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Match workload and international travel associated with (ACL) injuries in professional women's football

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Abstract

Women's football has grown in popularity, competitiveness and professionalism, increasing the demands placed on players and their injury risk. This study aimed to identify differences in the match workload and international travel between injured and non-injured professional women's footballers. The study was conducted as an observational, retrospective, case-control study over two football seasons (2021/2022 and 2022/2023) in four top-tier European women's football leagues. Fifty-eight professional women football players (81 injuries) formed the injury group and were matched with 81 elite women football players (162 non-injuries), from the same league, to form the control group. For each injury, cumulative match workload (minutes played, appearances, days between matches, rest) and international travel (distances, time, time zones crossed) were calculated over a 28-day period preceding the injury, for both the injured players and matched controls. The injured group had a higher number of *instances of less than 5 days between matches* compared to the controls (p = 0.03, effect size = 0.3, *small*). The anterior cruciate ligament injury group made more *appearances* (p = 0.09, effect size = 0.8, *moderate*), had more *instances of less than 5 days between matches* (p = 0.09, effect size = 0.8, *moderate*) and had less *rest time* (p = 0.12, effect size = 0.8, *moderate*) than the control group. No meaningful differences were observed between the hamstring injury group and the control group. These findings underscore the importance of careful consideration when developing match fixture schedules in elite women's football, particularly concerning the number of matches scheduled in a short period. Strategies to increase rest and recovery are recommended to safeguard players against injuries.

KEYWORDS
anterior cruciate ligament, elite, female, hamstrings, prevention, rest

Highlights

- Instances of less than 5 days between matches in elite women's football were significantly higher in the injured group compared to the non-injured group.
- Elite female footballers who sustained anterior cruciate ligament (ACL) injuries made more appearances, had more instances of less than 5 days between matches and had less rest time in the 28 days prior to the injury than the non-injured players.
- Elite female footballers who sustained ACL injuries also travelled further, for longer and crossed more time zones than the non-injured players.

1 | INTRODUCTION

The professionalisation of women's football has accelerated in some parts of the world during the last decade. The number of women playing organised football has increased by 24% between 2019 and 2023 and the number of officially ranked national teams has risen from 155 to 188 (FIFA, 2023a; FIFA, 2023b). Alongside this growth in professionalisation is an increased number of competitive matches, competition introduction and expansion, and overall balance of appropriate rest and retraining within an increasingly busy international match calendar. With this growth, however, comes an increase in the physical demands on players, potentially increasing their susceptibility to injury.

A systematic review and meta-analysis of injuries in women's football by (Horan et al., 2023) reported the overall injury incidence rates of 5.63/1000 playing hours in elite women's club football and 9.28/1000 playing hours in senior women's international football. The authors reported that lower limb injuries were the most frequent injury location in both the elite club and the senior international women's football (Horan et al., 2023). Muscle and tendon injuries and joint and ligament injuries were the most frequent type of injury in elite club and senior international women's football, respectively (Horan et al., 2023). Similarly, the UEFA Women's Elite Club Injury Study found that, over four consecutive seasons of elite club football (2018/2019 to 2021/2022), hamstring injuries were the most common injury and anterior cruciate ligament (ACL) injuries the most burdensome injury (Hallen et al., 2024). These findings are not surprising, as there is a growing concern over the prevalence of hamstring and ACL injuries in elite women's football (Ekstrand et al., 2023; Sandell, 2016).

Multiple intrinsic and extrinsic factors contribute to a player's susceptibility to injury (Meeuwisse, 1994). Intrinsic factors include among others age, technique and previous injury, while extrinsic factors can include working conditions, access to facilities, playing surface, travel, or workload. Identifying and modifying these contributing factors are crucial to prevent injury and to improve player welfare and safety (Meeuwisse, 1994; Meeuwisse et al., 2007).

In an effort to address excessive workload and safeguard player welfare, FIFPRO (The Fédération Internationale des Associations de Footballeurs Professionnels) launched the Player Workload Monitoring (PWM) tool (FIFPRO, 2023). This tool is a digital platform that collects ongoing data on match schedules and player workload, focussing on three extrinsic contributing factors: match workload, rest and international travel (FIFPRO, 2023). Currently, data from 300 professional and elite women footballers, are embedded on the tool, with data being collected since the 2017–2018 season onwards (FIFPRO, 2023).

Workload, the cumulative stress athletes endure over a given period (Jiang et al., 2022), can be measured over an acute period (typically 7 days) or a chronic period (typically 28 days) (Hulin et al., 2016). Match workload is typically quantified by the number of matches or minutes played in a period (Jiang et al., 2022). In elite men's football, both an acute overload of matches (fixture congestion) (Jiang et al., 2022; Moreno-Perez et al., 2021, 2023; Page et al., 2023), and a chronic underload of minutes played (Moreno-Perez et al., 2021, 2023), have been associated with an increased susceptibility to injury. However, little is known about the relationship between match workload and injury susceptibility in elite women's football.

Therefore, the aim of this study was to determine whether there were differences in the match workload (underload and overload) and international travel between injured and non-injured women's football players over two seasons of elite competition. Furthermore, because of the prevalence of ACL and hamstring injuries in women's football, the study aimed to specifically determine whether there were differences in the match workload (underload and overload) and international travel between elite women's football players who sustained ACL injuries or hamstring injuries and non-injured matched controls, over the same two seasons of competition. The null hypothesis was that there were no differences in the chronic match workload and international travel between injured and non-injured elite women's football players.

2 | METHODS

2.1 | Design

An observational case-control study over two football seasons (2021–2022 and 2022–2023) was conducted. The study was exempt from official ethical approval according to article 2.2b of Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (Canadian Institutes of Health Research NSaERCoC and Social Sciences and Humanities Research Council of Canada, 2022) (publicly available data) and was conducted in accordance with the Declaration of Helsinki (2013).

2.2 | Participants

Participants consisted of professional women football players. The inclusion criteria were that the players:

1. Competed in one of the following four national leagues (typically characterised as elite football) during the 2021/2022 and 2022/2023 football seasons:
   a. Division 1 Feminine (France).
   b. FA Women's Super League (United Kingdom).
   c. Frauen Bundesliga (Germany).
   d. Primera División Femenina (Spain).
2. Played for their national team in the season in which their data was collected (2021/2022 and/or 2022/2023 football seasons).
3. Were embedded within the FIFPRO PWM during the 2021/2022 and 2022/2023 football seasons.

Players that were injured in either season formed the injury group. These injured players were randomly matched with two players, who did not sustain an injury over the course of the two seasons and competed in the same national league as the injured player when the injury occurred, to form the control group. A sample size calculation, based on the minutes played between an injury and non-injury group as described in a previous study (Moreno-Perez et al., 2021), indicated that 58 injury events and 116 non-injury events were required (i.e., a total sample of $n = 174$ to ensure a 1:2 case-control ratio) (Lewallen et al., 1998) to achieve a power of 80% and a level of significance of 5% (two sided) for detecting a true difference in means between the injury and non-injury groups (Dhand & Khatkar, 2014).

2.3 | Match workload

Match workload for the 2021/2022 and 2022/2023 seasons was collected from the FIFPRO PWM tool, a digital platform that tracks the match workload for professional football players around the world (https://fifpro.org/en/workload-tool/). The following match workload variables were collected:

- Number of minutes played (club domestic league, club domestic cup, club international cup, club friendlies, national team competition and national team friendlies) (min).
- Number of match appearances (club domestic league, club domestic cup, club international cup, club friendlies, national team competition, national team friendlies) (n).
- Number of match appearances in the starting eleven (club domestic league, club domestic cup, club international cup, club friendlies, national team competition, national team friendlies) (n).
- Instances as an unused substitute, defined as the number of appearances on the bench without minutes played (club domestic league, club domestic cup, club international cup, club friendlies, national team competition, national team friendlies) (n).
- Rest time, defined as the period (in hours) between the end and start of consecutive matches (hrs)
- Instances of less than 3 days between appearances (n), a match fixture congestion cycle associated with a higher risk of injury (Carling et al., 2016).
- Instances of less than 5 days between appearances (n), a match fixture congestion cycle associated with a higher risk of injury (Carling et al., 2016).
- The number of critical zone matches, defined as an instance of less than 5 days between appearances, with a minimum of 45 min played in each appearance (n).

2.4 | International travel

Data related to players' travel for their match fixtures with their national team during the 2021/2022 and 2022/2023 seasons were collected from the FIFPRO PWM tool, a digital platform that tracks the travel for international fixtures for professional football players around the world (https://fifpro.org/en/workload-tool/). The following variables were collected:

- The number of hours spent flying (min).
- The number of kilometres travelled (km).
- The number of time zones crossed (n).

2.5 | Injuries

Injury data for the 2021/2022 and 2022/2023 seasons were collected from a publicly available data source (soccerdonna.de). The injury location, type and severity were recorded according to the consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries (Fuller et al., 2006), and the football-specific extension of the International Olympic Committee consensus statement: methods for recording and reporting of epidemiological data on injury in sport 2020 (Walden et al., 2023). To verify the injury data initially collected and secure its validity, each data point was verified through club and national team press releases, social media posts by either the club, national team or player, and/or direct communication with the player.

2.6 | Procedures

For each injury, the cumulative values of both match workload and international travel variables were calculated over a 28-day period preceding the injury date. This was done to determine the chronic match workload and international travel of the injured player for each respective variable. For the control group, the chronic match workload and international travel were calculated over the same 28-day period. In cases where the injured player did not participate in a

single match during the 28-day period, the injury and matched controls were not included in the analysis.

2.7 | Statistical analysis

Descriptive statistics for the chronic match workload and international were presented as means and standard deviations and medians and interquartile ranges. In addition, injury type, location and severity were described as frequencies and percentages and injury incidence rates were presented as the number of injuries per thousand playing hours, with the number of match minutes as the denominator. For the primary aim of the study, the data was tested for normality using the Shapiro-Wilk normality test and variance using Levene's test for equality of variances. Although the data was not normally distributed, as both sample sizes were greater than $n = 50$ and there was equal variance in the match workload variables, an independent *t*-test was used to compare the chronic match workload between the injury and control groups, for each respective variable (Rasch et al., 2007; West, 2021). As there was not equal variance in the international travel variables, the Welch *t*-test was used to compare the chronic international travel between the injury and control groups, for each respective variable (West, 2021). Hedge's G effect size statistic (G) was used to determine the magnitude of the differences between the groups. G were interpreted according to Hopkins et al. (2009) as *trivial* (<0.2), *small* (0.2–0.59), *moderate* (06–1.19), *large* (1.2–1.99), *very large* (2.0–3.99) and *extremely large* (>4.0) (Hopkins et al., 2009).

For the secondary aim of the study, two separate Mann-Whitney U tests were run, the first to compare the match workload and international travel between ACL injuries and matched controls and the second to compare the match workload and international travel between hamstring injuries and matched controls. Eta-Squared (η^2) was used to determine the magnitude of the differences between the groups and interpreted according to Cohen (1988), as *trivial* (<0.01), *small* (0.01–0.059), *moderate* (0.06–0.13) and *large* (>0.13) (Cohen, 1988). SPSS (version 28.01, IBM SPSS Statistics) was used for all statistical analyses.

3 | RESULTS

3.1 | Participants

One hundred and forty-three professional women footballers met the eligibility criteria for the study. Sixty-two players were injured at least once over the course of the two seasons. Of the 62 injured players, 4 players were not embedded within the FIFPRO PWM tool during the season in which the injury occurred and were thus excluded from the study. Thereafter, 139 elite female football players were included in the study, with 58 players forming the injured group and 81 the control group. The mean age of the players was 26 years old (Table 1). Sixteen percent of the players competed in the Division 1 Féminine, 33% in the Primera División Femenina, 28% in the FA Women's Super League and 23% in the Frauen Bundesliga, in the period when the data was collected.

3.2 | Injuries

Eighty-one injuries were identified and verified across the two seasons, resulting in an injury incidence rate of 6.19 injuries per 1000 match hours. The most frequent injury locations were the knee ($n = 27$, 32%) and the thigh ($n = 24$, 29%). The most frequent types of injuries were muscle strain/rupture/tear ($n = 30$, 36%) and joint sprain/ligament tear ($n = 21$, 25%). 37 injuries (44%) resulted in an injury layoff of 29–90 days and 18 injuries (21%) resulted in a layoff of 8–28 days. Twelve injuries were ACL injuries (14%) and 19 hamstring injuries (23%), with injury incidence rates of 0.92 and 1.45 injuries per 1000 match hours, respectively.

3.3 | Match workload & international travel and injuries

A summary of the chronic match workload and international travel of the players across the seasons is shown in Table 1. There was a small and significant difference in the *instances of less than 5 days between matches* ($p = 0.03$, $G = 0.3$) between the injury group and control group. Differences between groups for all match workload and travel load variables are shown in Table 2.

3.4 | Match workload & international travel and ACL and hamstring injuries

There were moderate differences in the *appearances* ($p = 0.09$, $\eta^2 = 0.08$), *rest time* ($p = 0.09$, $\eta^2 = 0.08$), *instances of less than 5 days between matches* ($p = 0.12$, $\eta^2 = 0.08$), *distance travelled* ($p = 0.10$, $\eta^2 = 0.08$), *travel time* ($p = 0.10$, $\eta^2 = 0.08$) and *time zones crossed* ($p = 0.09$, $\eta^2 = 0.07$) between the ACL injury group and the control group. Differences between the ACL injury and control groups and hamstring injury and control groups, for all match workload and travel load variables are shown in Tables 3 and 4, respectively.

4 | DISCUSSION

The objectives of this study were twofold: (i) to determine whether there were differences in the match workload (underload and overload) and international travel between injured and non-injured elite women's football players over two competitive seasons and (ii) to compare the chronic match workload and international travel between elite players who sustained ACL injuries or hamstring muscle injuries and non-injured matched controls. *Instances of less than 5 days*

TABLE 1 Age, chronic match workload and international travel variables of all players across seasons and both seasons combined (total).

	2021–2022 (n = 72)				2022–2023 (n = 171)				Total (n = 243)			
Variables	**Mean**	**SD**	**Median**	**IQR**	**Mean**	**SD**	**Median**	**IQR**	**Mean**	**SD**	**Median**	**IQR**
Age	25	3	26	23–28	26	3	27	24–29	26	3	26	23–28
Minutes played (min)	275	171	290	144–405	317	163	307	205–441	304	167	300	252
Appearances (n)	3.6	2.1	4.0	2.0–5.0	4.0	1.9	4.0	3.0–5.0	3.9	2.0	4.0	2.0
Appearances in starting eleven (n)	3.1	1.9	3.0	2.0–4.0	3.4	1.9	3.0	2.0–5.0	3.3	1.9	3.0	3.0
Unused substitute (n)	0.1	0.3	0.0	0.0–0.0	0.4	0.7	0.0	0.0–1.0	0.3	0.7	0.0	0.0
Rest time (hrs)	586	50	576	552–624	575	46	576	552–600	579	47	576	48
Less than 3 Days between matches (n)	0.4	0.7	0.0	0.0–1.0	0.4	0.6	0.0	0.0–1.0	0.4	0.7	0.0	1.0
Less than 5 Days between matches (n)	1.8	1.9	1.0	0.0–3.0	1.8	1.7	2.0	0.0–3.0	1.8	1.8	1.0	3.0
Critical zone matches (n)	1.2	1.5	1.0	0.0–2.0	1.4	1.5	1.0	0.0–2.0	1.4	1.5	1.0	2.0
Distance travelled (km)	3826	6296	569	0–5610	3706	6486	1508	0–3280	3742	6430	1508	3533
Travel time (min)	313	487	72	0–468	310	496	152	0–315	311	494	150	333
Time zones crossed (n)	2.7	4.6	0.0	0.0–4.0	2.3	4.3	0.0	0.0–2.0	2.4	4.4	0.0	2.0

Abbreviations: IQR, interquartile range; SD, standard deviation.

TABLE 2 Differences in workload variables between injury and control groups.

	Injury (n = 81)				Control (n = 162)				Injury versus control	
Workload variables	**Mean**	**SD**	**Median**	**IQR**	**Mean**	**SD**	**Median**	**IQR**	**G**	**Interpretation**
Minutes played (min)	314	155	300	194–425	300	173	301	166–441	0.1	Trivial
Appearances (n)	4.2	1.8	4.0	3.0–6.0	3.7	2.0	4.0	2.0–5.0	0.3	Small
Appearances in starting eleven (n)	3.6	1.8	4.0	2.0–5.0	3.2	1.9	3.0	2.0–5.0	0.2	Small
Unused substitute (n)	0.3	0.5	0.0	0.0–0.0	0.3	0.7	0.0	0.0–0.0	−0.1	Trivial
Rest time (hrs)	571	43	576	528–600	528	49	576	552–624	−0.3	Small
Less than 3 days between matches (n)	0.4	0.7	0.0	0.0–1.0	0.4	0.7	0.0	0.0–1.0	0.0	Trivial
Less than 5 days between matches (n)	**2.2**	**1.8**	**2.0**	**1.0–3.5**	**1.6**	**1.8**	**1.0**	**0.0–3.0**	**0.3***	**Small**
Critical zone matches (n)	1.5	1.5	1.0	0.0–2.0	1.3	1.6	1.0	0.0–2.0	0.1	Trivial
Distance travelled (km)	3025	4554	1507	0–3435	4100	7192	1492	0–3765	−0.2	Trivial
Travel time (min)	259	356	150	0–306	337	550	150	0–345	−0.18	Trivial
Time zones crossed (n)	2.0	3.5	1.0	0.0–2.0	2.6	4.8	0.0	0.0–2.0	−0.14	Trivial

Abbreviations: G, effect size; IQR, interquartile range; SD, standard deviation.
*$p < 0.05$.

TABLE 3 Differences in workload variables between anterior cruciate ligament injury and control groups.

	Injury (n = 12)				Control (n = 24)				Injury versus control	
Workload variables	**Mean**	**SD**	**Median**	**IQR**	**Mean**	**SD**	**Median**	**IQR**	**η^2**	**Interpretation**
Minutes played (min)	366	143	350	235–505	301	194	373	75–518	0.02	Small
Appearances (n)	**4.8**	**1.7**	**5.5**	**3.0–6.0**	**3.5**	**2.1**	**4.0**	**2.0–5.0**	**0.08**	**Moderate**
Appearances in starting eleven (n)	4.3	1.7	4.5	3.0–6.0	3.2	2.1	4.0	0.5–5.0	0.05	Small
Unused substitute (n)	0.2	0.4	0.0	0.0–0.0	0.3	0.6	0.0	0.0–0.8	0.01	Small
Rest time (hrs)	**558**	**40**	**540**	**528–600**	**587**	**51**	**576**	**552–624**	**0.08**	**Moderate**
Less than 3 days between matches (n)	0.3	0.5	0.0	0.0–1.0	0.2	0.4	0.0	0.0–0.0	0.03	Small
Less than 5 days between matches (n)	**2.5**	**2.1**	**2.5**	**0.3–4.5**	**1.4**	**1.8**	**0.0**	**0.0–3.0**	**0.07**	**Moderate**
Critical zone matches (n)	2.1	2.2	1.0	0.0–4.5	1.3	1.8	0.0	0.0–3.0	0.04	Small
Distance travelled (km)	**5012**	**5651**	**3276**	**1148–7195**	**2875**	**4353**	**652**	**0–4775**	**0.08**	**Moderate**
Travel time (min)	**420**	**434**	**294**	**111–631**	**242**	**348**	**59**	**0–416**	**0.08**	**Moderate**
Time zones crossed (n)	**3.5**	**4.4**	**2.0**	**0.3–5.5**	**1.9**	**4.0**	**0.0**	**0.0–2.0**	**0.08**	**Moderate**

Abbreviations: η^2, effect size; IQR, interquartile range; SD, standard deviation.
*$p < 0.05$.

between matches were significantly higher in the injured cohort compared to the controls. Players who sustained ACL injuries made more *appearances*, *had more instances of less than 5 days between matches* and had less *rest time* in the 28 days prior to the injury than the control group. The ACL injury group also travelled further, for longer and crossed more time zones than the control group. There were no meaningful differences between the players who sustained hamstring injuries and the control group.

Instances of less than 5 days between matches were significantly higher in the injured cohort compared to controls, with most injured players playing almost twice the number of back-to-back matches compared to the controls (a mean difference of 0.8 instances (2.2–1.6) and a median of 1.0 (2.0–1.0) between the groups). This finding is similar to research accumulated over the past decade in men's football, indicating that fixture congestion is a significant contributing factor to injuries (Carling et al., 2016; Page et al., 2023). The findings also substantiate the beliefs expressed by the team physicians at the 2019 FIFA Women's World Cup, who identified reduced recovery time between matches as the most important extrinsic non-contact injury risk factor (Saltzman et al., 2023), as well as players' beliefs, with elite players voicing their concerns over the increase in match fixtures in a season (James et al., 2023). No meaningful difference

TABLE 4 Differences in workload variables between hamstring injury and control groups.

	Injury (n = 19)				Control (n = 38)				Injury versus control	
Workload variables	**Mean**	**SD**	**Median**	**IQR**	**Mean**	**SD**	**Median**	**IQR**	**η^2**	**Interpretation**
Minutes played (min)	344	145	327	208–495	388	142	405	291–495	0.02	Small
Appearances (n)	4.7	1.7	5.0	3.0–6.0	4.8	1.7	5.0	3.0–6.0	0.00	Trivial
Appearances in starting eleven (n)	4.1	1.7	4.0	3.0–6.0	4.1	1.7	4.0	3.0–5.0	0.00	Trivial
Unused substitute (n)	0.3	0.5	0.0	0.0–1.0	1.3	0.9	0.0	0.0–0.0	0.02	Small
Rest time (hrs)	558	40	552	528–600	556	41	552	528–600	0.00	Trivial
Less than 3 days between matches (n)	0.6	1.0	0.0	0.0–1.0	0.7	0.9	0.0	0.0–1.0	0.01	Small
Less than 5 days between matches (n)	2.6	1.8	2.0	1.0–4.0	2.6	2.2	2.0	0.0–4.0	0.00	Trivial
Critical zone matches (n)	1.6	1.5	2.0	0.0–3.0	1.9	1.8	1.5	0.0–3.3	0.00	Trivial
Distance travelled (km)	1280	1470	1140	0–1836	5616	10,367	1493	0–5012	0.02	Small
Travel time (min)	124	135	125	0–177	450	788	150	0–444	0.02	Small
Time zones crossed (n)	1.2	1.6	0.0	0.0–2.0	3.6	6.1	1.0	0.0–4.0	0.02	Small

Abbreviations: η^2, Effect Size; IQR, interquartile range; SD, standard deviation.

*$p < 0.05$.

was found in the total *rest time* between the groups. This may suggest that the rest days between matches play a larger role in protecting players from injury, than the total number of rest days over a 28-day period. Adequate rest and recovery strategies, therefore, may play an important role in preventing injuries, with studies recommending at least 48 h of complete rest during congested fixture schedules to ensure appropriate recovery between matches in women's football (Goulart et al., 2022).

Eleven players (8%) sustained ACL injuries, with an average injury layoff of 293 days (~10 months). The ACL injury group had more *appearances*, more *instances of less than 5 days between matches* and less *rest time* than the control group. Although our sample size was relatively small, these findings suggest that an overload of match workload may increase a player's susceptibility to ACL injuries. It also highlights the important role stakeholders in women's football play in developing an international match calendar that safeguards players as the sport continues to grow. All three international travel variables were moderately higher in the ACL injury group compared to controls. This is the first study, to our knowledge, to find a link between international travel demands and injuries in athletes (Soligard et al., 2016). Previous studies in men's rugby (Fuller et al., 2015; Schwellnus et al., 2012) and football (Fowler et al., 2015) found no evidence to suggest that extensive travel, across multiple time zones, increased injury susceptibility. However, these studies included all injuries in their analyses, where we similarly found no differences in this study. As such, further research is needed to better understand the role extensive travel might play in the susceptibility of ACL injuries. Additionally, considering the high number and severity of ACL injuries in elite women's football, it is important to implement and maintain programs like the Swedish knee control program. This program has shown to reduce the incidence of cruciate ligament injuries in women's football by 13%. Implementing such programs can significantly reduce the susceptibility of ACL injuries and promote the overall safety and well-being of elite women football players.

There were no meaningful differences in the match workload and international travel variables between the players that sustained hamstring muscle injuries and the controls. Previously, a study in elite women's football found that an acute match schedule did not cause muscle inflammation (Povoas et al., 2022), supporting our findings that an increased match workload may not increase a player's susceptibility to a hamstring muscle injury.

The use of publicly available data allowed access to an elite population, including players from multiple clubs, nations and leagues. This improves the generalisability of the findings, but also has some limitations. Specifically, regarding injury data, the accuracy of publicly available data has been questioned (Hoenig et al., 2022). To improve this, each injury data point in our study was verified and when an injury could not be verified, it was removed from the dataset. Furthermore, a portion of the verified injury data was confirmed directly by players included in the study. While this study primarily examined match workload and international travel, it is important to acknowledge that there are other factors, both intrinsic and extrinsic, that can influence a player's susceptibility to injury (Meeuwisse, 1994). These factors can include individual player characteristics, environmental factors and injury history (Smith et al., 2012). It should also be noted that the mechanism of injury was not described in this study. Therefore, some of the recorded injuries may have been caused by an inciting event rather than the result of an accumulation of load, fatigue, or other predisposing factors. Another limitation was that training data was not included in the dataset, as this data was not publicly available. Finally, due to the specific focus on ACL and hamstring injuries in the secondary aim of this study, a challenge arose in obtaining a sufficient

sample size for statistical analysis. Across the 2 seasons, a total of 12 ACL and 19 hamstring injuries were identified. Although practically this is a significant number of injuries over two seasons, statistically the sample sizes may be underpowered. However, the relatively small sample sizes should not detract from the findings of this study, as appropriate statistical analyses were used, nor discourage similar studies in the future, as more research is needed to mitigate injury risks in women's football.

5 | CONCLUSION

In summary, *instances of less than 5 days between matches* were higher in injured players. Players who sustained ACL injuries had more *appearances*, less *rest time* and travelled more extensively compared to the control group. No significant differences were found in the match workload and international travel patterns of players who sustained hamstring injuries and controls. This research underscores the need for careful consideration in developing match fixture schedules to protect players from injuries in elite women's football, and highlights the need for further research into the role of extensive travel in the susceptibility to ACL injuries in women's football. Strategies to increase rest and recovery are recommended to safeguard players.

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CONFLICT OF INTEREST STATEMENT

The authors report there were no competing interests to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, VG, upon reasonable request.

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