CHANGES OF THE FUNCTIONAL PARAMETER AND PHYSICAL PERFORMANCE DURING PARTICULAR PHASES OF A MENSTRUATION CYCLE – A PRELIMINARY STUDY

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Original scientific paper

Abstract

The aim of the study was to diagnose and analyse the changes in functional parameters and physical performance during phases of menstruation cycles of female university students. The experimental sample consisted of three female university students (age = 23.8±0.6 years) who had a regular menstruation cycle (MC) with the length of 28 days. The functional status of the students was diagnosed by the Ruffier functional test. Parameters of the physical performance were two chosen tests: reaction time (RT) measured by FiTRO Agility Check device; tapping frequency (TFLL) measured by a FiTRO tapping device. The best functional status of each student was diagnosed in the III. phase (ovulation). Each student achieved the best physical performance in RT test during the II. phase of the menstruation cycle (post menstruation, follicular). Student 1 and student 2 proved the best physical performance in the TFLL test during the II. phase of the menstruation cycle (post menstruation, follicular). Except mentioned parameters we detected and analysed the subjective feelings, which helped us in further results´ interpretation. Our probe is a preliminary study to monitor possible variations in chosen parameters of physical performance and functional parameter.

Key words**:** *reaction time, Ruffier functional test, tapping frequency of lower limbs*

Introduction

The menstruation cycle is a regular endogenous cycle which is an inherent part of women´s life. The first period is called menarche which is considered as the most significant milestone thanks to which each girl becomes a woman or in other words it is the transition from girlhood to womanhood. The influence of the cycle can be diagnosed in behaviour, physical performance and general psychological/ physical functioning. The behavioural and psychological changes are caused by the production of ovarian hormones. Chrisler et al. (2015) presents that women used to have negative attitudes during menstruation (menstruation phase) and were very moody. In our conditions, the menstruation cycle is divided into five phases according to Jančoková (1998): the I. phase of the menstruation cycle is called menstruation lasting from the 1st day to the 6th day. The II. phase, post menstruation (follicular - in the English terminology), is characterized for the 7th day to the 12th day of the cycle. The III. phase, ovulation, lasts from the 13th day to the 15th day. The IV. phase, post ovulation lasts from the 16th day to 25th day. The last phase, premenstruation, is characterized for the 26th to the 28th day. The English literature and terminology recognize four phases of menstruation cycle: the menstruation phase, follicular phase, ovulation phase and luteal phase. De Souza (1998), Broockset al. (1990), Christin-Maitre et al. (1996), Mukherjee, Mishra & Ray (2014), Jamieson (2015), Gursoy et al. (2015) Southam & Gonzaga (1965), Bendíková (2007, 2011) agreed with the mentioned classification. The menstruation cycle has (except specific phases) other very important characteristics: the length and regularity/irregularity (Cobb et al.2003; Munster, Schmidt & Helm, 1992; Barrow &Saha, 1988). Diaz, Laufer & Breech (2006) presented that abnormal menstruation cycles can be reasons for many health problems connected with blood pressure, heart rate or respiratory rate and they could be significant parameters of pregnancy. Jamieson (2015) stated that the abnormal (irregular) menstruation cycle is the main factor which causes psychological, emotional and physical strain in adolescent girls. Goel & Kundan (2011) presents that menstruation is a phenomenon that influences girls mainly emotionally. The irregular menstruation cycle is an abnormality which is caused by many emotional factors (stress, worry, upset depression) and physical factors (Can, 2008). Can (2008) also presents several types of abnormal (irregular) menstruation cycles: early menstruation cycle – this menstruation cycle comes 7-10 days earlier than usual, delayed menstruation cycle – the period occurs minimally a week later than usual, irregular menstruation cycle which is defined as the cycle which occurs alternatively – early or later as usually. The physical performance is very changeable and variable during the menstruation cycle. It is caused not only by the hormones´ fluctuations but also by lifestyle, eating habits, regularity/ irregularity of the menstruation cycle and the low bone mineral density. Hohmann et al. (2015) examined the tibial acceleration profiles during the particular phases of the menstruation cycle. The experimental sample consisted of female athletes (n=11, age 16-18 years). Their results showed significant difference in the time of top acceleration between menstruation and follicular

phase (p = 0.04), menstruation and ovulation phase (p = 0.001), menstruation and luteal phase (p = 0.002), and follicular phase and ovulation phase (p = 0.007). Finally, authors stated that the variation of the oestrogen level has very important effect on tibial acceleration profiles in female athletes. Tasmektepligil et al. (2010) diagnosed the motor performance of women. The results showed that the best motor performance was achieved during the II. phase (follicular phase – phase after the menstruation phase). Mukherjee, Mishra & Ray (2014) examined following menstruation characteristics: the age at menarche, cycle length, skipped cycle, premenstrual syndrome and heavy discharge. The results showed that menstruation (menstruation phase) is a very significant factor of low physical performance of women (high fatigue, psychological instability). Lebrun (2012) found out decrease of the sample´s physical performance in the luteal (pre-menstruation) and menstruation phase. The increase of the performance was diagnosed exactly in the follicular (post menstruation) phase.

According to the mentioned studies and researches we decided to realize research in which we found out the changes of functional parameters and physical performance during menstruation cycles of female university students attending physical education studies. The aim of the study was to diagnose and found out the changes of functional status and physical performance in particular phases of menstruation cycle of female university students.

Methods

Characteristics of the sample

The sample consisted of three female university students (age = 23.8±0.6 years) studying the physical education in combination at Matej Bel University in Banská Bystrica. The main criterion for each student was to have regular menstruation cycle lasting for 28 days. The students participated in research voluntarily (because the testing was realized five times a month in specific days and time). One of the most important information was the fact about the first menarche. We detected that student 1 had the first menarche at the age of 13. 5. Student 2 had the first period at the age of 10 and student 3 at the age of 14. Student 1 was interested in many sports and physical activities (modern dances, dance aerobics and athletics). Currently, she is practising dance aerobics regularly as a trainer. Student 2 was also interested in athletics during all studies at lower secondary school. Nowadays, she is interested in sport only in a recreational way. Student 3 was a basketball player in a Basketball team in Ružomberok but nowadays she also practices sport only in a recreational way.

Organization

The research was realized during the academic year 2014/2015 in theperiod from October 2014 to February 2015 in Diagnostic laboratory at Department of Physical education and Sports of Faculty of Arts at Matej Bel University in Banská Bystrica. In our probe, we monitored variations in particular parameters during two menstruation cycles. The length of the one cycle was 28 days. The concrete measurement was realized approximately in the middle of each phase (according to concrete phase of menstruation cycle) in the morning hours (from 9.00 AM to 11.00 AM) because this time interval is the most appropriate and optimal.

Measuring procedure

Firstly, we used a non-standardised interview as one of the primary method. Thanks to the interview we detected important information about the subjective feelings of each student. These findings were very important in results´ interpretation to analyse and find out relationship between the performance, status and condition. The interview consisted of 5 spheres of questions by which we registered information of:

- *state of health* - if she was healthy, ill, if she overcame some illness, if she felt pain, if she had some complications;
- *taking of medicaments* before or during the menstruation cycle (we tried to find out which medicine was used and for what)
- *psychological stability* - if she was nervous, depressed, sensitive, emotionally stable /unstable /calm;
- *realization of sports activities and their impact on organism*;
- *food intake and drinking* - if students were thirsty or hungry, if they drunk something before the measurement – coffee, water, energetic drinks;

They must not drink minimally half an hour before the measurement. Secondly, we diagnosed variations in functional parameter:

The functional status

The Ruffier functional test was used to monitor the changes of students´ functional state. The test monitored the performance of the cardiovascular system which, in simple way and with sufficient rate of reliability, set the functional state of the system and readiness of the organism for load. It consisted of three parts: In the first part - after the 5 minutes relax, we conducted the measuring of the heart rate (HR) in the sitting position – S1. In the second part we did 30 squats in 45 seconds and immediately measured the HR, similarly as in part one – S2. In the last part of the test the subject is again calming down in a sitting position for 1 minute and there is consecutive measuring of HR – S3. The index value was calculated from formula: RI = [(S1 + S2 + S3) - 200]/10 (sportinweb.sk, 2016). The Ruffier functional test was realized once. Finally, we monitored the changes and variations in physical performance.

Parameters of the physical performance

The first parameter, the reactiontime (RT) was measured through the device FiTRO Agility Check (FiTRONiC, Bratislava, Slovak Republic) consisted of four contact mats fixed and situated on the floor. Mats were placed into the shape of a square (with

external side size of 1.2 m) and were connected to a computer. The result of one measurement was a reaction time in milliseconds (ms) which was calculated as a mean of 50 visual signals generated randomly in a time interval 500-3000 ms on the computer´s screen to four directions according to mats placement (rear left, rear right, front left, front right). The measurement was realized twice and into the evaluation we noticed the better one from two realized experiments. The second parameter, the tapping frequency of lower limbs (TFLL) was measured by the device FiTROtapping (FiTRONiC, Bratislava, Slovak Republic) consisted of two contact mats fixed and placed on the floor and they were connected to the computer by an interface. The main task of the student was to touch alternately right and left mat by his left and right lower limb, as fast as possible (do maximal contacts with mats), during 6 seconds. The result of one measurement of tapping frequency of lower limbs was the number of contacts of both lower limbs on mats of the device FiTROtapping (FiTRONiC, Bratislava, Slovak Republic) lasting 6 seconds. The measurement was realized twice. We noticed the better one from two realized experiments.

Statistical analysis
In present study we used periphrastic characteristics of descriptive statistics arithmetic average (x) from the point of view of the position measures and standard deviation (SD) from the point of view of variability measures.

Results

Interpretation of the changes of the functional parameter and physical performance of the student 1

Table 1. presents the changes of the functional parameter and physical performance of the student 1 during the I. menstruation cycle lasting from 12/11/14 to 04/12/14.

Table 1. Variations of the functional parameter and physical performance in the I. MC of student 1

I. MC	Reaction time (ms)	Tapping frequency (n - contacts in 6 s)	Ruffier functional test (number of squats/functional state)
I. phase (MP)	645.7±177.9	63*	30/8
II. phase (PMP)	596.7±189.4*	58	30/9.5
III. phase (OP)	663.0±233.4	59	30/7.5
IV. phase (POP)	623.6±121.3	55	*11~*
V. phase (PP)	649.6±194.6	59	19/5.1*

Legend: * – the highest values; *~– test was stopped because of the pain*; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Table 2 presents the changes of functional parameter and physical performance of the student 1 during the II. menstruation cycle lasting from 28/01/15 to 20/02/15.

Table 2. Variations of functional parameter and physical performance in the II. MC of student 1

II. MC	Reaction time (ms)	Tapping frequency (n - contacts in 6 s)	Ruffier functional test (number of squats/functional state)
I. phase (MP)	588.8±118.7	64	29/8
II. phase (PMP)	545.0±136.8	69ˣ	30/9.8
III. phase (OP)	529.7±125.6ˣ	67	30/6.7
IV. phase (POP)	564.9±181.7	66	30/6.2ˣ
V. phase (PP)	623.5±136.5	67	*24~*

Legend: * – the highest values; *~– test was stopped because of the pain*;MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Table 3 presents the summarization and mean values of functional parameter and physical performance during two menstruation cycles of the student 1 which were monitored from 12/11/14 to 20/2/15.

Table 3. Variations of functional parameter and physical performance in the I. and II. MC of student 1

Parameters	**MP**	**PMP**	**OP**	**POP**	**PP**
Index of the Ruffier functional test	8.0±0.0	9.7±0.2	***7.1±0.6**	*~3.1±4.4*	*~2.6±3.6*
Reaction time (ms)	617.3±40.2	***570.9±36.6**	596.4±94.3	594.3±41.5	636.6±18.5
Tapping frequency (n)	***63.5±0.7**	63.5±7.8	63.0±5.7	60.5±7.8	63.0±5.7

Legend: * – the highest values; *~– test was stopped because of the pain*;MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Thanks to results´ summarization and mean values we denoted that student 1 achieved the best

physical performance in reaction time test (RT) during the II. phase (post menstruation, follicular) with the mean value of 570.9±36.6 ms. The best physical performance in tapping frequency of lower limbs (TFLL) was diagnosed during the I. phase (menstruation) where she realized 63.5±0.7 contacts. The lowest values in RT were diagnosed during III. (ovulation) and V. phase (premenstruation, luteal). The lowest mean values in TFLL were diagnosed in IV. phase (post ovulation, luteal). The Ruffier functional test showed that the best functional status of the student 1 was diagnosed in I.MC during the V. phase (premenstruation, luteal) but she realized only 19 squats from 30 required because of the patellar and coxal pain which she mentioned in the interview before testing.

The best functional status during the II. MC was diagnosed in the IV. phase (post ovulation, luteal) with the value of 6.2. According to mentioned facts we got misrepresented results because student 1 felt less fatigue after a low number of realized squats where the index of RS was 5.1 and it was considered as the best index diagnosed in the I. MC but the point was that she felt pain and she could not finish the test. The test was stopped (no continuance) in the I.MC during the IV. phase (postovulation, luteal) analsod in the II.MC during the V. phase (premenstruation, luteal) because of the patellar pain. Thanks to the mean values we diagnosed that the best functional status of the student 1 was diagnosed in the III. phase (ovulation). Thanks to the interview we registered that the student 1 felt pain in the abdominal and pelvic features (regions) during menstruation and pre menstruation phase(in the I.MC). That is why she could not continue and finish the Ruffier functional test. The most interesting fact is that she achieved the best performance in TFLL test exactly during the menstruation phase (I. MC.) because she presented that she suffered from headache, patellar, coxal and breast pain and she felt very tired and wearily during each menstruation phase.

Table 4. Variations of functional parameter and physical performance in the I. MC of student 2

I. MC	Reaction time (ms)	Tapping frequency (n - contacts in 6 s)	Ruffier functional test (number of squats/ functional state)
I. phase (MP)	662.3±131.6	58	28/13.6
II. phase (PMP)	**620.2±87.6**×	**63**×	25/13.1
III. phase (OP)	725.4±204.3	61	28/12.3
IV. phase (POP)	712.4±141.4	61	29/12.1
V. phase (PP)	712.4±98.3	60	**27/10.8**×

Legend: * – the highest values; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Interpretation of the changes of the functional parameter and physical performance of the student 2

Table 4 presents the changes of functional parameter and physical performance of the student 2 during the I. menstruation cycle lasting 30/10/14 to 24/11/14.

Table 5 presents the changes of functional parameter and physical performance of the student 2 during the II. menstruation cycle lasting from 28/11/14 to 22/12/14.

Table 5. Variations of functional parameter and physical performance in the II. MC of student 2

II. MC	Reaction time (ms)	Tapping frequency (n - contacts in 6 s)	Ruffier functional test (number of squats/functional state)
I. phase (MP)	734.6±209.8	58	**30/7.7**×
II. phase (PMP)	**696.1±173.4**×	63	29/10.9
III. phase (OP)	709.9±125.7	62	30/8.2
IV. phase (POP)	702.4±115.7	**64**×	28/13.0
V. phase (PP)	718.2±87.1	63	30/15.4

Legend: * – the highest values; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Table 6. presents the changes of functional parameter and physical performance during two menstruation cycles of the student 2 which were monitored from 30/10/14 to 22/12/14.

Table 6. Variations of functional parameter and physical performance in the I. & II. MC of student 2

Parameters	MP	PMP	OP	POP	PP
Index of the Ruffier functional test	10.7±4.2	12.0±1.6	***10.3±2.9**	12.6±0.6	13.1±3.3
Reaction time (ms)	698.5±51.1	***658.2±53.7**	7171.7±11.0	707.4±7.1	715.3±4.1
Tapping frequency (n)	58.0±0.0	***63.0±0.0**	61.5±0.7	62.5±2.1	61.5±2.1

Legend: * – the highest values; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular);OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

The student 2 had following development of the physical performance. The best physical performance was measured in I. MC during the II. phase (post menstruation –follicular) in RT and TFLL tests and in the II. MC during the II. phase (post menstruation –follicular) in RT test. Our results agreed with results of Slezáková (2008) who discovered the best performance of sample´s physical abilities during the II. phase (post menstruation –follicular). Jančoková et al. (2011) stated that II. phase and the IV. phase (post ovulation, luteal) are the most suitable and appropriate to develop specific abilities (speed development, special endurance, speed – strength abilities). This fact was confirmed also in student 2 in the II. MC during the IV. phase (post ovulation, luteal) when she achieved the best performance in TFLL test where she realized 64 contacts.

The mean values showed that student 2 achieved the best physical performance in both tests (value of RT – 658.2±53.7 ms,value of TFLL – 63.0±0.0 contacts) during the II. (post menstruation, follicular) phase. The lowest mean values in RT test (7171.7±11.0ms) were monitored during the III. (ovulation) phase and in TFLL test (58.0±0.0 contacts) during the I. phase (menstruation).

Ferin, Jewelewiczký & Warenn (1997) presented that the hormonal changes (caused by the progesterone and oestrogen) before and after the menstruation can cause very uncomfortable pain and in some cases low performance. We agreed with authors because she felt uncomfortable from a psychological and physical point of view and she felt exhausted during the menstruation phase. In comparison with other phases she was thirsty, she had cramps in the pelvic region, she felt pain in her breasts and she had a strong headache. She also added, that last two days she had felt stressed, irritated and annoyed. We can state that these feelings are results of the exam period. The stress and neurosis were presented also during the IV. phase (post ovulation, luteal). The best functional status of the student 2 was diagnosed in the I. MC during the V. phase (premenstruation, luteal) with the value of 10.8 and in the II. MC during the I. phase (menstruation) with the value of 7.7. When we calculated the mean values we found out that the best mean value in the Ruffier functional test was diagnosed during the III. (ovulation) phase.

Interpretation of the changes of the functional parameter and physical performance of the student 3

Table 7. presents the changes of the functional parameter and physical performance of the student 3 during the I. menstruation cycle from 30/10/14 to 24/11/14.

Table 7. Variations of the functional parameter and physical performance in the I. MC of student 3

I. MC	Reaction time (ms)	Tapping frequency (n - contacts in 6 s)	Ruffier functional test (number of squats/functional state)
I. phase (MP)	593.2±136.3	61	**30/10.8**×
II. phase (PMP)	**558.0±62.5**×	56	30/14.7
III. phase (OP)	640.1±84.6	57	29/11.2
IV. phase (POP)	584.4±99.8	**62**×	30/14.3
V. phase (PP)	618.5±110.2	59	26/11.4

Legend: * – the highest values; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Table 8. presents the changes of the functional parameter and physical performance of the student 3 during the II. menstruation cycle lasting from 28/11/14 to 22/12/14.

Table 8. Variations of the functional parameter and physical performance in the II. MC of student 3

II. MC	Reaction time (ms)	Tapping frequency (n - contacts in 6 s)	Ruffier functional test (number of squats/functional state)
I. phase (MP)	606.5±123.3	54	30/11.8
II. phase (PMP)	**558.8±82.1**×	51	30/15.9
III. phase (OP)	589.2±67.2	48	**30/10.1**×
IV. phase (POP)	604.4±76.7	48	29/17.3
V. phase (PP)	710.1±151.5	**57**×	30/16.8

Legend: * – the highest values; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

Table 9. presents the changes of the functional parameter and physical performance during two menstruation cycles of the student 3 which were monitored similarly like in student 2 - from 30/10/14 to 22/12/14.

Table 9. Variations of the functional parameter and physical performance in the I. & II. MC of student 3

Parameters	MP	PMP	OP	POP	PP
Index of the Ruffier functional test	11.3±0.1	15.3±0.8	***10.7±0.8**	10.8±4.9	14.1±3.8
Reaction time (ms)	599.9±9.4	***558.4±0.6**	614.7±36.0	594.4±14.1	664.3±64.8
Tapping frequency (n)	*57.5±5.0	***53.5±3.5**	52.5±6.5	55.0±9.9	58.0±1.4

Legend: * – the highest values; MC – menstruation cycle; MP – menstruation phase; PMP– post menstruation phase (follicular); OP – ovulation phase; POP – post ovulation phase (luteal); PP – premenstruation phase (luteal); ms – milliseconds; n – the number of contacts on mats of the device FiTROtapping in 6 seconds

The student 3 presented the highest values in particular parameters during various phases of the menstruation cycle. She proved the best performance in RT test in both cycles during the II. phase (post menstruation, follicular) with the mean value of 558.4±0.6ms. In TFLL test, she achieved the best performance differently. In the I. MC she proved the best results during the IV. phase (postovulation, luteal) with 62 contacts and in the II. MC we diagnosed the best performance during the V. phase (premenstruation, luteal) with 57 contacts. The mean values definitely showed that student 3 proved the best performance in RT and TFLL tests during the II. phase (post menstruation, follicular). The best functional status of the student 3 was diagnosed in the I. MC during the I. phase – menstruation (10.8) and the lowest status was diagnosed during the II. phase– post menstruation, follicular (10.1).The best functional status was achieved in the II. MC during the III. phase (ovulation) with the value of 10.1 and the lowest value was diagnosed during the V. phase (premenstruation, follicular) with the value of 16.8.

She proved the best mean functional status during the III. phase –ovulation(10.7±0.8). From the point of view of subjective feelings we came up with the following information. Bad states of health, patellar pain, fatigue and feeling full of water were presented in the II. MC during the V. phase (premenstruation, luteal). Jančoková et al. (2011) characterized the premenstruation phase as the phase of hidden menstruation in which the levels of total body water are increased because of the hormones´ effects. Ďurič (1975) stated that the fatigue has significant impact on the overall status and functioning.

Discussion

Summarization and detailed analysis of particular parameters showed that the physical performance and functional status are characterized by the fluctuation during the menstruation cycle. Janse de Jonge (2003) presented that hormones caused the fluctuations of the exercise and physical performance during the menstruation cycle. The author Janse de Jonge (2003) also stated the fact that the menstruation cycle could have a significant impact mainly for prolonged exercise performance. In our probe we also diagnosed variations and fluctuations in performance during the menstruation cycles. Sarwar, Niclos & Rutherford (1996) monitored the increase in fatigability during the ovulation phase. This fact can be compared with our results because in our sample we monitored decrease of physical performance during ovulation phase (student 1 achieved the lowest values in RT test in the I. MC during the ovulation phase, the student 2 proved the lowest mean values in RT test during the III. (ovulation) phase. Different results were detected by Bambaeichi et al. (2004) who presented very interesting research focused on a menstruation cycle in the comparison with the diurnal variations. Authors examined impact of time-of-day (measured at 06.00 AM and 6.00 PM) and circa mensal variation (menses, mid-follicular, ovulation, mid-luteal, late luteal phases) on muscle strength.

They detected that there is no interaction between diurnal rhythms and the menstruation cycle. The peak torque and the best values of knee flexors, extensors, and isometric contraction were observed during the ovulation phase. Kishali et al. (2006) diagnosed subjunctive feelings of professional athletes during the menstruation period. Authors found out that the competition was a very motivational factor because all respondents presented that they had painful menstruation but the pain disappeared and decreased during the competition. We monitored only two menstruation cycles from five of the recommended, which could be considered as one of the probe´s limit, but despite of this, we can state that discovered results could reveal potential variations and changes in physical performance during the menstruation. The low number of examined menstruation cycles was caused because of the continuous practice which students had to realize during the summer semester of the academic year 2014/2015. Each student realized it in her birthplace. The practice lasted for two months and that is why we could not diagnose the changes of the functional parameter and physical performance in more menstruation cycles. Another limit of the probe was the fact that we did not monitor the flexibility of the body (suppleness). The next research will monitor minimally five menstruation cycles, during which we will observe not only changes in physical performance (supplemented with more tests of physical performance) but also variations of physiological parameters like: basal temperature, body weight, total body water etc.

Conclusion

Our probe interpreted the diagnostics and analysis of the changes of the functional parameter and physical performance during two menstruation cycles of female university students. The diagnostics is very time-consuming in general and has difficult realization from the point of view of space because the menstruation cycle cannot be influenced. It requires the measurement in specific day, time, space and conditions. Two female students had the menstruation cycle at the same time. This fact is very rare and unique. The menstruation cycle of one student had a different interval. The menstruation cycle is a significant parameter in planning of training load in sports preparation of women. The researches confirmed that women were able to fulfil the difficult load in all phases of the menstruation cycle but only at the time when the training process was organized in accordance with their biological peculiarities and psychological stability. The motivation is another important factor which helps female athletes to overcome pain during competitions. We denoted variations in functional parameter and physical performance during particular phases of the menstruation cycle. The results have confirmed already existed knowledge that there are fluctuations and variations of the physical performance during the menstruation cycle. The best functional status of each student was diagnosed during the III. phase (ovulation) and the best physical performance was detected in the II. phase (post menstruation –follicular).

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PROMJENE FUNKCIONALNOG PARAMETRA I TJELESNE IZVEDBE TIJEKOM OSOBITIH FAZA MENSTRUALNOG CIKLUSA - PRELIMINARNO ISTRAŽIVANJE

Sažetak
Cilj ovog istraživanja bio je dijagnosticirati i analizirati promjene u funkcionalnim parametrima i tjelesnoj izvedbi tijekom faza menstrualnog ciklusa fakultetskih studentica. Eksperimentalni uzorak sastojao se od tri fakultetske studentice (dob = 23.8±0.6 godina) koje su imale redovit menstrualni ciklus (MC) duljine 28 dana. Funkcionalni status studentica dijagnosticiran je Ruffierovim funkcionalnim testom. Parametri tjelesne izvedbe bila su dva izabrana testa: vrijeme reakcije (RT) mjereno FiTRO Agility Check uređajem; učestalost tapinga (TFLL) mjerena FiTRO taping uređajem. Najbolji funkcionalni status svake studentice dijagnosticiran je u III. fazi (ovulacija). Svaka studentica postigla je najbolju tjelesnu izvedbu u RT testu tijekom II. Faze menstrualnog ciklusa (postmenstruacija, folikularna). Studentica 1 i studentica 2 pokazale su najbolju tjelesnu izvedbu u TFLL testu tijekom II. faze menstrualnog ciklusa (postmenstruacija, folikularna). Osim spomenutih parametara, otkrili smo i analizirali subjektivne osjećaje, što nam je pomoglo u daljnjoj interpretaciji rezultata. Naše ispitivanje je preliminarno istraživanje u svrhu nadziranje mogućih varijacija u odabranim parametrima tjelesne izvedbe i funkcionalnog parametra.

Ključne riječi: *vrijeme reakcije, Ruffierov funkcionalni test, učestalost tapinga donjih udova*

Received: January 12, 2016
Accepted: August 10, 2016
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Acknowledgement
This project was supported by VEGA 1/0795/15.