INTERNATIONAL SEVEN JOURNAL
OF HEALTH RESEARCH
ISSN: 2764-9415

Influence of the phases of the menstrual cycle on strength capacity in resistance training

Influência das fases do ciclo menstrual na capacidade de força no treinamento resistido

DOI: 10.56238/isevjhv2n2-002
Receiving the originals: 03/03/2023
Acceptance for publication: 24/03/2023

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ABSTRACT

It is known that resistance training for women brings several benefits such as improved health, physical and emotional well-being, and improved strength capacity, and can also help in the menstrual cycle. Most women believe that menstrual symptoms such as weight gain, cramps, bloating, and discouragement are factors for the loss of muscle performance; however, regular and periodized training according to the biological individuality can minimize these symptoms. The objective of the study was to carry out a bibliographic review about the influence of the phases of the menstrual cycle on the strength capacity in resistance training. Consultations were made to the following databases: Scielo, Medline, Lilacs, and Pubmed, using the following criteria: date of publication between January 2000 and December 2019; languages, Portuguese and English; terms included in the title and/or abstract - woman, strength training, menstrual cycle, resistance exercise, strength levels, and effects of the phases of the menstrual cycle on resistance training. Eight studies were analyzed, where four observed menstrual cycle interferences on strength performance and four did not. Thus, it can be concluded that the relationship of strength during the phases of the menstrual cycle are still controversial. It is suggested that further studies be carried out to verify and prove the influence of the phases of the menstrual cycle on strength capacity in resistance training.

Keywords: Weight training, Luteal phase, Follicular phase, Strength exercise.

1 INTRODUCTION

The menstrual cycle is divided into three distinct phases: follicular, ovulatory, and luteal. The follicular phase starts on the first day of menstruation and the ovulatory phase can last up to

three days, in these phases' estrogen levels are high, while the luteal phase that goes from the end of ovulation until the beginning of menstrual flow is characterized by high levels of progesterone, having its highest peak right after ovulation. In the last days of the menstrual cycle progesterone and estrogen fall, causing the onset of menstruation (CHAVES et al., 2002), along with menstrual symptoms consisting of weight gain, bloating, cramps and discouragement (BURROWS, PETERS, 2007).

According to Dedrick et al. (2008) there are estrogen receptors present in skeletal muscle, which can affect the maximum activity of skeletal muscle fiber, altering motor control and force transmission. Progesterone has a central thermogenic effect, which can raise body temperature from 0.3ºC to 0.5ºC (CONSTANTINI et al., 2005).

Strength capacity according to the literature, is said to overcome the force of gravity, friction, air, water, elastic objects, body weight, or of additional weights. There are two strands: the external forces, which act externally to the body, such as gravity, friction, inertia. And the internal forces, which are produced by the muscles, ligaments, and tendons, and which allow overcoming resistance (RODRIGUES, 2000).

Resistance training can be defined as regular, systematized, and controlled physical exercises that involve muscle contraction in order to sustain or move a resistance employed against a certain movement (FARINATTI, 2008).

Several studies have verified beneficial effects of resistance exercise for women in the primary and secondary prevention of many diseases, such as heart disease, osteoporosis, hypertension, diabetes, among others, as well as improvements in psychological depression and hot flashes, which consist of a sudden and transient sensation of moderate or intense heat in the pre-climacteric period (LEITÃO et al., 2000).

Over the years there has been a large increase in the demand for resistance training for women of all ages, both for aesthetic and high-performance purposes, and for improved health, well-being, self-acceptance, and improved self-esteem (SANTOS et al., 2019).

The biological individuality of each person should be observed and taken into consideration when setting up a training/periodization (HEBERTZ, 2019). Therefore, according to Neis, Pizzi (2018) it is important to consider the phases of the menstrual cycle and hormonal changes when planning and applying a training. The objective of the present study was to perform a literature review about the influence of the phases of the menstrual cycle on strength training.

2 METHODOLOGY

Literature review in which queries were made to Scielo, Medline, Lilacs, and Pubmed databases, using the following criteria: publication date between January 2000 and December 2019; languages, Portuguese and English; terms included in the title and/or abstract - woman, strength training, menstrual cycle, resistance exercise, strength levels, and effects of menstrual cycle phases on resistance training.

To select the articles, the abstracts were read, verifying if they contained the following criteria: studies with participants whose menstrual cycle was not interrupted, using or not contraceptives; studies that evaluated the effects and the influences of the different phases of the menstrual cycle on resistance training. The selected articles were read in full.

3. RESULTS

Based on the criteria described in the methodology, eight articles that portray the influence of the phases of the menstrual cycle on strength capacity during resistance training were selected, as shown in table 1.

Table 1. Selected articles regarding the influence of the phases of the menstrual cycle on strength capacity during the menstrual cycle.

Author (year)	Goal	Result	Conclusion
DIAS et al., 2005	To verify the effect of different phases of the menstrual cycle on strength performance in a 10-repetition maximal test.	Frontal pull up had no significant difference. Leg press was found to vary without significant differences in loads, especially between the follicular and luteal phases.	There were no significant variations in muscle strength during the phases of the menstrual cycle.
SIMÃO et al., 2007	To verify differences in the levels of muscle strength of the upper and lower limbs in women during the phases of the menstrual cycle	Front pull up (PF) there was no significant difference in any of the phases. Leg press (LP) significant differences between the first and the other three phases.	The influence of the menstrual cycle on strength capacity in the lower limbs is suggested, but the same cannot be said for upper limbs.
LOUREIRO et al., 2011	To compare the muscle strength of women in the premenstrual, menstrual and postmenstrual phases, through 10RM tests.	Extending chair and flexor chair, did not show a major increase in performance over the tests.	Difference in maximal strength in the post menstrual phase greater than in the menstrual and premenstrual phase.
LOPES et al., 2013	To evaluate the influence of the menstrual cycle on muscle strength performance.	A drop in muscle performance occurred only in the follicular period.	It influences muscle strength performance in the upper limbs, with impaired strength during the follicular phase.

BEZERRA et al., 2015	To evaluate muscle strength in different phases of a menstrual cycle - menstrual and post-menstrual period.	Straight press there was no significant difference. Leg press there was a significant difference in the menstrual period compared to the post menstrual period.	The phases of the menstrual cycle can influence lower limb strength performance, with worsening in the follicular phase.
RIBAS et al., 2016	To analyze the profile of resistance muscle strength during the menstrual cycle in women exercisers.	No significant difference was found between the phases of the menstrual cycle and between the groups.	Knee flexor endurance muscle strength did not decrease during the phases of the menstrual cycle.
FRACARO et al., 2018	Influence of follicular and luteal phases on lower limb strength performance.	In the follicular phase a significant increase in strength occurred with respect to the luteal phase.	The phases show significant differences in the performance of lower limb muscle strength, a decrease in strength was noted in the luteal phase.

Some studies state that there are significant differences in the phases of the menstrual cycle, while others say the opposite and add that the "lack" of strength may be related to psychological reasons such as lack of enthusiasm in training.

In the studies of Dias et al. (2005) and Simão et al. (2007), they verified if there were differences in the levels of muscular strength of the upper and lower limbs, using for these two exercises, the frontal pulls in pulley, that works the trapezius, latissimus dorsi, rhomboids and biceps and the leg press 45º, that has the action of the quadriceps, ischiotibials and sural triceps. It was noticed in both studies that in relation to the frontal pull up exercise, there was no significant difference, but in the leg press exercise, Simão et al. (2007) verified a difference of load between the menstrual phase with the other phases, while Dias et al. (2005) observed variations without significant differences in loads ($p = 0.292$), mainly between the follicular and luteal phases.

In the first phase, the exercise was performed with a load of 121 kg± 1.0 kg, while in the other three phases a load of 130 kg± 5.0 kg was used; however, for the upper limbs, the load found in the four phases was 33 kg± 2.0 kg. However, Dias et al. (2005) affirm that there are no significant variations in muscular strength during the phases of the menstrual cycle, therefore the hormonal alterations are not enough to affect the physical performance, therefore they recommend not to deprive the students of the resistance training.

When they carried out tests with the exercises: leg press 45º, horizontal supine, extensor chair and biceps curl, they verified that there is an increase of 5% in strength only in the leg press exercise comparing the luteal phase with the follicular and ovulatory phase, the others had no difference in strength. It was concluded in the study that resistance exercises, whether for large or

small muscle groups, in different body segments, single or multi-joint, are not influenced by the phases of the menstrual cycle (LOUREIRO et al., 2011).

In the study by Celestino et al. (2012), the authors compared the muscle strength of women in the follicular, ovulatory, and luteal phases, there were 8 participants divided into two groups of 4 people each, the control group (CG) and the trained group (GT), all of them were submitted to the 10RM test in the extensor chair and flexor chair apparatus, the average was analyzed by the number of plates of the Righetto apparatus where each plate weighs 5kg. They noticed that the WG presented higher loads, in the extensor chair exercise in the luteal phase presented an average of 10.1±1.3 plates, the follicular phase 10.5 (± 1.5) plates and the ovulatory phase 10.8 (± 1.3) plates.

In the ergonomic chair exercise, the luteal phase presented an average of 7.7 (± 0.5) plaques, the follicular phase 7.4 (± 0.9) plaques and the ovulatory phase 7.9 (± 0.5) plaques, compared to the CG that, in the extension chair exercise, the luteal phase presented an average of 7.7 (± 1.2) plaques, the follicular phase 7.8 (± 1.3) plaques and the ovulatory phase 8.2 (± 1.3) plaques. In the flexor chair exercise, the luteal phase presented an average of 6.7 (± 0.8) plaques, the follicular phase 6.8 (± 0.7) plaques and the ovulatory phase 7.3 (± 1.0) plaques. This is due to the fact that the WG already practiced resistance exercises. After the tests they could observe that the knee flexion exercises in the flexor chair and knee extension in the extensor chair did not show an important increase in performance, but due to a minimal variation in the results of maximum strength in the ovulatory phase greater than in the follicular and luteal phase, the authors highlighted the need for a periodized planning during the phases of the menstrual cycle (CELESTINO et al., 2012).

The 20 volunteers for the study of Lopes et al. (2013), were submitted to the protocol of 1RM to determine the maximum load, during 26 days, where it was evaluated only the strength of upper limbs in the exercise of supine straight. According to the phases of the menstrual cycle (follicular, ovulatory and luteal), they observed a drop in muscle performance only in the follicular phase, so they consider the planning of training for women taking into account the phases of the menstrual cycle.

The tests of Bezerra et al. (2015) were performed only in the menstrual and postmenstrual periods, with the straight supine and leg press exercises using the 1RM protocol for maximum strength evaluation. According to the authors, in the straight supine exercise there was no variation in strength, but in the leg press exercise they observed a variation in the menstrual period in relation

to the postmenstrual period. Therefore, they prioritize the periodization for women, because according to them, the phases of the menstrual cycle can influence the strength performance.

In a study with 36 women whose objective was to analyze the profile of the muscular strength during the menstrual cycle, they made the evaluations during the three phases of the menstrual cycle on the extensor chair apparatus and found no significant differences between the phases of the menstrual cycle, they could notice that there is a correlation between muscle mass and the number of repetitions, verifying that the greater the muscle mass, the greater the number of repetitions, in the follicular phase R= 0.5024, P= 0.020, ovulatory R= 0.7482, P= 0.0001 and luteal R= 0.4704, P= 0.031, where R= is Pearson's correlation coefficient, this coefficient assumes values between - 1 and 1. P= value when ≤0.05 demonstrates a significant correlation between the variables. For the authors there was no decrease in quadriceps muscle strength during the phases of the menstrual cycle and added that there is no need to reduce loads (RIBAS et al., 2016).

Finally, Fracaro et al. (2018) analyzed the influence of the follicular and luteal phases in the performance of lower limb strength, a 1RM test was performed on the leg press 45º apparatus in 18 women who practiced weight training. It was possible to visualize through the test that in the follicular phase occurred a significant increase of force compared to the luteal phase, in the follicular phase they obtained an average of 191.05 kg while in the luteal phase an average of 189.83 kg. As a conclusion they state that the follicular and luteal phases have significant differences in lower limb strength performance and a decrease in strength in the luteal phase.

4 DISCUSSION

The objective of this review was to verify in the literature the influence of the phases of the menstrual cycle on strength capacity in resistance training. According to the articles studied we could observe a divergence of results found.

According to Dias et al. (2005), Simão et al. (2007) and Bezerra et al. (2015) there were no upper limb variations, but lower limb variations, the studies point out that there was a worsening in performance only in the menstrual phase.

In the study by Lopes et al. (2013), the authors aimed to evaluate upper limb muscle strength in trained women. It was possible to observe that there was a decrease in muscle performance only in the follicular period. At the beginning of the follicular phase the estrogen and progesterone levels are low, thus occurring the beginning of menstruation (JANSE DE JONGE., 2003).

In the studies of Dias et al. (2005), Simão et al. (2007), Bezerra et al. (2015) and Lopes et al. (2013), the authors believe that the decrease in strength during menstrual period can be influenced by psychological factors such as motivation, feeling of vigor, willingness to exercise, also some menstrual symptoms such as fluid retention, weight gain, fatigue and dysmenorrhea, which refers to the symptoms before or during menstruation such as cramps and abdominal pain, bring harmful effects to the performance of women (BURROWS et al., 2007).

Even with a small variation in strength in the different phases of the menstrual cycle in both groups, the increase in performance in the post-menstrual phase is characterized by the elevation in estrogen levels, which besides having an anabolic effect on muscles (ISOTTON et al., 2008), can act on the central nervous system and alter motor control and force transmission pattern, due to the fact that there are estrogen receptors present in skeletal muscles (DEDRICK et al., 2008).

There was no decrease in strength performance in lower limbs in the study by Ribas et al. (2016), and they added that the lower the fat mass and the higher the lean mass, the influence of the menstrual cycle phases will be less evident in the performance of women, due to the fact that they are more active. This is explained because women who exercise regularly have relief from menstrual symptoms (LEITÃO et al., 2000).

A significant increase in strength during the follicular phase compared to the luteal phase, may occur due to progesterone reaching its highest blood concentration during the luteal phase having a catabolic effect on muscles (FLECK AND KRAEMER, 2017), for this fact the authors justify the lower performance in the luteal phase.

Estrogen in turn has an anabolic effect on muscles, which also explains the better performance of women in the phase of its highest peak. Loureiro et al. (2011) suggest that new studies should be conducted with a larger number of participants, better methodological control and better control of the exercise variables, such as rest intervals, speed of execution, among others.

5. CONCLUSION

It is concluded based on the articles selected in this literature review that four articles found influence of the phases of the menstrual cycle in the capacity of strength in resistance training and four did not verify influences, with this, it is still observed a discrepancy in the results of the analyzed articles, making still inconclusive the subject in question. It is known that the main hormones of the menstrual cycle are estrogen, which has an anabolic effect on the muscles, and progesterone, with a catabolic effect. It is suggested that further studies be carried out in order to

verify and prove the influence of the phases of the menstrual cycle on the strength capacity in resistance training.

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