

## ACUTE ANXIOLYTIC AND THE MOOD BALANCING EFFECTS OF AEROBICS: IN RELATION TO ENVIRONMENTAL CONDITIONS

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### Abstract:

The aim of the study was to test the hypothesis that diverse environmental conditions may modulate the acute psychological outcome of sessions of aerobics. 70 healthy women (age 17 to 35 years) exercised in three groups, two in unsatisfactory environmental conditions and one in excellent conditions. The acute effects of a standardized 40-min session of aerobics were recorded using the State-Trait Anxiety Inventory (STAI) and the Positive and Negative Affect Scale (PANAS). Personality traits were assessed with the aid of the Big Five Personality Inventory. The paired t-test showed that the session reduced state anxiety and negative affect in the group exercising in excellent conditions. In the groups exercising in unsatisfactory conditions the negative affect level did not change. State anxiety was reduced only in one of the two groups. MANOVA showed that the initial levels of state anxiety or negative affect had a stronger main effect on the changes of these parameters than the environmental conditions. Taking into account the results of the univariate test of F significance and the level of statistical power, it was possible to establish that the environmental conditions attributed 11%, the initial level of state anxiety 36%, the initial level of trait anxiety 18%, openness 24% and interaction of extroversion with environmental conditions 12% to the variance of state anxiety.

**Key words:** aerobics, positive affect, negative affect, state anxiety, trait anxiety

### AKUTE BERUHIGENDE UND STIMMUNGSBALANCIERENDE WIRKUNG DES AEROBICS IM BEZUG AUF UMGEBUNGSBEDINGUNGEN

#### Zusammenfassung:

Das Ziel der Studie war es, die Hypothese zu prüfen, ob unterschiedliche Umgebungsbedingungen das akute psychologische Ergebnis einer Aerobicstunde modulieren können. 70 gesunde Frauen (im Alter von 17 bis 35 Jahre) übten in drei Gruppen, von denen zwei in den unbefriedigenden und eine in den ausserordentlichen Bedingungen arbeiteten. Akute Wirkungen einer standardisierten 40-Minuten langen Aerobicstunde wurden mittels State-Trait Anxiety Inventory (STAI) und Positive and Negative Affect Scale (PANAS) aufgezeichnet. Persönliche Gefühle wurden mit Hilfe von Big Five Personality Inventory bewertet. Der gepaarte t-Test zeigte, dass die Beängstigung und die negativen Gefühle in der Gruppe, die in den ausserordentlichen Bedingungen übte, durch die Aerobicstunde vermindert wurden.

In den beiden in unbefriedigenden Bedingungen übenden Gruppen ist die Ebene der negativen Gefühle gleich geblieben. Die zuständige Beängstigung wurde nur in einer dieser Gruppen reduziert. MANOVA zeigte, dass die Anfangsebenen der Beängstigung oder der negativen Gefühle eine stärkere Hauptwirkung auf die Umwandlung dieser Parameter hatten, als die Umgebungsbedingungen.

Wenn man die Ergebnisse des univariaten Tests von F-Bedeutung sowie die Ebene der statistischen Kraft in Betracht zieht, konnte man feststellen, dass die Umgebungsbedingungen für etwa 11%, die Anfangsebenen der zuständigen Beängstigung für 36%, die Anfangsebenen der persönlichen Beängstigung für 18%, die Offenheit für 24% und die Interaktion des Extravertiertseins mit Umgebungsumständen für 12% der Varianz der zuständigen Beängstigung verantwortlich waren

**Schlüsselwörter:** Aerobic, positive Gefühle, negative Gefühle, zuständige Beängstigung, Angstneurose

### Introduction

Aerobic dance and gymnastics are widespread in schools, exercise clubs, health

centres and in various professional organizations or establishments. The environmental conditions for exercising may vary substantially. In some cases the group of gymnasts is too crowded in relation to the

floor surface in the room. In other cases the ventilation or sanitary conditions are not at the required level and the aesthetic outlook of the sports hall may vary. Conditions for taking a shower and relaxing immediately after the session are also important. It is therefore justified to ask whether the expected positive effects of exercising are influenced by the environmental conditions. At least the anxiolytic effects (Morgan, 1979; Petruzzello et al., 1991) and mood effects (Rockefeller, Burke, 1979; Gauvin et al., 1996; McGowan et al., 1996) of exercising may be influenced by stimuli arising during and after the session from other sources in addition to the direct effect of the exercises performed.

The aim of this study was to test the hypothesis that diverse environmental conditions may cause stimuli which modulate the acute psychological outcome of sessions of aerobics. The effects of the sessions of aerobics on anxiety and its affect level were assessed in groups exercising in excellent or unsatisfactory environmental conditions.

## Material and methods

**Participants** - 70 healthy women (age 17 to 35 years) gave an informed consent to participate in the study. They had all regularly exercised in aerobics groups 2 to 3 times weekly for 1 to 4 years. Obese women were not included in the body of participants.

**Methods** - The acute effect of the sessions of aerobics on anxiety and affect levels was tested with the aid of the State-Trait Anxiety Inventory, STAI (Spielberger et al., 1983) and the Positive and Negative Affect Scale, PANAS (Watson, Clark, 1994). The personality traits were assessed with the aid of the Big Five Personality Inventory (Costa, McCrae, 1985). The tests were used in Estonian versions (Allik, Realo 1997; Pulver et al., 1995).

**Procedure** - The participants exercised in three groups. The first (33 women, mean age  $\pm$ SD  $23 \pm 4.0$  years) and the third (20 women,  $24 \pm 1.2$  years) group exercised in unsatisfactory environmental conditions. The area per gymnast was  $1.2 \text{ m}^2$  in the sports hall.

Unsatisfactory and relatively unaesthetic conditions occurred in the dressing rooms and bathrooms. The second group (17 women,  $24 \pm 1.2$  years) exercised in excellent conditions. Both the sports hall (the area per gymnast  $5.6 \text{ m}^2$ ) and other rooms were aesthetically inspiring and corresponded to high hygiene standards.

The first two groups (one exercised in unsatisfactory conditions and the other in excellent conditions) were supervised by the same instructor while the third group was conducted by another instructor.

The investigated sessions of aerobics were standardized and principally the same in all three groups. The duration of the session was 40 min. The session consisted of a warm-up (5 to 10 min), the main part (30 min) and the cool-down or relaxation part (5 to 10 min). The main part was performed as a non-stop activity combined of various aerobics routines - gymnastic exercises and dance movements. In the main part the exercise intensity was adjusted to maintain the heart rate level at 75-80% of the individual's maximum. The actual level of the intensity of the session load was checked by monitoring the heart rate from the onset up to the end of the session with the aid of a Sport tester (PE 3000, Polar Electre OY, Ltd, Finland). The heart rate monitoring took place in three randomly selected subjects during each studied aerobics session. All the sessions were performed to music.

In order to avoid the possible influence of the time of day on any psychological responses (Trine, Morgan, 1995), all the sessions took place between 5 and 7 p.m.

Testing with the aid of STAI and PANAS was performed before and within 10 to 20 min after the standardized session of aerobics, in all cases post shower. The following day, after the testing of the session effect, the participants were asked to fill in the Big Five Personality Inventory.

**Data analysis** - The possibility of any differences in the distribution of recorded parameters in the three groups was tested with the aid of ANOVA. Individual changes induced by the exercise session were calculated for anxiety and affect parameters and evaluated using the paired *t*-test. MANOVA was computed in order to

characterize the effects of the environmental conditions, initial anxiety or affect levels, and personal traits. The results of the multivariate test of significance were evaluated by Wilks' lambda, F, size effect (ES) and statistical power at probability of 0.05. The results of the univariate F-test were characterized by a significance of F (5.64 degrees of freedom), designating the 0.05 probability level as significant, ES and statistical power. According to Cohen (1988) the statistical power at  $p=0.05$  was considered sufficient if the value was  $> 0.8$ . Eta-square ( $\lambda$ -Wilks' lambda) was computed for each factor to characterize the contribution of the factor in the variance of experimental results. The amount of variance attributable to the effect of the main factor was expressed as a percentage of the total variance.

Data analysis was processed using SPSS (Windows, Release 6.0).

## Results

ANOVA showed that no significant difference ( $p>0.05$ ) existed between groups in

state and trait anxiety, and affect levels before the exercise session although in the second group the mean values of state and trait anxiety and negative affect levels were higher than in the other groups (Table 1). The paired *t*-test showed that under the influence of exercise session the state anxiety decreased in groups 2 and 3, but not in group 1. In group 2 (exercising in good conditions) a statistically significant reduction of trait anxiety and negative affect as well as an increased positive affect were also found (Table 1).

MANOVA indicated that the effect of the environmental conditions is characterized by Wilks' lambda (0.856) and significant F value (2.74,  $p=0.036$ ). The ES was 0.144, statistical power 0.72 (lower than 0.8). The univariate test of F significance (1.68) showed that the effect was on changes in state anxiety ( $F=8.36$ ,  $p=0.005$ ), trait anxiety ( $F=5.10$ ,  $p=0.027$ ) and negative affect ( $F=4.40$ ,  $p=0.040$ ). The statistical power was sufficiently high only with regard to the action of state anxiety (0.81). According to eta-square, conditions attributed 11% to the variance of change in state anxiety.

Significant effects were exerted by an initial level of state (Wilks' lambda =0.51,

**Table 1:** Acute effects of a standardized session of aerobics gymnastics in three groups that exercised under different conditions (arbitrary units, mean±SD)

		Instructor 1		Instructor 2	Difference between group levels (one-way ANOVA)
		1 <sup>st</sup> group Unsatisfactory conditions	2 <sup>nd</sup> group Excellent conditions	3 <sup>rd</sup> group Unsatisfactory conditions	
Number of participants		33	17	20	
State of anxiety	before	32.4±7.1	42.9±12.5	33.7±9.0	N.S.
	after	33.0±8.6	34.8±10.1	29.3±7.1	N.S.
	t	N.S.	6.95	2.25	
	p		<0.001	0.036	
Anxiety trait	before	43.0±9.8	46.8±10.7	41.6±10.5	N.S.
	after	42.3±10.6	42.5±7.9	39.8±10.3	N.S.
	t	N.S.	2.43	N.S.	
	p		0.027		
Positive affect level	before	32.3±7.6	31.0±4.7	29.9±7.3	N.S.
	after	32.3±8.2	33.6±4.4	30.5±6.5	N.S.
	t	N.S.	4.35	N.S.	
	p		<0.001		
Negative affect level	before	15.3±3.7	19.1±9.1	14.6±3.7	N.S.
	after	15.4±5.4	15.8±6.5	13.0±3.9	N.S.
	t	N.S.	4.30	N.S.	
	p		0.001		

Changes induced by the exercise session were evaluated with the aid of the paired *t*-test

$F=2.90$ ,  $p<0.001$ ,  $ES=0.154$ , power 0.97) and trait anxiety ( $\lambda=0.44$ ,  $F=2.82$ ,  $p<0.001$ ,  $SE=0.184$ , power=0.99) as well as by the initial level of negative affect ( $\lambda=0.58$ ,  $F=2.35$ ,  $p=0.003$ ,  $ES=0.129$ , power=0.93). According to the values of eta-square, the initial level of state anxiety accounted for 36% of the variance in state anxiety change (power=0.99) and 13% of the variance in trait anxiety changes (power=0.81). The initial level of trait anxiety contributed to 18% of the variance in the state anxiety changes (power=0.80) and 26% in trait anxiety change (power 0.96). The effect of pre-exercise on the level of negative affect accounted for 19% of variance in trait anxiety changes (power = 0.86) and 24% variance in negative affect changes (power=24%). The interaction of the initial state and conditions of circumstances did not reveal any significant effect.

With regard to the significance of personal traits, MANOVA showed that the significant main effect was exerted only by openness (Wilks'  $\lambda = 0.59$ ,  $F=2.24$ ,  $p=0.005$ ,  $ES=0.124$ , power = 0.91). The interaction of the conditions and circumstances with various personal traits did not exert any significant effect on the changes studied. Taking into account the results of the univariate F significance test and the corresponding level of statistical power, the effects were exerted on the changes of state anxiety by openness ( $F=5.11$ ,  $p=0.001$ , power=0.95) and by the interaction of extroversion with the conditions of the circumstances ( $F=8.47$ ,  $p=0.005$ , power=0.82). Computed eta-square indicated that openness was attributable to 24% and the interaction of extroversion with environmental conditions to 12% of variance of state anxiety changes.

## Discussion

The obtained results demonstrate that the acute exercise-induced anxiolytic (Morgan, 1979; Petruzzello et al., 1991) and mood balancing (Morgan, 1985; McGowan et al., 1996; Gauvin et al., 1996) effects may not appear when a session of aerobics takes place in unsatisfactory environmental conditions. The reduction of state anxiety, found in excellent conditions, appeared in one but not in the other group which exercised in

unsatisfactory conditions. A reduction in trait anxiety, as well as an increase in the positive affect level and a decrease in negative affect level appeared only in the group exercising in excellent conditions.

The "instructor effect" was not the main factor in the differences emerging between group responses. The first two groups (one exercising in unsatisfactory and the other in excellent conditions) were supervised by the same instructor. All the responses were significant in the group exercising in excellent conditions, but not in the other group. The other instructor supervised the same exercise session in the third group, which also exercised in unsatisfactory conditions. In this group the state anxiety was reduced, but other responses were not observed. Obviously, only the appearance of the anxiolytic effect despite the unsatisfactory conditions, might be related to the instructor's effect. However, taking into account the results obtained in all three groups, the fact that unsatisfactory environmental conditions may exclude both the anxiolytic and mood balancing effects of the aerobics session was suggestive.

According to the theory of measurement of anxiety states (Spielberger, 1972), the trait anxiety should be constant. Therefore, the reduction found in trait anxiety should not be a direct index of the acute anxiolytic effect of exercising. Since the muscular activity increases a person's self-esteem (Sonstroem, 1984), the changes found were, probably, responsible for an underestimation of the trait anxiety after a session. It is logical to suggest that unsatisfactory conditions may block the positive impact of exercising on one's self-esteem. Actually, the decrease in reduction was not found in either group exercising in unsatisfactory conditions despite a decrease in state anxiety in one of these groups.

Further analyses confirmed that the exercising conditions affect significantly the changes in both the state and trait anxiety as well as in the negative affect level. However, the magnitude of the effect was not pronounced. Taking into account the calculated statistical power, only the effects on the state anxiety changes were justified. The effect of conditions attributed only 11% in the variance of change in state anxiety.

The results presented show that the most pronounced effects were exerted by initial levels of state anxiety, trait anxiety and negative affect on the changes of the same parameters (accounted for 36%, 26% and 24% of variance, respectively). Interactions of environmental conditions and initial level indices did not have any significant effects on the changes studied. A significant effect of openness on state anxiety changes (attributed to 24% of variance) and of the interaction of extroversion with the environmental

conditions (attributed to 12% of variance) were found.

Evidence has been collected about the significance of the psychological outcomes on the involvement of exercises and maintaining the activity (Dishman et al., 1985; Biddle, 1992). Taking into consideration the results presented, exercising in unsatisfactory environmental conditions may fail to produce the involvement and maintain any effects.

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