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The influence of physical activity on the mood of people subjected to standard rehabilitation after cardiac surgery

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Abstract

Aim: The aim of this study was to assess the correlation between standard post-operational early rehabilitation and compare the differences between mood before and after rehabilitation.

Materials and methods: 51 people were examined. The study group included patients from the Department of Cardiac Surgery, SPSK No. 2, PUM in Szczecin. The data was collected using a standardized UMACL scale and an original survey to collect basic data. On the UMACL scale, there are three mood determinants: Hedonic Tone (HT), Tense Arousal (TA) and Energy Arousal (EA). A high level of Hedonic Tone and Energy Arousal as well as low

Tense Arousal are considered a good mood. The respondents first filled the UMACL scale questionnaire, then proceeded to a 10-minute drive on the rotor. After completing physical activity, they again completed the same UMACL scale. The obtained results were subjected to statistical analysis.

Results: Energy Arousal and Hedonic Tone values increased, and Tense Arousal values decreased in post-operative patients.

Conclusions: Even short, one-off physical activity has a positive effect on the mood in cardiac surgery patients.

Key words: physical activity, mood, UMACL scale, cardiac patients

Introduction

Physical activity is an indispensable part of every human's life. It can be defined as every form of active movement engaging skeletal muscles to work. It is important that physical activity must have an energy expenditure higher than when at rest. It has many effects that can cause significant mood changes.

During physical exercise, especially long and intense, the amount of endorphins increases. Such activity also affects dynorphins and enkephalins, which affects the improvement of well-being, a feeling of pleasure, increased pain resistance and in high doses, can lead to euphoria. Moderate use of physical activity stimulates the production of phenylethylamine, which is responsible for good emotional state. It also increases the concentration of anandamide - an alkaloid affecting regions in the brain responsible for emotions and memory. Serotonin and epinephrine affecting good mood are also activated and increased by physical effort. There is also an increase in the amount of protein - BDNF (brain-derived neurotrophic factor) which affects the development, differentiation and cell vitality. Thanks to it, memory is developed, it also reduces the risk of depression and the level of stress [1, 2].

The functioning of the brain changes through physical activity. This positively affects cognitive functions. In developmental age perceptual abilities and intelligence quotient increases. Changes also appear in the structure of white matter and gray matter [1, 3, 4].

Mood in the UMACL scale (University Mood Adjective Check List) is defined as affective experience with moderate duration (at least a few minutes), unrelated to the object or related to a quasi-object, covering three dimensions of essential affect: tense arousal, energy arousal and hedonic tone. The concept of mood is often confused with emotion. Emotion is an experience lasting much shorter than the mood, but more intensely. It is also stimulated by a single stimulus and the mood is stimulated by a series of stimuli. Emotion is also characterized by the fact that, unlike mood, it causes a characteristic mimic expression [5].

The aim of the study is the assessment of the correlation between standard post-operational early rehabilitation and the differences in mood before and after rehabilitation.

Material and methods

The study was carried out among 51 people in Department of Cardiac Surgery, SPSK2 PUM in Szczecin. All the patients have been subjected to a cardiac surgery with use of extracorporeal circulation. The study was performed among patients in 3. day after the surgery. 27,45% of subjects are women and 72,54% are men.

The study has been carried out with the use of a questionnaire, which consisted of two parts. The first one includes an original survey about basic metrical data. The second part is the standardized UMACL scale.

The UMACL scale covers three aspects: tense arousal, energy arousal and hedonic tone. High levels of energy arousal and hedonic tone, as well as low level of tense arousal are known as a good mood. Higher level of tense arousal is a mood considered as stressed. Likewise, a lowered level of energy arousal is tiredness. The level of each aspect is determined by the subjects answers to a following question: “Does that adjective describe your current mood?”, asked about each of 29 adjectives from the scale. The subject was asked to choose one of the following answers: definitely yes, rather yes, rather no, and definitely no. Depending on the answers, hedonic tone, energy arousal and tense arousal points were given according to the key.

There are various stages of cardiac rehabilitation after the surgery: First stage of cardiac rehabilitation (an important stage in the whole treatment after cardiac surgery), second stage and third stage. The first stage is the hospital stage and it begins with preoperative rehabilitation and ends with discharge from Cardiac Surgery Department.

Second stage of cardiac rehabilitation can be carried out in stationary form in Cardiac Rehabilitation Department, Sanatorium, ambulatory or at home. The third stage takes place under periodic GP or physiotherapist's control [6, 7].

Rehabilitation during the first stage in the first day after cardiac surgery consist of anticoagulant exercises, resisted exhalation exercises, evacuation of residual secretions are conducted. Patients are also educated on how to properly handle a postoperative wound while coughing and changing their position. The second day the patient is being verticalized and the previous day exercises are repeated. Beginning with the third day and until the end of the first rehabilitation stage, in addition to the first day exercises, new activities such are limited distance marching, coordination and balance exercises, general gymnastics in the group and general improving exercises of the lower extremities on the "minibicycle" are being introduced. "Minibicycle" exercises effect on the mood has been studied.

Subjects were asked to fill out the questionnaire (with UMACL scale) before and after the physical activity. A 10 minute rotor exercise was being performed under a researchers supervision.

Statistics analysis

The statistical analysis was performed using the STATISTICA 12 software package. (StatSoft, USA). The Shapiro-Wilk test was used to check normality of distribution. The Wilcoxon test was used to assess the differences between before and after results. The differences between sexes were assessed using the nonparametric Mann-Whitney U test..The statistical significance was assumed to be $p < 0.05$.

Results

In the study group the level of hedonic tone and energy arousal after the physical activity has increased considerably. The level of tense arousal has, in turn, decreased. It means that the mood has improved. The result was statistically significant (table nr 1).

Table 1. The Average amounts of HT, EA i TA before and after the physical activity among subjects

	BEFORE TRAINING		AFTER TRAINING		p-value
	mean	±SD	mean	±SD	
HT	29,24	4,68	33,36	5,24	<0.001
TA	18,60	4,49	14,62	4,39	<0.001
EA	25,22	4,59	30,74	4,70	<0.001

Legend: p-statistical significance; SD-standard deviation; HT-Hedonic Tone; TA-Tense Arousal; EA-Energy Arousal

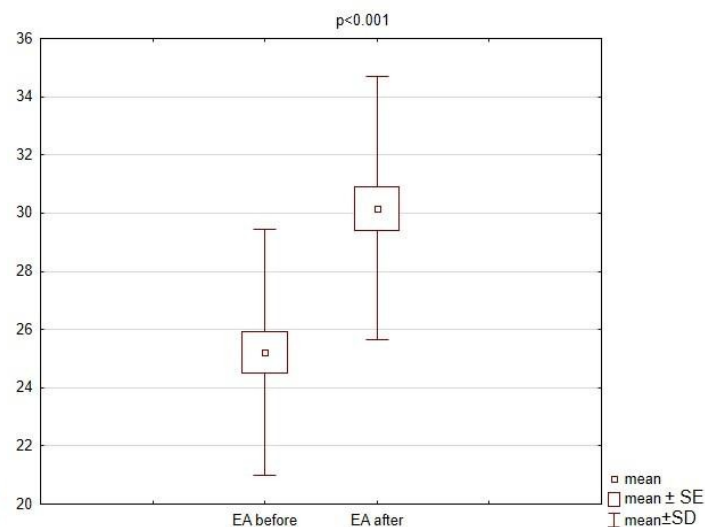
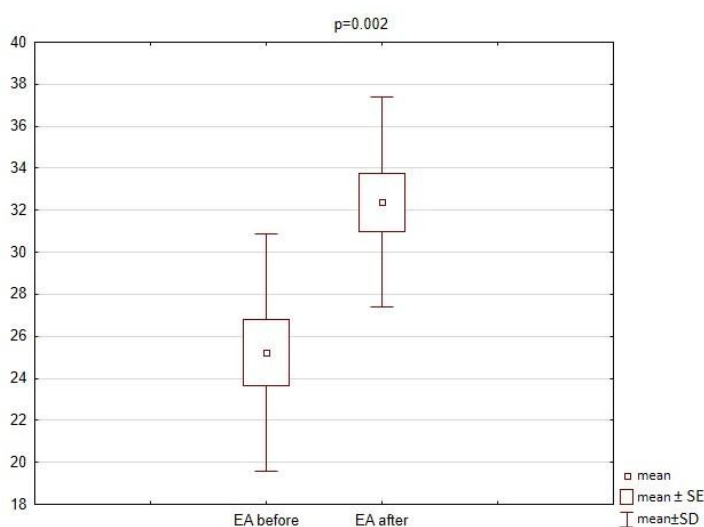


Figure 1 - EA before and after exercise in women after surgery Figure 2 - EA before and after exercise in men after surgery

The Evaluation of the variability of energy arousal points before and after training was presented in women (Figure 1) in men (Figure 2). Before the exercise EA oscillated at a very similar level in both sexes - 25.22 in men and 25.23 in women. After the activity in women, the number of points increased to 32.38 and in men to 30.16.

This indicates the fact, that in both sexes there is an increase in energy after a physical activity. In women, the difference before and after exercise is slightly higher than in men, however, it is not statistically significant ($p = 0.149$).

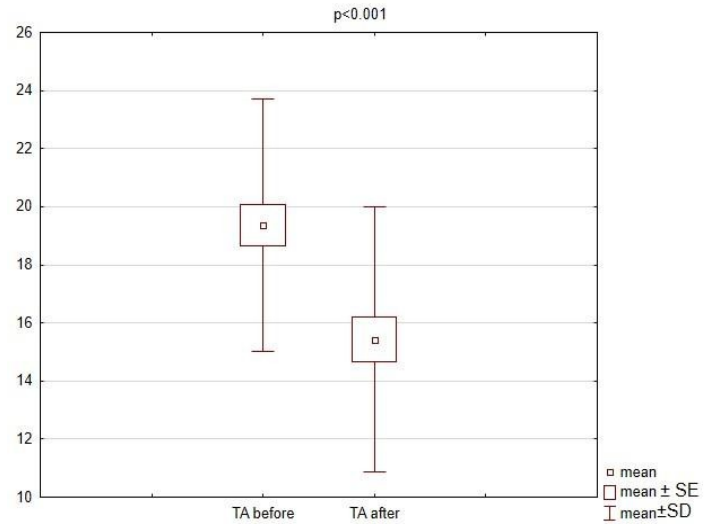
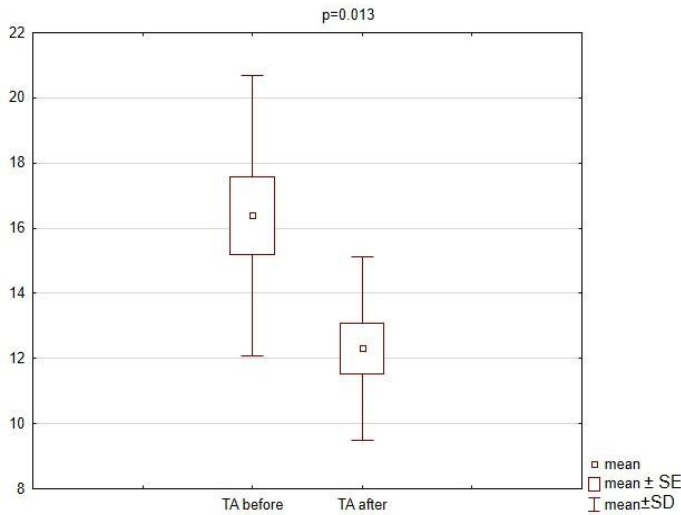


Figure 3 - TA before and after exercise in women after surgery Figure 4 - TA before and after exercise in men after surgery

The Women before physical activity had 16.38 TA points, men had more - 19.38 points. The difference between them is statistically significant ($p = 0.045$). After exercise in the female sex, the TA level decreased to 12.31 points, in male sex to 15.43. The difference between them is statistically significant ($p = 0.021$). The difference between the initial and final state is similar in both groups and is not statistically significant. It can be concluded that men after surgery are more stressed than women. In both groups, however, there is a visible reduction in tension after exercise, which indicates a similar effect of physical activity on the reduction of tense arousal in both women and men.

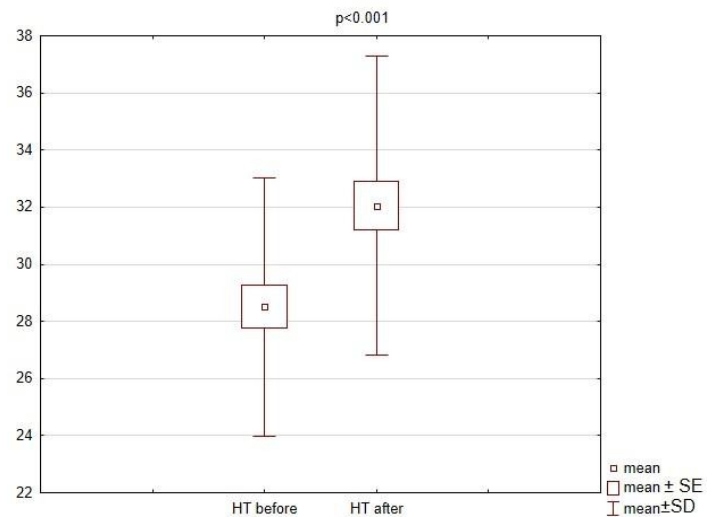
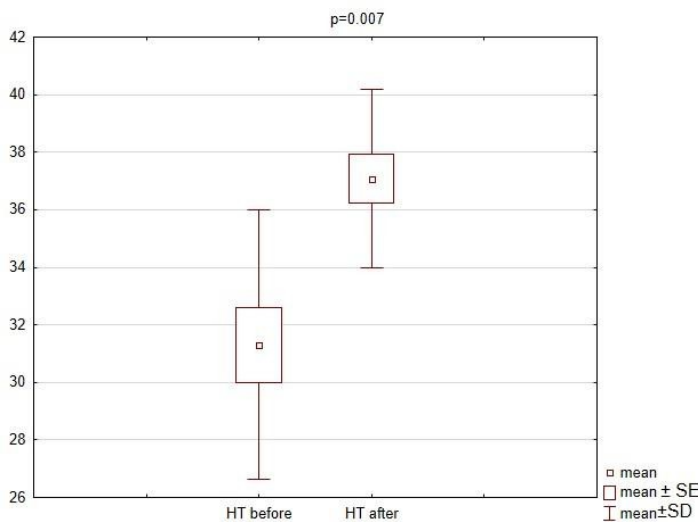


Figure 5 - HT before and after exercise in women after surgery Figure 6 - HT before and after exercise in men after surgery

The above graphs show the difference in the number of HT points among women and men after cardiac surgery. Among women before physical activity, the number of points was 31.31 and in men 28.51. After the exercises, the number of points increased in both sexes, however, in women the increase was significant, because at the end of the activity the number of points was 37.08 and in men 32.05. The difference between these levels is statistically significant ($p < 0.001$). This may indicate a worse mood in men compared to women after surgery and a smaller impact of physical activity on improving the well-being of the male sex.

Days after surgery and mood

Table 2. Average values of HT, TA and EA before and after exercise in cardiac patients in 3-4 days and in later days after surgery.

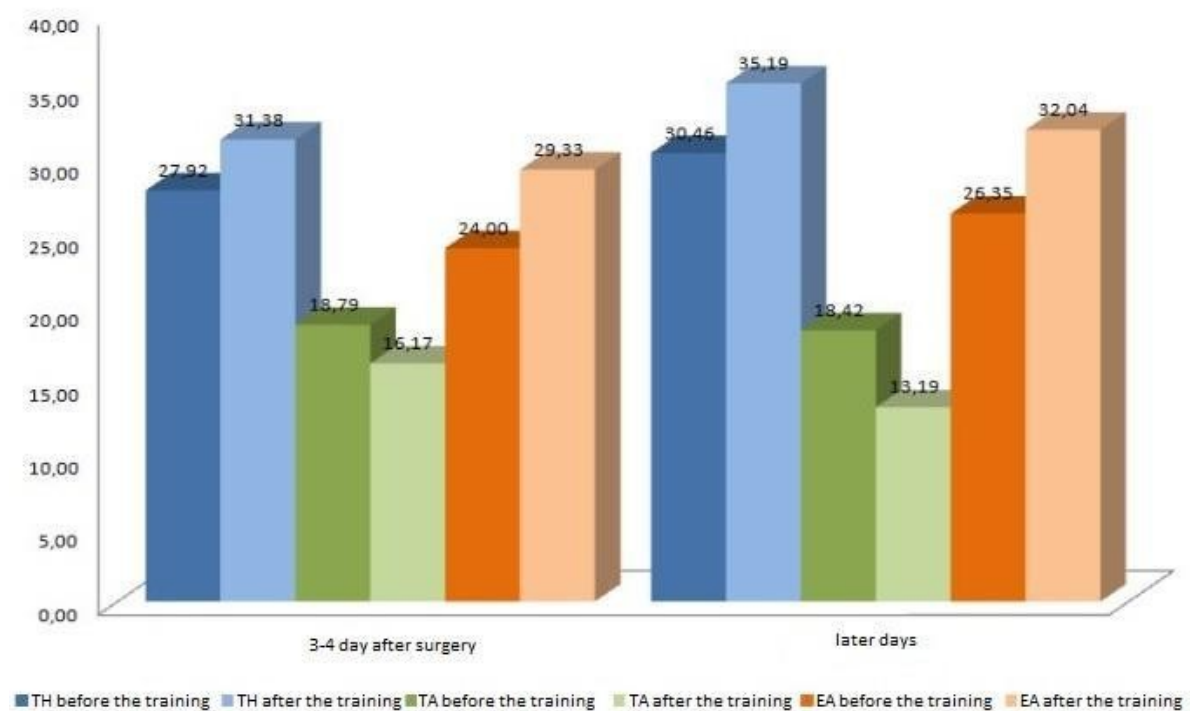


Table 2 shows mood changes depending on the day after surgery. In later days, both the initial and end state is better than in people who are 3-4 days after surgery. Both HT and EA increased before and after exercise, while TA before and after exercise decreased. This may mean that the general well-being of patients is at a higher level the more time has passed

after surgery, and the tension is getting smaller. Physical activity contributes to even better results in the initial days as well as in the later period.

Discussion

The above results indicate that the singular physical activity exerts a statistically significant influence on the mood and reduces the tension in people after cardiac surgery. Other authors also show a positive effect of physical activity on various aspects of mood. Niedermeier M. et al. checked in his research using Feeling Scale, Felt Arousal Scale and a Mood Survey Scale, whether the mood is better influenced by physical activity in the form of mountain hiking in the fresh air or walking on the treadmill. 63 people were examined in both groups. The results show that activity in the fresh air influences the mood better. The activity positively influenced similar aspects to those surveyed in the UMACL Scale [8].

Similarly, Bergouignan A. et al. in his research checked how physical activity in the form of a moderately intense walking on the treadmill affects the mood. The subjects were divided into a group performing one 30-minute activity per day (ONE) and a group performing six daily 5-minute trainings (MICRO). The following scales were used: Profile of Mood State questionnaire and visual analog scales. In both groups, the amount of energy and vigor in subjects after physical activity increased. In the MICRO group, the mood improved more than in the ONE group. The MICRO Group also achieved a greater drop in fatigue from the ONE group [9]. In our own research, all activities were carried out as a one-time effort. In the future, one should check the impact on the mood of shorter and more frequent trainings, because they may be more effective in improving the mood among patients of the Cardiac Surgery Department.

The research by Monedero J. et al. introduced an interesting perspective on the influence of physical activity on the mood. The impact of activity in the form of active computer games related to fitness and active entertainment computer games with standard physical activity without the participation of computer games was compared. The most active influence on the mood was played by active entertainment computer games. It should be remembered, however, that significantly higher energy consumption was found among people performing standard physical activity [10].

According to other studies conducted on a group of 76 elderly women, the results showed that depending on the exercises after only one physical exercise, there are visible

benefits in the emotional state of the subjects, where the level of anxiety significantly decreases. However, it should be noted that the change in mood was also dependent on the nature of the exercises. Positive results were noted after gymnastics and aqua-gymnastics classes, but no changes were noted after nordic walking [11].

Świdarska's research on 45 women of all ages showed that both one-time exercises and systematic aerobics trainings improve mood, which expresses a higher hedonic tone and energy arousal and a reduced tense arousal. 2-month-long exercises brought better results than a single activity, and the most satisfied with life were women from the oldest age group [12].

Guszkowska in her research, which included 163 women aged 16-56, pointed to the fact that regular exercises, lasting 2-3 months, are conducive to the greatest reduction in the level of anxiety. The most beneficial are the mixed routines combining both endurance and strength exercises. On the other hand, one-off physical activity brings varied reactions depending on the type of exercises performed and the experience of people exercising physical effort [13].

Conclusions

Even short, one-off physical activity has a positive effect on the mood in cardiac surgery patients. It was also observed that women after cardiac surgeries have a better mood than men, and also physical activity has a greater impact on the female mood. In addition, the more time passes from the operation, the more the well-being of patients improves, while the physical activity applied already in the early days after surgery gives a positive effect in the form of a better mood.

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