Article

Not peer-reviewed version

Exploring the Impact of Menstrual Cycle Phases on Agility Performance in Semiprofessional Female Soccer Players

Florent Osmani * , Maria Villar-Varela , Carlos Lago-Fuentes

Posted Date: 22 July 2025

doi: 10.20944/preprints202507.1760.v1

Keywords: Football; athletic performance; sex hormones; menstruation; follicular phase; perceptual variables

Article

Exploring the Impact of Menstrual Cycle Phases on Agility Performance in Semiprofessional Female Soccer Players

Florent Osmani [1,2,*], María Villar-Varela [1] and Carlos Lago Fuentes [1]

[1] Faculty of Health Sciences, Universidad Europea del Atlántico, 39011, Santander, Spain
[2] Universidad Internacional Iberoamericana, 24560, San Francisco de Campeche, Mexico
* Correspondence: florent.osmani@uneatlantico.es; Tel.: +34 942 24 42 44

Abstract

Background/Objectives: To analyze how the different phases of the menstrual cycle affect agility in female football players; **Methods**: 11 female football players were selected from the 3rd tier of the Spanish Football Federation (3rd RFEF) and it was conducted an agility test (T-Test) to measure agility during the three phases of the menstrual cycle: menstrual, late follicular, and mid-luteal. These phases were determined through self-report and by using ovulation test strips for luteinizing hormone detection. Perceptual variables such as sleep quality, stress, muscle pain, and fatigue, as well as the rating of perceived exertion, were also measured; **Results**: No significant differences were found between the phases of the menstrual cycle (MC) and the Agility test ($F_{(2,20)} = 1.86$; $p = 0.18$). No significant differences were found between any of the perceptual variables or RPE and the phases of the menstrual cycle ($p > 0.05$). Better results were obtained in the late follicular phase for all perceptual variables related to the wellness questionnaire; **Conclusions**: No significant differences were found regarding the influence of menstrual cycle phases on agility, although there was a slight trend of improvement in the mid-luteal phase. No significant differences were found in the perceptual variables. Both objective and perceptual variables should be taken into account for any study or training based on the menstrual cycle.

Keywords: Football; athletic performance; sex hormones; menstruation; follicular phase; perceptual variables

---

1. Introduction

Greater emphasis should be placed on studies involving women in the field of sports science, as the representation is notably low, with participation rates below 35% [1,2] It is essential to consider the complexity in women's sports as well, given the unique characteristic of women experiencing a menstrual cycle (MC) with hormonal fluctuations each month [3]. Nevertheless, the number of women engaging in sports continues to rise, with football being one of the most prominent disciplines, both at training and elite levels. Consequently, the MC emerges as a critical factor to consider, not only for athletic performance but also for training planning [4]

The MC is a physiological process of the body with different hormonal variations. This cycle spans the time between two menstrual or bleeding phases, encompassing distinct stages, and is considered normal or eumenorrheic if it lasts between 21 and 35 days [5] During this period, women undergo the different phases of the cycle: menstrual, follicular, ovulatory, and luteal. These phases are characterized by hormonal fluctuations [3] which influence the function of organs and tissues in the body, as well as energy levels, perceived exertion, mood, and various other factors that may impact athletic performance [6]

During the menstrual phase or early follicular phase (EFP), hormone levels of estrogen and progesterone are low (days 1–5 of the MC). In the late follicular phase (LFP), it has an estrogen peak

 doi:10.20944/preprints202507.1760.v1

(days 6–12 of the MC), which is often associated with an enhanced anabolic response to exercise. And in the mid-luteal phase (MLP), characterized by progesterone peaks (days 20–24 of the MC), a possible catabolic effect is observed [7–9]. These phases are therefore more likely to exhibit variations or differences in performance [9,10]

Currently, scientific literature has not identified clear evidence regarding how the phases of the MC may influence athletic performance [9]. Neither is it clear in more specific capacities such as strength, as Colenso-Semple et al. [11] comment that there is no influence, while Niering et al. [12] do observe some differences towards the LFP, while in endurance performance variables, Taylor et al. [13] also found no differences according to MC phases. Understanding how hormonal fluctuations throughout the MC can impact athletic performance is therefore essential for coaches and physical trainers, as female athletes will undergo training and competitions during the various phases of the cycle [14,15]. This knowledge is key to optimizing the training process, improving load adaptation, and implementing preventive strategies, taking into account the specific characteristics of each phase of the cycle [16].

Performance in football is influenced by numerous physical, physiological, psychological, social, technical, and tactical variables [17], making its analysis through performance indicators inherently complex [18]. So agility is defined as the ability to change body position quickly and effectively [19]. This skill is essential in football, as it enhances players' ability to move rapidly and efficiently across the field. Given that the MC is an additional variable to consider in women's sports, it may influence athletes' agility due to hormonal fluctuations [20] or alterations in muscle elasticity and tone [21], and other physical and physiological changes occurring throughout the cycle. Nowadays, it is not clear how exactly the MC phases affect the performance in football [22]. Understanding how the MC affects agility could serve as an effective tool for designing training plans aimed at improving agility, thereby enhancing performance, preventing injuries, improving directional changes, dribbling skills, and even reaction times in unexpected situations [23]

Due to the controversy, lack of knowledge, and researches regarding how the phases of the MC may influence athletic performance [1,3,9,11,12,14,24], so there is a recognized need to examine the influence of MC phases on agility in female athletes. Therefore, the objective of this study are to analyze how the different phases of the MC affect agility in female football players and to analyze the influence of MC phases on perceptual variables.

2. Results

2.1. T-Test and MC Phases

No significant differences were found between the phases of MC and the Agility test ($F_{(2,20)}$ = 1.86; p = 0.18). There was a trend towards improvement in the mid-luteal phase (11.34s) compared to the menstrual (11.58s) and follicular (11.47s) phases, with these differences being more notable in the first part of the T-test (Table 1).

Table 1. T-test results based on MC Phases.

Variables	Menstrual Phase		Late follicular phase		Mid-luteal phase		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	$F_{(2,20)}$	P
Total time	11.58	0.53	11.47	0,6	11.34	0.42	1.86	0.18
Sprint Out	2.67	0.15	2.57	0.25	2.58	0.18	1.16	0.33
Shuffle right	1.6	0.13	1.54	0.12	1.51	0.13	3.27	0.06
Shuffle left	2.87	0.18	2.92	0.17	2.85	0.16	3.24	0.06
Shuffle right(2)	1.59	0.1	1.63	0.1	1.6	0.1	0.74	0.49

Sprint Back	2.84	0.11	2.8	0.15	2.79	0.1	0.72	0.5

Note.. SD (Standard deviation), T.total (s), Sprint Out (s), Shuffle right (s), Shuffle left (s), Shuffle right 2 (s), Sprint Back (s), ANOVA: analysis of variance; F: Snedecor's F, P: p-value.

2.2. Perceptual Variables and MC Phases

No significant differences were found between any of the perceptual variables or RPE and the phases of the MC ($p > 0.05$). Better results were obtained in the late follicular phase for all perceptual variables related to the WQ (Table 2).

Table 2. Comparative analysis of perceptual variables.

Variables	Menstrual Phase		Late follicular phase		Mid-luteal phase		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F(2,20)	P
Fatigue	3.18	0.98	2.36	0.81	3.09	1.58	2.43	0.11
Sleep quality	3.27	1.01	2.91	1.38	3.18	0.87	0.37	0.69
Stress	2.91	1.04	2.36	1.12	2.82	1.17	1.22	0.32
Muscle soreness	2.82	0.75	2.45	0.93	3.09	1.3	1.71	0.21
WQ	12.2	1.72	10.1	3.05	12.2	4.14	2.52	0.11
RPE	5.09	1.51	5.36	1.36	5.27	1.27	0.48	0.63

Note. SD (Standard deviation),, Fatigue (Scale of 1 to 7), Sleep Quality (Scale of 1 to 7), Stress (Scale of 1 to 7), Muscle soreness (Scale of 1 to 7), RPE (Rating of Perceived Exertion Scale 1-10), WQ (Wellness Questionnaire, sum of perceptual variables: fatigue, sleep, stress, muscle pain), ANOVA: analysis of variance; F: Snedecor's F, P: p-value.

3. Discussion

The results obtained show that participants performed better in the agility test (T-Test) during the MLP compared to the EFP (0.24s) and the LFP (0.13s), although no significant differences were observed. The perceptual variables showed better results in the LFP, with greater differences in fatigue, stress, and the total WQ score.

Currently, there are few studies which have analyzed how the phases of the menstrual cycle influence agility performance. Agility is essential as it combines accelerations and decelerations as quickly as possible, reflecting the developed force ratio capacity [33]. According to hormonal impact, strength capacity is greatly influenced by estrogen and progesterone, as estrogen has a positive effect, providing a neuroexcitatory effect, and progesterone inhibits cortical excitability [34]. In contrast, [9], after analyzing 78 studies, found only a trivial effect of worse performance in the menstrual phase compared to the others. Likewise, Carmichael et al. [10] did not found differences in anaerobic performance. These findings align with the results obtained in the present study, which also did not show significant differences in agility performance, although the trend was more favorable towards the MLP.

More specifically, in studies analyzing agility tests, Juillard et al. [35] observed that in the Illinois agility test performed with football players, the results were very similar across the different phases of the MC. This was also observed by Oğul et al. [36] with physically active women, although with a slight tendency toward the MLP. This could be due to the fact that stiffness does not seem to vary significantly during the MC [37]. On the other hand, Sawai et al. [38] found that agility performance worsened during the EFP, possibly due to fluid retention during this phase. Our results seem to align with the current evidence, showing no significant differences, although there is a slight trend towards improvement in the MLP. However, further specific study is needed to better understand the effect that the phases of the menstrual cycle have on agility performance.

Sports performance should not only be measured objectively, also the subjective and perceptive aspects should also be taken into account, as these perceptual variables are an important aspect in studies related to women and the MC [10]. In general, women experience more negative symptoms related to the MC during the EFP, with over 50% of athletes reporting such symptoms [39], followed by the late luteal phase, which can affect up to 83% of athletes, leading to more fatigue or poorer physical performance perception [40]. In our findings, an improvement in all perceptual variables is observed during the late follicular phase, possibly due to the increased production of estrogen, which indirectly leads to an increase in serotonin hormone [41], potentially improving the mood and fatigue of athletes.

Sleep quality can be affected by the phases of the MC, mainly showing poorer quality during the premenstrual and menstrual phases [42], with possible improvement during the transition from the follicular to the luteal phase [43]. In this case, the perceived sleep quality of our athletes was worse during the menstrual phase, as also observed by Osmani et al. [44], possibly due to menstrual symptoms. The RPE does not show differences based on the phases of the menstrual cycle, which is corroborated by several studies reviewed by Ekenros et al. [45], who also found no differences in this variable. According to the results obtained, perceptual variables based on the menstrual cycle should be taken into account to properly periodize training. This aligns with the comments made by Julian et al. [46], but further studies should continue to focus on objective performance while considering perceptual variables, in order to eventually fit this into the practical context with correct individualization for each athlete.

Despite the findings obtained, some limitations should be considered. First, hormone concentration measurements were not performed through blood analysis; however, LH ovulation kits and self-recording of menstrual cycle phases via a mobile application were used to determine the phases of the menstrual cycle as objectively as possible, as recommended by McNulty et al. [47]. Second, the number of participants was limited (n = 11), but with "moderate statistical power" for this sample. Third, although the participants were familiar with the agility test and performing direction changes, there may have been a learning effect through the different test attempts.

4. Materials and Methods

Experimental Approach to the Problem

A cross-sectional cohort experimental study with repeated measures was conducted to analyze the effect of the menstrual cycle (MC) phases on agility, perceptual variables from the Hopper scale, and the subjective perception of effort (RPE). The MC phases were determined using two tools: a calendar and a luteinizing hormone (LH) urine kit [25] Participant assessments were conducted during three phases of the menstrual cycle: the menstrual phase or early follicular phase, the preovulatory phase or late follicular phase, and the postovulatory phase or mid-luteal phase.

Subjects

11 female football players were selected from the 3rd tier of the Spanish Football Federation (3rd RFEF), corresponding to TIER 3 level [26], (mean ± standard deviation): age = 18.7 ± 3.3 years; height = 1.62 ± 0.07 m; weight = 58.6 ± 6.7 kg. The inclusion criteria were: i) having a regular MC (21-35 days) in the last 6 months; ii) at least 2 years of football experience; iii) not using contraceptives; iv) not suffering from any disease or injury. The procedure and instruments to be used were explained to the participants prior to the start of the protocol. Informed consent was signed by each participant, which addressed the protection of personal data and ethical criteria for human experimentation, as well as the highest confidentiality and scientific rigor as detailed in the 1975 Declaration of Helsinki. Furthermore, the study was previously approved by the Ethics Committee (CEI 03-2024). The sample size was selected based on convenience, and a post hoc power analysis was conducted using G*Power

software (version 3.1.9.7) with $\alpha = 0.05$, power $(1 - \beta) = 0.8$, and an effect size of 0.25, with the statistical test ANOVA: repeated measures within factors, yielding a moderate power of 0.37.

Protocol

The participants were scheduled 3 times during the study, corresponding to their training field and during the 3 phases of the MC to be analyzed: i) menstrual phase, between days 1-5; ii) late follicular phase, between days 6-12; and iii) mid-luteal phase, between days 20-24.

Determination of the MC phases: The MC of the participants was monitored using the mobile application (Clue® Period Tracker, BioWink GmbH, Berlin, Germany) and the LH ovulation kit (Ovulation LH Test Strip, Cuckool, Nantong, China). The tests were conducted during the menstrual phase (2.82 ± 1.08 days), late follicular phase (10.2 ± 1.17 days), and mid-luteal phase (21.8 ± 1.33 days). Once a positive LH result was confirmed, the test was repeated a few days later, approximately between days 20-24 of the menstrual cycle. The average day on which the players tested positive with the ovulation kit was 14.7 ± 1.27 days.

Agility Test (T-Test): This test was chosen to assess the agility of each player, being a valid and reliable test for this purpose [27,28]. Two valid attempts were made, with a 3-minute rest between them to ensure complete recovery [28,29]. The players started the test with both feet behind the sensor (BlazePod® Reaction Training System, BlazePod Ltd., Tel Aviv, Israel), ran forward 9.14 meters, and touched the next sensor. Then, the players moved 4.57 meters to the right to touch another sensor with their right hand, followed by a lateral movement to the left for 9.14 meters to touch the sensor with their left hand. They then moved again 4.57 meters to the right to touch the second-to-last sensor. Finally, the players ran backward to reach the final sensor. Tests in which players crossed their feet, missed a BlazePod sensor, or did not face forward were considered invalid [30]

Perceptual Variables: During the intervention days, the wellness questionnaire (WQ) test was administered before the test. It was also used the day after the test to assess the participants' sleep quality, fatigue, muscle soreness, and stress variables, with values ranging from 1 to 7, where 1 represented very good and 7 represented very bad [31]. The range of perceived effort (RPE) (scale 1-10) [32] was also recorded after each T-Test to determine the participants' subjective effort perception. All participants were familiarized and trained on the proper use of these tools.

Statistical analysis

A descriptive analysis was conducted, with data presented as mean ± standard deviation (SD). All data were recorded in an Excel database, and the statistical analyses were performed using Jamovi software. A repeated measures ANOVA was conducted to compare execution time, T-test sector performance, and perceptual variables across the three phases of the CM. Normality was assessed using the Shapiro–Wilk test ($p < 0.05$).

5. Conclusions

No significant differences were found regarding the influence of MC phases on agility, although there was a slight trend of improvement in the MLP. The results on perceptual variables show an improvement in the LFP, without statistical significance, which could be an aspect to consider when creating a correct individualized training periodization in a real-world context for athletes. Both objective and perceptual variables should be taken into account for any study or training based on the MC.

Author Contributions: Conceptualization, F.O. and M.V-V.; methodology, F.O. and M.V-V.; investigation, F.O. and M.V-V.; resources, F.O. and M.V-V. writing—original draft preparation, F.O., M.V-V and C.L-F.; writing—review and editing, F.O., M.V-V and C.L-F.; supervision, F.O. and C.L-F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Universidad Europea del Atlántico (protocol code **CEI 03-2024** and 21/02/2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Costello, J.T.; Bieuzen, F.; Bleakley, C.M. Where Are All the Female Participants in Sports and Exercise Medicine Research? *Eur J Sport Sci* **2014**, *14*, 847–851, doi:10.1080/17461391.2014.911354.
2. Mujika, I.; Taipale, R.S. Sport Science on Women, Women in Sport Science. *Int J Sports Physiol Perform* **2019**, *14*, 1013–1014, doi:10.1123/ijspp.2019-0514.
3. Elliott-Sale, K.J.; Minahan, C.L.; de Jonge, X.A.K.J.; Ackerman, K.E.; Sipilä, S.; Constantini, N.W.; Lebrun, C.M.; Hackney, A.C. Methodological Considerations for Studies in Sport and Exercise Science with Women as Participants: A Working Guide for Standards of Practice for Research on Women. *Sports Medicine* **2021**, *51*, 843–861, doi:10.1007/s40279-021-01435-8.
4. Sánchez-Migallón Menéndez, M. "PROXECTO DE INTERVENCIÓN: INFLUENCIA DO CICLO MENSTRUAL NA FORZA EXPLOSIVA DO TREN INFERIOR" "INTERVENTION PROJECT: INFLUENCE OF MENSTRUAL CYCLE ON LOWER BODY EXPLOSIVE STRENGTH," 2020.
5. Reed, B.G.; Carr, B.R. *The Normal Menstrual Cycle and the Control of Ovulation.*; K. R. Feingold.; 2018;
6. Findlay, R.J.; Macrae, E.H.R.; Whyte, I.Y.; Easton, C.; Forrest (née Whyte), L.J. How the Menstrual Cycle and Menstruation Affect Sporting Performance: Experiences and Perceptions of Elite Female Rugby Players. *Br J Sports Med* **2020**, *54*, 1108–1113, doi:10.1136/bjsports-2019-101486.
7. Chidi-Ogbolu, N.; Baar, K. Effect of Estrogen on Musculoskeletal Performance and Injury Risk. *Front Physiol* **2019**, *9*, doi:10.3389/fphys.2018.01834.
8. Hackney, A.C. *Sex Hormones, Exercise and Women: Scientifics and Clinical Aspects*; 1ª Edición.; Springer: Chapel Hill, 2017;
9. McNulty, K.L.; Elliott-Sale, K.J.; Dolan, E.; Swinton, P.A.; Ansdell, P.; Goodall, S.; Thomas, K.; Hicks, K.M. The Effects of Menstrual Cycle Phase on Exercise Performance in Eumenorrheic Women: A Systematic Review and Meta-Analysis. *Sports Medicine* **2020**, *50*, 1813–1827, doi:10.1007/s40279-020-01319-3.
10. Carmichael, M.A.; Thomson, R.L.; Moran, L.J.; Wycherley, T.P. The Impact of Menstrual Cycle Phase on Athletes' Performance: A Narrative Review. *Int J Environ Res Public Health* **2021**, *18*, 1667, doi:10.3390/ijerph18041667.
11. Colenso-Semple, L.M.; D'Souza, A.C.; Elliott-Sale, K.J.; Phillips, S.M. Current Evidence Shows No Influence of Women's Menstrual Cycle Phase on Acute Strength Performance or Adaptations to Resistance Exercise Training. *Front Sports Act Living* **2023**, *5*, doi:10.3389/fspor.2023.1054542.
12. Niering, M.; Wolf-Belala, N.; Seifert, J.; Tovar, O.; Coldewey, J.; Kuranda, J.; Muehlbauer, T. The Influence of Menstrual Cycle Phases on Maximal Strength Performance in Healthy Female Adults: A Systematic Review with Meta-Analysis. *Sports* **2024**, *12*, 31, doi:10.3390/sports12010031.
13. Taylor, M.Y.; Osborne, J.O.; Topranin, V.D.M.; Engseth, T.P.; Solli, G.S.; Valsdottir, D.; Andersson, E.; Oistuen, G.F.; Flatby, I.; Welde, B.; et al. Menstrual Cycle Phase Has No Influence on Performance-Determining Variables in Endurance-Trained Athletes: The FENDURA Project. *Med Sci Sports Exerc* **2024**, *56*, 1595–1605, doi:10.1249/MSS.0000000000003447.
14. Meignié, A.; Duclos, M.; Carling, C.; Orhant, E.; Provost, P.; Toussaint, J.-F.; Antero, J. The Effects of Menstrual Cycle Phase on Elite Athlete Performance: A Critical and Systematic Review. *Front Physiol* **2021**, *12*, doi:10.3389/fphys.2021.654585.
15. Oosthuyse, T.; Bosch, A.N. The Effect of the Menstrual Cycle on Exercise Metabolism. *Sports Medicine* **2010**, *40*, 207–227, doi:10.2165/11317090-000000000-00000.
16. Datson, N.; Hulton, A.; Andersson, H.; Lewis, T.; Weston, M.; Drust, B.; Gregson, W. Applied Physiology of Female Soccer: An Update. *Sports Medicine* **2014**, *44*, 1225–1240, doi:10.1007/s40279-014-0199-1.
17. Sánchez-Sánchez, J.; Carretero, M.; Assante, G.; Casamichana, D.; Los Arcos, A. Efectos Del Marcaje al Hombre Sobre La Frecuencia Cardíaca, El Esfuerzo Percibido y La Demanda Técnico-Táctica En Jóvenes

Jugadores de Fútbol. *RICYDE. Revista internacional de ciencias del deporte* **2016**, *12*, 90–116, doi:10.5232/ricyde2016.04401.
18. Carling, C.; Wright, C.; Nelson, L.J.; Bradley, P.S. Comment on 'Performance Analysis in Football: A Critical Review and Implications for Future Research.' *J Sports Sci* **2014**, *32*, 2–7, doi:10.1080/02640414.2013.807352.
19. Sheppard, J.M.; Young, W.B. Agility Literature Review: Classifications, Training and Testing. *J Sports Sci* **2006**, *24*, 919–932, doi:10.1080/02640410500457109.
20. Romero-Moraleda, B.; Coso, J. Del; Gutiérrez-Hellín, J.; Ruiz-Moreno, C.; Grgic, J.; Lara, B. The Influence of the Menstrual Cycle on Muscle Strength and Power Performance. *J Hum Kinet* **2019**, *68*, 123–133, doi:10.2478/hukin-2019-0061.
21. Miyazaki, M.; Maeda, S. Changes in Hamstring Flexibility and Muscle Strength during the Menstrual Cycle in Healthy Young Females. *J Phys Ther Sci* **2022**, *34*, 2021–2147, doi:10.1589/jpts.34.92.
22. Hamed-Hamed, D.; González-Muñoz, A.; Cuevas-Cervera, M.; Perez-Montilla, J.J.; Aguilar-Nuñez, D.; Aguilar-García, M.; Pruimboom, L.; Navarro-Ledesma, S. Effects of the Menstrual Cycle on the Performance of Female Football Players. A Systematic Review. *Front Physiol* **2024**, *15*, doi:10.3389/fphys.2024.1359953.
23. Sekulic, D.; Foretic, N.; Gilic, B.; Esco, M.R.; Hammami, R.; Uljevic, O.; Versic, S.; Spasic, M. Importance of Agility Performance in Professional Futsal Players; Reliability and Applicability of Newly Developed Testing Protocols. *Int J Environ Res Public Health* **2019**, *16*, 3246, doi:10.3390/ijerph16183246.
24. Igonin, P.-H.; Rogowski, I.; Boisseau, N.; Martin, C. Impact of the Menstrual Cycle Phases on the Movement Patterns of Sub-Elite Women Soccer Players during Competitive Matches. *Int J Environ Res Public Health* **2022**, *19*, 4465, doi:10.3390/ijerph19084465.
25. Janse de Jonge, X.; Thompson, B.; Han, A. Methodological Recommendations for Menstrual Cycle Research in Sports and Exercise. *Med Sci Sports Exerc* **2019**, *51*, 2610–2617, doi:10.1249/MSS.0000000000002073.
26. McKay, A.K.A.; Stellingwerff, T.; Smith, E.S.; Martin, D.T.; Mujika, I.; Goosey-Tolfrey, V.L.; Sheppard, J.; Burke, L.M. Defining Training and Performance Caliber: A Participant Classification Framework. *Int J Sports Physiol Perform* **2022**, *17*, 317–331, doi:10.1123/ijspp.2021-0451.
27. Chaabene, H.; Negra, Y.; Capranica, L.; Bouguezzi, R.; Hachana, Y.; Rouahi, M.A.; Mkaouer, B. Validity and Reliability of a New Test of Planned Agility in Elite Taekwondo Athletes. *J Strength Cond Res* **2018**, *32*, 2542–2547, doi:10.1519/JSC.0000000000002325.
28. Pauole, K.; Madole, K.; Garhammer, J.; Lacourse, M.; Rozenek, R. *Reliability and Validity of the T-Test as a Measure of Agility, Leg Power, and Leg Speed in College-Aged Men and Women*; 2000; Vol. 14;.
29. Taati, B.; Arazi, H.; Bridge, C.A.; Franchini, E. A New Taekwondo-Specific Field Test for Estimating Aerobic Power, Anaerobic Fitness, and Agility Performance. *PLoS One* **2022**, *17*, e0264910, doi:10.1371/journal.pone.0264910.
30. Sassi, R.H.; Dardouri, W.; Yahmed, M.H.; Gmada, N.; Mahfoudhi, M.E.; Gharbi, Z. Relative and Absolute Reliability of a Modified Agility T-Test and Its Relationship With Vertical Jump and Straight Sprint. *J Strength Cond Res* **2009**, *23*, 1644–1651, doi:10.1519/JSC.0b013e3181b425d2.
31. Hooper, S.L.; Mackinnon, L.T. Monitoring Overtraining in Athletes. *Sports Medicine* **1995**, *20*, 321–327, doi:10.2165/00007256-199520050-00003.
32. Borg, G.A. Perceived Exertion: A Note on "History" and Methods. *Med Sci Sports* **1973**, *5*, 90–93.
33. Maffiuletti, N.A.; Aagaard, P.; Blazevich, A.J.; Folland, J.; Tillin, N.; Duchateau, J. Rate of Force Development: Physiological and Methodological Considerations. *Eur J Appl Physiol* **2016**, *116*, 1091–1116, doi:10.1007/s00421-016-3346-6.
34. Smith, M.J.; Adams, L.F.; Schmidt, P.J.; Rubinow, D.R.; Wassermann, E.M. Effects of Ovarian Hormones on Human Cortical Excitability. *Ann Neurol* **2002**, *51*, 599–603, doi:10.1002/ana.10180.
35. Juillard, E.; Douchet, T.; Paizis, C.; Babault, N. Impact of the Menstrual Cycle on Physical Performance and Subjective Ratings in Elite Academy Women Soccer Players. *Sports* **2024**, *12*, 16, doi:10.3390/sports12010016.
36. Oğul, A.; Ercan, S.; Ergan, M.; İnce Parpucu, T.; Çetin, C. The Effect of Menstrual Cycle Phase on Multiple Performance Test Parameters. *Turkish Journal of Sports Medicine* **2021**, *56*, 159–165, doi:10.47447/tjsm.0552.

37. Miller, B.F.; Hansen, M.; Olesen, J.L.; Schwarz, P.; Babraj, J.A.; Smith, K.; Rennie, M.J.; Kjaer, M. Tendon Collagen Synthesis at Rest and after Exercise in Women. *J Appl Physiol* **2007**, *102*, 541–546, doi:10.1152/japplphysiol.00797.2006.
38. Sawai, A.; Tochigi, Y.; Kavaliova, N.; Zaboronok, A.; Warashina, Y.; Mathis, B.J.; Mesaki, N.; Shiraki, H.; Watanabe, K. MRI Reveals Menstrually-Related Muscle Edema That Negatively Affects Athletic Agility in Young Women. *PLoS One* **2018**, *13*, e0191022, doi:10.1371/journal.pone.0191022.
39. Solli, G.S.; Sandbakk, S.B.; Noordhof, D.A.; Ihalainen, J.K.; Sandbakk, Ø. Changes in Self-Reported Physical Fitness, Performance, and Side Effects Across the Phases of the Menstrual Cycle Among Competitive Endurance Athletes. *Int J Sports Physiol Perform* **2020**, *15*, 1324–1333, doi:10.1123/ijspp.2019-0616.
40. Armour, M.; Parry, K.A.; Steel, K.; Smith, C.A. Australian Female Athlete Perceptions of the Challenges Associated with Training and Competing When Menstrual Symptoms Are Present. *Int J Sports Sci Coach* **2020**, *15*, 316–323, doi:10.1177/1747954120916073.
41. Amin, Z.; Canli, T.; Epperson, C.N. Effect of Estrogen-Serotonin Interactions on Mood and Cognition. *Behav Cogn Neurosci Rev* **2005**, *4*, 43–58, doi:10.1177/1534582305277152.
42. Alzueta, E.; Baker, F.C. The Menstrual Cycle and Sleep. *Sleep Med Clin* **2023**, *18*, 399–413, doi:10.1016/j.jsmc.2023.06.003.
43. Baker, F.C.; Lee, K.A. Menstrual Cycle Effects on Sleep. *Sleep Med Clin* **2022**, *17*, 283–294, doi:10.1016/j.jsmc.2022.02.004.
44. Osmani, F.; Terán-Fernández, D.; Alonso-Pérez, S.; Ruiz-Alias, S.A.; García-Pinillos, F.; Lago-Fuentes, C. Can Women Maintain Their Strength Performance Along the Menstrual Cycle? *Applied Sciences* **2024**, *14*, 9818, doi:10.3390/app14219818.
45. Ekenros, L.; von Rosen, P.; Solli, G.S.; Sandbakk, Ø.; Holmberg, H.-C.; Hirschberg, A.L.; Fridén, C. Perceived Impact of the Menstrual Cycle and Hormonal Contraceptives on Physical Exercise and Performance in 1,086 Athletes from 57 Sports. *Front Physiol* **2022**, *13*, doi:10.3389/fphys.2022.954760.
46. Julian, R.; Sargent, D. Periodisation: Tailoring Training Based on the Menstrual Cycle May Work in Theory but Can They Be Used in Practice? *Science and Medicine in Football* **2020**, *4*, 253–254, doi:10.1080/24733938.2020.1828615.
47. McNulty, K.L.; Taim, B.C.; Freemas, J.A.; Hassan, A.; Lupton Brantner, C.; Oleka, C.T.; Scott, D.; Howatson, G.; Moore, I.S.; Yung, K.K.; et al. Research Across the Female Life Cycle: Reframing the Narrative for Health and Performance in Athletic Females and Showcasing Solutions to Drive Advancements in Research and Translation. *Women Sport Phys Act J* **2024**, *32*, doi:10.1123/wspaj.2024-0064.