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Original Article

Evaluation of lactic acid anaerobic effort capacity recovery through the association of Yumeiho therapy with other means of recovery

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Abstract
Recovery in sports has become an increasingly important and sensitive subject for coaches/physical trainers in Romania. The purpose of our studywas to demonstrate that the use of the Yumeiho technique within the post-effort recovery schedule in terms ofaccelerating the lactic acid speed recovery capacity of football (soccer) players .We identified the measurement/test instruments to use to evaluate the effects of the independent variable, and theYumeiho technique was implemented during the recovery strategy that we used to determine the lactic acid level and Dorgo index for the experimental group. To achieve this purpose, we performeda longitudinal study of the C.S. International Balesti teamin League IIIduring the competition year of 2017–2018, whose players were divided into two groups, and the recoveriesof each group were different. We selected and used the following evaluation instruments for objective measurement of the investigated parameters: 1) the Lactate Pro 2 Device to determine the lactic acid (LA) level in the bloodand thelactic acid anaerobic speed movement and Dorgo teststo determine the individual recovery capacity.The results for the two groups showedthe association of the Yumeiho technique with the traditional recovery means, and we determined thesuperior recovery level. The players in the experimental group showed a rangeof individual LA levels between 2.7 and 3.5 mmol/blood lite, which was a significant difference from the witness group at a margin of0.01, and the Dorgo index showed similar results.
Keywords: lactic acid anaerobic capacity, recovery, Yumeiho technique

Introduction

Our studywas realised based on background and ideas from documentation we have produced.

In this study, we took into consideration the definition of effort capacity, which was providedby the most important physiologist in Romania, whostated that it represents "the body's possibility to unfold a labor, a mechanical work of a high intensity and to maintain for a long time as possible" (A. Demeter, 1972), and the fact that anaerobic lactic acid effort has as an energetic substrate, glycogen (muscular), which decomposes to pyruvic acid and 2 ATP moles. Pyruvic acid becomes lactic acid, which accumulates locally. First, 1/5 of the lactic acid goes to the heart, and this transforms into energy, and then, 3/5 of the lactic acid goes to the liver, where glycogenesis is achieved, producing glucose. Thisprocess requires20 to 40 s (A. Cretu and M. Bratu, 2003, p. 14).

Currently, the increase of performance capacity in high-level sports is possible only viaspecific, modern and general methods and actions. Post-effort recovery occurs after the effort has stopped, and it is tied to the elimination of secondary metabolic products afterrefilling the energy reserves and to the initiation of tissues (Ivy, 2004, p.33). The effort capacity recovery is an integral part and an essential component of the training process (Sabau, 2006).

In afootball (soccer) game, effort is mixed as aerobic and anaerobic, and there are three processes of energy release involved: aerobic, anaerobic non-lactic and aerobic lactic (T. Bompa, 2013).

We took into consideration the results published by Reilly (2005), who examined the effects of an active recovery session (12 minof stretching and slow running) on the total recovery time after a football (soccer) game. Overthe next 3 days, the football (soccer) players who practiced active recovery achieved recovery much faster and reported a substantial decrease of muscle pains compared with the football (soccer) players who had an exclusive passive recovery.

We agree that "…active recovery follows a typical schedule with low volume and intensity and in relation with the current capacity and training load of each player.This recovery can be used in the immediate period of high intensity trainings and also during competition, especially when the anaerobic glycolysis process is substantially involved" (Mihailescu, P.D., 2011, p.88).

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Yumeiho is a 'therapeutic and prophylactic technique'that is used forrestoring the biomechanical alignment for the mio–artro–kinetic system and muscle relaxation and toincrease of the conjunctive tissue elasticityvia stretching osteopathy combined withdifferent massage-type elements (Bratu, 2014, p.113).

Through the induced effectsat the psychosomatic and energeticlevel, the Yumeiho technique helps the biological and energetic structures that are affected by illness for athletes and non-athletesby increasingthe health state recovery capacity of the body. Theseeffects are due to local vascularization, muscular and articular, and energylevelimprovements (Bratu, 2014, p.113)

The purpose of the studywas to demonstrate that the use of Yumeiho therapy in post-effort recovery for determiningthe acceleration of the lactic acid speed capacity recovery for football (soccer) playersincentral defender, central midfielder, and forward (central field area players) positions compared to that of lateral field area players, and it has a positive influence on the effort capacity recoveryoverall.

Materials and methods

We performed an experimental longitudinal studybetween 01.07.2017 and 24.06.2018on the C.S. International Balesti team, which included 16 playersbetween 19 and 37 years of age, and we divided them into anexperimental group and witness group.

Regardingspecificity of the effort and movement qualities, when we divided the two groups, we took into consideration the following: 1) that the lateral field area players (lateral defenders and midfielders) present the same characteristics of very good speed and acceleration, very good skills, and very good anaerobic resistency and 2) that thecentral field area players (central defenders, central midfielders and the forward) present the same characteristics of good anaerobic resistency, good aerial play, and power.

The game takes place primarilyin the central area of the field with the number of offense/defence actions being higher than in the lateral areas of the field. That is why we chose to put the lateral players in the first group, where we applied aclassic recovery, andwe put the central players in the second group, where we applied the Yumeiho technique as well. Of note, M.D. and A.S. are multipurpose players, and during the season, they played in the central field area; for this reason, we chose to test them as central field area players.

For the study, we used multiple instruments/devices/tests for our measurementsand evaluation. These includedthe Lactate Pro 2 deviceto determine the lactic acid level in the blood, and the analysis wasmade viathe electrochemical methodusing an enzymatic reaction. The blood collection (only 0.3 mL of blood) wasobtainedviacapillary action. The beginning of the analysis wastriggered automatically atthe moment when 0.3 ml of blood (the device does nothave a start button) entered the capillary, and the result was determined in 15 s. We also used themovement lactic acid anaerobic speed test, which is a run witha total distance of 60 m. # cones werelaidat 10-m intervals, and the player started at the middle cone (cone number 1).Then, the player ran10 m to the second cone, sloweddown, and touched it with ahand.Then, the player accelerated, ran to the third cone, slowed down again, touchedthe cone, accelerated again, came back by running 20 m to the number 2 cone, sloweddown, touched it, accelerated again, and then came back by running 10 m to the number 1 cone.

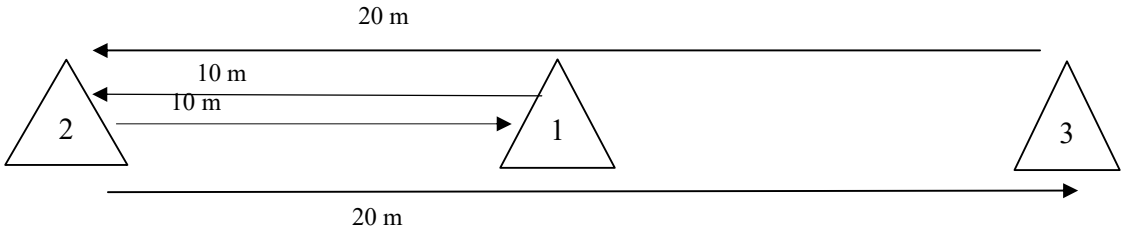

Figure 1. Representation of the lactic acid speed test

To determine the individual recovery capacity of the players, we used the Dorgo testto determine the specific recovery index. The Dorgo test analyses the heart rate, i.e., individual heart behaviour during the exertion of effort. The individual values of the heart rate were collectedduring rest, in the first minute, third minute, and fifth minute after training. The interpretation of resultstook into consideration approaches that are used in previous studies.The recovery strategy was implemented between 19th of July and 19th of November 2017 using 20 sessions.The recovery strategyhad the following objectives: fatigue removal, muscle relaxation, tissue elasticity increase, maintaining the heart rate over the rest frequency and increased metabolism of lactic acid, improvement of the blood flow at muscular level, tensed muscle relaxation, achieving a well-being state by decreasing the stress level, cooling down of muscles involved in the effort,improving blood flow, decreasing the discomfort created by articular and muscular solicitation.

Methodsused for the recovery strategy:

1. Slow run at the heart rate of 120–130 beats/min(10 min)
2. Static stretching (2 sessions of 5 min each, with 30 s of muscle stretching and 30 s of rest)
3. Cryotherapy (iced bath at +10–15°C); 3 sessions of 30 s of diving in an ice pool; 30 s of rest
4. Yumeiho therapy: applied over 9 sessions, with an average duration of 38–40 min per session

Results

The experimental research started byevaluating the C.S. International Balesti team players with a focus on the level of the players.The two evaluated indicators were lactic acid and the Dorgo index. The analysis of 16 players from different positions within the team showed that 43.75% of the players had a very good tolerance to lactic acid, 43.75% had good tolerance, and 12.5% had weak tolerance; 87.5% of the players had a weak recovery index, and 12.5% had an unsatisfactory index.

At the end of the experiment, after the last few recovery sessions, lactic acid measurements were performed. After all recovery sessions, the Dorgo index was determined for both groups.

Table 1. Results of the control group during the final testing

Nr. crt.	**Name and surname**	**Play position**	**L.A.after effort** (mmol/L)	**L.A. after run** (mmol/L)	**L.A. after stretching** (mmol/L)	**L.A. after cryotherapy** (mmol/L)
1.	N.C.	Lateral defender	18.3	13.7	12.3	10.4
2.	A. M.	Lateral defender	23.5	17.6	15.8	13.4
3.	F. R.	Lateral defender	13.2	9.9	8.9	7.5
4.	B. D.	Lateral midfielder	19.9	14.9	13.4	11.3
5.	S. D.	Lateral midfielder	18.1	13.5	12.1	10.2
6.	S. A.	Lateral midfielder	22.4	16.8	15.1	12.8
7.	V. S.	Lateral defender	20.7	15.5	13.9	11.8
8.	D. C.	Lateral midfielder	23.2	17.4	15.6	13.2
Statistic indicators						
Centrality						
Arithmetic average			19.91	14.91	13.39	11.33
Median			20.30	15.20	13.65	11.55
Release						
Variation			10.30	7.70	6.90	5.90
Standard deviation			11.63	6.56	5.27	3.85
Standard error			3.41	2.56	2.30	1.96
Variation coefficient			1.21	0.91	0.81	0.69
			17.13	17.17	17.15	17.33

The results of the witness group show that, on average, the players of the witness group improved their tolerance for lactic acid compared to the initial evaluation (lactic acid after effort) from 19.91 to 11.33.The best result was obtained after cryotherapy, which is an improvement of 56%. During the lactic acid test, after standard effort, the group was heterogeneous, with large standard deviation.After the recovery procedures, the group was homogenized, and the standard deviation dynamics was improved by7.78, from 11.63 to 3.85. The obtained results confirmed that the recovery schedulethat we used for 20 sessionswas correct.

Table 2.Results of the experimental group uponfinal testing (T2)

Nr. crt.	**Name and surname**	**Play position**	**L.A. after effort** (mmol/L)	**L.A. after run** (mmol/L)	**L.A. after stretching** (mmol/L)	**L.A. after cryotherapy** (mmol/L)	**L.A. after Yumeiho** (mmol/L)
1.	I. N.	Central defender	22.1	16.5	14.8	12.5	9.3
2.	Bă. D.	Central defender	23.2	17.4	15.6	13.2	9.9
3.	L. L.	Central defender	18.7	14.0	12.6	10.7	8.0
4.	Ș. H.	Central midfielder	22.1	16.5	14.8	12.5	9.3
5.	C. D.	Central midfielder	19.1	14.3	12.8	10.8	8.1
6.	M. D.	Central defender/ central midfielder	24.1	18.0	16.2	13.7	10.2
7.	P. E.	Forward	19.6	14.7	13.2	11.2	8.4
8.	A. S.	Lateral/central	24.1	18.0	16.2	13.7	10.2

		midfielder					
Statistic indicators							
Centrality							
Arithmetic average			21.63	16.18	14.52	12.29	9.18
Median			20.30	15.20	13.65	11.55	9.30
Release							
Amplitude			10.30	7.70	6.90	5.90	2.20
Variation			11.63	6.56	5.27	3.85	0.83
Standard deviation			2.21	1.63	1.48	1.24	0.91
Standard error			1.21	0.91	0.81	0.69	0.32
Variation coefficient			17.13	17.17	17.15	17.33	9.92

The results of the analysis for the experimental group showthat the lactic acid level of each playeris better.The smallest value is obtained afterusing the Yumeiho technique.The average value is11.45 mmol/L, which is an improvement of the lactic acid tolerance with an average of 41.49 mmol/L.The group ismore homogenous. The standard deviation hasa decreasing dynamics (from 2.21 to 0.91), and the correlation coefficient is smaller by57.8%.

The results of the final evaluation forthe Dorgo testare shown in Table 3 and indicate that 100% of the subjects fromthe experimental grouphavea"very good" rating, while the players from the witness group havemedium values.

Table 3. Results forthe two groups for theDorgo test

Experimental group				**Witness Group**		
Nr. crt	**Name and surname**	**Dorgo index**	**Interpretation**	**Name and surname**	**Dorgo index**	**Interpretation**
1.	I. N.	−5.6	Very good	N.C.	+3.0	Medium
2.	Bă. D.	−5.2	Very good	A. M.	+2.7	Medium
3.	L. L.	−5.2	Very good	F. R.	+2.3	Medium
4.	Ș. H.	−5.0	Very good	B. D.	+2.1	Medium
5.	C. D.	−5.1	Very good	S. D.	+2.1	Medium
6.	M. D.	−5.3	Very good	S. A.	+1.7	Medium
7.	P. E.	−5.4	Very good	V. S.	+1.8	Medium
8.	A. S.	−5.4	Very good	D. C.	+1.8	Medium

Table 4. Mathematical significance of differences for the evaluated indicators at the end of the experiment

Evaluated indicators	**Determined statistical indicators**						
	Average		**Standard deviation**		**T Test**	**Interpretation**	**Significance margin**
	Experimental group	**Witness group**	**Experimental group**	**Witness group**			
L.A.fT	*21.63*	*19.91*	*2.21*	*3.41*	*-1.19*	*Not significant*	*p>0.05*
L.A fT	*9,18*	*11,33*	*0.91*	*1.96*			
Dorgo Index iT	*6.9*	*8.7*	*1.16*	*1.87*	*2,31*	*Not significant*	*p>0.05*
Dorgo Index fT	*−5.27*	*2.18*	*0.19*	*0.46*			

Conclusions

At the end of the study, the results obtainedby the athletes from both groups, the analysis, and the values dynamics interpretation for the applied tests and measurements allow us to formulate the following conclusions:

- Compared to the annual training plan and competition system in which the team participated, the recovery program developed and implemented by us was observed to be efficient for both groups of players. This is confirmed by the positive evolution of the analysed parameters, i.e., lactic acid level and Dorgo index.

- This study shows that the recovery approach and techniques used and the independent variables of the experiment correspond with the level of lactic acid in the blood, the dependent variable, the first indicator of recovery after anaerobic lactic acid efforts, and the most solicited efforts in competition for the playing positions within the team.
- The association of the Yumeiho technique and classical recovery approaches specific for football (soccer) players indicates the superior level of recovery for the investigated approach, which is confirmed by the significant differences for all investigated parameters between the groups in this study. The analysis of obtained results for the experimental group shows that the use of the Yumeiho technique in the post-effort recovery program accelerates the lactic acid speed recovery capacity of football (soccer) players [specifically for central defender, central midfielder, and forward positions (central field area players)] and positively affects the general effort recovery capacity.

References

Bădescu, V., 2006, "*The importance of therecoveryswimmingandtoknowingtheconflictingeffects of enduranceand sprint training",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 6.

Bădescu, V., 2004, *"Testarea concentrației acidului lactic sanguin și monitorizarea antrenamentului în înot". [Blood lactic acid concentration testing and swimming training monitoring],* Journal of Physical Educationand Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 4. [in Romanian]

Bekris, E., Mylonis, L., Gioldasis, A., 2016, *"Aerobic and anaerobic capacity of professional soccer players in annualmacrocycle",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 16, pp. 527 – 533.

Bompa, T., 2013, *Antrenamentul pentru sporturile de echipă*. *[Team sports training],* Publishing house SC Ad Point Promo SRL, București [in Romanian], pp. 31.

Bratu, M., 2014, *Terapii complementare*. *[Complementary therapies],* Publishing house Bren, București, [in Romanian], pp.113.

Cepková, A., Zemková, E., Buková, A., 2016, *"En bloc analysis of exhaustive exercise and recovery phases during the cycle ergometer test",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 16, pp. 875 – 882.

Crețu, A., Bratu, M., 2003, *Refacere în sport,[Recovery in sports],*Publishing house Alexandru 27, București, [in Romanian], pp. 76

De Souza, B.C., Ribas, M.E, Lopes, A.L., 2017,*" Periodontal disease influences the recovery processes in the skeletal muscles in trained mices",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 17, pp. 572 – 581.

Dragnea A., 2002, *Teoria Sportului, [Sports Theory],* Publishing house FEST, București, [in Romanian].

Demeter, A., 1972, *Fiziologia sporturilor*, *[Physiology of sports],*Publishing house Stadion, București, [in Romanian].

Gantois, P., Aidar, F.J., De Matos, D.G, 2017,*"*Repeated sprints and the relationship with anaerobic and aerobic fitness of basketball athletes*",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 17, pp. 910 – 915.

Ivy, J., Portman, R., 2004, *The Future of Sports Nutrition: Nutrient Timing,*Publishing house Basic Health, North Bergan, New Jersey.

Kozina, Z., 2015,*" Recovery functional condition of sportsmen using individual non-traditional means of rehabilitation",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 15, pp.634 – 639.

Kozina, Z., Nikolaeva, V., Safronov, D., 2018, *" The relationship of recovery performance indicators after exercise with indicators of body weight and length of fitness sessions for 24-28-year-old women",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 18, pp.2497- 2503

Kozina, Z., Safronov, D., Kozin, S., 2019,*" Use of non-traditional recovery means to improve performance of 11-12-year-old athletes specializing in rowing and canoeing",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 19, pp. 756 – 764.

Lytle, R., Cline, J., 2006,*"Implications of play research on programming and intervention for children with autism contributions concerning the anaerobic capacity optimization in 400 m runners",* Journal of Physical Education and Sport (JPES) online,ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 6.

Marin, T.C., Peçanha, T., De Oliveira Pires, F., 2020,"Effect of exercise intensity after a single session of isocaloric aerobic exercise on the heart rate recovery", Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 20, pp. 2851 – 2858.

Mihăilescu, L., 2008,*" Contributions concerning the anaerobic capacity optimization in 400 m runners",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 8.

Mihăilescu, P.D., 2011, *Refacerea în sportul de performanță, teza de doctorat,[Recovery in performance sports, doctoral thesis]*, Publishing house University of Pitesti, Pitești, [in Romanian].

Reilly, T., Ekblom, B., 2005, *The Use of Recovery methods post-exercise,* Journal of Sports Sciences.

Sabău, E., 2006, *Refacere-recuperare, Kinetoterapie în activitatea sportivă, [Restoration-recovery, Physiotherapy in sports activity],* Publishing house Fundației România de Mâine, București, [in Romanian].

Shesterova, L., Yefremenko, A., Nizhevskaya, T., 2017, *"Modern methods of increasing working capacity and recovery processes of sportsmen in the system of organization of sports training",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 17, pp. 2129 – 2134.

Simion G., Vladu L*.,* 2006, *"Study concerning the report of the anerobic non lactic acid and the forecast of the sports performances",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 6.

Vanyuk, A., Vindyk, A., Zakharina, I., 2020,*" Improving the functional preparedness of volleyball players aged 18–22 using recovery measures",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 20, pp. 2086 – 2093.

Zubitashvili, G., Qobelashvili, D., Chkhikvishvili, M., 2013,*"Predominant influence of the age and/ or the performed work on the functional system recovery",* Journal of Physical Education and Sport (JPES) online, ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 – 8051, vol. 13, pp. 163 – 165.