THE INFLUENCE OF ENVIRONMENTAL CONDITIONS ON THE BENEFITS OF AEROBIC GYMNASTICS

Anu Järvekülg

Institute of Exercise Biology, University of Tartu, Estonia

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Abstract:

It has been showed that the positive mood effects of aerobics may be eliminated by unpleasant working conditions. The aim of this study was to test the dependence of fitness improvement in aerobics on environmental conditions. The study was performed on three aerobic dance groups (total of 42 women, aged between 19 and 27 years old). According to a special questionnaire, the participants evaluated the environmental working conditions as *good* in two groups and *unsatisfactory* in the third group. Mood testing (STAI and PANAS) confirmed positive acute affects in groups 1 and 2 and a lack of positive mood changes in group 3. The heart rate monitoring showed that the workload of the exercise sessions observed was approximately the same. The 12-week training programme caused significant improvements of *forward trunk bend* in all groups. No significant changes occurred in *Harvard step-test index* (obviously due to the high initial level) and *standing broad jump.* The *medicine ball throw* improved in group 1 and group 3 but not in group 2. The number of *squats in 30 s* increased in groups 1 and 2, and of *sit-ups* only in group 3. In conclusion, the negative mood affects generated by the unpleasant working conditions did not alter the influence of aerobics dance on fitness improvement.

Key words*: influence of environmental conditions, exercise induced mood changes, heart rate, training effects, women*

EINFLUSS DER ARBEITSBEDINGUNGEN AUF DIE POSITIVEN EFFEKTE DER AEROBIC-GYMNASTIK

Zusammenfassung:

Es wurde schon bewiesen, dass die positiven Effekte des aeroben Trainings auf die Laune in unangenehmen Arbeitsbedingungen abhanden kommen können. Diese Arbeit hat das Ziel, die Abhängigkeit zwischen durch Aerobic-Gymnastik bewirkte Fitnessverbesserung und den Arbeitsbedingungen festzustellen. Die Untersuchung wurde in drei Gruppen durchgeführt (insgesamt 42 Frauen im Alter zwischen 19 und 27 Jahren). Mittels Fragebogen bewerteten die Befragten die Arbeitsbedingungen als *gut* in zwei Gruppen und als *ungenügend* in der dritten Gruppe. Die Tests der Laune (STAI und PANAS) bestätigten den positiven akuten Effekt in Gruppen 1 und 2, und die Abwesenheit von positive Änderungen der Laune in Gruppe 3. Die Herzfrequenzkontrolle zeigte, dass die Belastung während einer Trainingseinheit fast gleich war. Das 12-wöchige Trainingsprogramm verursachte signifikante Verbesserung der *Rumpfvorbeuge* in allen Gruppen. Keine signifikanten Änderungen waren im Harvard Step-Test Index (offensichtlich wegen hohen Anfangsniveaus) und *Standweitsprung* zu merken. Die Medizinballwurfwerte nahmen in Gruppen 1 und 3 zu, nicht aber in Gruppe 2. Die Anzahl von *Hocken in 30 Sekunden* nahm in Gruppen 1 und 2 zu, und von *Sit-Ups* nur in Gruppe 3. Daraus lässt sich schließen, dass die durch unangenehmen Arbeitsbedingungen entstandenen negativen Effekte den Einfluss der Aerobic-Gymnastik auf die Fitnessverbesserung nicht ändern.

Schlüsselwörter*: Einfluss von Arbeitsbedingungen, durch das Üben bewirkte Änderungen der Laune, Herzfrequenz, Trainingseffekte, Frauen*

Introduction

One of the essential effects of exercising is the positive influence on the mood (Weyerer & Kupfer, 1994; Biddle, 1995; Morgan & O`Connor, 1988). Several studies have evidenced an anxiolytic effect (Raglin & Morgan, 1987; Trine & Morgan, 1997; Breus & O`Connor, 1998). Our previous study indicated that the anxiolytic effect as well as elevation of the positive affect level and a decline of the negative affect level appeared only in the good environmental conditions of exercising (Järvekülg, Neissaar, & Viru, 2001). Obviously, unpleasant working conditions cause influences which evoke certain functional changes in the central nervous structures. As a result of these changes the influence of aerobics on the state and trait anxiety and affect levels was inhibited.

Neural adaptation contributes significantly to the formation of training effects (Sale, 1992). Therefore, the question arises whether the influence reflected in either positive or negative mood changes is strong enough to interfere with the neural adaptation and thereby alter the training effects. Several studies have indicated that the influence of exercise on the metabolism during exercise might be modified by emotional factors (Morgan, 1985). Mechanical efficiency has been found to vary when running was performed in different psychological states of people (Benson, Dryer, & Hartley, 1978; Williams, Krahenbuhl, & Morgan, 1991). In persons with high trait anxiety, the catecholamine responses to exercise were higher and testosterone levels lower than in the low scorers in the STAI test (Perronnet; Blier, Ledoux, Diamand, Volle, & Carafel, 1982). High scorers in the Beck Depression Inventory showed a blunted increase of growth hormone concentration during incremental exercise (Harro, J., Rimm, Harro, M, Grauberg, Karelson, & Viru, 1999). After a tennis match (Booth, Shelley, Mazur, Thorp, & Kettok, 1989) and a judo bout (Elias, 1981) the level of testosterone was increased in the winners but decreased in the losers. After a competition, triathletes who felt high fatigue had lower blood levels of β-endorphine and noradrenaline than athletes who reported high vigour (Odagiri, Shimomitsu, Iwane, & Katsumura, 1996).

The purpose of the study was to clarify whether the influence of unpleasant environmental or working conditions alters the fitness improvement as a result of the systematic exercise in aerobics gymnastics. In order to find the answer, a 12-week experiment was performed. The design of the experiment was founded on three presumptions: (1) the gymnasts feel the unpleasant influence of environmental conditions, (2) the workload of the exercise sessions was the same in those who exercised in unpleasant conditions compared to those who exercised in good conditions, (3) the influence of exercise sessions on the mood was different independent of the working conditions. In order to check the presumptions, the participants were asked to evaluate the actual environmental conditions for exercising with the aid of a special questionnaire. Heart rate monitoring was used to check the actual workload of the sessions. Finally, before a randomly selected session the actual mood affects were recorded with the aid of the STAI and PANAS procedures.

Methods

Subjects. The study was performed with 42 women, aged between 19 and 27 years. Their previous experience in aerobic dances and programmes varied from 3 to 9 years. No symptoms of acute or chronic diseases were found in any participant at the medical examination by a physician. The convenience sample consisted of three groups. The first (n=12) and the second group (n=13) exercised in good working conditions, whereas in the third group (n=17) the conditions were unsatisfactory (too small gymnasium, imperfect room ventilation, unsatisfactory sanitary conditions of the changing room and showers, see Table 1). In groups 2 and 3 the exercising was guided by the same instructor. Thus a comparison of the groups allowed us to clarify whether the instructor's effect determined the differences found between the groups that exercise in variable environmental conditions.

All the three groups exercised three times a week. The duration of sessions was 45 minutes. Each session consisted of: warming up 5 to 10 minutes, combo aerobics 30-35 minutes, and stretching 5 to 10 minutes. The intensity of exercises was chosen to cause heart rate corresponding to 75 - 80 % of the maximal heart rate. In order to eliminate the possible effect of the circadian rhythm, all sessions took place between 5 and 7 p.m.

The design of the study and the methods used. The study consisted of four parts. The first part was aimed at clarifying how the members of each group evaluate the conditions of exercising. They were asked to fill in a questionnaire composed by the author. Each participant had to evaluate the exercising conditions in the gym, as well as the changing and shower rooms (13 questions, Table 1). Further questions were about the session and about relationships among the members of the group (12 questions, Table 2). Two to four variants of answers were offered in each question. The participant chose the answer according to her own opinion. The most positive answer was designated by 4 in the case of four answers, by 3 in the case of three answers, etc. The most negative evaluation was designated by 1. In order to validate the questionnaire, the reliability of the answers was controlled after two weeks in 5 randomly selected persons who were asked to fill in the same questionnaire again. No difference in answers was found. Using an interview method, four specialists in aerobics evaluated the conditions

in the gym, in changing rooms and in showers. The results were in complete accordance with the answers of the participants.

The 12-week training programme was identical in all three groups. After a 6-week period a session was selected for heart rate monitoring and testing the state and trait anxiety and the positive and negative affect level before and after the session. Heart rate monitor POLAR VANTAGE NV (Finland) was used for heart rate monitoring in three randomly selected persons from each group. The mood state was tested in all the participants 15 minutes before and after the session with the aid of State and Trait Anxiety Inventory (STAI; Spielberger, Gorsech, Lushene, Vagg, & Jacobs, 1983) and the Positive and Negative Affect Scale (PANAS; Watson & Clark, 1994).

The following fitness tests were performed before and after a 12-week period: *squats in 30 seconds*, *sit-ups in 30 seconds* (both tests were performed for the highest number of repetitions), *standing forward trunk bend on a gymnastic bench* (the subject performed a forward trunk bend and tried to reach with her fingertips a point as low as possible below the support level of her feet, knee flexion was not allowed; the difference between fingertips and toes was measured), *standing broad jump* (the result was recorded with the aid of a plastic tape, measurement precision ±1 cm), *medicine ball throwing* (2 kg) with two hands in the sitting position while the back was fixed in the vertical position, *Harvard step-test* modified for women (step's height 40 cm) by Sloan (1954). *Heart rate* was recorded with the aid of the heart rate monitor. In *standing broad jump* and *medicine ball throwing* each person had three attempts. The best result was recorded. In *squats* and *sit-ups* the measurer recorded only perfectly performed movements. In the *forward trunk bend* a special care was taken to avoid knee flexion.

Statistical analysis. The ANOVA with the Tucker`s *post hoc* procedure was used for comparison of the groups. The individual changes of mood parameters during the session and of fitness tests before and after the period of observation were evaluated with the aid of paired *t*-test. $P<0.05$ was designated as significant.

Results

Working conditions. The analysis of the answers from the questionnaire showed that the subjects evaluated the situation during and after the session as was expected. The participants of groups 1 and 2 evaluated the gym, its lightening and cleanliness as well as the sanitary conditions of the changing rooms and showers positively. The average evaluations in a 3-point scale system were within 2.44-2.89 (Table 1). Somewhat lower were the evaluations on the gym's ventilation, size and equipment of the changing room (average evaluation within 1.67-2.11). In group 3 most of these evaluations were significantly lower (Table 1).

Table 1. Evaluations of exercise working conditions and conditions of sanitary block (changing and shower rooms) (mean ± SD). Range of possible answers/grades 1 - 3 (the best grade was 3)

	Group 1	Group 2	Group 3	Statistical significance of the difference between groups (p)		
				Group 1 vs. 2	Group 1 vs. 3	Group 2 vs. 3
Dimensions of the gym	2.55±0.52	2.89±0.33	1.96±0.68	0.05	0.005	0.001
Lightening of the gym	2.82±0.4	2.89±0.33	2.32±0.56	N.S.	0.003	0.001
Cleanness of the gym	2.18±0.6	2.78±0.44	1.96±0.61	0.01	N.S.	0.001
Ventilation of the gym	2.00±0.89	1.78±0.67	1.36±0.49	N.S.	0.02	0.06
Collisions with group-mates	2.36±0.67	2.56±0.53	2.48±0.77	N.S.	N.S.	N.S.
Unpleasant feelings due to insufficient lightening	2.91±0.3	3.00±0.0	2.76±0.52	N.S.	N.S.	0.01
Unpleasant feelings due to sanitary problems	2.27±0.47	2.44±0.53	2.00±0.56	N.S.	N.S.	0.02
Unpleasant feelings due to insufficient room ventilation	2.00±0.89	2.00±0.87	1.64±0.57	N.S.	N.S.	N.S.
Dimensions of the changing room	1.82±0.4	1.67±0.5	1.12±0.33	N.S.	0.001	0.001
Equipment of the changing room	2.09±0.3	2.11±0.6	1.16±0.37	N.S.	0.001	0.001
Cleanness of the changing room	2.55±0.52	2.33±0.5	1.84±0.62	N.S.	0.001	0.001
Showers	3.00±0.0	3.00±0.0	1.92±0.28	N.S.	0.001	0.001
Hygiene of the showers	2.45±0.52	2.44±0.53	1.28±0.46	N.S.	0.001	0.001

In all the groups the training sessions, the instructor and the group-mates received mostly positive evaluations (Table 2). Almost maximal evaluations were given to the explanation of how an exercise should be performed and group acknowledgments. Although positive the evaluation for personal acknowledgments was lower. Differences between groups were not found in these evaluations, except for the evaluation of exercise difficulty. Group 2 evaluated the exercises to be less difficult than group 1 and 3 (Table 2).

Heart rate monitoring. The average heart rate during the main part of a randomly selected session in group 1 was 157±12 (mean +SD), in group 2 it was 159± 10, and 160±12 beats per minute in group 3. The increase of heart rate during the warming-up as well the reduction of the heart rate during the final part of the session were most pronounced in group 1 (Table 3).

Mood changes during the session. In groups 1 and 2, who exercised in good conditions, the paired *t*-test indicated a significant reduction of both the state anxiety and trait anxiety (Figure 1). No significant changes were found in group 3, who exercised in unpleasant conditions. The positive affect level increased and the negative affect level (Figure 2) decreased significantly in groups 1 and 2, but not in group 3 in which the initial level of trait anxiety,

Table 2. Evaluations of aerobic gymnastic sessions and group-mates (mean ± SD)

	Group 1	Group 2	Group 3	Statistical significance of the difference between groups (p)		
				Group 1 vs. 2	Group 1 vs. 3	Group 2 vs. 3
Duration of the session (grades 3; 2; 1)	2.82±0.4	2.67±0.5	2.72±0.61	N.S.	N.S.	N.S.
Exercise difficulty (grades 3; 2; 1)	2.82±0.4	2.33±0.5	2.88±0.44	0.02	N.S.	0.006
Choice of music (grades 3; 2; 1)	2.55±0.52	2.67±0.5	2.76±0.44	N.S.	N.S.	N.S.
Volume of music (grades 2; 1)	2.0±0.0	1.89±0.33	1.88±0.33	N.S.	N.S.	N.S.
Instructor (grades 4; 3; 2; 1)	3.91±0.3	3.78±0.44	3.84±0.37	N.S.	N.S.	N.S.
Correcting mistakes in performance (grades 3; 2; 1)	2.91±0.3	2.56±0.73	2.84±0.37	N.S.	N.S.	N.S.
Explanation of exercise action (grades 2; 1)	1.91±0.3	2.0±0.0	2.0±0.0	N.S.	N.S.	N.S.
Personal acknowledgement (grades 2; 1)	1.36±0.5	1.22±0.44	1.20±0.41	N.S.	N.S.	N.S.
Acknowledgement of the group (grades 2; 1)	1.91±1.3	1.89±0.33	2.0±0.0	N.S.	N.S.	N.S.
Relationships with group-mates (grades 3; 2; 1)	2.82±0.4	2.67±0.5	2.56±0.51	N.S.	N.S.	N.S.
Conflicts with group-mates (grades 3; 2; 1)	3.0±0.0	3.0±0.0	3.0±0.0	N.S.	N.S.	N.S.
Finding new friends among group-mates (grades 2; 1)	1.27±0.47	1.33±0.5	1.56±0.51	N.S.	N.S.	N.S.

Table 3. Heart-rate monitoring during aerobics session; beats per minute (mean±SD)

	Group 1	Group 2	Group 3
Warm-up	144±7	133±3	139±7
Main part of the session	157±12	159±10	160±12
Cooling down and stretching	128±6	140±11	136±13

Figure 1. State and trait anxiety levels before and after aerobics sessions. Group average and SD are indicated. I, II and III denotes the groups.
** Denotes the statistically significant ($p<0.05$) difference between the values obtained before and after the gymnastics session (according to paired t-test).*

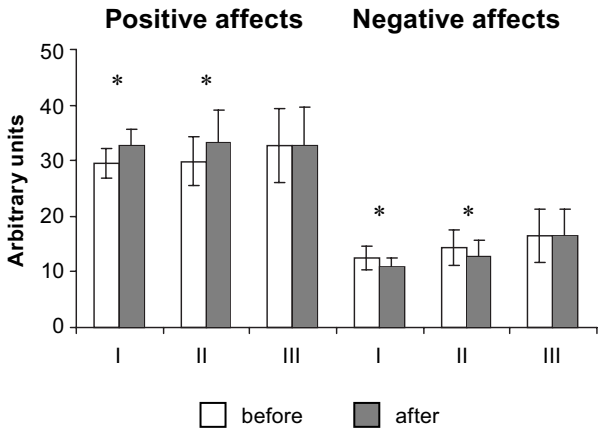

Figure 2. Positive and negative affect levels before and after aerobics sessions. Group average and SD are indicated. I, II and III denotes the groups.
** Denotes the statistically significant ($p<0.05$) difference between the values obtained before and after the gymnastics sessions (according to paired t-test).*

Table 4. Results of physical fitness tests before and after the 12-week training period (mean±SD)

		Group 1	Group 2	Group 3
Squats in 30 s	Before After	27±3 28±2*	28±1 29±1*	29±2 29±2
Sit-ups in 30 s	Before After	19±2 20±2	20±2 20±2	19±3 21±3*
Forward trunk bend (cm over the level of toes)	Before After	16±5 18±4*	17±4 19±4*	12±7 14±6*
Standing broad jump (cm)	Before After	171±12 172±12	162±12 163±2	170±1 171±14
Throwing the medicine ball (cm)	Before After	378±21 381±17*	385±15 386±17	374±20 377±21*
Index of Harvard step-test	Before After	89.5±13.1 90.7±11.7	95.0±18.3 97.4±16.4	83.5±11.9 86.3±13.7

Asterisk denotes the significant change according to paired *t*-test ($p<0.05$)

positive affect level and the negative affect level were higher than in the other groups. By the rule of the initial level, it should have promoted anxiety reduction and a decrease of negative affect level and inhibited any increase of positive affect level.

Improvements in fitness indices. Significant differences were not found in the initial level between the groups except for the higher values of the *Harvard index* in group 2 (Table 4). All the groups demonstrated a significant improvement of *forward trunk bend.* The *Harvard step-test index* and *standing broad jump* did not improve in any group. The *medicine ball throwing* improved in groups 1 and 3, but not in group 2. The number of *squats in 30 seconds* increased in groups 1 and 2, and of *sit-ups* only in group 3.

Discussion and conclusions

The study aimed at comparing the influence of aerobic gymnastics performed in either good or unsatisfactory conditions. According to the questionnaire used, the opinion of gymnasts of two groups (groups 1 and 2) was that they exercised in good environmental conditions, whereas the gymnasts of the third group reported unpleasant and unsatisfactory conditions. At the same time all the participants positively evaluated the design of the training sessions, the activities of the instructor and the relationships with the other members of the group. Since one group exercising in good conditions (group 2) and the group exercising in bad conditions (group 3) were guided by the same instructor, the differences between the groups were not related to the so

called "instructor effect". The testing of the mood effects of the exercise session confirmed our previous results (Järvekülg, Neissar, & Viru, 2001) that unpleasant working condition eliminate the positive mood effects of the aerobic gymnastics.

The results of heart rate monitoring were in accordance with the results of other authors on the acute influence of aerobic gymnastics on heart rate (Millburn & Butts, 1983), as well as with the recommendation that during aerobics gymnastics the heart rate must be maintained within 60-90% of the individual heart rate maximum (Watterson, 1984). The lack of heart rate differences between the observed groups supported the presumption that the actual load was similar in the three groups. At the same time the equal heart rate did not support the possibility that negative emotions arising from the unpleasant conditions might increase the heart rate in exercise.

The effect of a 12-week period of aerobic gymnastics on fitness parameters was variable. A general positive effect was the improved *forward trunk bend* found in all three groups. This result is in accordance with the data obtained in a 3-month longitudinal study (Neissaar, 1999). According to the previous study, the positive change in *forward trunk bend* is a result of the use of special exercises for flexibility development.

Changes in functional strength were minimal and variable. Paired *t*-test indicated that the number of *squats in 30 seconds* increased in the groups who exercised in good conditions, but the same occurred with the number of *sit-ups in 30 seconds* in the group exercising in unsatisfactory conditions. *Medicine ball throwing* scores improved in one group working in good and in the group working in unsatisfactory environmental conditions. The results of *standing broad jump* (explosive strength) did not change significantly in any group. One previous study showed that the improvement of functional strength could be promoted by including strength and flexibility exercises into the programme of aerobics (Neissaar, 1999).

In several studies the improvement of aerobic working capacity has been documented as the result of involvement in systematic aerobics gymnastics or aerobics dance (Jürimäe, Neissaar, & Viru, 1989; Williford, Scharff-Olson, & Blessing, 1989). This background makes it possible to expect that the *Harvard step-test index* should have increased as was found in the earlier study on aerobics (Neissaar, 1999). However, this result was not obtained in the present study. The plausible explanation is that the initial high level of the index (83…95) inhibited the positive change. It has been reported that the higher the initial level, the greater the training workload is necessary to improve the Harvard step-test index (Viru & Viru, 1975).

The improved trait anxiety after the session of aerobics dance was an unexpected result. The trait anxiety was used for the evaluation of personal traits and should not have changed. Obviously, under the influence of aerobics gymnastic programme people begin to evaluate their usual state in a different manner. It may be related to the effect of physical activity on self-esteem (Weyerer & Kupfer, 1994).

In conclusion, the present study with a controlled design, indicates that the negative mood effects, generated by unpleasant environmental conditions, do not alter the influence of aerobics programmes on fitness improvement.

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Correspondence to:
Anu Järvekülg, MSc
Institute of Exercise Biology
University of Tartu,
Ylikooli 18, Tartu 51014 Estonia
Phone: + 372 5 184 098
Fax: + 372 7 375 367
E-mail: Anu.Jarvekylg@mail.ee

UTJECAJ UVJETA ZA VJEŽBANJE NA POZITIVNE UČINKE AEROBIKE

Sažetak

Uvod

Dokazano je da neprikladni uvjeti rada (vježbanja) mogu poništiti pozitivan učinak vježbanja aerobike na raspoloženje. Cilj je ovoga istraživanja bio testirati ovisnost aerobikom uzrokovanog poboljšanja funkcionalnih sposobnosti o uvjetima u kojima se vježba.

Metode

Istraživanje je provedeno na tri skupine vježbačica aerobika (ukupno 42 žene u dobi od 19 do 27 godina). Ispitanice su prema specijalnom upitniku ocijenile uvjete vježbanja. Tijekom slučajno odabranih satova aerobike testirano je raspoloženje (STAI i PANAS) i praćena je frekvencija srca. Napredak u stupnju funkcionalnih sposobnosti tijekom 12-tjednog perioda vježbanja procijenjen je pretklonom na klupi, brojem čučnjeva u 30 sekundi, brojem podizanja trupa iz ležanja na leđima u 30 sekundi, skokom udalj iz mjesta, bacanjem medicinke i harvardskim step-testom.

Rezultati

Analiza ispunjenih upitnika pokazala je da su ispitanice situaciju tijekom i nakon sata ocijenile kako je bilo i očekivano. Vježbačice iz skupina 1 i 2 pozitivno su ocijenile dvoranu, njeno osvjetljenje i čistoću, kao i sanitarne uvjete svlačionica i kupaonica. Prosječne ocjene na skali od tri stupnja kretale su se između 2.44 i 2.89 (tablica 1). Nešto niže ocjene dale su vježbačice dvoranskoj ventilaciji, veličini i opremljenosti svlačionica (prosječna ocjena između 1.67 i 2.11). U skupini 3 većina ocjena bila je značajno niža (tablica 1).

Na satovima vježbanja svih grupa, instruktor i ostali polaznici grupe dobili su većinom pozitivne ocjene (tablica 2). Objašnjenje vježbe i uzvratna potvrda grupe ocijenjeni su gotovo maksimalnim ocjenama. U tim evaluacijama nisu pronađene razlike među skupinama, osim u evaluaciji težine vjež-bi. Za razliku od skupina 1 i 3, skupina 2 ocijenila je da su vježbe manje teške.

Prosječna frekvencija srca tijekom glavnog dijela slučajno odabranog sata vježbanja u skupini 1 bila je 157±12 otk/min (aritmetička sredina + SD), u skupini 2 iznosila je 159±10, a u skupini 3 160±12 otk/min. Porast frekvencije srca tijekom zagrijavanja, kao i pad frekvencije srca tijekom završnog dijela sata bili su najizraženiji u skupini 1 (tablica 3).

Rasprava i zaključak

Kod skupina 1 i 2, koje su vježbale u dobrim uvjetima, *t*-test za zavisne uzorke pokazao je značajnu redukciju anksioznog stanja i anksioznosti (slika 1). U skupini 3, koja je vježbala u neprikladnim, lošim uvjetima nisu nađene značajne razlike. U skupini 1 i 2 značajno je porasla razina pozitivnih osjećaja i snizila se razina negativnih osjećaja (slika 2), do čega nije došlo u skupini 3. U toj skupini inicijalna razina anksioznosti te razine pozitivnih i negativnih osjećaja bile su više no u ostalim skupinama. Prema pravilu inicijalne razine, to bi trebalo potaknuti smanjenje anksioznosti i pad razine negativnih osjećaja te inhibirati porast razine pozitivnih osjećaja.

Među skupinama nisu pronađene značajne razlike u inicijalnoj razini funkcionalnih sposobnosti, osim viših vrijednosti harvardskog indeksa u skupini 2 (tablica 4). Sve skupine pokazale su značajan napredak u pretklonu na klupi. Nijedna skupina nije pokazala poboljšanje indeksa harvardskog step-testa ni skoka udalj iz mjesta. Poboljšanje u bacanju medicinke zabilježeno je u skupinama 1 i 3, ali ne i u skupini 2. Broj čučnjeva u 30 sekundi povećao se u skupinama 1 i 2, a broj podizanja trupa iz ležećeg položaja samo u skupini 3.

Zaključno, ovo istraživanje kontroliranog dizajna pokazalo je da negativni učinci na raspoloženje, izazvani neprikladnim uvjetima za vježbanje, nisu izmijenili utjecaj programa aerobike na poboljšanje razine funkcionalnih i motoričkih sposobnosti, odnosno fitnesa.