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The effect of menstrual cycle on anaerobic power and jumping performance

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Background and Study Aim There has been a significant increase in the participation levels of women in competitive sports in recent years. This has contributed to the increase of research on women's participation in sports and their health. The aim of this study is to investigate the effect of the menstrual cycle on anaerobic power and jumping performance.

Material and Methods In this study, 15 female athletes between the ages of 18-24, who have a regular menstrual cycle for the last 6 months. They have not used any hormone preparations, have not received any medical support in the last month. They are healthy and actively engaged in sports in university teams (basketball, futsal, volleyball) participated voluntarily. Wingate Anaerobic Power Test and Active Jumping Test applied to athletes during their menstrual phases (second day of the menstruation period) and follicular phases (14th day of the menstruation period). In the statistical analysis of the data, descriptive analyses of test measurements of athletes were calculated as mean and standard deviation. Whether there is a significant difference between the measurements taken on two different days was analyzed using the t-test in dependent groups.

Results It was determined that the anaerobic power and active jump performances of the participants had an effect on peak power, fatigue index and active jump performance between day 2 and day 14 values. Also, there was a statistically significant difference between these values ($p<0.05$).

Conclusions: This situation can be explained as a result of the hormonal changes in the menstrual period of the athletes and the effects of psychological factors specific to this period.

Keywords: menstruation, performance, sport, anaerobic power, active jumping.

Introduction

Women have a different structure compared to men with their physiological, anatomical, psychological and special conditions. The difference in these structures greatly affects the sportive performance of both breeds. The biggest physiological difference that separates women from men is the menstrual cycles under the control of the hormonal system [1]. In addition, when both sexes are examined in terms of anatomical structure, there is a 5-10% difference between them, while this rate varies around 10-20% in terms of their physiological structures [2].

In recent years, there has been a significant increase in the participation levels of women in competitive sports. This situation has contributed to the increase of research on women's participation in sports and their health. According to researches, it has been stated that varying hormone levels within the menstrual cycle can affect sports performance [3-6].

Female athletes who have regular menstrual cycles do not need to correct their menstrual bleeding for maximal performance in sports branches that require strength and power, and in sports where high levels of aerobic-anaerobic capacity are required. It is very important to organize mental and physical functions in a balanced way for maximal physical performance. Since the effects of menstruation on sportive performance are remarkable, there have been many studies in the literature examining the relationship between menstruation and sports [7-11].

Studies on the subject in the literature have shown that menstruation does not have a great effect on the organism and women can easily participate in sports activities. In fact, it has been observed that many female athletes performed successfully and achieved significant degrees during their menstrual periods [12] In addition, it is known that irregularities of the menstrual cycle are often seen in endurance athletes [13]. In a study conducted on adolescent athletes, it was reported that menstrual disorders are quite common [14].

In the findings of these studies, it was determined that it was not revealed exactly whether menstruation affects sports performance in women. It is very important to determine how the menstrual period affects women's sports performance and their capacity to use motor characteristics. In this context, this research was conducted to investigate the effect of the menstrual cycle on anaerobic power and jumping performance.

Material and Methods

Research Group

In this study, 15 female athletes between the ages of 18-24, who have a regular menstrual cycle for the last 6 months. They have not used any hormone preparations, have not received any medical support in the last month. They are healthy and actively engaged in sports in university teams (basketball, futsal, volleyball)

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participated voluntarily.

Prior to the study, 18 June 2021 (Decision number: 60116787-020-64733) ethics committee approval was obtained from Pamukkale University Non-Invasive Clinical Research Ethics Committee.

Participants were given detailed information about the risks that may be encountered in the study, and the voluntary consent form was read and signed. In addition, participants were asked to sleep for at least 8 hours before each test, to avoid intense physical activity the day before and on the test day, and to quit alcohol and caffeine intake 24 hours before each test.

Procedure

On which day of the menstrual cycle of the subjects, the subjects were asked verbally in advance and the measurements were planned based on the information provided by the subjects. In this study the measurements were taken in the menstrual phase, which is the second day of the menstruation period, and the ovulation phase (ovulation period), which is the 14th day. The menstrual calendars of the subjects were recorded one month before the measurement started.

Exclusion Criteria

* Using a menstrual regulator,

* Disabled or sick on the day of measurement,

* Participants with suspected pregnancy were excluded from the study.

Data Collection Tools

Anthropometric Measurements

Participants' height was measured with a wall-mounted stadiometer (Holtain, England), which can measure with an accuracy of 0.1 cm, and body weight with an electronic scales (Tanita TBF 401A, Japan) that can measure with an accuracy of 0.1 kg.

Performance Tests

Active Jumping Test

A total of 8 minutes of warm-up protocol was applied to the participants including 5 minutes of low-tempo warm-up and 3 minutes of dynamic flexibility movements for lower extremities before the test. Later, the active jumping performances of the participants were measured with Smart Jump. The athletes climbed on the mat in light sports clothing (tights and T-shirt) and made a quick downward slump from the upright position, jumped upward with maximum force and were placed back on the mat. This jumping was repeated 3 times. The best and average jump height and the best and average hovering times were read and recorded from the computer program as the hops time in the air in milliseconds (ms) and height in centimeters (cm).

Wingate Anaerobic Power Test

A pre-test warm-up protocol was applied to the participants. After the participants sit on the bicycle ergometer, the appropriate sitting height was set. Warm-up included pedaling at 60-70 RPM (RPM) for 4 minutes. The participant applied 3-second maximal pedaling protocols 1 minute 30 seconds after the beginning of this warm-up period and 2 minutes and 30 seconds later. By observing the maximum RPM speed of the participant at these maximal pedal speeds, the required saddle release pedal speed for the test was determined. After the warm-up was finished, the participants were given a 5-minute recovery period. Then, when the participants reached the maximal pedal speed within the first 5 seconds, the weight seat was automatically released and they pedal at the maximum speed on the bicycle ergometer against the predetermined constant load for 30 seconds to provide the highest mechanical power. During the test applied, measurements were made automatically every five seconds at six equal time intervals and the relative power data were recorded as maximum anaerobic power (W / kg), average anaerobic power (W / kg) and minimum anaerobic power (W / kg).

Statistical Analysis

SPSS 22.0 for Windows package program was used in the analysis of the data obtained. Descriptive analyzes of the participants' basic characteristics were calculated as mean and standard deviation. Whether the data showed normal distribution was evaluated using the Shapiro-Wilk test. Whether there is a significant difference between the measurements taken on two different days was analyzed using the t-test in dependent groups. The level of significance was set at $p < 0.05$.

Results

Descriptive characteristics of the participants are shown in Table 1.

As a result of the measurements made, it was determined that wingate anaerobic test and active jump performances of the participants had an effect on peak power, fatigue index and active jump performance between day 2 and day 14 values. There was a statistically significant difference between these values ($p<0.05$). In the study, when the performance values in different phases of the menstrual cycle were compared, it was found that the anaerobic performances and jumping performances of female athletes were higher on the 14th day, that is, during the ovulation period (Table 2).

Table 1. Descriptive characteristics of the participants

Variables	N	Mean ± Sd	Min. Value	Max. Value
Age (years)	15	21.27 ± 2.05	18	24
Body weight (kg)	15	60.40 ± 5.88	50,20	72,50
Height (cm)	15	167.40 ± 4.69	160,44	175,78

Table 2. Anaerobic power and jump performance menstrual phase difference analysis table

	Parameters	Mean ± Sd	t	p
Anaerobic Power	Peak Power (W) 2nd day	873,96 ± 98,29	-2,80	0,001*
	Peak Power (W) 14th day	950,46 ± 83,31		
	Average Power (W) 2nd day	612,45 ± 88,86	-1,33	0,20
	Average Power (W) 14th day	647,68 ± 97,41		
	Min Power (W) 2nd day	344,90 ± 98,56	-1,79	0,09
	Min Power (W) 14th day	399,89 ± 71,58		
	Fatigue Index (%) 2nd day	60,73 ± 9,46	3,19	0,01*
	Fatigue Index (%) 14th day	51,19 ± 10,82		
Jumping	Active Jumping (cm) 2nd day	25,67 ± 4,92	-3,80	0,00*
	Active Jumping (cm) 14th day	27,39 ± 5,82		

(p<0,05)

Discussion

The menstrual cycle affects many parameters in metabolic, cardiovascular and respiratory aspects besides athletic performance due to the changes it causes in hormonal structure. Since there are many factors that affect athletic performance, researchers have also done a lot of research on performance changes during menstrual periods. When the studies in the literature are examined, it is seen that the findings of the research examining the relationship between sportive performance and menstrual cycle periods are contradictory [15]. In some studies, there was no significant change in sports performance parameters during menstruation [16-18], on the other hand, in some studies, it was determined that there was an increase or decrease in sports performance elements during this period [19-21].

According to the findings of the study, it was determined that wingate anaerobic test and active jump performances of the participants had an effect on peak power, fatigue index and active jump performance between day 2 and day 14 values and there was a statistically significant difference between these values (p<0.05). In the study, when the performance values in different phases of the menstrual cycle were compared, it was found that the anaerobic performances and jumping performances of female athletes were higher on the 14th day, that is, during the ovulation period.

Looking at the studies parallel to the findings of our study, Masterson [22] found a difference in the wingate anaerobic power test performed in the follicular phase and luteal phase in his study on 32 college athletes in terms of anaerobic capacity between phases and the maximum power values they can produce. According to the test results, anaerobic capacity and maximum power values were higher in the follicular phase compared to the luteal phase. In a similar study by Karacan [23] it was reported that premenstrual syndrome, in which physical, psychological and behavioral changes are experienced in the second half of the menstrual cycle three days before menstruation, negatively affects attention, concentration, motivation, speed and quickness, which are among the determinants of performance. Colakoglu et al. [24] investigated the relationship between exercise-menstruation and training age-menstrual cycle pattern in a survey they conducted on 56 active female volleyball players, and as a result, they found that exercise did not affect menstruation and that menstruation psychologically affected sports activity. Karacan et al. [25] in their studies investigating the relationship between menstruation and different branches of football, basketball, handball and field hockey, among 133 women athletes from the Turkish First League and Turkish Super League, it was stated that menstruation physically affected sportive activity as well as sports activity. Also reported that it affects the menstrual cycle. Kucuk and Ozgıder [26] in the survey they conducted on 72 volunteer women volleyball players, the athletes' menstruation; They reported that it affected their daily life and physical performance. In a study conducted by Akkus [27] on athletics and volleyball athletes, it was found that the strength, speed and endurance performances of athletes differ in different stages of the menstruation period, and these changes were found to be at a statistically significant level. Smith et al. [28] showed that menstruation was affected by high intensity exercises in the responses to exercises of different intensity in 3 different periods of menstruation. Aras et al. [29] examined anaerobic power

values according to the phases of the menstrual cycle in their study. For the 9 volunteers who participated, they found that the anaerobic power values did not change in the follicular, ovulation and luteal phases of the menstrual cycle.

There are studies in the literature that do not parallel our study findings. In a study conducted by Higgs and Robertson [30] it was found that there is no change in the sportive performance of female athletes before and during menstruation. Ertas and Ersoz [31] reported in their study on 28 female athletes with 14 regular and 14 irregular menstruations, and the best degrees of athletes were at the beginning of menstruation. Cakmakcı et al. [2] applied wingate test to female university students on the 2nd and 14th day of their menstrual cycle and reported that anaerobic performance obtained in menstruation and follicular phases was not different as a result of the research. Dolek and Ersoz [32] in their study on swimmers, showed that athletes with regular menstruation periods are best 25 meters They reported that they demonstrated their swimming performances on the 2nd and 15th day of their menstrual cycle, respectively, and the worst degrees occurred on the 26th day of the cycle, and there was a statistically significant difference between the results. In another study conducted by Bushman et al. [33] anaerobic power in moderately active women between menstrual period and luteal period after the wingate test in both normal menstrual cycles (n = 7) and oral contraceptive users (n = 17) It has been determined that there is no difference. Tsampoukos et al. [34] in their study on 8 healthy female athletes, reported that the mean peak power and mean power values did not differ statistically between phases. Hazır et al. [35] found no effect of menstruation on repetitive sprint performance and recovery rate in the repetitive sprint test and recovery rate measurements they performed in the midfollicular phase and luteal phase on 11 female athletes with regular menstruation. In the study conducted by Stefanovsky et al. [36] on judo athletes, the participants were applied the wingate test and their performance values in different phases of the menstrual cycle were compared. It has been reported that there is no statistically significant difference between the performance values. Moraleda et al. [16] in their study on 13 female triathletes, performed half squats with 50% of their 1RM on athletes. It has been reported that the performances of the athletes in 3 different menstrual cycles did not make a significant difference. In a study conducted by Guler [37] on volleyball players, it was reported that the menstrual cycle did not have any effect on the flexibility, muscle strength, anaerobic power and sprint performances of the athletes. The period of menstruation, physiological changes in body weight, edema in the abdomen, wrists and ankles, pain in the abdomen and waist area, psychological anxiety, irritability, minor depressive states, and mental depressions are clinical symptoms of premenstrual syndrome. Physiologically and psychologically negative effects are thought to affect performance negatively [23].

Conclusions

As a result, it can be said that physiological changes during menstruation should be known by trainers and it should be taken into consideration that these changes may affect sportive performance. In addition, in new studies on the subject; the number of phases measured, the number of similar tests and subjects can be increased. In other branches where the anaerobic energy system is dominant, the measurement can be made by applying the same test protocol and the results can be compared.

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Conflicts of Interest

The authors state no conflicts of interest.

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