EXERCISE AND SPORTS MEDICINE CLINIC

ORIGINAL ARTICLE

INFLUENCE OF DIFFERENT PHASES OF MENSTRUAL CYCLE ON FLEXIBILITY OF YOUNG WOMEN

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ABSTRACT

Introduction: The menstrual cycle is the main responsible for changes in female physiology, which may affect some morphofunctional responses. Objective: to investigate the influence of the different phases of the menstrual cycle on the physical flexibility of young women. Methods: 44 volunteers were divided into a control group (n = 24), which made regular use of hormonal contraceptives, and an experimental group (n = 20), which did not use contraceptives. All volunteers underwent three days of evaluations, one for each phase of menstrual cycle (follicular, ovulatory and luteal). Anthropometric data (body mass, body mass index, waist and abdomen circumferences), and body composition data (body fat percentage and lean mass) were assessed. Flexibility was then analyzed through the sit and reach test on Wells bench. The non-parametric Mann-Whitney test was then applied for intragroup comparisons, and the Friedman test for comparison between the different menstrual phases. Results: No significant differences between groups within and between different phases of the cycle were observed ($p > 0.05$). Greater variability within the control group was observed when compared to the experimental group. Conclusion: Regardless of the menstrual cycle phase and of the use of hormonal contraceptives, the physical flexibility is not altered in young women.

Keywords: joint range of motion, gonadal hormones, menstruation period.

INTRODUCTION

The menstrual cycle is a biological phenomenon which occurs in healthy women which has as notable characteristic the vaginal blood flow. Such phenomenon has a cyclic characteristic which occurs as a direct result of variations of the hormone concentrations secreted by the hypothalamus-hypophysis-gonadal axis[1,2]. The menstrual cycle lasts in average 28 days, and can be divided in three phases: follicular, ovulatory and luteal. The follicular phase begins on the first day of menstruation and lasts until the ninth day; the ovulatory phase occurs between days 10 and 14; and the luteal phase begins in the end of the ovulation and lasts until the beginning of the menstrual flow[3]. The use of hormone contraceptives avoids ovulation; that is to say, the release of eggs by the ovaries (ovulatory phase) due to the suppression of the gonadotropins secretion.

Some studies have analyzed the influence of the menstrual cycle on some morphofunctional parameters such as anaerobic power[4], pulmonary function[5], resting metabolic rate[6], body composition[7], muscle strength[8] and flexibility[9-11]. Moreover, review articles have reported divergence about the influence of the menstrual cycle on the sports performance[12-14].

Different physical capacities demonstrate contradictory responses concerning the menstrual cycle. Some studies report that the different phases of the cycle do not interfere in flexibility[9,10]. On the other hand, Bell *et al.*[11] found more extensibility of the hamstring muscles during the ovulatory phase when compared with the menstrual phase (follicular).

It is speculated that the menstrual cycle may affect the level of articular range of motion. Despite of that, the literature does not have it clear about the influence of this relation between women who make use or not of contraceptive methods. Thus, the present study had the aim to verify the influence of the different phases of the menstrual cycle on flexibility of apparently healthy young women.

METHODS

Sample recruiting and selection

82 apparently healthy women aged between 18 and 40 years were conveniently recruited. Inclusion criterion selected those women who had full knowledge about their menstrual cycle, which could be regular between 25 and 40 days[4]. After the initial selection, those who reported history of any disorder related to the endocrine system and/or who did not have regular menstrual cycle were excluded. Therefore, initially anamnesis was applied for the first triage of the volunteers in which personal data including name, age, address, telephone number, besides information about the menstrual cycle and habitual practice of physical activity were recorded. Those who reported systematized physical activity practice for at least three consecutive months with minimum frequency of three weekly days and time equal or longer than 30 minutes per session were classified as physically active.

After the initial procedures and drop-outs by several reasons during the data collection period, the sample was composed of 44 women who signed a Free and Clarified Consent Form which respects the resolution # 196/96 of the National Health Board. The present study was submitted to and approved by the Ethics in Research with Humans Committee of the Holy House of Mercy of Juiz de Fora, MG, under the legal opinion number 011/10.

Experimental protocol

After the initial procedures the volunteers were familiarized with the environment in which the data collection occurred and the professional involved in the experiment. Therefore, the sample was divided in two groups: one experimental group (EG), which was composed of women who did not make use of hormone contraceptive (n = 20, out of which 13 were physically active); and a control group (CG), which was composed of women who made use of hormone contraceptives for at least two cycles (n = 24, out of which 11 physically active). All of them randomly paid three visits to the laboratory a (individual x phase of the cycle: follicular, ovulatory and luteal).

The phases were defined concerning the day of the cycle and subsequent data analysis according to the criterion proposed by Wojtys *et al.*[3] for eumenorrheic women in which the follicular phase begins on the first day of the cycle, that is, in the beginning of the menstruation, and lasts until the ninth day; the ovulatory phase occurs between days 10 and 14 and the luteal phase begins from the 15th day and lasts until the end of the cycle.

During each phase, the anthropometric measures were collected (body mass, stature and BMI) and of body composition (fat percentage and lean mass) to avoid any influence of the menstrual cycle in the sample characteristics. The fat percentage was calculated through the Siri formula[15] from the body density estimated by the Jackson *et al.* equation[16].

Flexibility was analyzed by the sit and reach test on the Wells bench, by Cefise® (Brazil), on which the volunteers performed the movement with hands overlapped, feet rested on the bench and knees totally extended with aid from the evaluator. As in the studies by Minatto *et al.*[17] and Ribeiro *et al.*[18], at the command to start, the volunteers would bend their backs forward with their heads between arms and reach as far as possible, holding for approximately two seconds until the reading was done. No previous warm-up was performed, and the furthest value reached in three attempts was validated, respecting a one-minute interval between them.

The time of the evaluations was standardized for each volunteer according to the first visit to the laboratory, keeping a distance from the first and the last hours of the day[10].

Statistical treatment

A Kolmogorov-Smirnov normality test was applied to verify the distribution of the sampling data. Since the data did not present Gaussian distribution, the descriptive results were represented by mean and standard deviation and the graphic values by median and amplitude.

Inferential analysis was possible through application of a Mann-Whitney non-parametric test for intergroup comparisons and for comparison between the phases of the menstrual cycle the Friedman test for dependent samples was used. Therefore, the SPSS® 12.0 software for Windows in which significance level adopted was $p < 0.05$ was used.

RESULTS

The sample was characterized using the measurements from the first visit, regardless of the menstrual cycle phase. According to table 1, significant difference in individual characteristics of the sample has not been observed between groups ($p > 0.05$).

Anthropometric (body mass, BMI, waist and abdomen circumference) and body composition data (fat percentage and lean mass) did not present differences in the menstrual cycle phases ($p > 0.05$). When these variables were compared in each phase of the cycle between the control and experimental groups, no significant difference was found ($p > 0.05$) (table 2).

Concerning the level of flexibility, figure 1 presents the median and amplitude values in each menstrual cycle phase, in which intra and intergroup significant differences have not been found ($p > 0.05$). However, from these median values, the follicular (CG: 30.2 ± 8.4cm; EG: 32.8 ± 5.7cm), ovulatory (CG: 30.2 ± 9.2cm; EG: 33.0 ± 5.3cm) and luteal (CG: 30.3 ± 8.7cm; EG: 33.2 ± 5.7cm) phases presented a difference in the variability coefficient between groups. The variability coefficient was higher in the control group when compared with the experimental one (Table 3).

Table 1. Mean values of the individual characteristics of the control and experimental groups.

	Control (n = 24)	Experimental (n = 20)	P value
Age (years)	24 ± 5	23 ± 5	0.334
Body mass (kg)	55.9 ± 6.9	61.0 ± 12.5	0.151
Stature (cm)	162.4 ± 5.5	163.2 ± 4.7	0.817
BMI (kg/m2)	21.1 ± 1.5	22.8 ± 3.7	0.125
Waist (cm)	67.3 ± 4.6	70.6 ± 8.1	0.214
Abdomen (cm)	78.0 ± 6.3	81.0 ± 11.2	0.495
Fat (%)	28.8 ± 4.3	30.9 ± 7.0	0.180
Lean mass (kg)	39.7 ± 3.9	41.6 ± 5.7	0.252

Values represented in mean ± standard deviation. Control group: with use of contraceptive; Experimental group: without use of contraceptive. P-value: significance level ($p < 0.05$).

Table 2. Anthropometric and of body composition values between the menstrual cycle phases.

	BM (kg)	BMI (kg/m2)	Fat (%)	LM (kg)	Waist (cm)	Abdomen (cm)
Control group: with use of hormone contraceptives						
Follicular	56.2 ± 7.0	21.1 ± 1.6	28.3 ± 4.2	40.0 ± 3.8	67.4 ± 4.5	77.5 ± 5.5
Ovulatory	56.1 ± 6.7	21.1 ± 1.5	28.4 ± 4.0	40.2 ± 3.9	68.0 ± 5.8	78.1 ± 6.2
Luteal	56.2 ± 6.8	21.1 ± 1.6	28.5 ± 4.5	40.0 ± 3.6	67.0 ± 4.7	78.3 ± 6.1
Experimental group: without hormone contraceptives						
Follicular	61.1 ± 11.9	22.9 ± 3.7	31.0 ± 6.8	41.2 ± 5.1	70.7 ± 7.6	81.6 ± 10.1
Ovulatory	61.0 ± 12.0	22.8 ± 3.8	31.4 ± 7.0	41.6 ± 5.3	70.5 ± 7.8	81.1 ± 10.5
Luteal	61.1 ± 12.1	22.8 ± 3.8	32.1 ± 7.4	40.9 ± 5.4	70.8 ± 8.3	81.4 ± 10.1

Values represented in mean ± standard deviation. BM body mass; BMI: body mass index; LM: lean mass.

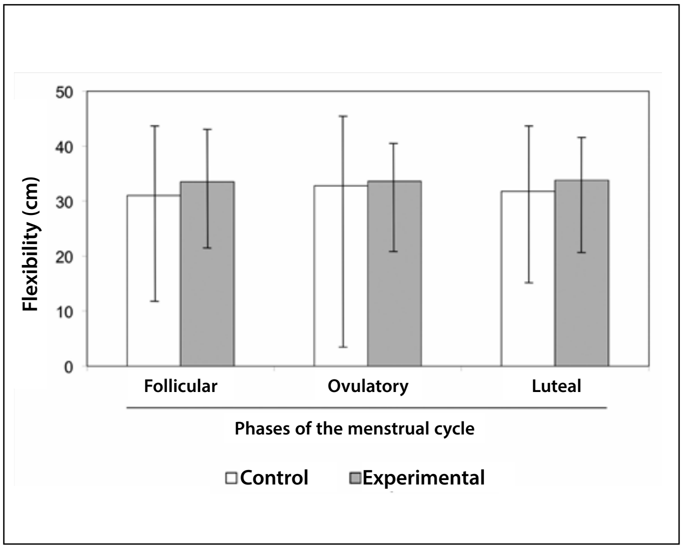

Figure 1. Flexibility response in the sit and reach test in each phase of the menstrual cycle. Values presented in median and amplitude.

Table 3. Mean values of flexibility through the sit and reach test.

	Control (n = 24)	Experimental (n = 20)
Follicular	30.2 ± 8.4 (27.8)	32.8 ± 5.7 (17.3)
Ovulatory	30.2 ± 9.2 (30.4)	33.0 ± 5.3 (16.1)
Luteal	30.3 ± 8.7 (28.6)	33.2 ± 5.7 (17.1)

Values represented in mean ± standard deviation (percentage of the variability coefficient). Control group: with use of contraceptives; Experimental group: without use of contraceptives.

DISCUSSION

The present investigation had the aim to verify the influence of the different phases of the menstrual cycle (follicular, ovulatory and luteal) in the flexibility response of young women. Flexibility was measured through the sit and reach test in the Wells bench, which is validated for flexibility measurement of trunk and hamstring muscles[17,18]. Therefore, the findings of this study should not be misinterpreted when the found values are reported.

Since it is known that alteration in the anthropometric and body composition variables could affect the flexibility level, these parameters were evaluated in each phase of the menstrual cycle. No difference of these variables was found intra and intergroup for each phase of the cycle. Thus, had flexibility suffered any alteration, the responses could be attributed to the different phases of the menstrual cycle These results are close to the ones found by Minatto *et al.*[17], who demonstrated that the sit and reach test did not suffer any influence from age, body mass, stature, body composition and sexual maturation.

The present study evidenced that probably the menstrual cycle does not statistically interfere in the level of range of motion, since the studied sample did not present intra and intergroup significant differences. However, it seems to present a variability difference between groups. Similar results were found by Chaves *et al.*[9] and Melegario *et al.*[10] when the flexibility behavior was analyzed in different menstrual phases; however, they presented different methodologies for the flexibility analysis (flexitest and goniometry, respectively). Chaves *et al.*[9] pointed out that absence of hormone analysis for determination of each phase of the cycle as a limitation to the study, which may have affected the results. Nevertheless, in this same flow of thinking, Melegario *et al.*[10] subsequently did not find differences in flexibility even when the hormone rate test was performed for determination of each phase of the menstrual cycle.

The absence in flexibility variance may be explained by the fact that the relaxin rates which act in the viscoelastic properties of the soft tissues[19] and/or in the consequent increase of body temperature[20] is not being able to affect the levels of range of motion during the phases of the menstrual cycle.

Contrary to what has been discussed, Bell *et al.*[11] observed increase of extensibility during the post-ovulatory phase compared to the analysis done three days after menstruation. No difference was found for muscular stiffness. The explanation mentioned was that the higher estrogen concentration during ovulation may increase the tolerance to the muscular strain, causing greater flexibility, without significant decrease of stiffness though.

Many investigations demonstrate that the different phases of the menstrual cycle affect ligament elasticity, in which risks to injury may increase[3,21-26]. It seems that the estrogen and progesterone hormone alterations are the main responsible for that. Such hormones directly act on the collagen metabolism, which, on its turn, acts on the properties of the ligaments[25]. This mechanism could also explain for some alteration in the flexibility level during the menstrual cycle. Despite of that, other authors did not find significant differences in the ligament laxity in the menstrual cycle phases[27,28].

As every experimental study, the present investigation presents some methodological limitations. The main limitation seems to do with the determination of the start and ending days of each phase of the menstrual cycle. The most accurate model would be through the analysis of serum levels of the estrogen/progesterone ratio in the urine[4,29], saliva[5] or blood[30]. Another limitation may be the lack of control in room temperature during the data collection, which may influence on the results due to the vasoconstriction response in lower temperatures and vasodilatation in higher temperatures[2]. Nonetheless, in order to minimize measurement errors during the tests, three movements were performed, being the highest one reached validated. It seems that during the attempts the body raises its inner temperature, which may improve performance.

As a conclusion, according to the findings here and considering the limitations of the present study, it seems that the different phases of the menstrual cycle do not interfere in the flexibility of young women. However, the variability among women who do not use contraceptive methods was higher than the ones who make use of them monthly. Finally, further investigation with more accurate definition of the menstrual cycle phases, women with different levels of physical activity as well as different levels of biological maturation, should be carried out in order to better compare the findings and clarify the theme.

All authors have declared there is not any potential conflict of interests concerning this article.

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