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Effects of an anaerobic lactic training session on the postural stability of athletes

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***Aim*. The aim of this study was to analyze the short-term effects of a lactate-accumulation training session on postural stability.**

***Methods*. Fifteen athletes performed two trainings sessions (warm-up and lactic-training session). Before training (Pre), immediately after ($Post_{0min}$), thirty minutes later ($Post_{30min}$) and after 24 hours ($Post_{24h}$), athletes were subject to a bipodal and a monopodal stabilometries and a lactate blood analysis to ensure a high stress level.**

***Results*. Variance analysis (α=0.05) showed that, in lactic training, athletes experienced an increase of length and velocity in $post_{0min}$, a decrease at $post_{30min}$ and a new decrease at $post_{24h}$, which was lower than basal values. In monopodal stability, left-leg support showed a decrease at $post_{0min}$ in anteroposterior plane of athletes after lactic training. Also, in both monopodal supports, athletes displayed higher values of length and velocity in $post_{0min}$ after lactic training, with a progressive decrease which was significant at $Post_{24h}$, when they reached baseline.**

***Conclusion*. Right after anaerobic lactic training, center-of-pressure dispersion variables in bipodal stabilometry are worsened. Thirty minutes later, stabilometric variables are still deteriorated. At 24 hours, stabilometry is better than baseline. In monopodal support, dispersion values are worsened after lactic training and anteroposterior stability is impaired in left monopodal support, although the deterioration is less evident as time passes.**

KEY WORDS: Lactate - Athletes - Postural balance.

A lactate accumulation after the practice of physical activity is considered the most important musculoskeletal stress level. The explanation is that in the face of an increase in the intensity of physical exercise, an accumulation of the lactate catabolite takes place, which at the same time increases the accumulation of hydrogen ions. These ions are responsible for muscle acidity and for subsequent contractile inefficacy.[1, 2]

Effects of this contractile inefficacy have been studied at stabilometric levels due to the relationship between postural stability deterioration and sports injuries.[3-8] Surenkok *et al.* in 2006 analyzed postural stability after a lactate-accumulation-inducing protocol and reported a deterioration in monopodal stability, although they observed no correlation between stability and lactate level.[9] Other authors have studied effects of intense exercise in the postural stability of athletes.[3, 4, 6, 10-14] Mello *et al.* assessed the effects of an exercises protocol consisting of a maximal oxygen uptake test and prolonged cycle ergometer exercise.[14] Results showed a stabilometric deterioration. Similar results were observed by all other authors, who concluded that intense exercise protocol deteriorates the postural stability of athletes, although none of them took into account lactate accumulation as an indicator of muscle stress.[3-9]

In spite of being the main indicator of muscle stress induced by intense physical activity, lactate accumulation has not been measured in most of the studies that have analyzed the effects of this type

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TABLE I.—*Demographic characteristics.*

	All (N.=15)
Age (y)	26.2±7.42
High (m)	1.75± 0.07
Weight (kg)	68.53±10.76
BMI (kg/m^2)	22.21±2.63
Experience (y)	9.53±4.61
Gender	
— Woman	2/13.3 %
— Man	13/86.7%
Student	
— Yes	9/60%
— No	6/40%

BMI: Body Mass Index. Data are expressed as mean±Standard Deviation for continuous variables and as frequencies and percentages for categorical variables.

of muscle stress on postural stability parameters. A close monitoring of lactate level as an indicator of high muscle stress and of its effects in postural stability would be of great importance in the prevention of injuries after practicing intense physical activity, and also to ensure the disappearance of effects 24 hours later, thus contributing to face the next training in the best conditions due to the fact that lactate-accumulation training sessions are normal training routine of sprinters.

Based on the mentioned reasons, the purpose of the present study was to analyze the short-term effects of lactate accumulation training session as normal training routine of sprinters on the postural stability of athletes until 24 hours after the end of lactic training session.

Materials and methods

A pre-experimental study was carried out with a group of 15 athletes, who completed two different training sessions: warm-up, which consisted of a 30-minutes warm-up session (including 10 minutes of low speed race, five minutes of dynamic stretching and fifteen minutes of technical running exercises), and lactic training session, consisting of the same 30-minutes warm-up, followed by an anaerobic lactic training which included two groups of two series of 300 m performed at 90-92%, with a five-minutes rest between series and a ten-minutes rest between groups.[15] A whole week passed between both training sessions. Four measures were carried out in each session: Pre=before training session, $Post_{0Min}$=immediately after training, $Post_{30Min}$=30 minutes later and $Post_{24H}$=24 hours after training. Every measure included three stabilometric values: one bipodal and two monopodal (left and right-leg support), in addition to the lactate blood level and heart rate as stress indicators. To determine the individual percentage of work in the 300 m run, the previous week all athletes performed a 300 m race at 100%.

Participants

Fifteen athletes with experience in performance of lactic trainings, and selected under randomized conditions from a total sample of 33 athletes, took part in the present study. The group comprised 2 female and 13 male athletes, between 18 and 33 years old (26.2±7.42 years), a mean weight and height of 68.53±10.76 kg and 1.75±0.07 m, respectively, and a BMI of 22.21±2.63 kg/m^2 (Table I). All athletes were specialists of the 200 m and 400 m races and had at least four years of experience in their respective modalities. The competition level of athletes was medium, so that their personal best results allowed them to compete in national championships. Before the study started, all athletes were briefed on the nature of testing and written informed consent was obtained from each subject, according to the standards of the Declaration of Helsinki. The study was approved by ethics commitee of University of the city.

Equipment

Baseline features of the athletes were collected with a 100 g-300 kg precision digital weight scale Tefal (France) and a t201-t4 Asimed adult height scale (Spain), which were used to obtain weight and height, respectively.

A FreeMed© BASE model baropodometric platform was used for the stabilometric measurements (Rome, Italy). The platform's surface is 555x420 mm, with an active surface of 400x400 mm and 8 mm thickness [16] by Sensormédica® (Sevilla, Spain). Calculations of center-of-pressure (CoP) movements were performed with the FreeStep© Standard 3.0 (Italy) software. The Lactate Pro blood lactate analyser™ (Japan) and the Lactate Pro Test Strip (Japan) were used to determine blood lactate accumulation. Heart rate was measured using the Polar RS300X

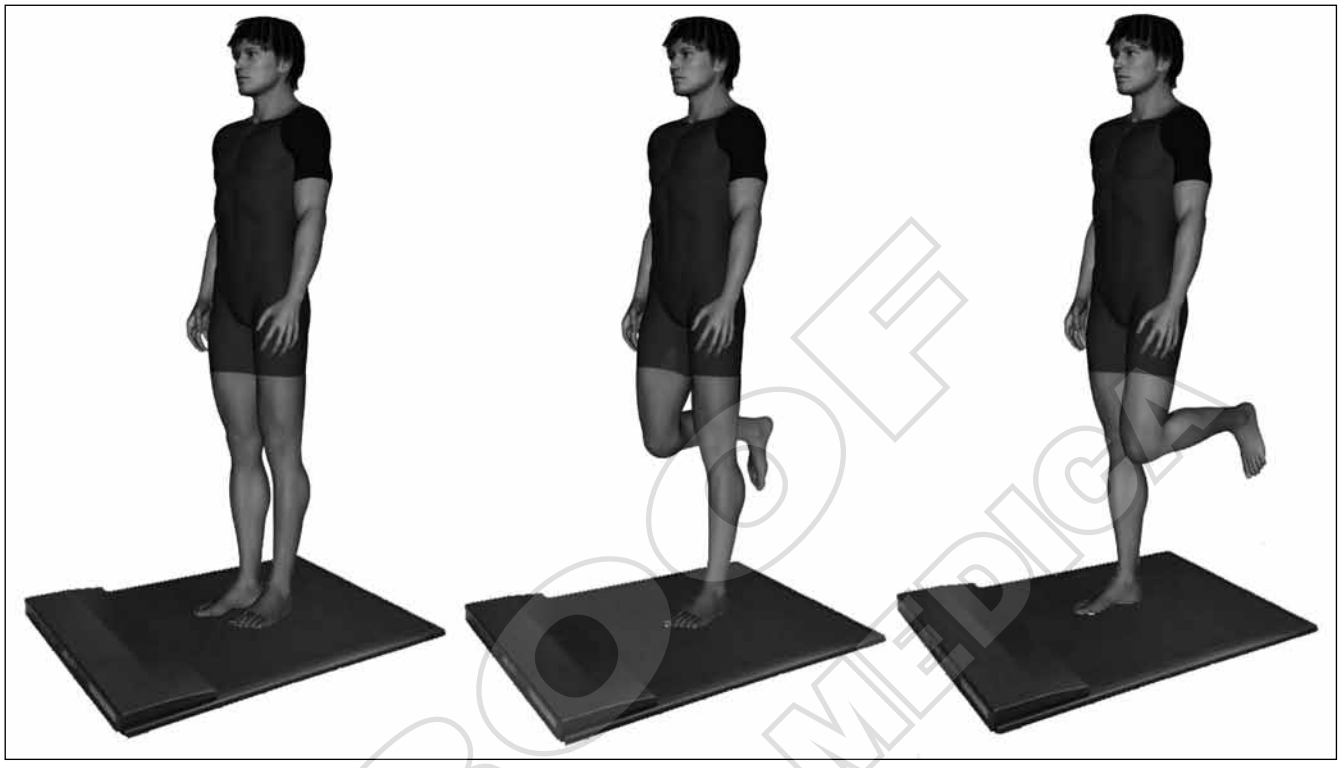

Figure 1.—Bipodal and left and right monopodal stability tests.

(Finland) pulsometer. Also, a Nike WR0082-630 chronometer was used to register the time for the 300 m runs and to control the resting time between repetitions and groups of repetitions.

Procedure

Bipodal stabilometry

Athletes were instructed to remain as still as possible on the baropodometric platform for 52 seconds, with a between-heels separation of five cm and their feet forming a 30º angle (Figure 1).

Monopodal stabilometry

Athletes stood on each of their lower limbs for 10 seconds (left leg first) on the center of the platform (Figure 1).

The following parameters were recorded for the bipodal test as well as for the left-leg and right-leg monopodal tests: length and area of the path described by the center of pressure, the speed for the center-of-pressure movement (Velocity), and the position of the center of pressure in the medial-lateral (Xmean) and anteroposterior (Ymean) planes. These variables are marked "l" or "r" to indicate whether they belong to the left or right leg, respectively. Tests were carried out before training started, in order to avoid any interference. Also, athletes were instructed not to make any sports activity in the day of testing.

Blood lactate analysis

Samples of blood were taken from the forefinger of either the left or the right hand of athletes. The fingertip was cleaned with alcohol (96º) and pricked with a lancet which was previously installed in the lancet device. The first drop of blood was cleaned with a piece of cotton to avoid blood contamination. Immediately after that, the fingertip was squeezed to obtain the second and definitive blood drop, as the

TABLE II.—*Lactate level and heart rate.*

	Pre	Post 0M	Post 30M	Post 24H	Effects	P-value	Eta²
Lactate level (mol)					Time	<0.000***	0.996
Control	1.02±0.16	3.26±2.25	1.79±1.13	1.11±0.25	Training	<0.000***	0.880
Experimental	1.05±0.15	13.66±.86	11.90±2.10	1.03±0.13	Time*training	<0.000***	0.935
Heart rate (bpm)					Time	<0.000***	0.949
Control	71.00±11.46	104.67±15.39	73.40±13.23	69.00±6.99	Training	<0.000***	0.827
Experimental	70.13±10.01	177.27±9.89	94.47±14.22	70.00±8.96	Time*training	<0.000***	0.635

Data are expressed as mean±standard deviation. mmol: millimoles of lactate. bpm=beat per minute. ***P<0.001.

lactate analyzer and the lactate strip were ready to catch this blood drop just coming out of the skin. One minute later, the blood lactate analyzer informed of the blood lactate level of the athlete.

300 M RACE TEST

It was performed in the week before the trainings sessions started, in order to determine the individual percentage of work in 300 m repetitions. All athletes carried out only one 300 m race at 100%. Time scored by athletes in the 300 m race was recorded with a chronometer. This value later became the reference to calculate the 90-92% of work in the lactic training session.

ANAEROBIC LACTIC TRAINING SESSION (LACTIC TRAINING)

Athletes carried out the same 30-minutes warm-up performed in the warm-up training session, followed by an anaerobic lactic training which comprised two groups of two races of 300 m with an intensity of 90-92% of the time recorded for the 300 m reference test. Athletes rested for 5 minutes between races and for ten minutes between groups of races. Every race of 300 m was measured with a chronometer.

Statistical analysis

The description of continuous variables was performed through the mean and the standard deviation, and for the categorical variables through frequencies and percentages. The normal distribution of continuous variables was verified with the Kolmogorov-Smirnov test (P<0.05). A separate 2x4 repeated measures ANOVA was performed to examine the effect of training (warm-up or lactic training) and time (pretreatment, post-treatment, 30 minutes post-treatment and 24 hours post-treatment) on stabilometric dependent variables (length, area, velocity, X mean and Y mean), in three different tests (bipodal, left monopodal and right monopodal) and on parameters indicating stress level (lactate level and heart rate) to ensure the high stress level of lactic training session and the differences with warm-up training session. The hypothesis of interest was the time-by-training interaction at an alpha level of 0.05. For the determination of effect size of the time-by-training interaction, eta-squared was used. Additionally, if a significant interaction was identified, pairwise Bonferroni comparisons were performed to explore the differences between each training condition and within each time point. In order to analyze the relation between lactic acid concentration and stabilometric variables, Pearson's correlation was used. Management and data analysis were performed with the statistical package SPSS for Windows version 17.0 (SPSS Inc, Chicago, IL, USA) and MedCalc 12.5 (MedCalc, Mariakerke, Belgium). The level of statistical significance was set at P<0.05.

Results

All the subjects performed the planned actions and completed the study. Table II shows the mean values of lactate level and heart rate on both lactate training session and warm-up session (P_s<0.001). Main time and training effects and the interaction time-by-training was statistically significant for lactate level and heart rate. Athletes showed an increase in lactate level and heart rate significantly higher after lactic training session than after warm-up session (P_s<0.001). Eta-squared was 0.935 for lactate level and 0.635 for heart rate (Table II), and it can be con-

TABLE III.—*Bipodal analysis*.

	Pre	Post 0min	Post 30min	Post 24h	Effects	P-value	Eta²
Lenght					Time	<0.001***	0.709
Control	396.75±163.94	414.43±191.10	433.45±174.51	401.27±177.93	Training	0.331	0.068
Experimental	409.41±89.95	563.69±103.27	470.15±83.83	324.97±143.03	Time*training	<0.001***	0.579
Area					Time	0.002**	0.302
Control	51.04±39.09	104.47±123.29	109.98±143.82	93.65±131.72	Training	0.455	0.041
Experimental	57.23±42.26	192.66±196.77	94.39±59.10	74.31±60.89	Time*training	0.075	0.150
Velocity					Time	<0.001***	0.707
Control	7.80±3.19	8.11±3.73	8.49±3.40	7.89±3.48	Training	0.220	0.105
Experimental	8.27±1.94	11.23±2.07	9.42±1.71	6.38±2.81	Time*training	<0.001***	0.582
X Mean					Time	0.690	0.034
Control	-1.84±6.21	-2.47±5.35	-0.63±4.87	-4.75±10.07	Training	0.744	0.008
Experimental	-4.05±7.64	-4.18±10.04	-2.92±6.45	-0.07±6.43	Time*training	0.053	0.165
Y Mean					Time	0.480	0.057
Control	-8.18±9.20	-7.03±7.68	-7.17±8.00	-6.47±7.02	Training	0.913	0.001
Experimental	-7.35±10.53	-4.79±8.28	-9.06±7.33	-8.12±7.11	Time*training	0.211	0.101

Data are expressed as mean±Standard Deviation. Length: lenght of center of pressure movement; Area: area of center of pressure movement; Velocity: velocity of center of pressure movement; X Mean: mean position of center of pressure in medial-lateral plane; Y Mean: mean position of center of pressure in anteroposterior plane. *P<0.05 **P<0.01 ***P<0.001.

cluded that the interaction effect accounted for over 94% of the variation for lactate level and 64% for heart rate.

On bipodal tests, the interaction time-by-training was statistically significant for the length sway of center-of-pressure (P<0.001), velocity of the center-of-pressure (P<0.001) and was on the limit of statistical significance for the sway area and X mean position (Table III). Eta-squared was 0.579 for length and 0.582 for velocity (Table III), and it can therefore be concluded that the interaction effect accounted for over 50% of the variation for length and velocity of sway of center-of-pressure. On between-training analysis, pairwise Bonferroni comparisons showed worse stability values after lactic training, verified by an increment of length (P=0.004) and velocity (P=0.002) of center-of-pressure in the post-treatment evaluation. However, at 24 hours since training, better stability was observed after lactic training, expressed through significantly smaller length (0.031) and velocity (P=0.030) of sway of center-of-pressure. On within-training analysis, lactic training showed a statistically significant increase of length in $Post_{0min}$. (P<0.001), a decrease at 30 minutes (P=0.013) and a new decrease at 24 hours (P<0.001). Besides, these values at 24 hours were significantly lower than basal measures (P=0.046). No statistical change was observed on the warm-up training. The same effect was observed with the velocity of sway of center-of-pressure (P<0.001). No statistically significant changes were observed on area, X mean or Y mean.

On the left-leg monopodal test (Table IV) the time-by-training interaction was statistically significant for the anteroposterior position (Y mean) of the center-of-pressure (P=0.010). Eta-squared was 0.233, the time-by-training interaction effect accounting for over 20% of the variation for the Y mean position of center-of-pressure (Table IV). Pairwise comparison showed a more posterior position of center-of-pressure at 30 minutes after lactic training (P=0.01). On within-training analysis, length sway of center-of-pressure exhibited a statistically significant increase at 0 minutes post-treatment (P=0.004) and a gradual decrease that became significant at 24 hours (P=0.003) after lactic training. No other significant changes were observed after the warm-up training. A similar effect was observed on velocity of center-of-pressure with an initial increase at 0 minutes after lactic training (P=0.015) and a gradual decrease that became significant at 24 hours (P=0.016). No significant changes were observed on sway area, Y mean or X mean.

On the right-leg monopodal test no variable showed a statistically significant time-by-training interaction (Table V). However, on the velocity of sway of the center-of-pressure, a result was observed on the limit of significance (P=0.069). Furthermore, a temporary increase was observed at post treatment

TABLE IV.—*Left monopodal analysis.*

	Pre	Pos 0min	Post30min	Post24H	Effects	P-value	Eta2
Lenght (L)					Time	<0.001***	0.517
Control	256.17±82.82	345.49±115.15	262.05±59.41	234.33±84.09	Training	0.002**	0.499
Experimental	276.10±94.37	427.66±170.03	366.92±124.65	270.91±69.10	Time*training	0.266	0.089
Area (L)					Time	0.035*	0.184
Control	391.39±501.42	609.49±857.40	388.31±214.99	373.74±324.49	Training	0.626	0.017
Experimental	303.27±190.39	716.32±477.58	488.24±314.35	358.84±170.22	Time*training	0.759	0.027
Velocity (L)					Time	<0.001***	0.478
Control	22.31±8.04	28.41±11.80	22.49±5.22	22.02±6.35	Training	0.001**	0.532
Experimental	24.77±7.63	38.46±16.78	31.98±11.47	23.53±6.46	Time*training	0.109	0.133
X Mean (L)					Time	0.487	0.056
Control	-0.78±4.58	-2.08±10.24	-0.72±5.64	-1.22±3.87	Training	0.726	0.009
Experimental	-0.91±4.47	-4.75±20.35	-0.60±5.06	-0.88±3.02	Time*training	0.926	0.011
Y Mean (L)					Time	0.193	0.105
Control	-6.23±6.88	-6.89±10.61	-0.98±10.58	-3.69±9.26	Training	0.055	0.238
Experimental	-5.52±13.81	-10.66±9.92	-10.61±10.99	-7.27±8.97	Time*training	0.010*	0.233

Data are expressed as mean±Standard Deviation. Length (L): lenght of center of pressure movement in left monopodal support; Area (L): area of center of pressure movement in left monopodal support; Velocity (L): velocity of center of pressure movement in left monopodal support; X Mean (L): mean position of center of pressure in medial-lateral plane in left monopodal support; Y Mean (L): mean position of center of pressure in anteroposterior plane in left monopodal support. *P<0.05; **P< 0.01; ***P<0.001.

TABLE V.—*Right monopodal analysis.*

	Pre	Post 0min	Post 30min	Post 24h	Effects	P-value	Eta²
Lenght (R)					Time	0.006**	0.251
Control	229.95±34.43	258.97±54.10	270.94±100.32	244.66±58.36	Training	0.002**	0.495
Experimental	271.92±53.02	355.94±113.34	314.11±132.05	256.23±90.75	Time*training	0.130	0.124
Area (R)					Time	0.034*	0.185
Control	266.45±135.56	372.26±191.98	632.78±916.12	311.44±220.55	Training	0.160	0.136
Experimental	347.20±221.86	812.44±667.26	593.83±592.78	408.44±367.11	Time*training	0.190	0.106
Velocity (R)					Time	0.007**	0.249
Control	20.87±3.84	22.72±5.94	24.56±9.13	21.95±5.25	Training	0.003**	0.486
Experimental	24.00±5.79	32.96±10.39	28.11±12.93	23.28±9.32	Time*training	0.069	0.154
X Mean (R)					Time	0.409	0.066
Control	0.57±4.16	-1.10±3.87	10.36±26.39	5.22±15.05	Training	0.169	0.131
Experimental	-1.07±3.78	3.08±16.18	-0.01±3.45	-0.22±3.90	Time*training	0.165	0.113
Y Mean (R)					Time	0.889	0.015
Control	-3.04±10.60	-3.43±11.15	-2.01±11.35	-6.17±9.23	Training	0.018*	0.340
Experimental	-6.87±11.04	-7.09±10.70	-6.56±8.91	-4.51±13.40	Time*training	0.328	0.078

Data are expressed as mean±Standard Deviation. Length (R): lenght of center of pressure movement in right monopodal support. Area (R): area of center of pressure movement in righ monopodal support; Velocity (R): velocity of center of pressure movement in right monopodal support; X Mean (R): mean position of center of pressure in medial-lateral plane in right monopodal support. Y Mean (R): mean position of center of pressure in anteroposterior plane in right monopodal support. *P<0.05; **P<0.01; ***P<0.001.

evaluation after lactic training. On within-training analysis, length sway showed an initial deterioration at 0 minutes after lactic training (P=0.038) and a gradual decrease that became significant at 24 hours (P=0.038) and reached baseline. A similar effect was observed on velocity of sway (P=0.015). No significant changes were observed for area, X mean or Y mean.

Regarding the relation between lactate concentration and stabilometric variables, we found a positive correlation between length, area and velocity on the right-leg test at 0 minutes of warm-up training, and between area and velocity on the right-leg test at 30 minutes after the warm-up training with lactate concentration at 24 hours after training. The highest correlations were found for velocity on the right-leg

test at 0 minutes (adjusted R2=0.382, P=0.008) and for area on the left-leg test at 30 minutes (adjusted R2=0.668, P<0.001). These data could be interpreted as the level of lactate at 24 hours of warm-up training depending in 38% on the velocity values and in 66% on the area values at 0 minutes or 30 minutes after training, respectively. No significant correlation was found between stabilometric variables and lactate concentration after lactic training.

Discussion

The purpose of the present study was to analyze the short-term effects of a lactate-accumulation-induced training session on the postural stability of athletes until 24 hours after performing the lactic training session. Fifteen athletes performed a training session consisting of a 30-minutes warm-up session and, a whole week later, all athletes performed the same warm-up followed by an anaerobic lactic training session. Before training sessions, immediately after, 30 minutes later, and 24 hours later, athletes were subject to a bipodal and a monopodal stabilometry, in addition to a blood lactate analysis and with the heart rate to confirm the high stress muscle presence, so that athletes showed an increase in lactate level and heart rate significantly higher after lactic training session than after warm-up session.

Results from the bipodal stabilometry showed that after lactic training session, athletes had worse values of length and velocity in $Post_{0min}$. At $Post_{30min}$, despite a significant improvement, the stabilometric deterioration remained. The total recovery (and even an improvement of basal stability) was reached at $Post_{24h}$. Our results agree with those of Lepers *et al.*, who analyzed postural stability after 25 km of running or 25 km of cycling and reported deterioration on postural stability, despite with differences depending on the type of the exercise. Lepers *et al.* also evaluated sensory afferents, and stated that during physical exercise adaptations could occur to this prolonged proprioceptive stimulation, which could be responsible of postural control deterioration.[5] Besides, the results of the present study support the research by Paillard *et al.*, who assessed general and local stress level after intense exercise protocols and reported a subsequent deterioration of the postural stability of athletes, referring again to an alteration in sensory afferents and consequently, in motor control efferences.[6] At the same time, the results of the present study are in the same line of those found by Fox *et al.*, where athletes performing an anaerobic training session showed a deterioration in posterior stabilometric values.[4] However, in contrast with our results, Fox *et al.* stated that athletes had recovered from this deterioration within 13 minutes.[4] Similar results were reported by Yaggie and Armstrong in 2004, with athletes who had worse stabilometric values after a general and intense exercise protocol recovering their stabilometric baseline within 10 minutes.[17] Yet another example comes from Susco *et al.* , who reported stabilometric deterioration and a subsequent improvement after 20 minutes.[13] In the present study, although bipodal stability values significantly improved 30 minutes after lactic training, it remained significantly worse than baseline. It was not before 24 hours that baseline stabilometric levels were reached, and even improved. This improvement is consistent with results from Brown in 2002, who reported that after a prolonged proprioceptive stimulation, such as physical activity, athletes had better motor control.[18] This could lead us to the conclusion of Fanquin *et al.* about the better postural control from athletes *vs* non athletes due to the development of a more complex motor program brought about by sports practice.[19]

On the other hand, despite the fact that our results show worse stabilometric parameters in CoP dispersion variables on the monopodal stabilometric test after lactic training session, this test did not return results as clear as those of the bipodal testing. The inequality between bipodal and monopodal results is consistent with previous studies,[20, 21] where authors detected different results from both tests, with greater postural sway during monopodal, so that the difficulty added from monopodal stance could lead the difference between both tests.

Our investigation reported stabilometric deterioration right after lactic training in monopodal stability. Then, a progressive improvement appeared, which became statistically significant after 24 hours, although no significant deterioration appeared 30 minutes after the end of the lactic training session as was the case of bipodal stability tests. These findings agree with those of Surenkok *et al.* where athletes who performed a lactic training session later showed worse monopodal stability.[9] Similar results

were found by Brito *et al.*, who observed that after a competitive soccer match, soccer players exhibited a clear deterioration in the same CoP dispersion variables that do deteriorate in our study.[3]

Regarding CoP position variables in the present study, Xmean and Ymean, significant results were found in anteroposterior stability while on left-leg monopodal support. More specifically, athletes showed a more posterior-leaning position 30 minutes after lactic training session. These findings are in line with those of Vuillerme and Hintzy in 2007, who reported that after fifteen minutes of cycling at 200W, athletes showed no stabilometric deterioration in the medial-lateral plane, although the deterioration was found in the anteroposterior plane.[12] On the other hand, the inequality between right and left-leg monopodal support results, with worse stabilometric parameters for the left leg, could be explained by the fact that the type of athletes who took part in our study always train at tracks, where all turns are left-sided.

On the other hand, the warm-up training session showed a positive correlation between length, area and velocity at $Post_{0min}$ of right-leg monopodal stability tests and area and velocity at $Post_{30min}$ of left-leg monopodal stability tests with blood lactate levels at $Post_{24h}$. Thus, blood lactate level 24 hours after warm-up depended in 38% on the value of the velocity variable and in 66% on the value of the area variable at 0 minutes or 30 minutes after training, respectively.

In the lactic training session, no correlation between stabilometric variables and blood lactate level was found. These results support those of Surenkok *et al.*, who did not find any correlation between stability and blood lactate level after a lactic training.[9]

Results from the present study show that motor control deterioration, as stated by authors like Lepers *et al.* and Paillard *et al.* in their respective studies, take place as a consequence of the alteration of proprioceptive afferents due to a continuous proprioceptive stimulation during prolonged physical exercise and to the subsequent stress level.[5, 6] However, the duration of these stabilometric changes depends on the intensity and length of the exercise.[14] This deterioration becomes apparent in motor control efferences and therefore in the efficacy of sports movements.[22].

For future research, we suggest to include an intense exercise protocol with more frequent stability measures in order to be able to determine in detail the time spent to recover stabilometric baseline values. Furthermore, we suggest analyzing several types of training sessions in order to assess the effects of different types of training sessions on the stabilometric values of athletes.

Conclusions

An anaerobic lactic training session, as normal training routine of sprinters, contributes to an important deterioration of the center-of-pressure dispersion values in the bipodal stability of athletes. Thirty minutes later, stabilometric parameters remain deteriorated. After 24 hours, stability is better than basal level. On monopodal support tests, athletes show worse stability right after a lactic training, although this deterioration fades out in time. Regarding center-of-pressure position, a lactic training session induces a deterioration in anteroposterior stability while on left-leg monopodal support.

As a practical application, personal trainers and sports physical therapists should take into account the important stabilometric deterioration happening right after a lactic training, as well as its persistence at least 30 minutes later. The risk of injury must be taken into account, as proprioceptive afferences are disturbed and therefore motor control efferences are altered. Potential injuries might become more likely at least 30 minutes after training, although the persistence of the increased risk might depend on the intensity and length of training.

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