

The impact of the menstrual cycle on physical performance in senior women basketball players

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Abstract:

The aim of this research is to study the effects of menstrual cycle on physical performance. Twenty senior women basketball players, whose age is 23.25 ± 3.24 , participated and were tested in 02 occasions: before menstruation and during menstruation. For this purpose, we used physical tests (Sergeant test, agility T test, IFT 30-15, 30m test). For statistics, we calculated the mean, the standard deviation and Student t-test. The observance of physical performance during the menstrual cycle revealed that there was no disturbance in speed and agility while endurance and strength performance experienced changes during the different phases of the menstrual cycle. The menstrual cycle can negatively influence athletic performance.

Key words: menstrual cycle; performance; basketball players.

المخلص:

تهدف هذه الدراسة إلى معرفة أثر الدورة الشهرية على الأداء البدني لدى لاعبات كرة السلة اكابر، و لتحقيق ذلك استخدمنا المنهج التجريبي لملائمته و طبيعة اهداف الدراسة بحيث تتكون عينة البحث من 20 لاعبة كرة سلة من فريق عين بنيان. خضعت عينة البحث الى مجموعة من الاختبارات البدنية (اختبار سرجنت، اختبار سرعة 30م، اختبار المداومة 30-15، اختبار الرشاقة "ت") قبل و اثناء الحيض. بالنسبة للمعالجة الاحصائية، قمنا بحساب المتوسط الحسابي والانحراف المعياري واختبار ستودنت لعينتين مرتبطتين،

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حيث اظهرت نتائج المعالجة الاحصائية ان الدورة الشهرية لم تؤثر على السرعة و الرشاقة بينما اثرت سلبا على المداومة و القوة. و عليه يمكن القول أن الدورة الشهرية يمكن ان تؤثر سلبًا على الأداء الرياضي.

الكلمات المفتاحية: الدورة الشهرية؛ الأداء الرياضي ؛ لاعبات كرة السلة.

1-Introduction:

Sport is becoming an increasingly important part of life. These benefits are undeniable and proven on human health. Sport improves the quality of life (Pedersen et al, 2017:852-863), the level of self-esteem (Weiss et al, 1996:347-379), autonomous motivation (Rottensteiner et al., 2015:250-265), satisfies basic psychological needs (Cheval et al, 2016:132-137) and reduces the risk of several diseases ... Women's sport is taking more and more, a large scale, with a significant increase in the rate of participation of women in different competitions.

However, the woman athlete is regularly confronted with specific changes relating to her physiology like menstruation, pregnancy, menopause ... (Colin, 2013).

From puberty to menopause, women go through a series of anatomical and physiological changes known as menstruation, which occurs on a cyclical or periodic basis (Merviel, 2020:1-16). The menstruation can be influenced by physical activity by accentuating or reducing the physiological disorders that accompany it (breast tension, nervousness, nausea and abdomino-pelvic pain) (Jaffre, 2006:20-22) but the performance can also be affected by it (Maitre, 2007). The impact of the menstrual cycle on physical performance is still poorly known in the sports world and therefore little taken into account in planning of training (Wenger, 2019:250-65). Nevertheless, interest in the physiological changes related to the cycle has increased during the last decades.

In our search, relatively few studies were found that addressed the effects of the menstrual cycle on sports performance, especially in our country.

Kishali.(2006) followed 241 female athletes on basketball, judo and volleyball. He observed that menstruation did not influence performance and the dysmenorrhea has decreased during this period

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through training and competition (Kishali, 2006). In 2016, a study was conducted by Nkelifack in Cameroon that aimed to determine the effect of menstruation on the physical performance of 51 amateur athletes. As a result, physiological and performance parameters did not change in 55% of athletes who thought their periods were a hindrance (Nkenlifack, 2016:16-24). Keita (2015) also reported that there was no significant difference between the performance of menstruating and non-menstruating female soccer players (Keitta, 2015). In another research related to menstrual experiences and their influence on sports performance, Adjitte (2006) observed that there was stability in the score achieved in sprinting before and during menstruation thus the menstrual cycle did not affect sports performance. Mboup Diéye (2011) found no significant variation in physical variables (strength, speed, and endurance) during and after menstruation. Other studies found that sports performance was unaffected by menstruation (Somboonwong et al, 2015; Tsampoukos et al, 2010; Lara et al, 2020; Nevill & Sunderland, 2003; Tounsi et al, 2017).

Contrary to this, other studies have shown that sportswomen's menstrual cycles have a negative impact on their physical performance (Armour et al, 2020; Kartal and Ergin, 2020; Findally et al, 2020; Solli et al 2020). Takashi et al.(2015) reported that some menstrual cycle disorders can cause a decline in physical performance such as premenstrual syndrome . Therefore, controlling these is a requirement for training planning in order to safeguard sportswomen's health and boost their performance. Sutresna (2016) and Julian et al (2017) noted that endurance performance decreases during menstruation compared to other phases of the menstrual cycle. It has been suggested to adapt the training of different physical qualities according to the physiological and psychological fluctuations of the menstrual cycle phases in order to have a better performance.

According to the various studies, the topic of whether or not the menstrual cycle affects sports performance is contentious. Therefore, some inquiries may be made.

- ✓ Does the menstrual cycle affect an athlete's physical condition?
- ✓ Do irregular menstrual cycles affect athletic performance?
- ✓ Should training be adapted to the different phases of the menstrual cycle?

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- ✓ Is menstruation a real taboo for athletes?

So many questions that deserve to be fully addressed in order to answer them, because the scarcity of research and the lack of knowledge of this physiological phenomenon leaves the subject topical and deserves to be discussed at every opportunity.

However, in our country, few studies have been conducted on the impact of the menstrual cycle on physical performance in women basketball players. The purpose of this study is to conduct physical tests that would provide information on the effects of the menstrual cycle on the physical condition of women basketball players before and during menstruation. This will answer the question: How does the menstrual cycle affect the physical performance of women athletes?

Given the physiological changes of the menstrual cycle and the nature of training, menstruation should theoretically negatively affect the athletic performance of athletes.

2- General objective of the study:

The main objective of the present research is **to know the impact of the menstrual cycle on the sports performance of elite athletes.** The purpose is **to provide more clarity to coaches and specialists, specifying the different physiological and psychological changes that accompany the different phases of the menstrual cycle.** It should also include the importance of scientific (theoretical) and practical (applied) research.

3- Procedural definition of the concepts mentioned in the research:

3.1- Menstrual cycle: it is defined as cyclic events that take place in a rhythmic fashion during the reproductive period of a women's life. Menstrual cycle starts at the age of 12 to 15 years, which marks the onset of puberty. The commencement of menstrual cycle is called menarche. Menstrual cycle ceases at the age of 45 to 50 years. Permanent cessation of menstrual cycle in old age is called menopause (Sembulingam, 2019:515).

The researcher concludes that the menstrual cycle is considered like a mechanism that prepares the female body for pregnancy each month, from puberty to menopause. It begins on the first day of menstruation,

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ends on the first day of the next period and continues if there is no fertilization.

3.2- Performance (Platonov, Vladimir, 1984): it expresses the maximum possibilities of an individual in a discipline at a given moment of his development.

The researcher concludes that the performance is therefore the result of determinants linked to the athlete himself, his practice and his environment, whatever his level of practice at a given moment.

3.3- Basketball (Alexandru, Radu, 2010): it is one of the most popular sports in the world. Participants of all ages have discovered basketball to be fun, competitive educational, recreational, and fitness oriented. Individual skills, such as shooting, passing, dribbling, and rebounding, along with offensive and defensive teamwork, are prerequisites for successful participation in the sport.

4- The methodological procedures used in the study:

4-1 Method and tools: Method and tools: it is the road leading to the desired goal or the invisible thread that pulls the research from its beginning to the end in order to reach certain results (Abderahim, 2022: 910-1010).

-Approach used: in our study, we relied on the experimental approach of one group in two occasions (pre/post test) and this is to suit the nature of the subject as it allows us to verify the validity of the hypotheses that have been formulated, and is defined as an objective observation of a particular phenomenon in the field of sports that occurs in a particular situation and includes one or more variables while proving other variables.

-Sample: The sample was chosen from a group of 20 senior female basketball players from the Ain Benian basketball club who were 23.25 ± 3.24 years old. This group of girls has practiced sports for 9.85 ± 1.23 years. The players maintained their regular training program. The characteristics of the sample are shown in Table 1. The number of training sessions per week was three with an hourly volume of 06 hours. The subjects assured us that they were not taking any medication, exogenous supplements or other substances that could affect the balance of the body during this study. They stated that they did not suffer from severe menstrual cycle disorders. The subjects

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were informed about the experimental procedures and that the data from the study will be collected in a confidential and anonymous manner. Each girl was informed about the purpose of the study and gave her consent.

Table 1: Sample characteristics (mean: (M) $\pm$ standard deviation (SD))

Number of athletes	Age (year)	Weight (kg)	Taille (m)	IMC
20	23,25 $\pm$ 3,24	66,95 $\pm$ 11.25	1,68 $\pm$ 0,06	23.81 $\pm$ 4,32

Source: Table made by author's

- Research areas: The research was carried out within the following areas:

*Study community: in our study, the study community represents twenty basketball players of the team W.R.A.B of ain benian.

*Spatial domain: Experimental research was carried out in the basketball hall of the Omni-sport of ain benian in the Wilaya of Algiers.

*Time scope: The research was carried out from November 2021 to March 2022.

-Materials: In our study, players underwent physical testing on two separate occasions during and after menstruation using a pager, stopwatch, studs, decameter; running lane; My Jump 2 application and assistants.

-Field Tests: The following table details physical tests of strength, endurance, speed, and agility:

Table 2: Description of physical tests

TESTS	OBJECTIFS
Sprint 30 m (Cazorla, 1984)	Speed measurement
Vertical Jump (Bolliet, 2021)	Measurement of the strength of the lower limbs
T Agility Test (Barilari, 2018)	To evaluate the ability to change direction quickly while maintaining balance and without losing speed

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30"-15" IFT (Dellal, 2020)	Estimating intermittent endurance
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Source: Table made by author's

- **The scientific foundations of the tool:** We used field tests to confirm or refute our research hypothesis. And as with any measuring instrument, we proceeded to ensure the reliability and validity of the tests proposed in our research.

Reliability: to check the reliability of our tests (Table 03), we proceeded to calculate the correlation between the pre and post tests.

Table N° 03: Correlation results between pre/post tests

Designation	Number (N)	Degree of sig	Pearson's Correlation	Sig	Signification
Vertical jump (Cm)	10	0,05	0.997	,000	Significant
Sprint (30m) (S)	10	0,05	0,996	,000	Significant
T Agility Test (S)	10	0,05	0,999	,000	Significant
IFT 30"15" (Km/h)	10	0,05	0,970	,000	Significant

Source : Table made by author's

The analysis of the table above shows a Pearson correlation coefficient that varies between 97% and 99%. This means that there is a strong correlation between the pre and post tests, so we conclude that our tests are reliable and can be applied in our study.

Validity: to check the validity of our tests, we will proceed to calculate the root of the correlation coefficient between the pre and post tests.

Table N° 04: Presentation of the validity results of the pre/post tests

Designation	Sig	Reliability	Validity	Signification
Vertical jump (Cm)	0,05	0.997	0,998	Significant
Sprint (30m) (S)	0,05	0,996	0,997	Significant
T Agility Test (S)	0,05	0,999	0,999	Significant
IFT 30"15" (Km/h)	0,05	0,970	0,984	Significant

Source : Table made by author's

The analysis of the table above shows a validity coefficient that varies between 98% and 99%. This means that our tests are valid and can be applied in our study.

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-Statistical tools: for descriptive statistics, we calculated the mean and standard deviation. For the analytical statistics, we used the Student's t test for two matched samples. The calculations were made using the SPSS "24" and Excel 2013 software. The significance level used was $p < 0.05$.

5- Presentation and Analysis of Results:

The different results of the physical tests are reported in Table N°05 and the descriptive parameters are elaborated in mean values $\pm$ standard deviation.

Table N° 5: Descriptive and analytical statistical data of physical tests

Physical tests	Descriptive parameters		T- Student's test
	EL	EF	EL-EF
Vertical jump (Cm)	27,72 $\pm$ 5,23	29,62 $\pm$ 6,75	Significant difference (sig > 0,05)
Sprint (30m) (S)	7,18 $\pm$ 0,52	7,14 $\pm$ 0,45	Insignificant difference (sig < 0,05)
T Agility Test (S)	11,35 $\pm$ 0,66	11,31 $\pm$ 0,77	Insignificant difference (sig < 0,05)
IFT 30"15" (Km/h)	12,93 $\pm$ 1,45	13,48 $\pm$ 1,28	Significant difference (sig > 0,05)

Source: Values made by author's (Early Luteal phase ; EF : Early Follicular phase; Cm : Centimeter ; S : Second ; Km/h : Kilometer by hour)

5.1- The vertical expansion test:

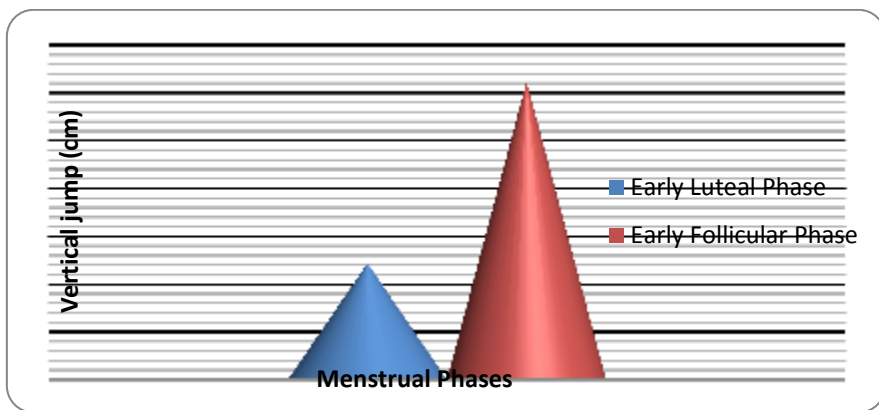
The analysis of the vertical jump test's results (table n°5) reveals a significant rise in the mean from 27.72 to 29.62, as well as an increase in the standard deviation from 5.23 to 6.75.

The significance value is higher than the 0.05 threshold which means that there is an improvement of the explosive strength in favor of the follicular phase compared to the luteal phase i.e. that menstruation has a positive effect on the explosive strength of the lower limbs.

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Figure 1: Variations of the vertical expansion during the menstrual cycle



Source: histogram made by author's

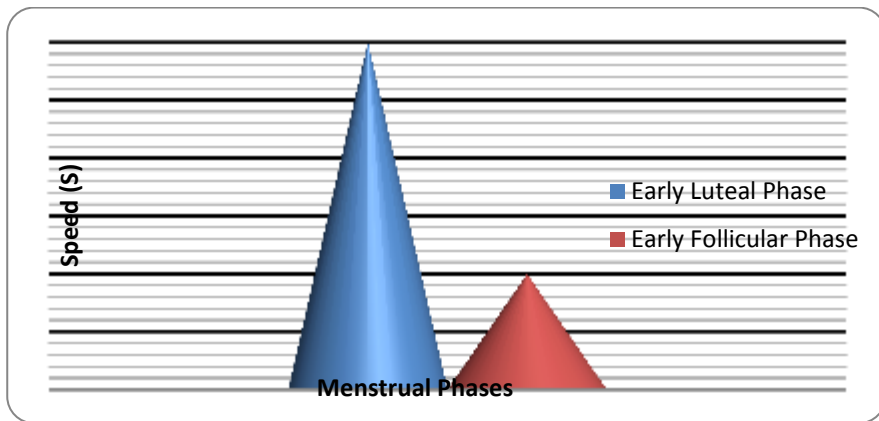
5.2- Sprint test (30m):

Through table 3, we notice that the speed decreased from 7.18 to 7.14 with a standard deviation of 0.52 and 0.45. This change is insignificant, which means that menstruation doesn't affect speed performance.

Figure 2: Variation of the speed on test 30m during the menstrual cycle

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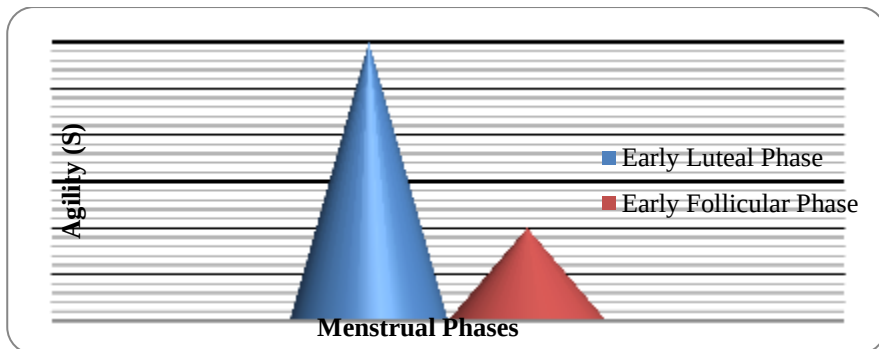


Source: histogram made by author's

5.3- Agility Test :

The results of the T-test comparison show that no significant changes were observed for this test during both the menstrual and non-menstrual periods. This means that the menstrual cycle has no effect on agility performance.

Figure 3: Variation in agility during the menstrual cycle



Source: histogram made by author's

5.4- Endurance test IFT 30''15''

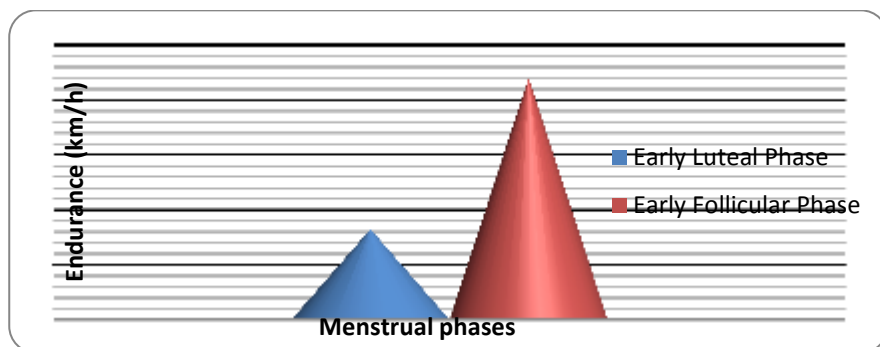
Analysis of the table (05) shows an increase in endurance from 12.93 to 13.48 respectively, of a decrease in standard deviation from 1.45 to 1.28. This improvement in endurance is in favor of the follicular phase

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which means that menstruation has a positive effect on endurance performance.

Figure 4: Variation of endurance during the menstrual cycle



Source: Histogram made by author's

6-Discussion and interpretation of the results:

The improvements recorded in the vertical relaxation test are in favor of the menstrual period. However, this increase in performance can be explained by the decrease in progesterone during the follicular phase compared to the luteal phase. Indeed, progesterone acts as an inhibitor of cortical excitability hence a negative effect on force production (Del Vecchio, 2019:2445-2456). Similarly, the body is more inclined to use carbohydrates and draw on glycogen stores, making it a good time for explosiveness work and muscle development resulting in improved strength (Wikström-Frisén, 2017:13-18).

Our results are consistent with those of Miyazaki. (2022); McNulty. (2020); Statham.(2020); Thompson et al. (2019); Sung et al. (2014); Tasmektepligil. (2010) and contrary to those of Kishali.(2004), Smirniotou.(2004); Vaiksaar. (2011); Julian. (2017); Lara.(2019); Romero-Moraleda.(2019); Arazi et al.(2019); Blagrove.(2020); Dasa et al.(2021) who state that there are no significant differences in strength performance during and outside of menstruation.

The velocity test shows no variation in velocity performance during the two cycle phases (follicular phase and luteal phase). This stability of speed can be explained by the fact that the stiffness of muscles doesn't change throughout the menstrual cycle (Tsampoukos et al,

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2010;245-250). Similarly, it can be explained to the short duration between the two tests (Pre/Post test).

Our results are similar to those of Sunderland. (2003); Smirniotou et al. (2004); Kishali. (2004); Tasmektepligil.(2010); Tsampoukous et al. (2010); Somboonwong et al. (2015); Julian et al. (2017, 2020); Tounsi. (2018); Arazi et al. (2019); Romero Moraleda. (2019); Lara et al. (2020); Dasa et al.(2021) which indicated that the menstrual cycle doesn't affect sprint performance and are in contrast to those of Guo et al. (2005); Seck et al. (2013) and Cook et al. (2018).

The agility test, like the speed test, does not show significant variations in performance during the menstrual cycle. A possible explanation for the lack of significant results between menstrual and non-menstrual agility times is related to the fact that the neuromuscular system is not affected by the menstrual cycle, making it unlikely that hormonal disturbances (estradiol) would have an effect on strength, power production, deceleration or acceleration (DiBrezzo, 1991). These results affirm that mental processing during the execution of athletic maneuvers may not be influenced by hormonal fluctuations (Jonge, 2003:28).

Our results are contradictory to those of Lebrun. (1993); kheniser. (2016) and Sawai et al. (2018) who show that the menstrual cycle affects agility performance and that agility becomes better during the follicular phase. On the other hand, it is worth mentioning that few studies that have focused on the impact of menstrual cycle on agility performance.

For the endurance test, the significant increase in performance during the follicular phase may be related to the decrease in progesterone production since its high level creates a great thermoregulatory and cardiovascular stress that potentially limits endurance performance (Goldsmith & Glaister, 2020). This could also be related to increased estrogen levels as estrogen would increase the availability of free fatty acids during exercise (Dokumaci& Hazır, 2019) and promote lipid oxidation in the muscles thus a more durable resistance to fatigue resulting in improved endurance performance (Slimani, 2016).

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The results of our study agree with those of Julian et al. (2017, 2020); Sutresna. (2016); Shakhlina. (2016); De Jonge. (2003); Graja.(2020); Carmicael et al. (2021); Barbara Moreno et al. (2022); Willett et al. (2021); Beatriz et al.(2021).

Arazi et al. (2019); Tounsi (2018);Vaiksaar et al. (2011); Hanif et al.(2011); Burrows & Bird. (2005); Oosthuyse et al. (2005); Sunderland et al. (2003) found no significant difference was recorded in endurance performance between follicular and luteal phase.

Conclusion:

The practice of performance sports by women remains nowadays still shy in our countries because of some social superstitions (Seck et al, 2013: 27-34). These superstitions are generally related to the physiology of women that differentiates them from men (Bach, 2018). The idea of whether menstruation exerts an influence on athletic activity in women has motivated much research. Various physical performance assessment methods have been conducted to answer this question.

For this study, our work was based on four physical qualities (vertical relaxation, speed, agility, intermittent endurance) whose objective is to highlight the impact of the menstrual cycle on the physical performance of high level female basketball players.

Of the overall physical parameters, only agility and speed did not experience a significant change related to the menstrual cycle. However, vertical relaxation and intermittent endurance experienced a significant improvement in performance in favor of the follicular phase which is consistent with the results of those Julian et al. (2017, 2020); Sutresna. (2016); Shakhlina. (2016); Graja.(2020); Carmicael et al. (2021); Barbara Moreno et al. (2022); Willett et al. (2021);

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Beatriz et al.(2021) Miyazaki.(2022);McNulty.(2020); Statham.(2020); Thompson et al. (2020); Sung et al. (2014); Tasmektepligil. (2010).

Other investigations on haematological, physiological, psychological and anthropometric parameters would allow us to have more information on the experience of the menstrual cycle in high level athletes. Dietary surveys over several days would allow objective planning of the athlete's diet, taking into account the alterations caused by the menstrual cycle. The use of a larger sample size and if possible with athletes and sedentary people would help to clarify certain metabolic variations.

Finally, a better knowledge of women's specificities (hormonal fluctuations) by the sports world would allow to adapt the management of high level sportswomen and to optimize their physical performances.

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