3126.1 <sup>A</sup>	3160.7	3073.6	2977.9
Distance	(2613.3, 3012.1)	(2966.0, 3174.2)	(2988.8, 3263.3)	(2991.5, 3329.9)	(2931.5, 3215.8)	(2865.6, 3090.2)
Medium-Intensity	315.8	369.3 <sup>A</sup>	385.7 <sup>A</sup>	373.2	359.6	367.0
Distance	(270.8, 360.9)	(3458., 392.8)	(354.7, 416.7)	(334.9, 411.5)	(327.4, 391.8)	(341.5, 392.4)
High-Intensity	129.6	153.1	158.6	164.3	145.5	148.4
Distance	(102.4, 156.7)	(138.9, 167.3)	(139.9, 177.3)	(141.3, 187.3)	(126.2, 164.8)	(133.1, 163.6)
Sprinting	52.1	51.7	54.6	58.2	46.9	53.8
Distance	(36.5, 67.7)	(43.5, 59.8)	(43.9, 65.4)	(45.1, 71.4)	(35.9, 58.0)	(45.1, 62.5)
Player Load	380.2	419.5 <sup>A</sup>	435.7 <sup>A</sup>	432.9	415.9	413.7
	(353.9, 406.4)	(405.8, 433.2)	(417.6, 453.7)	(410.5, 455.3)	(397.0, 434.7)	(398.8, 428.6)
Low-Intensity	1510.7	1644.2	1693.9 <sup>A</sup>	1713.4	1643.4	1602.7
Accel. Distance	(1388.4, 1632.9)	(1580.4, 1708.0)	(1609.8, 1778.1)	(1609.8, 1817.0)	(1556.3, 1730.5)	(1533.9, 1671.5)
Medium-Intensity	83.4	94.9 <sup>A</sup>	97.2 <sup>™</sup>	100.1	93.3	91.2
Accel. Distance	(73.9, 92.9)	(90.0, 99.9)	(90.7, 103.7)	(92.1, 108.1)	(86.5, 100.0)	(85.9, 96.5)
High-Intensity	43.2	49.7 <sup>A</sup>	50.7 <sup>A</sup>	50.9	49.2	47.9
Accel. Distance	(38.3, 48.2)	(47.1, 52.3)	(47.2, 54.1)	(46.6, 55.1)	(45.7, 52.8)	(45.1, 50.7)
Max-Intensity	63.2	71.4 <sup>A</sup>	72.3	74.6	70.1	68.5
Accel. Distance	(56.3, 70.2)	(67.8, 75.0)	(67.5, 77.1)	(68.7, 80.5)	(65.1, 75.0)	(64.6, 72.5)
Low-Intensity	951.8	1037.2	1072.0 <sup> A</sup>	1059.2	1036.8	1023.2
Decel. Distance	(870.8, 1032.9)	(995.9, 1079.5)	(1016.2, 1127.8)	(990.3, 1128.0)	(978.9, 1094.6)	(977.5, 1068.9)
Medium-Intensity	58.8	67.8 <sup>A</sup>	69.5 <sup>^</sup>	69.9	66.8	65.6
Decel. Distance	(51.1, 66.5)	(63.8, 71.8)	(64.2, 74.8)	(63.3, 76.4)	(61.3, 72.3)	(61.3, 69.9)
High-Intensity	21.9	25.7	25.9	27.0	24.9	24.3
Decel. Distance	(18.6, 25.3)	(23.9, 27.4)	(23.5, 28.2)	(24.2, 29.9)	(22.5, 27.3)	(22.4, 26.2)
Max-Intensity	22.3	25.6	26.7	29.1	24.5 <sup>A</sup>	24.3 <sup>A</sup>
Decel. Distance	(18.5, 26.0)	(23.7, 27.6)	(24.1, 29.3)	(25.9, 32.3)	(21.8, 27.2)	(22.2, 26.4)

**Table 3. Thursday Ratings of Perceived Fatigue:** Line 1: Adjusted Cumulative Monday – Wednesday Practice Session Predictions at the Means

 Line 2: Lower and Upper limits of 95% Confidence Interval

<sup>A</sup> Significantly different (p < 0.05) for 1 or 2 that were better than Sunday. <sup>B</sup> Significantly different (p < 0.05) for 1 or 2 that were same or worse than Sunday.

<sup>c</sup> Significantly different (p < 0.05) for a 3 that were better than Sunday. <sup>b</sup> Significantly different (p < 0.05) for a 3 that were same or worse than Sunday.

<sup>E</sup> Significantly different (p < 0.05) for 4 or 5 that were better than Sunday.

Movement	1 or 2 on Thursday		3 on Thursday		4 or 5 on Thursday	
Variables	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday
Total Distance	6349.5	6479.0	6560.7	6381.4	6501.7	6194.8
Total Distance	(5521.9, 7177.0)	(6339.8, 6618.2)	(6363.8, 6757.5)	6267.2, 6495.6)	(6280.6, 6722.9)	(5846.7, 6542.8)
Low-Intensity	5071.5	5224.6	5270.6	5110.8	5207.2	5015.4
Distance	(4434.6, 5708.4)	(5117.6, 5331.6)	(5119.3, 5422.0)	(5022.9, 5198.7)	(5037.2, 5377.2)	(4747.5, 5283.3)
Medium-Intensity	844.7	816.2	840.3	823.8	848.5	761.6 <sup>EC</sup>
Distance	(697.0, 992.4)	(791.3, 841.1)	(805.1, 875.5)	(803.5, 844.2)	(809.1, 888.0)	(699.7, 823.5)
High-Intensity	370.0	356.5	376.3	367.1	371.5	334.6
Distance	(278.2, 461.8)	(341.0, 371.9)	(354.3, 398.3)	(354.5, 379.8)	(346.9, 396.1)	(296.0, 373.2)
Sprinting	73.7	71.7	74.2	75.7	80.1	74.7
Distance	(41.5, 105.9)	(66.3, 77.1)	(66.5, 81.9)	(71.3, 80.2)	(71.5, 88.7)	(60.9, 88.4)
<b>Diaver Load</b>	801.5	801.4	813.5	793.7	800.3	783.1
Player Load	(720.3, 882.6)	(787.8, 815.0)	(794.2, 832.7)	(782.5, 804.8)	(778.8, 821.9)	(749.1, 817.1)
Low-Intensity	3000.2	2988.0	3026.3	2950.0	3005.4	2833.9
Accel. Distance	(2619.9, 3380.5)	(2923.9, 3052.1)	(2935.8, 3116.8)	(2897.5, 3002.4)	(2903.8, 3107.0)	(2673.2, 2994.7)
Medium-Intensity	191.8	189.9	193.8	189.7	193.7	178.8 <sup>EC</sup>
Accel. Distance	(165.1, 218.5)	(185.3, 194.4)	(187.5, 200.1)	(186.0, 193.4)	(186.5, 200.8)	(167.6, 190.1)
High-Intensity	106.2	105.1	108.4	104.9	107.9	101.1
Accel. Distance	(91.2, 121.3)	(102.6, 107.7)	(104.8, 111.9)	(102.8, 106.9)	(103.9, 111.9)	(94.7, 107.4)
Max-Intensity	189.4	185.6	189.9	185.1	188.3	175.7 <sup>EC</sup>
Accel. Distance	(164.8, 214.0)	(181.4, 189.8)	(184.0, 195.7)	(181.7, 188.5)	(181.8, 194.9)	(165.4, 186.0)
Low-Intensity	2294.9	2271.7	2304.5	2269.4	2294.9	2172.8
Decel. Distance	(2032.6, 2557.2)	(2227.4, 2315.9)	(2242.0, 2367.0)	(2233.2, 2305.5)	(2225.0, 2364.8)	(2061.8, 2283.9)
Medium-Intensity	173.0	168.7	173.7	170.2	172.1	159.0 <sup>EC</sup>
Decel. Distance	(147.6, 198.3)	(164.4, 173.0)	(167.7, 179.7)	(166.7, 173.7)	(165.3, 178.9)	(148.4, 169.7)
High-Intensity	65.0	63.1	66.0	63.9	66.0	59.0 <sup>EC</sup>
Decel. Distance	(53.5, 59.7)	(61.1, 65.0)	(63.2, 68.7)	(62.4, 65.5)	(63.0, 69.1)	(54.1, 63.8)
Max-Intensity	48.4	47.0	49.3	46.8	48.9	44.1
Decel. Distance	(37.1, 59.7)	(45.1, 48.9)	(46.6, 52.0)	(45.2, 48.3)	(45.9, 51.9)	(39.4, 48.9)

**Table 4. Thursday Ratings of Perceived Soreness:** Line 1: Adjusted Cumulative Monday – Wednesday Practice Session Predictions at the Means

 Line 2: Lower and Upper limits of 95% Confidence Interval

<sup>A</sup> Significantly different (p < 0.05) for 1 or 2 that were better than Sunday. <sup>B</sup> Significantly different (p < 0.05) for 1 or 2 that were same or worse than Sunday.

<sup>c</sup> Significantly different (p < 0.05) for a 3 that were better than Sunday. <sup>b</sup> Significantly different (p < 0.05) for a 3 that were same or worse than Sunday.

<sup>E</sup> Significantly different (p < 0.05) for 4 or 5 that were better than Sunday.

Movement	1 or 2 on Thursday		3 on Thursday		4 or 5 on Thursday	
Variables	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday
Total Distance	6477.8	6490.1	6503.2	6299.8	6337.2	6689.4 <sup>E</sup>
Total Distance	(6211.4, 6744.3)	(6367.2, 6613.1)	(6355.5, 6651.0)	(6162.6, 6437.0)	(6101.8, 6572.7)	(6354.0, 7024.9)
Low-Intensity	5182.6	5222.7	5218.5	5065.5	5090.9	5344.6 <sup>D</sup>
Distance	(4977.1, 5388.1)	(5127.8, 5317.6)	(5104.6, 5332.5)	(4959.7, 5171.2)	(4909.4, 5272.3)	(5086.5, 5602.7)
Medium-Intensity	834.4	827.8	833.1	800.9	810.4	880.1 <sup>D</sup>
Distance	(786.7, 882.0)	(805.8, 849.8)	(806.6, 859.6)	(776.4, 825.4)	(768.3, 852.5)	(820.2, 940.0)
High-Intensity	370.1	365.7	369.8	354.1	349.9	390.7
Distance	(340.4, 399.8)	(352.0, 379.4)	(353.8, 386.3)	(338.7, 369.4)	(323.6, 376.2)	(353.2, 428.2)
Sprinting	75.1	72.6	75.9	74.6	79.6	78.6
Distance	(64.7 <i>,</i> 85.5)	(67.8, 77.4)	(70.1, 81.6)	(69.3, 80.0)	(70.3, 88.8)	(65.5, 91.7)
<b>Diaver Load</b>	803.6	805.2	808.2	782.3 <sup>св</sup>	781.5 <sup>c</sup>	829.5 <sup>de</sup>
Player Load	(777.5, 829.7)	(793.2, 817.1)	(793.9, 822.4)	(769.0, 795.6)	(758.7, 804.3)	(797.0, 861.9)
Low-Intensity	3000.7	2994.3	2996.3	2910.9	2930.7	3081.1 <sup>D</sup>
Accel. Distance	(2878.0, 3123.5)	(2937.7, 3051.0)	(2928.2, 3064.5)	(2847.7, 2974.1)	(2822.2, 3039.1)	(2926.9, 3235.3)
Medium-Intensity	191.7	191.1	192.4	185.6	188.1	201.1 <sup>D</sup>
Accel. Distance	(183.1, 200.2)	(187.1, 195.0)	(187.7, 197.2)	(181.2, 190.0)	(180.5, 195.7)	(190.3, 212.0)
High-Intensity	106.8	106.1	106.6	102.9	104.8	111.6 <sup>D</sup>
Accel. Distance	(101.9, 111.6)	(103.9, 108.3)	(104.0, 109.3)	(100.4, 105.4)	(100.5, 109.1)	(105.5, 117.7)
Max-Intensity	188.0	186.0	188.9	181.4 <sup>c</sup>	183.2	197.0 <sup>de</sup>
Accel. Distance	(180.1, 195.9)	(182.3, 189.6)	(184.5, 193.3)	(177.3, 185.4)	(176.2, 190.2)	(187.0, 207.0)
Low-Intensity	2302.0	2284.3	2295.0	2230.1	2236.0	2345.7 <sup>D</sup>
Decel. Distance	(2217.5, 2386.4)	(2245.3, 2323.3)	(2248.1, 2341.8)	(2186.7, 2273.6)	(2161.4, 2310.6)	(2239.3, 2452.1)
Medium-Intensity	172.2	170.3	172.2	165.9	166.8	179.3 <sup>D</sup>
Decel. Distance	(164.0, 180.3)	(166.5, 174.1)	(167.7, 176.7)	(161.7, 170.1)	(159.6, 174.0)	(168.9, 189.6)
High-Intensity	64.7	63.6	65.3	62.5	62.9	68.9 <sup>DE</sup>
Decel. Distance	(60.9, 68,4)	(61.9, 65.3)	(63.2, 67.3)	(60.6, 64.4)	(59.6, 66.3)	(64.2, 73.6)
Max-Intensity	47.7	47.3	48.3	45.7	47.2	51.6 <sup>D</sup>
Decel. Distance	(44.0, 51.3)	(45.6, 48.9)	(46.3, 50.3)	(43.8, 47.6)	(44.0, 50.5)	(47.0, 56.2)

 Table 5. Thursday Ratings of Perceived Stress: Line 1: Adjusted Cumulative Monday – Wednesday Practice Session Predictions at the Means

 Line 2: Lower and Upper limits of 95% Confidence Interval

<sup>A</sup> Significantly different (p < 0.05) for 1 or 2 that were better than Sunday. <sup>B</sup> Significantly different (p < 0.05) for 1 or 2 that were same or worse than Sunday.

<sup>c</sup> Significantly different (p < 0.05) for a 3 that were better than Sunday. <sup>b</sup> Significantly different (p < 0.05) for a 3 that were same or worse than Sunday.

<sup>E</sup> Significantly different (p < 0.05) for 4 or 5 that were better than Sunday.

All distance measures are represented as meters. (\*\*There were no instances of individuals reporting a 1 or 2 on Thursday that were better than Sunday)

Movement	1 or 2 on Thursday		3 on Thursday		4 or 5 on Thursday	
Variables	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday
Total Distance		6516.1	6366.4	6394.5	6215.4 <sup>в</sup>	6649.4 <sup>de</sup>
Total Distance	-	(6324.2, 6708.0)	(6114.0, 6618.8)	(6287.8, 6501.2)	(6028.8, 6402.0)	(6454.7, 6844.0)
Low-Intensity		5265.6	5092.0	5151.9	5013.2 <sup>в</sup>	5285.8 <sup>E</sup>
Distance	-	(5116.7, 5414.4)	(4896.5 <i>,</i> 5287.5)	(5069.4, 5234.5)	(4868.9, 5157.6)	(5135.2, 5436.3)
Medium-Intensity	_	812.1	831.4	809.0	758.8	882.0 <sup>bde</sup>
Distance	-	(778.1, 846.1)	(786.6, 876.2)	(790.1, 828.0)	(752.6, 819.0)	(847.3, 916.6)
<b>High-Intensity</b>		362.5	372.0	354.3	346.8	391.9 <sup>de</sup>
Distance	-	(341.2, 383.7)	(344.0, 400.0)	(342.5, 366.2)	(326.1, 367.5)	(370.3, 413.5)
Sprinting		74.2	76.4	72.4	68.9	83.5 <sup>de</sup>
Distance	-	(66.7, 81.6)	(66.5, 86.2)	(68.2, 76.6)	(61.6, 76.2)	(75.9, 91.2)
Player Load	-	797.9	794.8	795.1	780.0	820.9 <sup>de</sup>
		(779.0, 816.7)	(770.0, 819.6)	(784.7, 805.6)	(761.6, 798.3)	(801.9, 839.9)
Low-Intensity		2975.8	2949.6	2950.5	2895.4	3072.0 <sup>de</sup>
Accel. Distance	-	(2886.9, 3064.7)	(2832.9, 3066.3)	(2901.0, 3000.0)	(2809.1, 2981.7)	(2980.9, 3163.0)
Medium-Intensity		189.8	189.1	188.7	181.3	199.6 <sup>de</sup>
Accel. Distance	-	(183.7, 196.0)	(181.0, 197.2)	(185.3, 192.1)	(175.3, 187.2)	(193.3, 205.9)
<b>High-Intensity</b>		105.3	105.6	104.3	101.5	111.0 <sup>BDE</sup>
Accel. Distance	-	(101.8, 108.8)	(101.1, 110.2)	(102.4, 106.2)	(98.2, 104.9)	(107.4, 114.5)
Max-Intensity		186.3	186.9	183.7	180.5	192.6 <sup>de</sup>
Accel. Distance	-	(180.6, 192.1)	(179.4, 194.5)	(180.5, 186.9)	(175.0, 186.1)	(186.8, 198.4)
Low-Intensity	_	2267.5	2254.4	2253.5	2211.6	2360.2 <sup>de</sup>
Decel. Distance	-	(2206.6, 2328.4)	(2174.5, 2334.3)	(2219.7, 2287.4)	(2152.6, 2270.6)	(2297.7, 2422.7)
Medium-Intensity	_	169.0	171.0	167.6	162.5	179.1 <sup>BDE</sup>
Decel. Distance	-	(163.2, 174.9)	(163.4, 178.7)	(164.4, 170.9)	(156.8, 168.1)	(173.1, 185.0)
High-Intensity	_	63.3	64.2	63.1	61.4	67.6 <sup>de</sup>
Decel. Distance	-	(60.6, 65.9)	(60.6, 67.7)	(61.6, 64.6)	(58.7, 64.0)	(64.9, 70.4)
Max-Intensity	_	47.3	48.6	46.4	44.7	50.4 <sup>de</sup>
Decel. Distance	-	(44.7, 49.9)	(45.1, 52.0)	(44.9, 47.8)	(42.1, 47.2)	(47.7, 53.0)

**Table 6. Thursday Ratings of Perceived Sleep Quality:** Line 1: : Adjusted Cumulative Monday – Wednesday Practice Session Predictions at the Means

 Line 2: Lower and Upper limits of 95% Confidence Interval

<sup>A</sup> Significantly different (p < 0.05) for 1 or 2 that were better than Sunday. <sup>B</sup> Significantly different (p < 0.05) for 1 or 2 that were same or worse than Sunday.

<sup>c</sup> Significantly different (p < 0.05) for a 3 that were better than Sunday. <sup>b</sup> Significantly different (p < 0.05) for a 3 that were same or worse than Sunday.

<sup>E</sup> Significantly different (p < 0.05) for 4 or 5 that were better than Sunday.

Movement	1 or 2 on Thursday		3 on Thursday		4 or 5 on Thursday	
Variables	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday	Better than Sunday	Same or Worse than Sunday
Total Distance	6501.4	6382.6	6172.8	6429.8	6454.2	6506.0
Total Distance	(5838.1, 7164.8)	(6204.6, 6560.5)	(5878.5, 6467.2)	(6298.1, 6561.4)	(6310.7, 6597.7)	(6370.8, 6641.2)
Low-Intensity	5269.8	5123.3	4964.3	5158.4	5164.6	5248.4 <sup>c</sup>
Distance	(4759.9, 5779.8)	(4986.4, 5260.3)	(4737.9, 5910.6)	(5057.2, 5259.6)	(5054.2, 5275.1)	(5144.2, 5352.6)
Medium-Intensity	799.0	813.1	796.4	822.1	837.5	824.0
Distance	(680.0, 918.1)	(781.0, 845.1)	(743.8, 849.0)	(798.5, 845.7)	(811.8, 863.2)	(799.8, 848.2)
High-Intensity	350.6	358.7	340.3	367.1	373.3	360.2
Distance	(277.1, 424.1)	(338.9, 378.6)	(307.5, 373.1)	(352.5, 381.8)	(357.4, 389.2)	(345.2, 375.2)
Sprinting	77.3	72.9	62.5	76.0 <sup>c</sup>	74.9	76.6 <sup>c</sup>
Distance	(51.7, 102.9)	(66.0, 79.8)	(51.1, 73.8)	(70.9, 81.1)	(69.3, 80.4)	(71.3, 81.8)
Disveriand	816.1	796.3	774.9	799.8	803.5	799.4
Player Load	(750.2, 882.0)	(778.9, 813.7)	(746.1, 803.6)	(786.9, 812.6)	(789.4, 817.5)	(786.2, 812.6)
Low-Intensity	3039.9	2964.2	2865.8	2981.9	2993.4	2967.5
Accel. Distance	(2733.8, 3346.0)	(2882.3, 3046.1)	(2730.4, 3001.3)	(2921.3, 3042.4)	(2927.3, 3059.4)	(2905.3, 3029.7
Medium-Intensity	189.6	188.6	184.4	189.8	193.0	190.2
Accel. Distance	(168.1, 211.2)	(182.8, 194.3)	(174.9, 193.9)	(185.5, 194.1)	(188.3, 197.6)	(185.8, 194.6)
High-Intensity	104.6	104.5	101.4	105.8	106.5	105.9
Accel. Distance	(92.5, 116.6)	(101.3, 107.8)	(96.0, 106.8)	(103.4, 108.2)	(103.9, 109.1)	(103.4, 108.4)
Max-Intensity	184.1	184.3	179.0	186.6	187.9	185.4
Accel. Distance	(164.4, 203.9)	(179.0, 189.6)	(170.3, 187.8)	(182.7, 190.5)	(183.6, 192.2)	(181.3, 189.4)
Low-Intensity	2261.0	2263.9	2208.0	2277.9	2287.9	2271.2
Decel. Distance	(2050.4, 2471.5)	(2207.4, 2320.4)	(2114.7, 2301.3)	(2236.2, 2319.6)	(2242.3, 2333.4)	(2228.4, 2314.1)
<b>Medium-Intensity</b>	165.1	167.3	164.8	170.2	172.9	169.3
Decel. Distance	(144.8, 185,4)	(161.8, 172.8)	(155.8, 173.8)	(166.1, 174.2)	(168.5, 177.3)	(165.2, 173.5)
High-Intensity	62.5	62.8	60.7	64.5	65.6 <sup>c</sup>	63.2
Decel. Distance	(53.2, 71.8)	(60.3, 65.3)	(56.6, 64.8)	(62.7, 66.4)	(63.6, 67.6)	(61.3, 65.1)
Max-Intensity	48.1	46.9	43.4	47.4	48.4 <sup>c</sup>	47.1
Decel. Distance	(39.1, 57.1)	(44.5, 49.4)	(39.4, 47.4)	(45.6, 49.2)	(46.5, 50.4)	(45.3, 48.9)

Category	5	4	3	2	1
Fatigue	Very Fresh	Fresh	Normal	More Tired Than Normal	Always Tired
Sleep Quality	Very Restful	Good	Difficulty Falling Asleep	Restless Sleep	Cannot Sleep
General Soreness	Feeling Great	Feeling Good	Normal	Increase in Soreness / Tightness	Very Sore
Stress Levels	Very Relaxed	Relaxed	Normal	Feeling Stressed	Very Stressed
Mood	Very Positive Mood	Generally Good Mood	Less Interested in Others / Activities than Normal	Aggravated / Short Tempered	Very Annoyed / Irritable
How Many Hours Did You Sleep? (Sleep Quantity)	More Than 10 Hrs.	8-10 Hrs.	6-8 Hrs.	4-6 Hrs.	Less than 4 Hrs.