

## AWARENESS OF WOMEN ATHLETES ABOUT REGULARITY OF THE MENSTRUAL CYCLE AND IT'S IMPACT ON THEIR PERFORMANCE

DOI:

(Original scientific paper)

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### Abstract

*The effect of the menstrual cycle on physical performance is being increasingly recognised as a key consideration for women's sport and a critical field for further research. The purpose of this research is to assess the awareness of the regularity of the menstrual cycle and its influence on sports woman performance. This study examine acquired performance, which consistently report that female athletes do not identify their performance as relatively variable depending on the different phases of the menstrual cycle. Overall sports performance can be influenced by acquired (subjective) consequences, physical factors and nutritional needs. Hence, to optimize performance and training management of eumenorrheic female athletes, there is a need for further research to quantify the influence of menstrual cycle phase on acquired and physical performance and to identify factors that influence variability in objective sports performance.*

**Key words:** Sport, Menstrual cycle, Nutrition, Performance

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### Introduction

The elements of the unique physiological process in women, i.e. the menstrual cycle and its different phases, as well as fluctuating female hormone concentrations are an important factor for optimizing sports performance and maintaining women's health among athletes. Studying the influence of the menstrual cycle on sports form is an important component that should develop the evidence base in women's sports science<sup>1</sup>. Development of this evidence base will enhance understanding of the menstrual cycle as it affects female athletes and inform the design of training, recovery and menstrual phase control programs.

### Physiology of the menstrual cycle

The menstrual cycle is a cycle that prepares the uterus for a potential pregnancy. It is regular and lasts between 21 to 35 days, known as eumenorrhoea. It is divided into two phases, follicular (ovum maturation) and luteal (free egg ready to be fertilized), which are then divided into subphases: menstruation, early and late follicular phase, ovulation, early and late luteal phase. According to the subphases, there is a fluctuation of sex hormones, namely FSH, LH, estrogen and progesterone<sup>2,3</sup>.

The early follicular phase begins with menstruation, which lasts 4-6 days, during this phase sex hormones have low concentrations. The follicular phase continues until ovulation, when estrogen is high, at the same time FSH increases its concentration, which causes LH to reach its highest peak concentration. This enables ovulation, i.e. the process of the egg leaving the follicle and going to the uterus, where the follicular phase ends and the luteal phase begins. An increased secretion of progesterone from the corpus luteum (produced by the ruptured follicle) and a small amount of estrogen begins. The luteal phase will end with pregnancy, if the fertilized ovum implants in the uterine wall, or the ovum remains unfertilized, the concentration of progesterone will fall and a new menstrual cycle will begin with bleeding<sup>4,5,6</sup>.

The menstrual cycle in girls starts around the age of 13<sup>7</sup> and will continue until menopause around the age of 50<sup>8</sup>, if it is not interrupted by pregnancy, hormonal contraceptives or due to a hormonal disorder.

Approximately 67-91% of elite female athletes are eumenorrheic<sup>9,10</sup> and half of them do not use contraceptives<sup>11,12</sup>. This indicates that a significant proportion of female athletes have cyclical hormonal fluctuations.

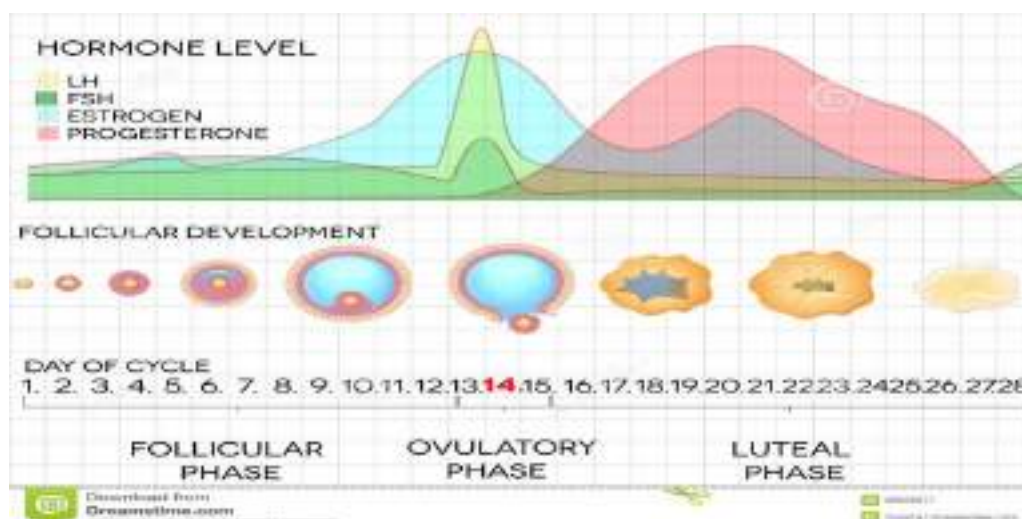


Figure 1. Hormonal fluctuations and phases of a 28-day menstrual cycle.

### Changes in performance based on mechanisms of the menstrual cycle

It is hypothesized that physical performance changes during the menstrual cycle due to various mechanisms, such as altered muscle activation, metabolic products, thermoregulation, and body composition. Concentrations of female sex hormones can be responsible for impaired energy production, so this can affect muscle strength and power. Estrogen has a neuroexcitatory effect<sup>13</sup>, and progesterone inhibits cortical excitability<sup>14</sup>, thus having a positive or negative effect on energy production<sup>15-18</sup>. It is assumed that greater strength and results would be obtained when estrogen reaches its peak, i.e. in the follicular phase, and lower results in the luteal (progesterone) phase. Another potential cause that can affect strength and performance is testosterone in the mid-luteal phase<sup>19</sup>. Testosterone enhances physical strength through better neural activation, muscle electrophysiological and contractile characteristics, and motor system function<sup>20</sup>.

This mechanism should be investigated, as it may have an impact on physical strength in the corresponding subphase of the menstrual cycle. Numerous studies indicate the luteal phase as a risk factor for soft tissue injuries<sup>21,22</sup>. Metabolic products are mechanisms that differ in different phases of the menstrual cycle and affect endurance performance. Estrogen increases the availability of free fatty acids as an energy source during exercise and stimulates lipid oxidation in skeletal muscle, while progesterone opposes the action of estrogen by limiting fat oxidation<sup>23</sup>.

### Purpose

The purpose of this research is to assess the knowledge of female athletes about Low Energy Availability and to determine the differences in the approach of female athletes who have and those who do not have knowledge about Relative Energy Deficiency in Sports (RED-S).

The results of this research will go in the direction of providing guidelines for the education of female athletes on regular menstrual cycle, proper training, maintenance of sports form, nutrition and recognition of symptoms of Low energy availability.

### Material and method:

In this research, 303 female athletes from the territory of the Republic of Macedonia who are professionally engaged in sports, in collective and individual sports, and train more than five times a week, were surveyed.

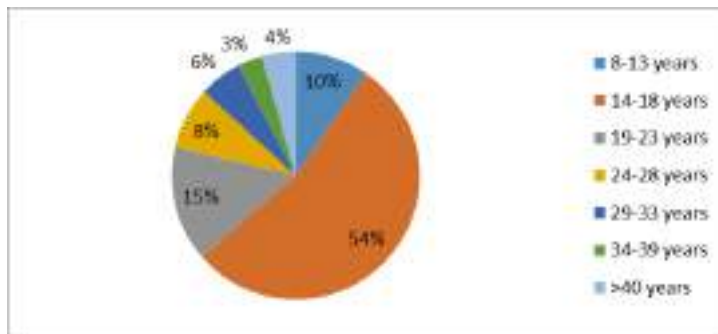
The research was prospective, conducted through an online Web-survey questionnaire during one month - December 2023, on a targeted group of female athletes.

### Results

The survey included 303 female athletes from different age groups, who train in different sports. 89.8% answered the survey question about age. From where it can be seen that the highest percentage of sportswomen are in the 14-18 age groups, even 54%, while 8-13 years and 19-23 years are the ages where interest decreases significantly. In the group of 8-13 years, girls are targeted in primary schools. The main

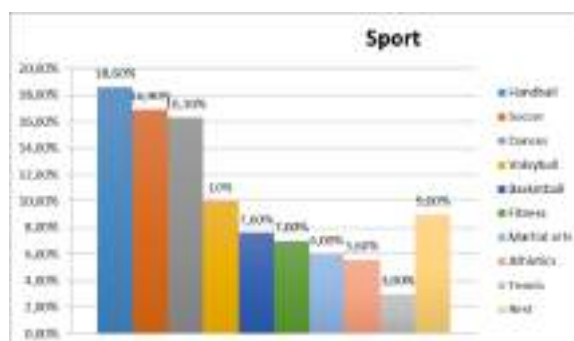
motivation for participating in sports are parents, teachers of physical education and sports, as well as friends who already play sports, so that's how sports are chosen.

While the group of 19-23 years with 15.1% shows decrease of the percentage of interesting in sports, for any reason (injury, college, pregnancy, emigration). Also the following categories, the percentage decreases, but there are still women who are over 40 years old with 4.4% and still actively engaged in sports.



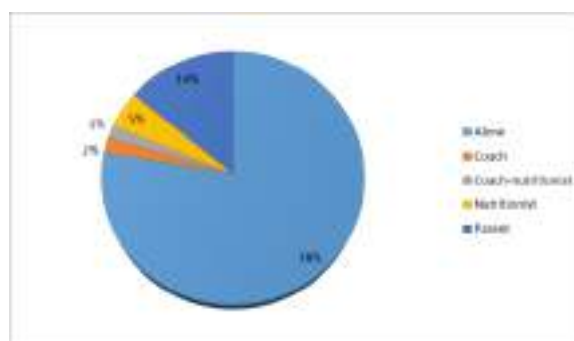
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99.3% answered about the type of sport they train. According to the percentage answers, participation in team sports is greater than in individual sports. However, the highest percentage is for handball with 18.6%, then football with 16.9%, dances 16.3% (ballet, acrodance, zumba, etc.), volleyball with 10%, basketball with 7.6%, fitness 7%, martial arts 6% (boxing, karate, judo, aikido), athletics 5.6%, tennis 3% and other sports (triathlon, cycling, ballet, fencing, figure skating, skiing, Nordic skiing, etc.) with 9%.



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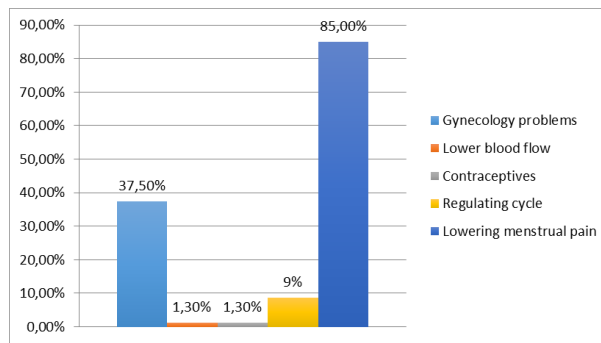
About the importance of sports nutrition and its connection with sports performance, 99.7% responded, of which 99% declared that proper sports nutrition is important. 99% answered the question of who determined their diet, of which 77.7% state that they determine their own diet, coach 2%, parent 14%, nutritionist coach 1.6% and a sports nutritionist 4.7%. The percentage of 6.3% collectively from a trainer nutritionist and a sports nutritionist points to the data that all the others do not know the importance and connection of nutrition with maintaining the sport performance and indirectly with the regular menstrual cycle.



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Female athletes were asked if they used oral contraceptives. 96% answered this question, of which 79.7% said they do not use it.

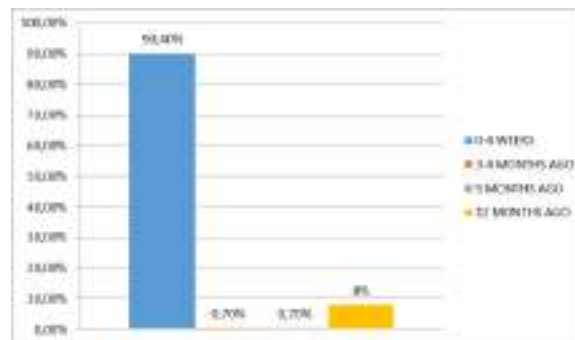
Only 26% answered the question what was the reason they used oral contraceptives, and the largest percentage is 85% for reducing menstrual pain, which is in the indication area of their use. All the answers offered are in the indicative area, but still the answer of 8.7% for the regulation of the menstrual cycle has an indication, but it should be considered in the direction of whether the irregular cycle is due to inadequate nutrition, with or without nutritional disorders, or due to maladjusted intense training and thus the reason for using oral contraceptives masks the real condition that needs consultation not only with a gynecologist, but also with a medical team trained to diagnose Low Energy availability.



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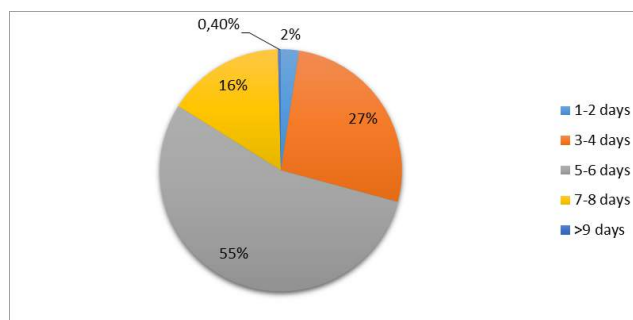
Sportswomen were asked if they have a regular menstrual cycle, to which 94.1% of those surveyed answered, and 88.1% declared that they have a regular menstrual cycle.

89.1% of female athletes answered the question when they had their last menstrual cycle, of which 90.4% in the last 0-4 weeks. We need to consider the others who have 0.7% before 3-4 months, 0.7% before five months ago, and especially the percentage of 8.2% before twelve months ago is in a critical risk group, where it is necessary for these athletes to approach with a multidisciplinary examination and to find the real reason for the irregular cycle.



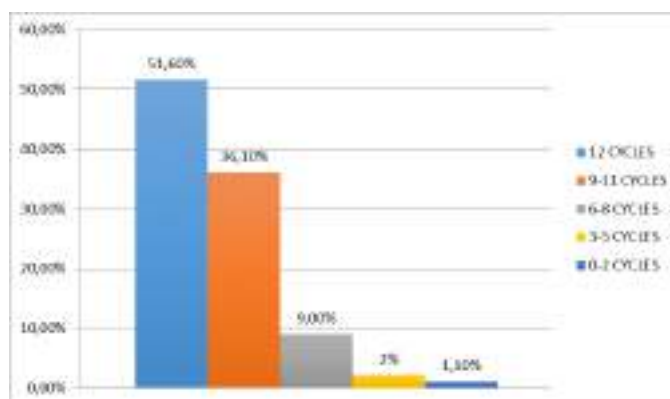
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Regarding the length of the menstrual cycle expressed in days, 94.7% of the female athletes gave an answer, 54.7% in the group 5-6 days, 26.8% to 3-4 days, 15.7% to 7-8 days, and the percentage of 2, 4% to 1-2 days and 0.4% more than 9 days is worrying and needs to be investigated.

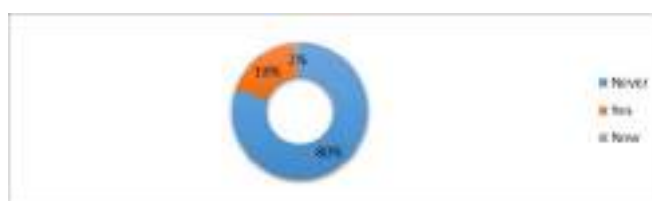


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Question of how many menstrual cycles they had last year, 91.4% of female athletes gave the following answers: 51.6% answered that they have 12 cycles a year, while female athletes in the group with an answer of 9-11 cycles will need to be carefully investigated. Those with 9 cycles in a year, there is a question where they subtly overtrained or it is the borderline for Low energy availability, of course if all organic causes of oligomenorrhea (menstrual cycle occurring for more than 35 days) are excluded. It can already be said with certainty that the groups of 6-8 cycles with 9%, 3-5 cycles with 2.2% and 0-2 cycles with 1.1% have a serious problem that must be investigated by a whole medical team of Relative energy availability syndrome (RED-S).

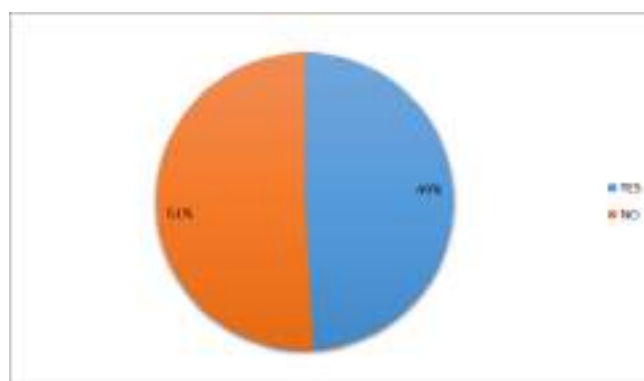


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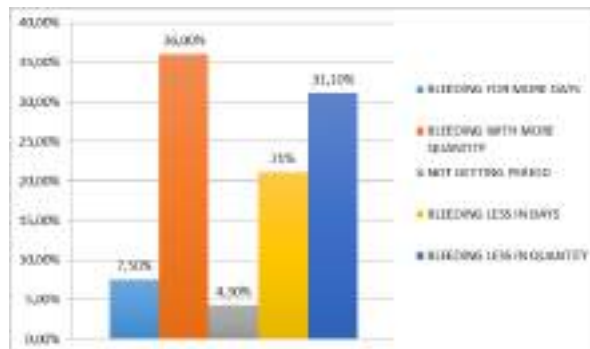
Regarding the regularity of the menstrual cycle, and is it more than three months late, 80% of the athletes answered that it was never late. While Yes, answered with 18.2% and Now with 1.8%. These are female athletes who should be further investigated to determine the cause of this condition. If we compare the percentage answers to this and the previous question, 80% declared for a regular cycle and compared to the answers for 12 cycles and 9-11 cycles together it is 87.7%. Which means 7.7% are those who deviate and need an examination by the RED-S medical team for counseling, change of training, rest or treatment, if needed. The remainder who said Yes at 18.2% and Now at 1.8% definitely need screening, which coincides with the combined percentage of irregular cycles 6-8, 3-5 and 0-2, which is 12.3% and plus 7.7%, the proportion that differed between 80% for a regular menstrual cycle and that of the sum of responses with 12 cycles and 9-11 cycles



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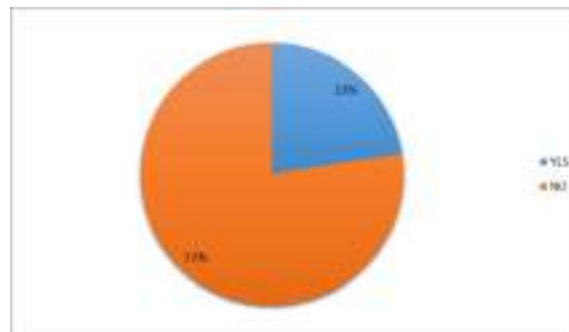
94,1% were asked if they have changes in the menstrual cycle, during a period of hard, intense training. So 49,1% answered yes, and 50.9% no. From this, we conclude that it is very important for women athletes, especially for themselves to be educated about their hygienic and dietary lifestyle. We must pay attention to the balance of training - nutrition - rest, otherwise there will be changes first in the sports performance, then in the regularity of the menstrual cycle, and further if this condition is not corrected, there may be psycho-physical consequences for the health of the athlete.

53.1% of female athletes responded to the question of what happens to the menstrual cycle during hard, intense training, of which 7.5% bleed more days, while 36% bleed more in volume. Bleeding less in days 21.1%, and bleeding less in volume 31.1%, and menstruation stops with 4.3%. From the answers of the last 3 groups, can be conclude the need for education and screening methods for Low Energy Availability, bance of training intensity and rest.



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95.7% of female athletes gave an answer for stress urinary incontinence, with 14.8% saying Yes, while 85.2% saying No. The percentage of 14.8% shows that female athletes need education to maintain pelvic floor muscle tone. But that does not mean that the group with No answer does not need education.



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## Discussion

First and foremost, RED-S is not something that can be supported or repaired on its own; ideally, this process involves a team of medical professionals (eg, sports physician, gynecologist, psychologist and dietician) who will work together with athletes and coaches, establishing best practices for training and encouragement for better medical work and protect the health of athletes. Although coaches or parents are the first line of defense to notice or respond when athlete health concerns issues related to RED-S. Contacting a team of clinical providers for more guidance around physical and mental health parameters of athlete is a critical initial step.

Within a team setting, regardless of your role, creating and fostering a safe environment for athletes to share or address issues related to eating, body image, and mental health disorders is another profoundly impactful way to reduce incidence of RED-S and providing appropriate support for any existing issues. Some activities that can help facilitate a safer environment.

If we take a good look at the age groups where 54% belong to the 14-18 years group, we cannot expect female athletes to know how and how much to dose the energy intake, which is expected if it is not balanced, unless a suitable team advises and educates them about the importance of balance between nutrition,



training and rest. There are sports that are at risk for Low Energy Availability, especially individual sports, but collective sports would not be left out, because screening programs for identifying athletes at risk of Relative Energy Availability in sports should be available to everyone.

In summary, the IOC REDS expert writing group defines the diagnosis of REDs as:

A diagnosis of REDs results from the clinical assessment by a physician with expertise in REDs, utilising information collected from a multi-disciplinary team (e.g., sports medicine physician, sports dietitian, sports gynecologist, sports physiologist, sports psychologist/psychiatrist), which ideally includes: 1) appropriately validated questionnaires and/or clinical interview; 2) physical assessment; and 3) laboratory and imaging data as indicated in the IOC REDs Severity/Risk Assessment and Stratification Tool. A REDs diagnosis is predicated on excluding other aetiologies in the differential diagnosis for each REDs indicator and ranges from yellow to orange to red severity/risk.<sup>5</sup>

## Conclusion

Our overall message is that it is worth noting these small effects of raising awareness among female athletes about menstrual cycle regularity, which have great importance for elite athletes where the difference between winning and losing is minimal. Therefore, from here we conclude that recommendations are needed to expand the medical team and practitioners who work with elite athletes, especially they should monitor and take into account the menstrual cycle and be aware of changes during the cycle and thus, when performance of exercise can be reduced or strengthened.

Sport and medical staff must set a clear, consistent message that athlete health is and always will be more important than athlete performance. We will not sacrifice the athlete's health in exchange for greater performance; in fact, athletes should understand that they cannot truly reach peak performance if they are in poor health.

This approach should be tailored and sufficiently accessible for information to the individual athlete.

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