DIFFERENCES IN HEART RATE AND LACTATE LEVELS AT THREE DIFFERENT WORKLOADS IN STEP AEROBICS

Petra Zaletel[1], Gordana Furjan-Mandić[2] and Meta Zagorc[1]

[1]*University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia*
[2]*University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia*

Original scientific paper
UDC 796.41.035:61:796

Abstract:

The aim of the research was to establish differences between the HR values and maximal blood lactate concentration assessed during the performance of a step aerobics programme at three different heights of step bench. The sample consisted of 12 female aerobics instructors, aged between 20 and 28. The subjects executed a pre-defined choreography uninterruptedly for 30 minutes on a step bench, which was set at three different heights: 20, 25 and 30 cm, and to the music set at 135 bpm. At the beginning and immediately after the 30-minute activity HRpeak and blood lactate - b[LA] concentration were measured. HR monitors, recording data every 5 minutes, controlled the HRpeak. Data processing was performed using SPSS statistical programme, descriptive statistics method and *t*-test for establishing differences between the subjects' HR. It was established that there were statistically significant differences between the subjects in terms of average HR at various step bench heights. It was also established that the lactate values did not rise proportionately to the HR values.

Key words: *step aerobics, exercise intensity, height of step bench, heart rate, blood lactate concentration*

Introduction

Regular participation in aerobics programmes has been found to elicit cardiovascular fitness improvements similar to those elicited by other endurance-type modes of exercise (Scharff-Olson, Williford, Blessing, & Brown, 1996) - activities that require only a moderate increase in oxygen consumption and therefore can be sustained longer.

Step aerobics exercise has become increasingly popular exercise in fitness and weight loss programmes (Olson, Williford, Blessing, & Greathouse, 1991). Step aerobics is an amalgamation of low-impact aerobic dance movements and bench stepping. It combines different movement structures into a logical composition – choreography; in order to achieve aerobic effects the choreography is repeated several times to music. It is suitable from beginners to advanced exercisers, and even top-level athletes (for physical conditioning). Stepping on and off the bench during step bench aerobics is a movement that corresponds to ascending or descending a hill, which is why it is an excellent activity for developing one's cardiovascular and respiratory abilities. The ACSM (American College of Sport Medicine) recommends that, in order to improve cardio-respiratory endurance, control body weight, and reduce the risk of premature chronic disease, an individual should perform 20 to 60 minutes of continuous or intermittent aerobic exercise at an intensity between 50% to 85% of oxygen uptake reserve, 3 to 5 days per week (ACSM, 2000; Pollock, et al., 1998). Olson, et al. (1991) demonstrated that aerobic bench stepping is an exercise modality that provides sufficient cardio-respiratory demand to enhance aerobic fitness and promote weight loss in females.

The authors of many aerobics researches have studied the influence of aerobic exercise on the fitness of the cardiovascular system, the sublevel of motor abilities, the sublevel of muscle and joint load as well as sublevel of personality changes (Bell & Bassey, 1996; Bernard, et al., 1997; De Angelis, Vinciguerra, Gasbarri, & Pacitti, 1998; Furjan-Mandić, et al., 2001).

During aerobics classes, the participants usually regulate their exercise intensity using the rating of perceived exertion (RPE; Borg, 1982). The RPE has been shown to correlate well with blood lactate, heart rate (HR), pulmonary ventilation and the oxygen uptake responses to exercise (Robertson & Noble, 1997). It has been shown that participants generally underestimate their level of cardiovascular strain by RPE compared to physiological estimates such as HR and maximal oxygen uptake (Clapp & Little, 1994; Schaeffer, Darby, Browder, & Reeves, 1995). The experiment of Clapp and Little (1994) has shown that the intensity level of performance of the instructor and the participants differ dramatically during aerobics classes, and that the physiological responses to exercise vary among individuals.

The assessment of intensity through the monitoring of HR is usually the most convenient method to determine the intensity of a workout (Ušaj, 1996; Zagorc, Zaletel, & Ižanc, 1996). Many authors have established that the 6-second method for monitoring HR did not yield sufficiently accurate results and that on this account the exercisers constantly underestimated the intensity of a workout. Some other authors have established that HR could be a good indicator of intensity so long as it is sufficiently low – approximately 50% of VO_{2max} (Berry, Cline, Berry, & Davis, 1992). HR monitoring has been used ever more often for its advantages: simplicity, availability and low cost of use. In aerobics, subjective methods for assessing effort have also been used frequently; the most frequently used is the Borg scale (Berry, et al., 1992; Ušaj, 1996; Zagorc, et al., 1996).

Benson (1995) defined target HR zones according to three general objectives for which people do sport: the 1st zone of weight managing (60–70% of HRmax), 2nd aerobic zone for maintaining a healthy heart (70–80% of HRmax) – it may be compared to the level of the moderately intensive-to-intensive effort according to Ušaj (1996), and 3rd zone of competitive training for peak performance (80–100% HRmax). Wilmore and Costill (1994) suggested the following intensity targets for aerobics phases of the classes: *light*, when HR was bellow 75% HR_{max}, *moderate*, when HR was between 75% and 85% HR_{max}, and *heavy*, when HR was between 85% and 90% HR_{max}.

Grier, Lloyd, Walker, and Murray (2002) investigated the metabolic and cardiovascular responses of aerobic dance bench stepping at 15 and 20cm height in two different cadences: 125 and 130 beats per minute (bpm) in healthy and adult female participants. The study revealed no differences between the 2 selected cadences; the significant differences were observed between the 2 step bench heights for HR, RPE, VO2 and caloric expenditure.

The purpose of the present research is to find out what type of effort is predominant in the workout of aerobics instructors and consequently of the exercisers taking classes of recreational aerobics on a regular basis. The aim of this work was to establish the differences in the HR of aerobics instructors exercising on a step bench set at different heights (20, 25 and 30 cm). The objectives of the research are to establish the following: 1) probable differences in average HR during exercise at various heights of the step bench (20, 25 and 30 cm), 2) level of subjects' HR during the major part of exercise at a given height of the step bench (workload), and 3) changes in the level of blood lactate concentrations in relation to the HR values.

In view of the set objectives, the following hypotheses were tested: H1 – the higher step bench statistically significantly induces the higher average HR; H2 – irrespective of the height of the step bench (20, 25 and 30 cm), most of the time (at least 70%) the subjects reach the level of medium intensive-to-intensive effort (according to Benson, 1995). The third hypothesis (H3) was – the levels of lactates rise proportionally to the HR values.

Methods

Twelve active female aerobics instructors volunteered to participate in the study. Their age was between 20 and 28, the average height was 167cm and weight 57.6 kg. All instructors had been teaching at least 4 step aerobic classes a week for the last 5 years; they also teach other kinds of aerobics classes a minimum 6 times a week for 2 hours, and they have an excellent technique of executing movements. They were all healthy when the measurements were taken.

The variables were measured three times, once a week on the same day (three weeks for each height of the step bench), from 9:30 to 10:00 a.m., the following were measured: HR at rest (HR_{rest}), average HR during physical activity (HR_{ave}), the highest value of HR/peak HR (HR_{peak}), momentary HR values in every 5 minute of the routine (HR_5, HR_{10}, HR_{15}, HR_{20}, HR_{25} and HR_{30}). The lactate levels were taken before warm-up (b[LA] start) and after exertion (b[LA] end).

Test protocol

The subjects simultaneously performed a pre-defined and pre-taught simple choreography on the step bench, at a constant music tempo (135 bpm). After individual warm-up before each measurement session, the participants executed a choreography composed of the basic movement structures of step aerobics, namely, for 30 minutes at each height of step bench (first 20, and then 25 and 30 cm). There was a break of one week between each measurement.

Heart rates were measured with heart rate monitors (POLAR X-TRAINER) that the subjects put on before warming up. The lactate levels were taken from the earlobes in a sample of capillary blood and later measured by Ependorf Ebio Plus. Lactates were measured before the exercise (starting) and in the first 30 seconds after the end of the 30-minute exercise (final lactates).

The scheme of executed movement structures:

Number of bpm	Movement structure
1 – 32	Basic step with right leg
1 – 32	Basic step with left leg
1 – 32	"V" step with right leg
1 - 32	"V" step with left leg
1 - 64	Knee-up, moving corner to corner (right leg – left leg)
1 - 64	Knee-up repeater, moving corner to corner (right leg – left leg)

Data processing methods

Data were processed using program package Statistica for Windows, ver. 5.0, at the Faculty of Sport, University of Ljubljana, and the basic statistical indicators were calculated. *T*-test for dependent samples (paired *t*-test) was used to establish the differences in HR between 1st and 2nd, 2nd and 3rd, and 1st and 3rd height of the step bench. The same method was used to establish the differences in blood lactate concentration at three different heights of step bench.

Results

Table 1 shows all the basic statistical parameters of the sample collected from all three measurements. HRs at rest are interesting, as they differ substantially in the 1st and 2nd measurement (SD=2.09). The highest value of HR at rest rose from 84 bpm to 91.7 bpm.

Table 1 shows a statistically significant difference in the 15th minute of exercise, where the value of the average HR increased by 12.4 bpm. In the 20th, 25th and 30th minutes of exercise between the 2nd and 3rd workload no statistically significant differences were established, nevertheless, a tendency was shown, as the t-values were close to .05.

The highest number of statistically significant differences was recorded between the 1st and the 3rd workload. The HRave rose by no less than 10 bpm; the same rise was observed in HRpeak when HR increased approximately by 15 bpm under the third workload in the 10th, 15th, 20th, 25th and 30th minutes. No statistically significant differences were observed at rest and in the 5th minute, which indicates that the efforts are still similar at the beginning of exercise, but afterwards the heights of step bench start to cause changes in effort, which impacts HR. A distinctive change was observed in the 30th minute of exercise, when arithmetic mean of heart rate (AMHR) rose to 171.

Discussion and conclusions

The highest value of HR at rest rose from 84 bpm to 91.7 bpm. This could probably be ascribed to the initial excitement of the organism, which is already familiar with the type of measurement but does not know what influence a higher step bench will have. The HRave in exercising on a 30cm step bench accounted for 70%–80% of the subjects' HR_{max}. According to Ušaj (1996) the level of 70%–80% represents medium to high intensity, which means that the effort is within the level of aerobic-anaerobic workload (Wilmore & Costill,

Table 1. Basic statistical characteristics of the sample of variables measured at all three workloads

	1ST MEASUREMENT		2ND MEASUREMENT		3RD MEASUREMENT		DIFFERENCES					
VARIABLES	AM	SD	AM	SD	AM	SD	1st -2nd *t*-test	1st -2nd p (t)	2nd -3rd *t*-test	2nd -3rd p (t)	1st -3rd *t*-test	1st -3rd p (t)
HR_{rest}	91.7	1.59	89.2	2.09	84.0	1.34	.34	.74	.78	.45	1.70	.12
HR_{ave}	141.8	1.44	146.2	1.55	150.8	1.74	-.84	.42	-.96	.36	-3.40	.01 *
HR_{peak}	164.1	1.17	166.8	1.65	175.4	1.59	-.55	.60	-1.87	.10	-5.11	.00 *
HR_5	137.2	2.65	147.2	1.38	141.7	3.49	-1.30	.22	.64	.53	-.64	.54
HR_{10}	146.8	1.48	156.2	1.55	161.4	1.72	-2.33	.04 *	-1.07	.31	-3.50	.01 *
HR_{15}	154.7	1.27	156.9	147	169.0	1.53	-.53	.60	-3.04	.01 *	-4.80	.00 *
HR_{20}	149.8	1.56	155.0	1.60	164.2	1.69	-.80	.44	-1.90	.08	-4.00	.00 *
HR_{25}	152.7	1.55	158.8	1.65	167.6	1.72	-.97	.35	-2.01	.07	-4.50	.00 *
HR_{30}	156.2	1.20	162.9	1.81	171.0	1.74	-1.27	.23	-1.67	.12	-5.35	.00 *
LA start (mmol/L)	1.1		1.3		.8							
LA end (mmol/L)	1.3		1.5		1.3							

Legend: AM – arithmetic mean, SD – standard deviation, HRREST – heart rate at rest, HRAVE – average heart rate during physical activity, HRPEAK – maximum heart rate, HR5, 10, 15, 20, 25, 30 – heart rate in the 5th, 10th, … 30th minute, LA start - average values of lactates in individual subjects at the start of exercise, LA end - average values of lactates in individual subjects at the end of exercise, p (t) – characteristic of *t*-test

1994). HRave of all the subjects accounted for 77% of their HR_{peak} on a 30-centimetre step bench. In the POLAR programme, which was used to monitor the HR of the subjects, the following levels were recorded: *above maximum* 1.3%, *above target zone* 38.8%, *in target zone* 56.2% and *below target zone* 4%.

The subjects reached 70% of their HR_{peak} at the beginning of the 5th minute of exercise. According to the formula "220 – age" (Wilmore & Costill, 1994), HR_{max} of the subjects was calculated and 70% (HR_{peak}) determined, representing the desired level. The recorded measurements of HR show in which minute the subject reached 70% of her HR_{peak}. Average values of HR were calculated for all three heights of step bench and it was established that the subjects reached the level in the 5th minute.

Laukkanen, et al. (2001) report that the mean HR during the warm-up and cool-down periods corresponded to 67%-69% of the HR_{max}, and during the aerobic phases, they corresponded to 79%-86% HR_{max}.

There were no statistically significant changes in the average HR at different heights of step bench. The calculated average HR in the first, second and third measurements accounted for 72%, 75% and 77% of the HR_{peak}, respectively. At the three different heights of step bench, there were no outstanding changes in the average HR values, which may be explained by the high degree of the subjects' fitness. The values were relatively high, as they exceeded the aerobic level in three measurements. Nevertheless, this workload did not represent such an exertion as it does to students during aerobics classes. Aerobics instructors constantly encourage their students during their classes and they announce moves to the rhythm of music, which is certainly an additional strain. The more experienced they become, the easier they deal with greater efforts. Buchowski, Darud, Chen, and Sun (1998) also suggested that instructors might exaggerate movements and increase the mechanical work even with controlled movements and cadences. Their study shows that habituation may affect the total amount of work performed during step aerobic exercise when the activity is performed frequently.

There was a statistically significant difference between the first and the second workload (height of step bench: 20 and 25 cm), but only in one variable: HR10. In the tenth minute of the routine the subjects had higher HR by as much as 10 bpm at the second load – height of step bench: 25 cm. Maximum and average heart rates did not change substantially, which indicated that both heights represented a similar level of effort, therefore the additional 5 cm of step bench height did not result in essentially higher workload.

We see in Figure 1 the average values of lactates measured at the beginning and at the end of work at all three step bench heights. We expected the values of post-exercise lactates to be much higher than those measured before. In most subjects there was an increase in values, but in some, the lactate values declined. It can be explained by several reasons: the subject could have had a demanding training the day before and her muscles had not yet recovered enough which meant that lactate acid had not yet been released from muscles to blood (Ušaj, 1996); the subject is highly trained and such effort represents low to medium load to her; the subject's movements are technically correct, i.e. highly economical, which results in a low energy consump-

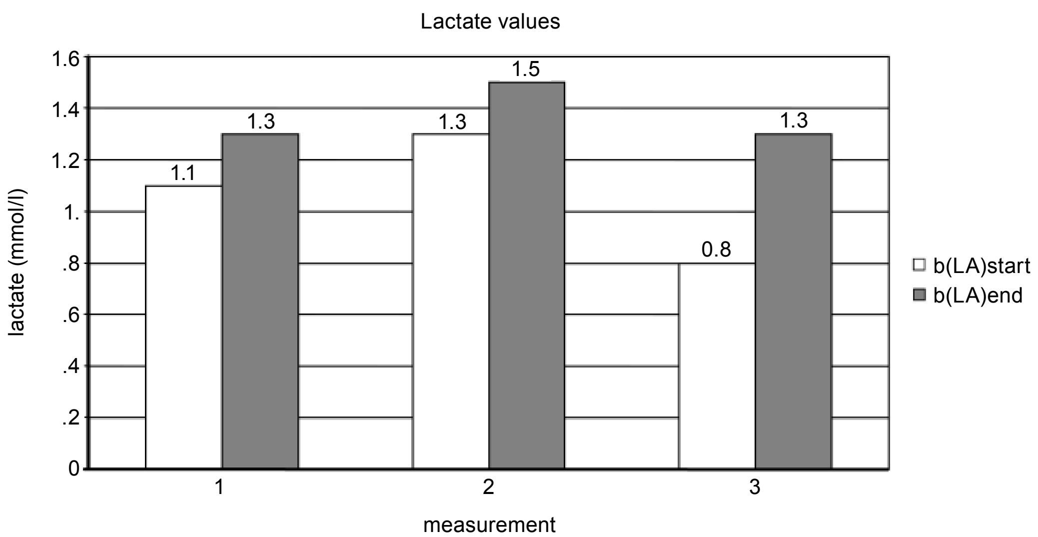


Figure 1. Average values of lactates in individual subjects at the start and at the end of exercise.

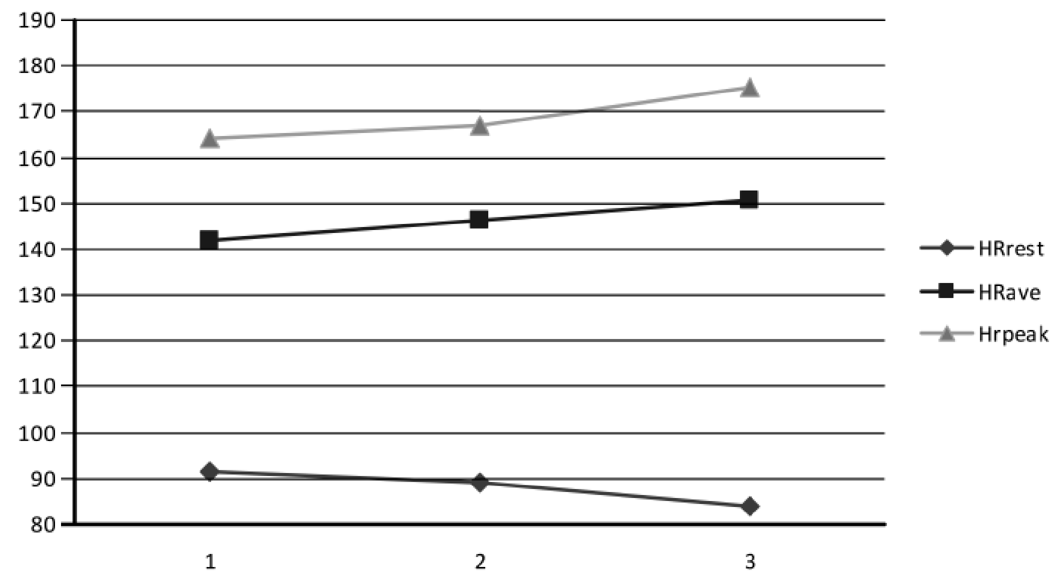
tion and reduces acidification of muscles; the subject is tall, and therefore the height of the step bench represents a much smaller effort than it does to the shorter subjects.

Buchowski, et al. (1998) found that during basic step aerobics movements and aerobics routines instructors had a higher work efficiency (ratio of mechanical work to the increase in energy expenditure caused by physical activity) than non-instructors. The authors explain the increase in the work efficiency of instructors by the habituation of step aerobics exercise caused by long-term participation in this activity.

The average values of lactates induced by the first workload were 1.1mmol/l and 1.3 mmol/l at the start and end, respectively. Under the second load the starting average lactate value of 1.3 mmol/l rose to the final of 1.5 mmol/l, while under the third load it rose from .8 mmol/l to 1.3 mmol.

In establishing whether the lactate values increased proportionally to the HR values at higher intensities, we concluded that for some of the subjects the workload was not that high to cause a rise in their lactate values. In some subjects, lactate values were lower at the end of the measurement than at the start, based on which the conclusion can be drawn that different heights of step bench (15, 20 and 25 cm) did not result in a high effort in these subjects. These heights represented low to medium intensive aerobic effort to them. Primarily taller subjects reached this low to medium intensive effort, which speaks in favour of the importance to taking anthropometric measures into account when determining the workload to step aerobics programme participants. The subjects whose -b [LA] values were 2 mmol/l or more also had distinctively higher HR, which speaks of the correlation between lactate and HR; nevertheless, this correlation was not statistically significant and was not applicable to all the subjects. It could be said that the workload we determined represented such a small effort to some of the subjects that it may be called an active-rest phase. When the activity of aerobic energy processes increase slightly, part of the lactate acid from blood is used as fuel, which is why the value of lactates in some of the subjects was lower at the end of the measurement than at the beginning (Ušaj, 1996).

It was established that the average HR during exercise on a 25-centimetre high step bench accounted for 70–80% of HRpeak. According to Benson (1995), this represents an aerobic exercise zone of maintaining a “healthy heart”, which may be equated to the level of medium to high intensity, as defined by Ušaj (1996). One may say that this is an anaerobic-aerobic effort.



Measurements	HR_{rest}	HR_{ave}	HR_{peak}
1	91.70	141.80	164.10
2	89.20	146.20	166.80
3	84.00	150.80	175.40

Figure 2. Heart rates in three measurements during exercise.

The average HR of the subjects accounted for 77% of their HR_{peak} on a 25cm high step bench. The subjects were within the limits of the target zone for 56.2% of time of the entire exercise. They were above the target zone for 40.1% of time of the entire exercise and below the target zone for 3.7%. The second hypothesis was confirmed; however, there was a tendency towards the level of aerobic--anaerobic movements of subjects.

The average HR changed statistically significantly when the step bench height was altered by ten centimetres (Figure 2). Change in average HR was statistically significant only between the 1st and 3rd height of step bench (20 and 30 cm), where no statistically significant differences were found only in the fifth minute of the workout. With each 5-centimetre change in step height the average HR changed by approximately 10 bpm.

At a higher average intensity the lactate values did not increase proportionally to the HR values. For some subjects the load represented such a low stimulus for aerobic energy processes that their body used part of the lactate from blood as fuel (according to Ušaj, 1996), which is why in some of the subjects the lactate value at the end was lower than that at the beginning of the workout.

Based on the results of the measurements the effort in aerobics classes may be accurately planned, certainly in line with the needs and goals of the participants. In the future, it would be sensible to study the levels of HR-defined effort of the exercisers, who are usually less trained than their leaders – the instructors.

References

American College of Sports Medicine. (2000). *Guidelines for Exercise Testing and Prescription* (6th ed.). Philadelphia: Lippincott Williams & Wilkins.

Bell, J. M., & Bassey, E.J. (1996). Postexercise heart rates and pulse palpation as means of determining exerising intensity in aerobic dance class. *British Journal of Sports Medicine*, *30*(1), 45 -52.

Benson, R. (1995). *Vodič k napredku v teku*. [Guide to improvement in running. In Slovenian.] Novo mesto: Eko projekt.

Bernard, T., Gavarry, O., Bermon, S., Giacomoni, M., Marconnet, P., & Falgairette, G. (1997). Relationships between oxygen consumption and heart rate in transitory and steady states of exercise and during recovery: influence of type of exercise. *European Journal of Applied Physiology*, *2*, 170-176.

Berry, M.J., Cline, C.C., Berry, C.B., & Davis, M. (1992). A comparison between two forms of aerobic dance and treadmill running. *Medicine & Science in Sports & Exercise*, *24*(8), 946-951.

Borg, G.A.V. (1982). Psychophysical bases of perceived exertion. *Medicine & Science in Sports & Exercise*, *14*(5), 377-381.

Buchowski, M.S., Darud, J.L., Chen, K.Y., & Sun, M. (1998). Work efficiency during step aerobic exercise in female instructors and noninstructors. *Research Quarterly for Exercise and Sport*, *69*(1), 82-89.

Clapp, J.F., & Little, K.D. (1994). The physiological responses of instructors and participants to three aerobic regims. *Medicine & Science in Sports & Exercise*, *26*, 1041-1046.

De Angelis, M., Vinciguerra, G., Gasbarri, A., & Pacitti, C. (1998). Oxygen uptake, heart rate and blood lactate concentration during a normal training session of an aerobic dance class. *Journal of Sports Medicine in Physical Fitness*, *78*(2), 121-127.

Furjan-Mandić, G., Juriša, M., Kondrič, M., Štihec, J., Videmšek, M., & Karpljuk, D. (2001). Heart rate and lactate values in step aerobics at different heights of the step-bench. *Acta Universitas Carolinae*, *37*(1), 55-65.

Grier, T.D., Lloyd, L.K., Walker, J.L., & Murray, T.D. (2002). Metabolic cost of aerobic dance bench stepping at varying cadences and bench heights. *Journal of Strength and Conditioning Research*, *16*(2), 242-249.

Laukkanen, R.M., Kalaja, M.K., Kalaja, S.P., Holmala, E.B., Paavolainen, L.M., Tummavuori, M., Virtanen, P., & Rusko, H.K. (2001). Heart rate during aerobics classes in women with different previous experience of aerobics. *European Journal of Applied Physiology*, *84*, 64-68.

Olson, M.S., Williford, H.N., Blessing, D.L., & Greathouse, R. (1991). The cardiovascular and metabolic effects of bench stepping exercise in females. *Medicine & Science in Sports & Exercise*, *23*(11), 1311-1318.

Olson, M.S., Williford, H.N., & Smith, F.H. (1992). The heart rate VO2 relationship of aerobic dance: a comparison of target heart rate methods. *Journal of Sports Medicine and Physical Fitness*, *32*(4), 372-377.

Pollock, M.L., Gaesser, G.A., Butcher, J.D., Despres, J.P., Dishman, R.K., Franklin, B.A., & Garber, C.E. (1998). The recommended quality and quantity of exercise for developing and maintaining cardio-respiratory and muscular fitness, and flexibility in healthy adults. *Medicine & Science in Sports & Exercise*, *30*, 975-991.

Robertson, R.J., & Noble, B.N. (1997). Perception of physical exertion: methods, mediators, and applications. In J.O. Holloszy (Ed.), *Exercise and Sport Science Reviews*, *25*, 407-452.

Schaeffer, S.A., Darby, L.A., Browder, K.D., & Reeves, B.D. (1995). Perceived exertion and metabolic responses of women during aerobic dance exercise. *Perceptual and Motor Skills*, *81*, 691-700.

Scharff-Olson, M., Williford, H.N., Blessing, D.L., Brown, J. (1996). The physiological effects of bench/step exercise. *Sports Medicine*, *21*, 164-175.

Ušaj, A. (1996). Deoxygenation of forearm muscles during different contraction-relaxation intervals. In I. Eržen & Z. Pajer (Eds.), *Life sciences: Proceedings of the 3rd International Conference*, Gozd Martuljek, Slovenia, September 21st - 26th, l996 (pp. 175-176). Ljubljana: Society for Stereology and Quantitative Image Analysis.

Wilmore, J.H., & Costill, D.L. (1994). *Physiology of Sport and Exercise*. Champaign, IL: Human Kinetics.

Zagorc, M., Zaletel, P., & Ižanc, N. (1996). *Aerobika*. [Aerobics. In Slovenian.] Ljubljana: Fakulteta za šport.

Submitted: October 16, 2007
Accepted: May 28, 2009

Correspondence to:
Petra Zaletel
Faculty of Sport, University of Ljubljana
Gortanova 22, 1000 Ljubljana, Slovenia
Phone: +386 1 5401077
Fax: +386 1 5402233
E-mail: petra.zaletel@fsp.uni-lj.si

RAZLIKE U FREKVENCIJI SRCA I RAZINAMA LAKTATA IZAZVANE TRIMA RAZLIČITIM RADNIM OPTEREĆENJIMA U STEP AEROBICI

Sažetak

Uvod

Step aerobika je vrsta aerobike u kojoj se različite kretne strukture kombiniraju u logičnu koreografsku strukturu koja se, radi postizanja željenih efekata, ponavlja nekoliku puta uz primjerenu glazbu. Ova vrsta aerobike primjerena je kako za početnike, tako i za napredne vježbače, pa čak i za vrhunske sportaše (u kondicijskoj pripremi). Penjanje na i spuštanje sa step klupice može se usporediti s hodanjem uzbrdo ili nizbrdo, što pogoduje poboljšanju srčanožilnog i dišnog sustava.

Mnogi su autori istraživali utjecaj vježbanja aerobike na funkcionalne i motoričke sposobnosti vježbača, na promjenu koštano-zglobnog i mišićnog sustava, kao i na promjene osobina ličnosti.

Razlog za ovo istraživanje bila je želja da se utvrdi razina opterećenja za vrijeme rada instruktora aerobike na satovima rekreacijske aerobike. Cilj je istraživanja bio da se utvrde razlike u frekvenciji srca (FS) kod instruktora aerobike za vrijeme rada na tri različite visine step klupice (20, 25 i 30 cm).

U eksperimentalnom postupku bila su praćena tri segmenta: 1. razlike u srednjim vrijednostima FS za vrijeme rada na tri visine step klupica (20, 25 i 30 cm), 2. razina FS instruktora aerobike za vrijeme najvećeg opterećenja u radu na tri visine klupice i 3. promjene u razini laktata u odnosu na razinu FS.

Metode

Uzorak ispitanika se sastojao od 12 odabranih instruktorica aerobike, u dobi od 20 do 28 godina. Sve instruktorice vježbale su aerobiku najmanje 4 do 6 puta tjedno, 2 sata dnevno i izvrsne su u tehnici izvođenja koraka step aerobike.

Praćene su sljedeće varijable: FS u mirovanju (HR_{rest}), srednja vrijednost FS za vrijeme rada (HR_{ave}), maksimalna FS (HR_{peak}), FS svakih pet minuta koreografije (HR5, HR10, HR15, HR20, HR25 i HR30), razina laktata prije zagrijavanja (Lstart) i razina laktata na kraju rada (Lend).

Opterećenje rada praćeno je pomoću monitora srčane frekvencije (POLAR X-TRAINER) koji su ispitanicama stavljeni prije zagrijavanja. Razina laktata mjerena je na uzorku krvi uzete iz ušne resice. Laktati su izmjereni prije početka vježbanja te nakon tridesete minute rada.

Podaci su obrađeni statističkim paketom SPSS, a izračunati su osnovni deskriptivni parametri. U svrhu utvrđivanja razlika FS za vrijeme rada na tri visine step klupice izračunat je t-test za zavisne uzorke (T-PAIRED).

Rezultati

Dobiveni rezultati prikazani su u tablici 1 kao i u dijagramu 1. Kao što se može vidjeti, najviše vrijednosti FS u mirovanju su između 84 i 91,7 bpm. U Tablici 1 mogu se uočiti statistički značajne razlike u FS u petnaestoj minuti vježbanja, gdje je razlika u srednjoj vrijednosti FS 12.4 (HR_{ave}) Najveće, statistički značajne razlike izmjerene su na prvoj i trećoj visini step klupice.

Rasprava i zaključak

U radu je utvrđeno da su srednje vrijednosti FS (HR_{ave}) na visini step klupice od 25 cm iznosile 70–80% od maksimalne FS. Prema Bensonu (1995), takva vrijednost predstavlja razinu opterećenja koja pogoduje očuvanju “zdravog srca”, a koja odgovara razini između srednjeg do visokog opterećenja za vrijeme vježbanja (Ušaj, 1996). Prema nekim stručnjacima, ta vrijednost odgovara aerobno-anaerobnoj zoni rada.

Srednje vrijednosti FS ispitanica za vrijeme rada na 25 cm visokoj step klupici iznosile su 77% od maksimalne FS. Iz rezultata je vidljivo da su bile u ciljanoj zoni 56.2% od ukupnog trajanja rada, iznad ciljane zone 40.1%, a ispod 3.7%. Naravno, takve vrijednosti se očekuju uslijed zadržavanja u aerobno-anaerobnoj zoni rada.

Statistički značajne razlike u vrijednostima srednjih FS (HR_{ave}) mogu se uočiti kada se visina step klupice povećala za 10 cm. Statistički značajne razlike srednjih vrijednosti FS uočene su samo za vrijeme rada na prvoj i trećoj visini step klupice (20 i 30 cm). No, u petoj minuti rada nije utvrđena razlika u FS vježbačica. Utvrđeno je također da su se s povišenjem step klupice za 5 cm, srednje vrijednosti FS mijenjale za približno 10 otkucaja.

Što se promjena laktatnih vrijednosti tiče, utvrđeno je da se pri većem naporu nisu mijenjale proporcionalno s povećanjem FS. Vjerojatno za neke ispitanice ovakav trening nije bio dovoljno intenzivan te su se pojavili metabolički procesi koji su koristili laktate iz krvi kao izvor energije (Ušaj, 1996), što je razlog zašto su kod nekih ispitanica vrijednosti laktata na kraju bile niže od onih na početku vježbanja.

Na temelju ovog istraživanja može se zaključiti da se opterećenje na satu aerobike mora pažljivo planirati, a u skladu s njegovim ciljevima. Istraživanje je također pokazalo da bi bilo potrebno utvrditi razinu FS kod vježbača rekreativaca koji su vjerojatno u lošijoj kondiciji od svojih instruktora aerobike. Na temelju dobivenih rezultata može se zaključiti da bi u jednom od sljedećih istraživanja bilo poželjno utvrditi razine FS kod vježbača rekreativaca koji uglavnom treniraju manje nego instruktori.