DOES THE MENSTRUAL CYCLE INFLUENCE THE SPORTS PERFORMANCE OF WOMEN VOLLEYBALL PLAYERS? A PILOT STUDY

¿INFLUYE EL CICLO MENSTRUAL EN EL RENDIMIENTO DEPORTIVO DE LAS JUGADORAS DE VOLEIBOL? UN ESTUDIO PILOTO

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Abstract

The menstrual cycle (MC) is a physiological concept that has had an exponential increase in the field of sports and research in recent years. In addition, it is a biological process corresponding to women and regulated by certain hormones that allow the possibility of fertility and may also affect other functional capacities of the female organism. Nevertheless, the related scientific literature is scarce. For this reason, the aim of the study was to perform research on female volleyball players, applying an educational methodology consisting of a talk and a workshop/focus group to discover the possible improvements in the analyzed variables. The sample consisted of eight female players (age = 20.5 ± 1.41 years; weight = 59.25 ± 7.59 kg; height = 168.75 ± 6.23 cm). A descriptive and association study was carried out between the study variables considering the time of data collection. The results highlight the importance of developing educational plans related to the MC in teams of female athletes because significant associations were found in the knowledge (question three and question six) and communication (question 14) sections. Finally, the results suggest the need to motivate and encourage the use of tools and education regarding to the MC both in sports and in the social sphere, to promote and improve knowledge, communication, and the perception of the influence of the MC. For this reason, it is recommended that sporting institutions to consider planning and developing informative talks before, during and after sports seasons.

Keywords: Female, sport, performance, communication, hormones, knowledge, perception

Resumen

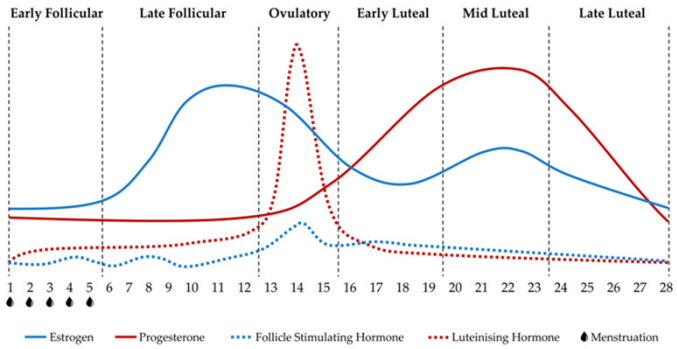
El ciclo menstrual (CM) es un concepto fisiológico que ha tenido un incremento exponencial en el campo del deporte y la investigación en los últimos años. Además, es un proceso biológico correspondiente a la mujer y regulado por determinadas hormonas que permiten la posibilidad de fertilidad y pueden afectar también a otras capacidades funcionales del organismo femenino. Sin embargo, la literatura científica al respecto es escasa. Por este motivo, el objetivo del estudio fue realizar una investigación en jugadoras de voleibol, aplicando una metodología educativa consistente en una charla y un taller/grupo focal para descubrir las posibles mejoras en las variables analizadas. La muestra estuvo formada por ocho jugadoras (edad = 20.5 ± 1.41 años; peso = 59.25 ± 7.59 kg; altura = 168.75 ± 6.23 cm). Se realizó un estudio descriptivo y de asociación entre las variables de estudio teniendo en cuenta el momento de la recogida de datos. Los resultados destacan la importancia de desarrollar planes educativos relacionados con el CM en equipos de mujeres deportistas ya que se encontraron asociaciones significativas en los apartados de conocimientos (pregunta tres y pregunta seis) y comunicación (pregunta 14). Por último, los resultados sugieren la necesidad de motivar e incentivar el uso de herramientas y educación respecto al CM tanto en el ámbito deportivo como en el social, para promover y mejorar el conocimiento, la comunicación y la percepción de la influencia del CM. Por ello, se recomienda a las instituciones deportivas que consideren planificar y desarrollar charlas informativas antes, durante y después de las temporadas deportivas.

Palabras clave: Femenino, deporte, rendimiento, comunicación, hormonas, conocimiento, percepción

Introduction

The menstrual cycle (MC) is a biological process specific to women, involving certain hormones responsible for regulating this biological activity, with progesterone and estrogens being the most important hormones (Figure 1). This process induces some structural and functional changes in the body of the women (Wojtys et al., 2015), this cycle starts on the first day of menstruation, with a duration of 4-8 days (Rodríguez Jiménez & Curell Aguilá, 2017). In addition, through the MC, is possible to evaluate the health of the woman because it is associated with some specific parameters, such as the type, the quantity of bleeding, duration, pain, or the existence of clots (Bruinvels et al., 2017).

Figure 1
Menstrual Cycle With the Main Regulator Hormones



Note. Reprinted from Carmichael et al., 2021.

However, menstrual disorders, such as amenorrhea, oligomenorrhea, and anovulation, may produce some variations in the cycle, being more frequent in high-performance athletes (Redman & Loucks, 2005), associated with high-stress levels that can affect the MC (Vannuccini et al., 2020). Within the sports context, the MC becomes a variable that determines the performance of the athletes (Carmichael et al., 2021; Constantini et al., 2005). The symptoms associated with MC in women's sports are anxiety, fatigue, associated pain, muscle stiffness, fatigue, camps, or water retention, among others (Bruinvels et al., 2021). In the same way, this process may affect the external load of the players, developing higher values in the ovulation phase, and more intense values in the follicular phase (Arenas-Pareja et al., 2023). Different studies previously investigated how the MC affects performance in different sports as perceived by female players (Ekenros et al., 2022; Findlay et al., 2020).

The perception of MC is a very important factor because each woman has different symptoms, which affect sports performance physically and psychologically (Garcia et al., 2023; Paludo et al., 2022). Within sports, different barriers affect the player's performance, as a self-perceived issue arising in the social model, which often causes the MC and menstruation to become a taboo subject (Höök et al., 2021). It is considered of great importance to measure knowledge and education regarding the MC, both in coaches, as well as in athletes associated with individual and team sports (Ekenros et al., 2022). Therefore, more knowledge and the improvement of communication regarding the MC is of relevant interest, particularly in improving the relationship between athletes and coaches (Laske et al., 2022) and medical staff (Clarke et al., 2021).

Considering that the MC naturally maintains its flows and fluctuations, the increased use of contraceptive methods and their influence on sporting performance, as well as on this biological process should be considered (Cheng et al., 2021). The use of contraceptive methods (daily pills) is frequent in sports, with its risks, such as the female triad of low energy levels, weak bones, and alterations in menstruation (Martin et al., 2018; Teal & Edelman, 2021). In conclusion, the use of contraceptive methods may affect sports performance through psychophysiological risks (Casto et al., 2022). In addition, it is important to assess female athletes' knowledge of their MC and the influence of contraceptives (Cheng et al., 2021), to understand the levels and promote increased education regarding this topic.

However, it should be borne in mind that little education is provided about the MC and that there are also shortcomings in teaching the perception of the influence of the MC on sports performance according to the different phases, as well as the lack of improvement in the communication regarding this subject within the sport, these arguments are the main reason for carrying out this study. The MC is a taboo within the female sport, as they sometimes find it difficult to talk about it or they are not in an environment that helps them to communicate how it affects them. Hence, the main objective of the study was to find out and analyse the knowledge, perception and way of communication of volleyball players about the MC. With this, it will be determined if there are any difficulties for the players when communicating with their coaches or teammates, and to be able to improve these communication processes.

Materials and Methods

Design

Following Ato et al. (2013) proposal, this study is positioned within descriptive studies, through an associative and longitudinal strategy, to analyze the knowledge, perception, and communication of the players regarding the MC.

Participants

Eight female volleyball players participated in the study, which played in the 2nd federated autonomic division. Table 1 shows the characterisation of the sample, including the experience and the average training hours by week. Data are shown as mean and standard deviation.

Table 1
Characterization of the Sample

Number of players	Age (years)	Weigh (kg)	Height (cm)	Experience (years)	Training hours/week
8	20.5 ± 1.41	59.25 ± 7.59	168.75 ± 6.23	10.50 ± 2.07	4.75 ± 1.04

Variables

For the development of the study, the independent variables considered were group and moment of the data collection, while the dependent variables were knowledge, communication, and perception of the MC influence on sports performance.

Instruments

The studies developed by Armour et al. (2020), Clarke et al. (2021), and McNamara et al. (2022), should be taken as a reference, as documents aimed at knowing and developing the knowledge, communication, and perception part, considering that their methodology is based on completing different questions and questionnaires with a qualitative/quantitative component, with descriptive and dichotomous answers. Finally, the questionnaire was made up of 20 questions divided between knowledge about the MC (eight questions), communication (six questions), and perceived influence on sports performance (six questions) (Table 2). The questions contain closed-choice answers, varying between dichotomous and choice scales.

Table 2
Menstrual Cycle Questionnaire

Categorial Core	Question
Knowledge	Q1: What are the main hormones of the menstrual cycle?
	Q2: Can the menstrual cycle be divided into at least two phases?
	Q3: How long is the menstrual cycle in a healthy menstrual cycle?
	Q4: How long does bleeding last in a healthy menstrual cycle?
	Q5: When does ovulation occur in the healthy menstrual cycle?
	Q6: Is amenorrhea the equivalent of menstruation or bleeding?
	Q7: Is the menstrual cycle the same if contraceptives are used daily?
	Q8: Which of the following terms are hormonal contraceptives?
	Q9: Do you find the menstrual cycle a taboo subject?
Communication	Q10: Even if it doesn't come up as a need, would you be able to communicate with the coaching staff and talk about your menstrual cycle sometimes?
	Q11: Who would you prefer to talk to about your bleeding or menstruation?
	Q12: If the trainer is a man, would you be able to discuss your menstruation situation with him?
	Q13: Would you find it more bearable if you talked about it with partners?
	Q14: Do you think it would improve your comfort and would you like your performance to be considered if you discussed your menstrual cycle situation with the coaching staff and teammates?
Perception	Q15: Have you noticed any negative influence on your performance in training and/or competition during the time of bleeding?
	Q16: In which phase of your menstrual cycle do you notice the most negative influence on your performance when training and/or competing?
	Q17: Do you feel that training has affected and/or produced changes in your menstrual cycle?
	Q18: Do you think any phase has a higher risk of injury?
	Q19: Does the bleeding phase affect my concentration and mood?
	Q20: In which phase do you feel more fatigued when you finish training and/or competing, or during training and/or competition?

Procedure

Firstly, authorization was requested from the sports club where the research was to be carried out. Additionally, this study was conducted in accordance with the ethical principles established in the Declaration of Helsinki (World Medical Association [WMA], 2013) and the ethical consideration for sports science studies (Harriss et al., 2022). Subsequently, descriptive data was taken from the team members, having selected the group of female players as participants. On the first day, using a QR code, an instrument that redirects to a Google form survey to record the data, the data collection will be carried out after having signed the informed consent form. From the pre-test to the post-test, a methodology of two lectures/workshops/focus groups focused on learning and analysis of the players concerning knowledge, communication, and influence and perception on sports performance is applied.

Also, on the first day of the methodology, a pre-test was carried out, which would later be accompanied by the first talk/workshop on knowledge of the MC and sporting performance. On the second and last day, which completed the experimental procedure, a focus group was carried out, with a first part in which groups of three were divided into groups to reflect on different questions, followed by a second part in which the whole group participated, considering that the questions that were dealt with were about perception and communication. Finally, on the second day, the test was taken again, to ascertain knowledge about the proposed dependent variables.

Statistical Analysis

A descriptive analysis of all variables (frequency and percentage) was performed. To analyze the differences between the pre-and post-test data collection moments, the Chi-square (χ^2) and Cramer's Phi coefficient (φc) were used (Newell et al., 2014), as well as the Fisher's Exact Test (FET) using the Monte Carlo procedure, which allows the analysis of two variables with more than two associated categories. The level of association of the Cramer's Phi coefficient indicator was interpreted through Crewson (2006) proposal. The degree of association between the dependent variables of the study (knowledge, communication, and perception of influence) with the independent variables (group and moment of data collection) was carried out through the Adjusted Standardized Residuals (ASR) of the continence tables (Field, 2013).

Results

Table 3 shows the different associations between the responses to the questionnaire used to determine the variables of knowledge of the cycle, communication, and perception of the influence of the MC and the moment of data collection. The results show lower values of $p < .05$, which corroborate the association in all the variables analysed with the time of collection. Question 11 was removed from the table because all players chose only one answer.

Table 3
Results From the Association Between the Dependent Variables and the Moment of Data Collection

Variables		χ^2	*df*	*p*	φc	*p*	Association level
Knowledge	Question 1	5.333	2	.069	.577	.069	-
	Question 2	1.067	1	.302	.258	.302	-
	Question 3	9.600	2	.008*	.775	.008*	High
	Question 4	2.286	1	.131	.378	.131	-
	Question 5	3.818	2	.148	.489	.148	-
	Question 6	7.273	1	.007*	.674	.007*	High
	Question 7	0.000	1	1.000	.000	1.000	-
	Question 8	1.067	1	.302	.258	.302	-
Communication	Question 9	0.000	2	1.000	.000	1.000	-
	Question 10	2.286	1	.131	.378	.131	-
	Question 12	1.067	1	.302	.258	.302	-
	Question 13	1.333	2	.513	.289	.513	-
	Question 14	6.571	2	.037*	.641	.037*	High
Perception	Question 15	0.000	1	.000	.000	1.000	-
	Question 16	0.424	2	.809	.163	.809	-
	Question 17	3.692	1	.055	.480	.055	-
	Question 18	2.286	2	.319	.378	.319	-
	Question 19	2.000	2	.368	.354	.368	-
	Question 20	2.333	2	.311	.382	.311	-

Note. χ^2: Chi-square; *df*: degree of freedom; *$p < .05$; φc: Cramer's Phi coefficient

In Table 4, descriptive analysis is shown related to the answer to each question related to knowledge. ASR is shown regarding the data collection moment.

Table 4
Descriptive Results and ASR of Each Question Related to Knowledge and the Data Collection Moment (n = 16)

Variables			*n*	%	Pre-test	Post-test
					ASR	ASR
Knowledge	Q 1	Progesterone and/or estrogen	12	75.0	-2.3	2.3
		Testosterone y serotonin	1	6.3	1.0	-1.0
		Not know	3	18.8	1.9	-1.9
	Q 2	Yes	15	93.8	-1.0	1.0
		Not know	1	6.3	1.0	-1.0
	Q 3	25-32 days	10	62.5	-3.1	3.1
		20-28 days	5	31.3	2.7	-2.7
		24-36 days	1	6.3	1.0	-1.0
	Q 4	2-7 days	14	87.5	-1.5	1.5
		3-5 days	2	12.5	1.5	-1.5
	Q 5	Between the late follicular and luteal phase	11	68.8	-1.6	1.6
		After the luteal phase	2	12.5	0.0	0.0
		Not know	3	18.8	1.9	-1.9
	Q 6	No	11	68.8	-2.7	2.7
		Not know	5	31.3	2.7	-2.7
	Q 7	No	14	87.5	0.0	0.0
		Not know	2	12.5	0.0	0.0
	Q 8	Combined oral contraceptives, injectable contraceptives and contraceptive patches	15	93.8	-1.0	1.0
		Not know	1	6.3	1.0	-1.0

Note. Q = Question; ASR > 1.96.

A descriptive analysis regarding the answer to each question related to communication is presented in Table 5. ASR is shown regarding the data collection moment.

Table 5
Descriptive Results and ASR of Each Question Related to Communication and the Data Collection Moment (n = 16)

Variables			*n*	%	Pre-test	Post-test
					ASR	ASR
Communication	Q 9	Yes	2	12.5	0.0	0.0
		No	12	75.0	0.0	0.0
		Indifferent	2	12.5	0.0	0.0
	Q 10	Yes	14	87.5	-1.5	1.5
		Indifferent	2	12.5	1.5	-1.5
	Q 11	I could discuss this with anyone in the team (staff and/or mates)	16	100.0	0.0	0.0
	Q 12	Yes	15	93.8	-1.0	1.0
		No, I would feel uncomfortable	1	6.3	1.0	-1.0
	Q 13	Yes	12	75.0	0.0	0.0
		I don't know (indifferent)	3	18.8	-0.6	0.6
		No	1	6.3	1.0	-1.0
	Q 14	Yes	7	43.8	-2.5	2.5
		I don't know (indifferent)	8	50.0	2.0	-2.0
		No	1	6.3	1.0	-1.0

Note. Q = Question; ASR > 1.96.

Considering Table 5, question 11 was answered equally in both moments. The Table 6 highlights a descriptive analysis related to the answer to each question associated with perception. Also, ASR is shown regarding the data collection.

Table 6
Descriptive Results and ASR of Each Question Related to Perception and the Data Collection Moment (n = 16)

Variables			*n*	%	Pre-test	Post-test
					ASR	ASR
Perception	Q 15	Yes	12	75.0	0.0	0.0
		No	4	25.0	0.0	0.0
	Q 16	Early follicular phase	11	68.8	-0,5	0.5
		Luteal phase	3	18.8	0.6	-0.6
		Indifferent	2	12.5	0.0	0.0
	Q 17	Yes, positively	2	12.5	1.5	-1.5
		No	14	87.5	-1.5	1.5
	Q 18	Yes	14	87.5	-1.5	1.5
		No	1	6.3	1.0	-1.0
		Not know	1	6.3	1.0	-1.0
	Q 19	Yes	14	87.5	0.0	0.0
		No	1	6.3	-1.0	1.0
		Indifferent	1	6.3	1.0	-1.0
	Q 20	Early follicular phase	12	75.0	-1.2	1.2
		Luteal phase	2	12.5	1.5	-1.5
		Equally	2	12.5	0.0	0.0

Note. Q = Question; ASR > 1.96.

Discussion

This study aimed to analyze the knowledge, perception, and communication of female volleyball players regarding MC. The results reported significant differences in the three topics presented in the questionnaire. Two of them were included in the knowledge part and the remaining question in the communication part. On the other hand, the descriptive results showed significant differences regarding the moment of data collection. These results underline the importance of analyzing the information regarding MC in female athletes and the potential influence of the MC on sports performance, and also carrying out an educational methodology to improve communication between technical staff and players (Clarke et al., 2021). Therefore, it is recommended to develop workshops, lectures, or teaching/learning methods to raise awareness of the MC and broaden knowledge regarding this topic. In addition, it can be a useful tool for improving communication and self-perception of the influence of each of the phases of the MC in sports performance.

Concerning the results obtained in the third question corresponding to the knowledge part, the results were significant (p < .05). In the scientific literature, there are no documents that corroborate the results obtained in this question. Therefore, the length of the healthy MC is questioned, with a noticeable change in the tendency of responses from the first to the second moment of data collection, showing a significant difference. Nevertheless, the documents that exist in the scientific literature are intended to observe the knowledge of the MC, so the evidence is low (Ayoola et al., 2016). The MC is a factor that can directly influence female sports performance (Carmichael et al., 2021; Constantini et al., 2005). Therefore, it is recommended that coaches carry out informative talks/workshops related to the importance of the MC during the pre-season of women's teams. It also seems to be essential to include an expert on the subject in the coaching staff of the teams to increase sporting performance. The results related to the knowledge section (question six) also show significant differences (p < .05). The main purpose of the question is to evaluate if the term amenorrhea is similar, or equivalent compared with the term menstruation. In this question, again, changes in the trend of responses were observed and there is a significant difference, varying from the answer "I don't know" for the most part to the correct answer "No".

There is little scientific literature aimed at measuring knowledge and therefore proposing educational methodologies (Ekenros et al., 2022). Furthermore, six out of eight players stated that they had received at least once in their lives an educational talk/workshop about the MC, which suggests that little information is provided or that no correct education has taken place. Therefore, it is recommended to increase the initiative to learn about this aspect and its importance, to be a tool to bring it to the field of physical preparation and sports performance in women's teams.

Finally, significant differences were also found in one of the responses within the communication part ($p < .05$). This may indicate an improvement in the process of communication by and for the volleyball team players, denoting a change of trend in the choice as well as a significant result in this question. On the other hand, the question was asked about whether it would improve comfort and would be pleasant for individual performance to be considered if the coaching staff talked about the MC. In this part, "yes" was the answer most selected. Not developing a correct process of communication between the coach and players, may affect the performance, the confidence, and the personal status of the players (Bergström et al., 2023). Therefore, the coaches should receive training about the MC, how to develop positive conversations, and using the correct terms would reduce the problems derived due to the lack of communication, with improvement in the knowledge about this cycle (Brown et al., 2021). Also, there is no significant data related to perception questions. In the scientific literature, there are no documents that corroborate the results obtained in the present investigation. Therefore, it is recommended to increase knowledge related to the topic under study.

The main limitation of this study was the low sample number, because only one volleyball team was studied. In addition, three players had to abandon the study, and they could not finish the intervention. Designing and validating a questionnaire that measures the knowledge, communication, and perception of female athletes in the different phases of the MC is a future line proposed. In the same way, it would be interesting to analyze and evaluate the fitness condition of the athletes in the different stages of phases of the MC.

Understanding the influence that the MC can have on athletic performance is crucial. Educating individuals about this topic can significantly enhance both physical and psychological performance. It is beneficial to promote awareness of the MC and focus on improving perception and communication, as these factors play a vital role in overall performance. To facilitate this, it is recommended to organize informative talks and workshops before, during, and after the volleyball teams' season. Additionally, this approach can be applied to younger age groups to help teach and instill healthy behaviors and habits regarding the MC.

Conclusions

The results showed the importance of carrying out training processes related to the MC in female volleyball teams. In addition, the proposed talk and workshop/focus group methodology are fundamental for analyzing the knowledge, communication, and perception of the sportswomen's performance.

Little education regarding this topic emerged from the answers of the female volleyball players, not only at the sporting level but also in the social sphere, regarding knowledge, communication, and perception of the influence of the MC on sporting performance. Therefore, we consider that it is a factor that can affect the physical, metabolic, endocrine, psychological, and neural aspects of female athletes.

Ethics Committee Statement

The study was conducted in accordance with the Declaration of Helsinki.

Conflict of Interest Statement

No conflicts of interest.

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Authors' Contribution

Conceptualization VHB., MCE and JMG; Methodology DSM, VHB, and LFCCC; Software VHB., MCE and JMG; Validation MCE, LFCCC and JMG; Formal Analysis VHB., and JMG; Investigation DSM, VHB., and JMG; Resources DSM and JMG; Data Curation VHB., MCE, LFCCC and JMG; Writing – Original Draft DSM and JMG; Writing – Review & Editing VHB., MCE, LFCCC and JMG; Visualization VHB., MCE, LFCCC and JMG; Supervision VHB., MCE, LFCCC and JMG; Project Administration DSM and JMG; Funding Acquisition MCE, and JMG.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author (vhernandpw@alumnos.unex.es)

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