KAUNAS UNIVERSITY OF MEDICINE

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EVALUATION OF THE CARDIOVASCULAR SYSTEM, ANXIETY AND DEPRESSION SYMPTOMS IN FEMALE STUDENTS ATTENDING AEROBIC CLASSES

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KAUNO MEDICINOS UNIVERSITETAS

Ernesta Sendžikaitė

STUDENČIŲ, LANKANČIŲ AEROBIKOS PRATYBAS, ŠIRDIES IR KRAUJAGYSLIŲ SISTEMOS BEI NERIMO IR DEPRESIJOS SIMPTOMŲ ĮVERTINIMAS

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ABBREVIATIONS

ABP	–	arterial blood pressure
BMI	–	body mass index
ECG	–	electrocardiogram
CI	–	confidence interval
JT	–	interval in elektrocardiogram from junction point J to T wave end (JT interval)
JT/RR	–	repolarization ratio, ratio of interval JT and RR
R	–	amplitude from izoelectric line to top of R segment
HADs	–	Hospital Anxiety and Depression Scale
QRS	–	time interval in electrocardiogram from Q to S value (QRS complex)
RR	–	time interval between two heart contractions (RR interval)
OR	–	odds ratio
CVS	–	cardiovascular system
HR	–	heart rate

INTRODUCTION

A good state of health is the main precondition for the social, economical and personal development and it is also the important constituent of life quality. Personal health is understood as the whole of possibilities of the systems of the main body functional reserve into which not only the present functional body condition must be included but also the possibility to improve it. Such holistic approach to health is based on the person‘s significantly higher responsibility for health, which 50 % depends on lifestyle [Sveikata 21, 2000].

In Lithuania as in most developed countries of the world the diseases of the cardiovascular system rank the first position in the range of diseases. The newest epidemiological studies not only confirm the importance of physical activity in primary prevention of the cardiovascular diseases but also stress health – enhancing benefit of the properly selected, individualized physical activity [J.Poderys, 2004, T.Hilberg, 2008]. It is reported that in the Europe a big attention is given to the prevention of the pathologies of the cardiovascular system that are responsible for prevalence of mortality in young exercising people [D.Corrado et all., 2005].

Nowadays mental health disorders become more frequent. According to some prognoses, in 2020 the mental disease depression will take the second place as the most prevalent disability in the world [World Health Organization. WHO, 2001]. Physical activity has a preventive as well as a positive effect on treatment of mental disorders. This is relatively a new area of scientific studies. There is a lack of a bigger amount and high quality studies observed. [C.Bauchard et all., 2007]. Modern university studies are distinguishing in the excessive flow of information, intensity of the study process, increased requirements to the quality of specialists training. All that creates a particular psychoemotional strain and increase the possibility of the pathological deviations of students health. Students‘ physical capacity is proved to be not sufficient in our country, and the state of health is becoming poorer [J.Petkevičienė, K.Kardelis, 2002]. Due to the increase of flow of information and intensity of study process, students‘ physical activity is decreasing, thus, it is necessary to combine the increasing mental load with the volume and intensity of physical work, as well as with positive emotions. Therefore, the evaluation of students mental and physical health, the optimization of health – enhancing and physical activity programmes are the urgent scientific problem.

Aerobic classes have been remaining as the most popular form of physical activity among female students over the last 10 years. The questionnaire revealed that 35.1 % of students would choose aerobic exercise, 29.6 % – swimming, 29.9 % of students – running [A.Muliarčikas, 2003]. According to the most of authors, aerobic exercise is a health - enhancing measure during which physical exercises have many benefits: they are emotional in character, accessible and attractive. The application of the different purposes physical exercises to aerobic classes has an effect on the development of important to human health physical peculiarities (aerobic capacity, muscle power endurance, suppleness, coordination of movement) as well as the improvement of psychoemotional state [M.Estivill et all., 1995; J.Henriksson et all., 1999]. However, the problem of the optimization of physical exertion and its individualization still remains urgent due to the fact that aerobic classes are the group exercises, where young women with the different level of capacity and training participate. The music applied to training adds a particular attractiveness and emotional nuance, thus creating many positive emotions, which suppress the signals of fatigue sent by the body. The body functional possibilities are frequently exceeded during such exercises, and that causes health problems. Thus, it is very important to determine and evaluate exercise-induced changes in human body, also to draw up some methodological recommendations. *We anticipate that the students who are attending aerobic exercise have better indicators of the cardiovascular system and emotional state, compared with non-sporting students.*

The aim of the study – to evaluate the functional indicators of the cardiovascular system and emotional state in female students, who are attending aerobic classes.

The objectives of the study:

1. To evaluate functional indicators of the cardiovascular system in sporting female students during 24-hours and to compare with non-sporting female students.
2. To assess the functional indicators of the cardiovascular system during aerobic exercise in relation to training length of female students.
3. To determine and compare the strength of expression of depression and anxiety symptoms among exercising and non-sporting female students.
4. To determine the associations of emotional state and the functional indicators of the cardiovascular system in female students.

Novelty of the study and significance

There are several worldwide studies that evaluated the effect of aerobic exercise on human body. However, most of these studies observed only heart rate (HR) using the pulsometers or measuring the pulse rate by palpation method. The use of the newest technologies in our study made it possible not only to record HR but also the electrocardiographical indicators during typical physical exercion – i.e. aerobic classes**.** So far, the examination of the functional indicators of the cardiovascular system of women exercising in aerobics, was performed by studying the observation of ECG not during the specific physical activity (e.g. using aerobic cycling, treadmill). Therefore, we tried to evaluate the effect of aerobic exercise on human body during 24-hours and, independently, the effect of physical exertion during aerobic training.

The results of the first in Lithuania ECG observation research during tipical physical exercion supplement the data on specifity of the adaptation of young women's body to aerobic exercises, also the evaluation of the functional capacity of the cardiovascular system. We think that putting the scientific research results into practice will contribute to health-enhancing.

The tendency towards mental health deterioration enables to seek suitable means of impact. In our opinion, the evaluation of the effect of aerobic exercises as a regulated physical activity form has a significance for practical application. Although recently the benefit of physical activity to mental health is well known, a shortage of the level of physical exertion and practical recommendations on intensity are observed. Complex evaluation of associations of psychophysiological indicators due to the effect of physical exercises is also urgent.

1. MATERIALS, METHODS AND CONTINGENT

1.1. The study contingent

The study sample consisted of 115 female students of Kaunas university of Medicine. The studied were grouped into: a group of women attending aerobic classes (sporting) and a group of physically inactive i.e. not exercising regularly and not having a purposeful physical activity – non-sporting (control). According to the length of attendance at aerobic classes, sporting women were further grouped as following: 1st group – attending exercise more than one year and 2nd group – attending exercise less than

one year. Characteristics of the studied groups are presented in the first table (Table 1.1). The studied female students were chosen to take part in the research according to the given criteria of including – excluding.

Table 1.1. *Characteristics of the studied groups*

Groups / **Feature**	**Sporting students (n=66):**		**Control group (n=49) $\bar{x}$ (CI 95%)**	**Significan level, p**
	1 group (n=31) $\bar{x}$ (CI 95%)	**2 group (n=35) $\bar{x}$ (CI 95%)**		
Age, year	22.24 (21.6–22.9)	21.84 (21.0–22.6)	21.7 (21.1–22.2)	> 0.05
BMI, kg/m²	21.14 (20.21–21.86)	21.27 (20.76–22.1)	20.9 (20.4–21.5)	> 0.05
ABP systolic, mmHg	117.31 (114.9–119.7)	117.22 (114.5–119.9)	117.8 (115.9–119.8)	> 0.05
ABP diastolic, mmHg	67.59 (64.8–70.4)	66.22 (63.7–68.7)	67.65 (65.5–69.8)	> 0.05

1.2. Methods

1.2.1. Evaluation of the cardiovascular system functional parametre

Electrocardiography. Technical hard-ware of long term ECG observation system consists of an equipment of 40×55×10 mm size, 19 g weight ECG register, which is comprised of the disposal five electrode tape to register two bipolar ECG derivations, developed by the company „PicoMed“ (Germany), and the special equipment for read-out of data. The sofware system developed by the laboratory of automatization of the Cardiological researches consists of the initial processing of data, noise filtration, ECG recognition of complexes, measurement of parameters, QRS classification of complexes, data presentation, reflection, editing of conclusions and printing programme, developed on the base of WINDOWTM95/98/NT. In the case of mobile registration and storing of data the registration module of data is put on a studied person and activated. The module has a card of data storing, which allows to read out data using the read-out equipment after registration and then the data is entered into PC memory, analyzed and protocols of long term ECG obser-

vation are obtained. „Cardio Scout“ apparatus is fixed to the projection of the rib cage. The arterial blood pressure (ABP) was measured by auscultation of Korotkov's tones with a stethoscope in the humeral artery area. ABP was measured in sitting position at rest.

1.2.3. Body composition assessment

We calculated body mass index, measured skinfolds, and calculated body fat. Body mass index was calculated using formula: BMI= weight/ height² (here-weight measured in kg, height – in m). BMI categories were estimated according to Word Health Organization recomendations. Caliper was used to measure skinfolds. There were measured triceps, suprailium and thigh skinfolds.

1.2.4. Questionnaire

A questionnaire was presented to the studied subjects in order to find out their age, length of the exercise attendance and other factors that may influence the cardiovascular system and emotional state. To evaluate emotional state *HAD scale* (*Hospital Anxiety and Depression Scale – HADS*) was used [A.S.Zigmond, R.P.Snaith,1983; R.P.Snaith, A.S.Zigmond, 1994]. In Lithuania the skale was adapted by R.Bunevičius and S.Žilėnienė (1991). The latter scale – reliable and a widely used questionnaire of the selection of depression and anxiety disorders. The seven guestions of HAD scale is designed to evaluate the symptoms of anxiety, the other seven guestions – to assess the symptoms of depression. Four answers were presented to each guestion. The studied person had to choose only one question that the most precisely reflects her well-being over the last week. The strength of the expression of depression and anxiety symptoms were evaluated according to the total number of points in the subscale of HAD scale (HAD and HADn): no – < 8 points; moderately expressed – ≥ 8 and < 11 points, very expressed – ≥ 11 points [A.Mykletun A., E.Stordal, A.A.Dahl, 2001].

The level of physical activity was evaluated using standardized Baecke questionnaire of habitual physical activity (Baecke Questionnaire of Habitual Physical Activity). In order to evaluate objectively physical activity in relation to lifestyle the score of physical activity was calculated at work, at sport and at rest. The sum of these three parts shows the general level of physical activity of the studied.

According to (KIHD 24 – Hour Total Physical Activity Record. 1997) the offered calculator of the intensity of physical load we calculated MET (MET – metabolism equivalent) of every studied female student during 24

hours. The studied were given the diary of physical activity, with the help of which we gathered information about physical activity at the day of the study.

1.3. Organization of the study and protocol

The study was conducted during the period of 2004–2008, in September–May. Testing was carried out on the day when a studied person participated in aerobic exercise session. The study started in the morning (about 8–9 h). In the beginning, the studied were answering to the questions of the questionnaire. Then "Cardio Scout" equipment was fixed and activated to record ECG. ECG registration was finished in 24 hours.

Protocol, which was designed for analysis of ECG data, consisted of six parts. The first free parts of ECG parametres were registered during 24-hours over different period of time: in the morning, in the evening and at night:

In the morning the parameters of the cardiovascular system were recorded during the sleep considering HR, which at the time was the lowest.

In the evening the registered ECG parameters were selected for analysis according to the protocol, in which the studied pointed out her performance of the day. After evaluation of the evening performance, the evening point data were recorded about 1hour before sleep. The data of recording were selected considering the lowest HR.

Night period was recorded after 2–3 hours of sleep when HR was the lowest. This period was selected according to the protocol, which was filled in by the studied.

The other part of the protocol was designed to mark ECG parameters registered during *aerobic exercise*, and which were analysed in the free parts of exercise:

During low-intensity phase ECG parameters, which were registered in the beginning of exercise (3–5 min), were recorded when the highest HR was observed.

During the highest – intensity phase, the data were recorded considering the highest HR value achieved during aerobic exercise (30–35 min).

During recovery, the parameters of ECG were registered in the end of exercise (55–60 min), when HR noticeably reduced.

The following indicators were investigated in the study: RR interval, JT interval and QRS complex duration, R amplitude of wave, heart rate (HR), the proportion of JT and RR duration (JT/RR).

1.4. Mathematical statistics

For statistical analysis of data we calculated the mean value of 10 following each other recorded cardiocycle measurement of every studied person, and standard deviation (SD), after that, statistical data analysis of all group indicators was performed using *SPSS 10.0 for Windows and Microsoft Exel XP* software. All values were presented as arithmetic means ($\bar{x}$) ± standart error (SEM) and 95% confidence interval (CI 95%).

Hipothesis concerning the difference of mean values was verified using Stjudent t criterion for independent and dependent samples. To detect the differences of determinants of several groups multifactorial dispersion analysis ANOVA was performed. Using univariate regression model we calculated the odds ratio (OR), which enabled us to predict the probabilities of dependent determinant by the values of independent determinants.

The difference when p values were less than 0.05 was considered statistically significant. To evaluate the proportion between the cardiovascular and psychoemotional indicators the Spearman‘s correlation coefficient was calculated.

1.5. Characteristics of physical effect

Physical exertion of every training was the same or similar. The studied women attended aerobic exercise class 2–3 times per week on average, length of exercise was 1hour. We distinguished three parts in the exercise:

- **During the low- intensity phase (in the beginning)** the studied performed the low intensity aerobic movements: various basal steps and their combinations, dynamic stretching exercises (duration 10–15 min).
- **During the high-intensity phase** combined class of aerobics was applied, i.e. low and high intensity **(**without a flight phase and with a flight phase), more complicated in view of coordination combinations of aerobics steps. Also, local exercises inreasing muscle capacity were performed (duration 35–40 min).
- **During recovery** streching and relaxation exercises were performed (duration 5–10 min). **Intesity of aerobic exercise resulted from amplitude** of movements, character of aerobics steps and speed of musical rhyhm, which is measured by beats per minute (b/min). During the study selected musical record for aerobic exercise was:

- low-intensity phase 128–135 beats/min,
- for the complex of the low-intensity exercises 130–140 beats/min,
- for the complex of the high-intensity exercises 140–150 beats/min,
- for strength exercise 115–125 beats/min,
- for recovery (for final part) about 100–110 beats/min.

2. RESULTS

2.1. The data of change in the functional indicators of the cardiovascular system at the different time during 24-hours

During the rest at different time during 24-hours the determined mean values of HR did not differ, compared with the groups of sporting and non -sporting female students ($p>0.05$) (Fig. 2.1). The highest values of HR were registered during the rest in the evening (if compared with the average values registered at night and in the morning) ($p<0.001$): 68.88 ± 1.52 t/min – in the group of non- sporting female students and 72.05 ± 1.47 t/min – in the group of sporting female students. In the morning and at night recorded mean values of this indicator did not differ ($p>0.05$).

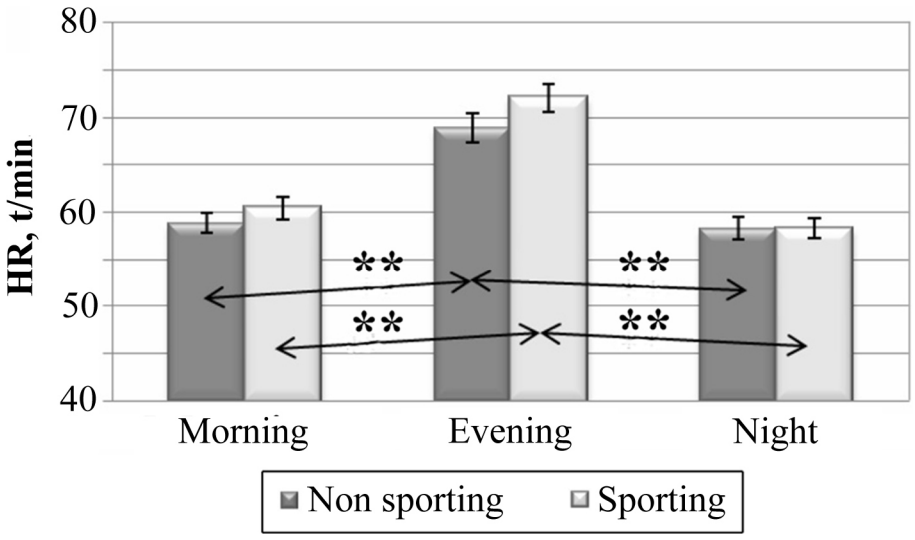

Fig. 2.1.1. *HR change at different time during 24-hours (** – $p<0.001$)*

We determined that values of R **wave amplitude** during separate periods of the rest were slightly higher in the group of the female students attending aerobics exercise but statistically confident difference was not found ($p>0.05$). In the morning the mean R wave amplitude in the group of non-sporting students reached 2.19 ± 0.12 mV, sporting female students – 2.29 ± 0.13 mV, in the evening point – 2.29 ± 0.13 mV, and 2.42 ± 0.13 mV, respectively, and at night – 2.21 ± 0.15 mV and 2.39 ± 0.15 mV, respecti-

vely. The data of the study showed that the mean indicators of R wave amplitude of the studied in both groups did not differ in the morning, in the evening and at night (p>0.05) (Fig. 2.1.2).

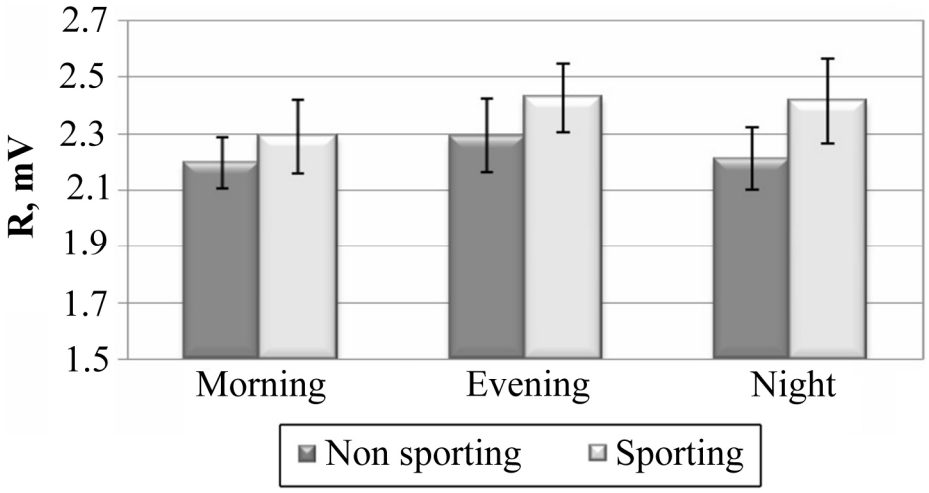

Fig. 2.1.2. *R wave amplitude change at different time during 24-hours*

When comparing the results of QRS complex values of both groups we determined that a value of this indicator of non-sporting female students in the evening (78.9 ± 1.22 ms) was statistically confidently lower than that of female students attending aerobics exercise (82.6 ± 1.01 ms; p<0.05) (Fig.2.2.3). A similar tendency was observed in the morning (80.01 ± 1.29 ms and 82.95 ± 1.02 ms), and at night (80.93 ± 1.31 ms and 84.13 ± 1.02 ms), but statistically significant difference was not detected (p>0.05). The analysis of the comparison of change in QRS complex duration during 24-hours revealed that values did not differ in the group of trained women (p>0.05). For non-sporting women QRS complex duration was shorter, compared with the mean values recorded in the evening and at night and in the morning (p<0.05).

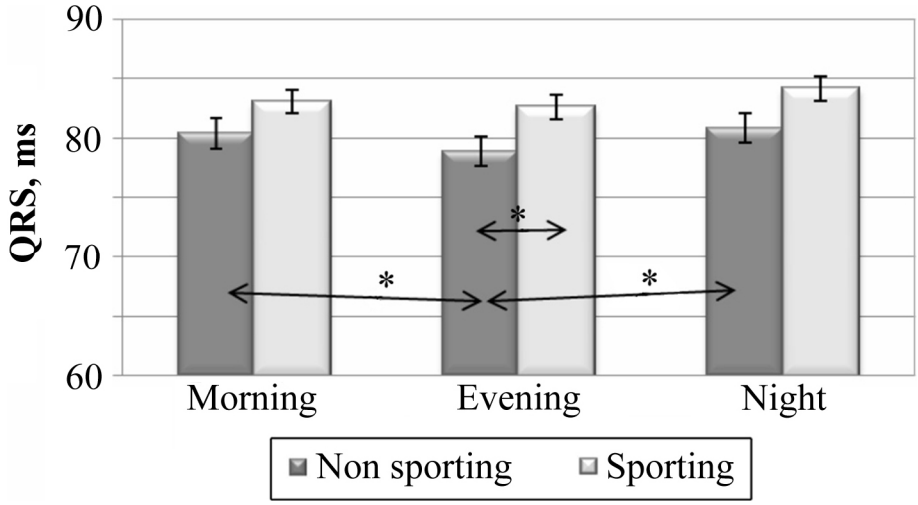

Fig. 2.1.3*. Change in QRS complex duration during 24-hours (* – p<0.05)*

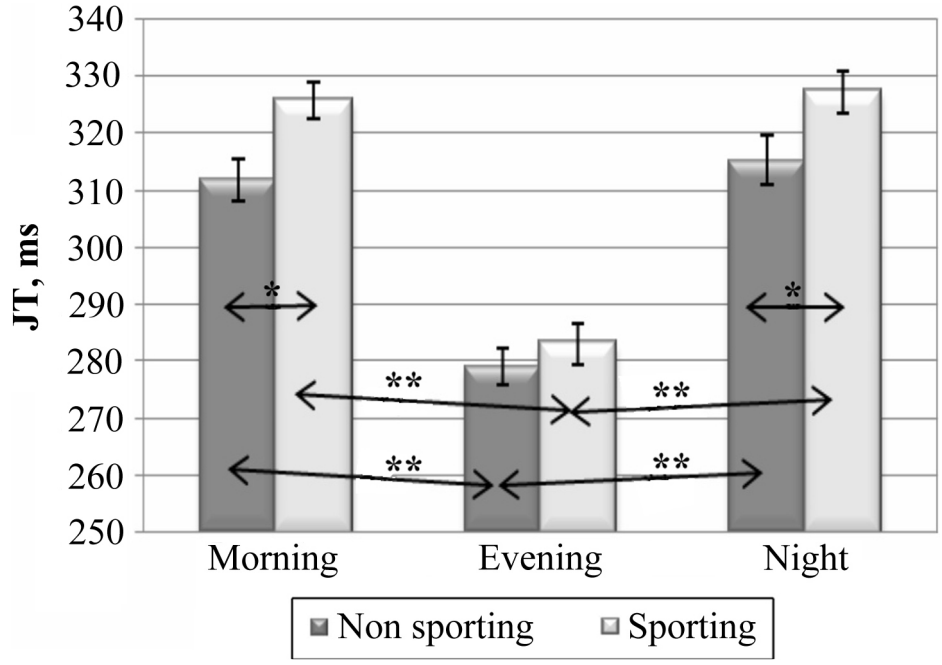

Fig. 2.1.4. *JT interval at different time during 24-hours (* – p<0.05, ** – p<0.001)*

The analysis of the comparison of changes in JT interval during 24-hours of the young women attending aerobics exercise and women that were not sporting determined that in the morning and at night the duration of this parameter was longer than that of non sporting women ($p<0.05$). In the morning registered mean value of JT interval of sporting female students was 322.24 ± 3.22 ms, at night on average it lasted 327.22 ± 3.65 ms, while the mean value of non sporting female students – 311.8 ± 3.67 ms and 315.06 ± 3.07 ms, respectively. The data of the study demonstrated that JT interval duration registered in the evening in the group of the exercising female students (282.98 ± 3.65 ms), and in the group of non-sporting female students (279.08 ± 4.37 ms) was shorter, compared with the determined mean values of this ECG parametre ($p<0.001$) (Fig. 2.1.4).

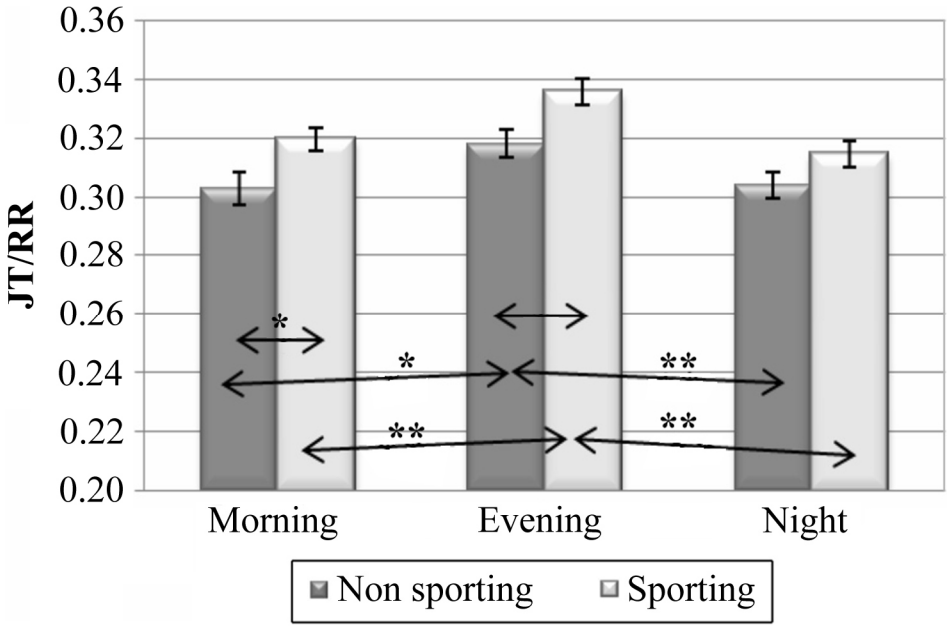

Fig. 2.1.5. *JT/RR at different time during 24-hours (* – p<0.05, ** – p<0.001)*

The analysis of the comparison of the proportion of JT and RR intervals of electrocardiogram of studied groups showed that it was bigger in the group of exercising female students in the morning (0.32 ± 0.005) and in the evening (0.34 ± 0.004) in respect to that of non-exercising young women – 0.30 ± 0.004 and 0.31 ± 0.004 ($p<0.05$) (Fig. 2.1.5.). The mean values of JT/RR recorded at night in both groups were similar ($p>0.05$). The proportion of mean duration of JT and RR intervals of the female students atending aerobic exercise at night was slighty higher (0.31 ± 0.005) compared to that of the control group (0.30 ± 0.004). Observation of the change in parameters of ECG during 24-hours determined that the mean value proportion of JT/RR intervals in both studied groups remained steady in the morning and at night ($p>0.05$), but became longer in the evening ($p<0.05$, $p<0.001$).

2.2. The data of functional indicators of cardiovascular system recorded during aerobic exercise in female students with the different duration of training

We determined that in the beginning of exercise the mean values of HR differed in relation to the training level of the studied ($p<0.05$). The mean value of HR recorded in the beginning of exercise for the vomen with attendance at aerobics exercise longer than one year was 112.06 ± 3.25 t/min, while for women with a lower level of training this indicator was 122.0 ± 2.77 t/min, respectively. The analysis of the comparison of the

mean values of HR at the time of the highest-intensity and relaxation in both studied groups did not reveal statistically confident differences (p>0.05). The highest HR mean values were recorded at the time of highest-intensity (in 1 group 166.13 ± 3.02 t/min, in 2 group 167.24 ± 2.44 t/min; p<0.001) (Fig. 2.2.1).

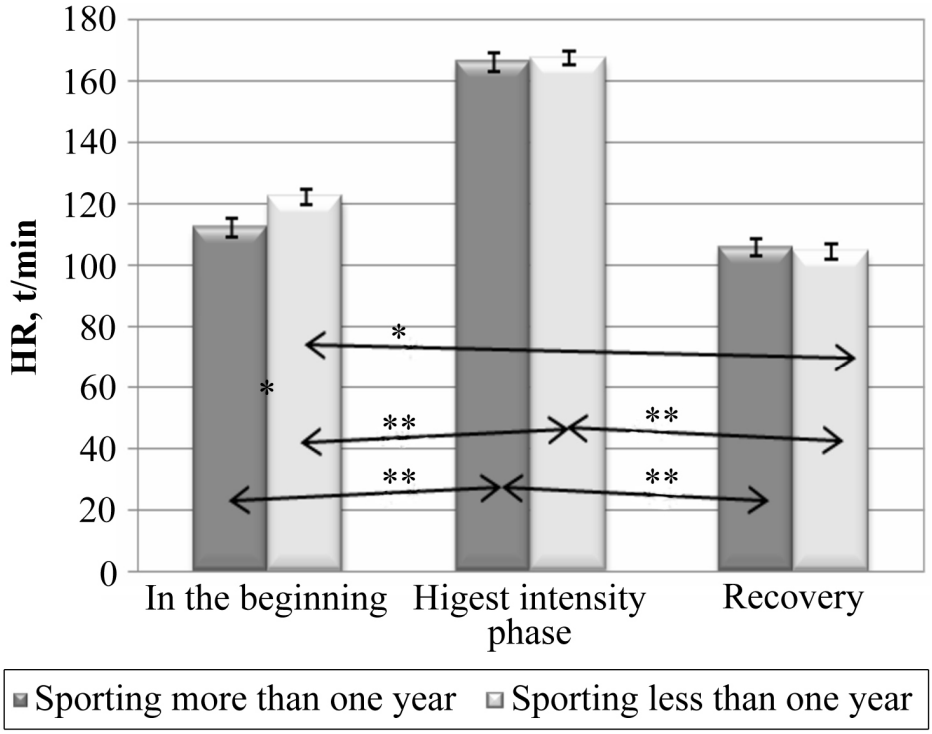

***Fig. 2.2.1**. HR during exertion (* – p<0.05, ** – p<0,001)*

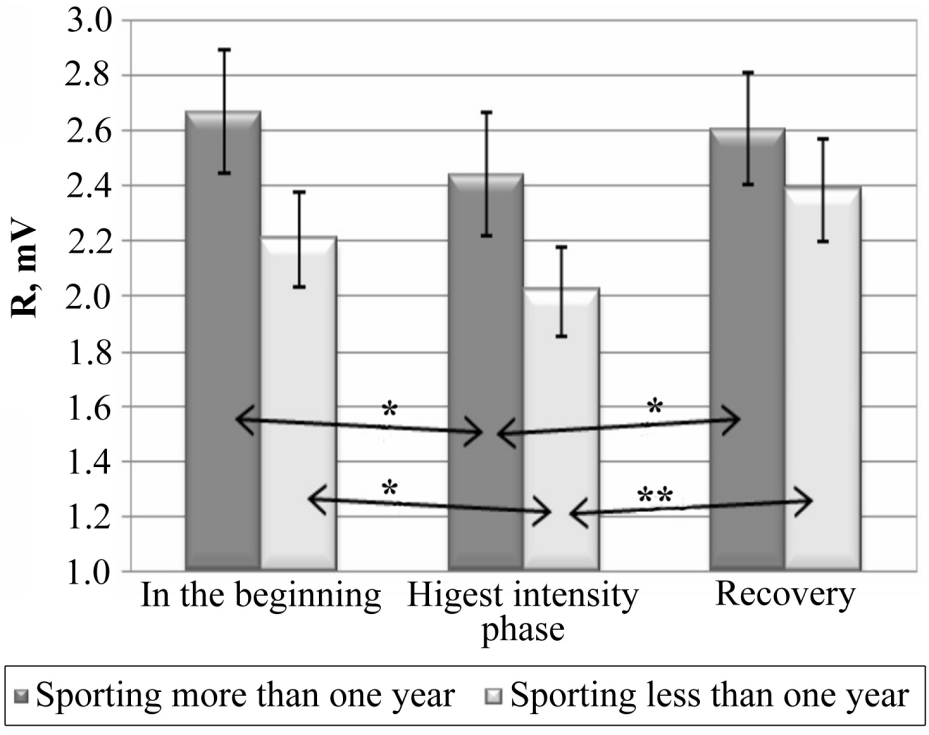

***Fig. 2.2.2.** Change in R wave amplitude during exertion (* – p<0.05, ** – p<0.001)*

Fig. 2.2.2 showed that values of R amplitude were slightly higher in all phases of aerobic exercise than in the first group, but statistically confident difference was not detected ($p>0.05$). Mean R amplitude in the beginning of exercise in the first studied group was 2.67 ± 0.22 mV and in the second – 2.20 ± 0.17 mV, at the point of the highest-intensity – 2.44 ± 0.22 mV and 2.02 ± 0.16 mV, respectively. During recovery, the mean values of the investigated indicator were 2.60 ± 0.2 mV (1 group) and 2.38± 0.19 mV (2 group). The data of the study showed that the registered means of R amplitude did not differ in both groups of the studied in the beginning of exercise and during recovery ($p>0.05$), but when comparing the values recorded in the beginning of exercise and during recovery with the indicators of the highest-intensity, we did not observe significantly confident difference ($p<0.05$, $p<0.001$).

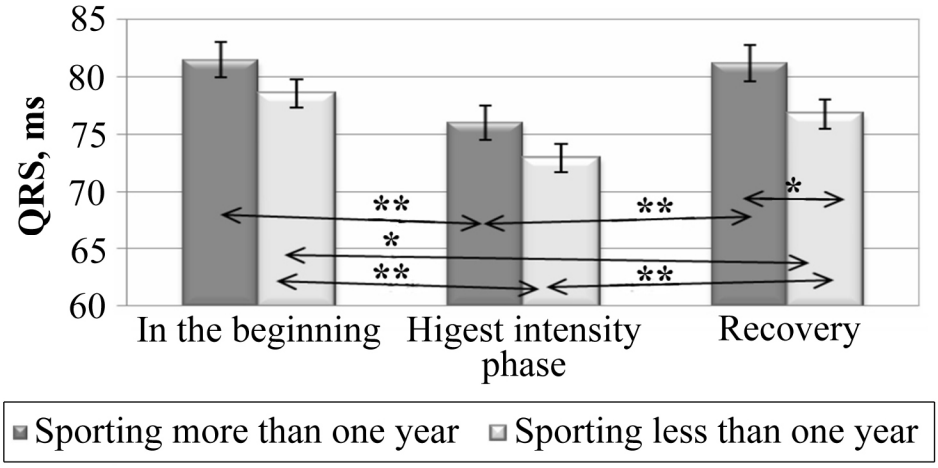

Fig. 2.2.3. *Change in QRS complex during exertion (* – p<0.05, ** – p<0.001)*

Having made a comparison of the results of QRS complex of the studied both groups we defined that the value of this parameter (76.77 ± 1.28 ms) during recovery of the studied women with the lower level of training was statistically confidently lower, compared with the women with longer attendance at exercise (81.22 ± 1.58 ms) ($p<0.05$). A similar tendency was observed in the beginning of exercise, and during the highest-intensity, however, the significant difference was not detected ($p>0.05$). The analysis of the comparison of change in QRS complex duration during exertion did not reveal the difference in values in the beginning of exercise and during recovery in the group of the women with a higher level of training ($p<0.05$). The recorded values of this ECG parameter in the beginning of exercise and during recovery in the group taken separately, differed, com-

pared with the indicators registered during the highest-intensity ($p<0.001$) (Fig. 2.2.3)

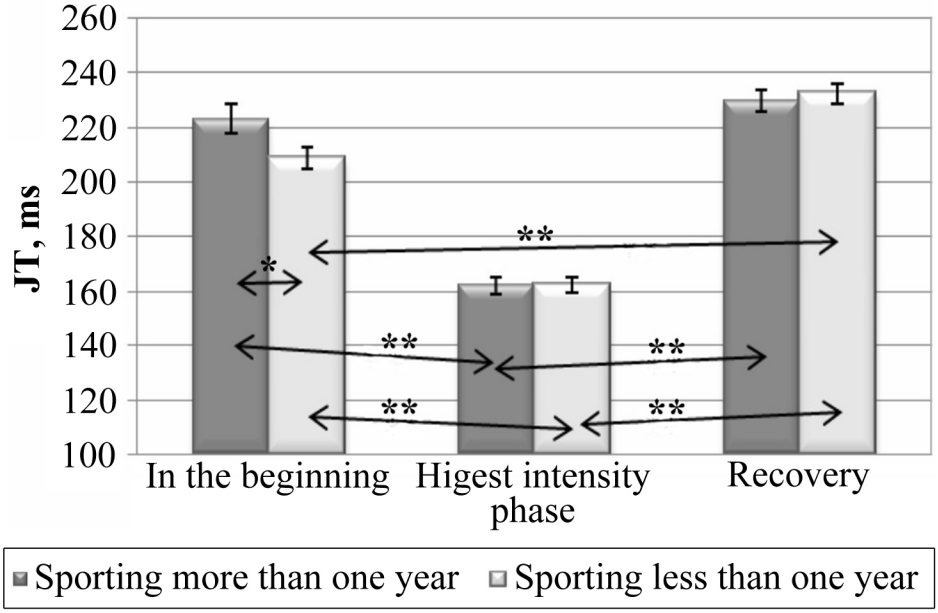

Fig. 2.2.4. *JT interval duration during exertion (* – $p<0.05$, ** – $p<0.001$)*

The analysis of the comparison of the female students in relation to the level of training showed a longer JT interval duration registered in the beginning of aerobic exercise in the group of the women with more than one year attendance at exercise (223.05 ± 5.4 ms) than that of in the group of the studied with the lower level of training (208.53 ± 3.93 ms) ($p<0.001$). The lowest JT interval duration was observed in both groups during the highest intensity: in the first group 162.56 ± 16.14 ms and in the second group 162.31 ± 3 ms ($p>0.05$). For students with a longer length of training JT interval duration registered during recovery was 227.15 ± 3.85 ms, and 232.24 ± 3.7 ms – for students with a shorter length of training, respectively. Observation of change in JT interval during aerobic exercise determined that the mean values during the low intensity phase (in the beginning) and recovery did not differ in the second group ($p>0.05$). The recorded values of this ECG parameter in the beginning of exercise and during recovery in the groups taken separately, differed if compared with the indicators registered during the highest-intensity ($p<0.001$) (Fig. 2.2.4).

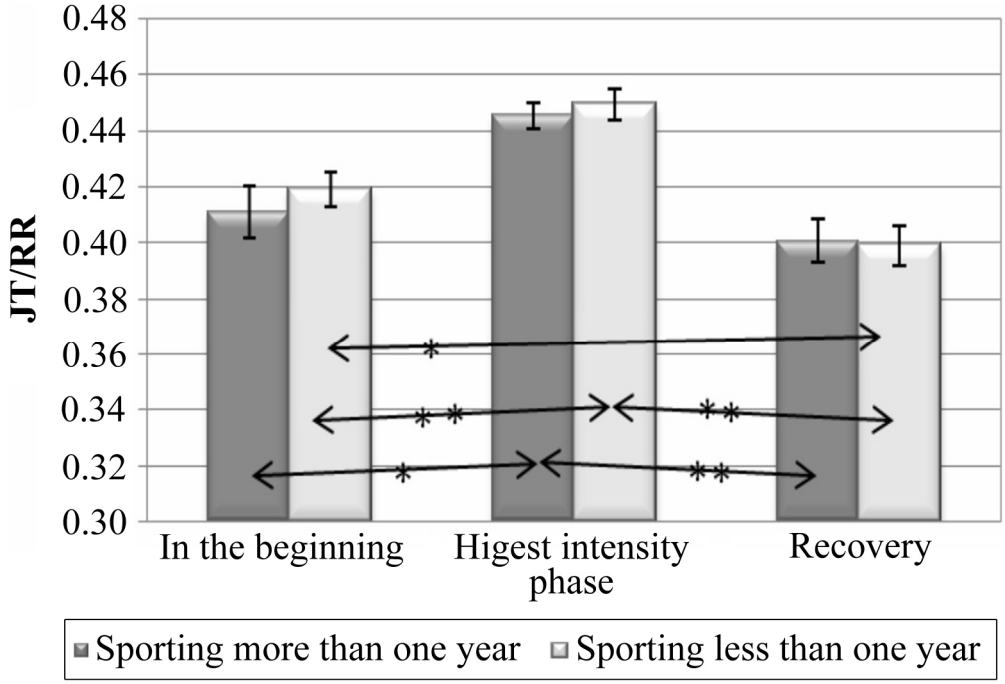

***Fig. 2.2.5**. Change in proportional repolarization (JT/RR) during exertion (* – p<0.05)*

Analysis of ECG parameters of women with the higher level of training in the beginning (0.41 ± 0.009) and recovery (0.40±0.007) revealed a similar proportion of JT/RR interval ($p>0.05$), but the value of registered indicator was the highest during the highest phase of intensity (0.44 ± 0.004; $p<0.05$, $p<0.001$) (Fig. 2.2.5). Statistically confident differences of mean values of JT and RR intervals were observed in the group of the students with a shorter attendance of aerobic exercise, compared with the phases in the beginning (0.41 ± 0.006), recovery (0.39 ± 0.007) and the highest-intensity ($p<0.05$). The analysis of the comparison of the studied groups showed that the mean values of JT/RR proportion in all parts of aerobics differed slightly ($p>0.05$).

2.3. The data of evaluation of emotional state of the studied subjects

The study demonstrated that the strength of anxiety expression in the groups of exercising and not exercising young women is different ($\chi^2=5.29$, $p<0.05$) (Fig. 2.3.1). We determined that anxiety was not expressed in 80.6% of the female students attending aerobics exercise, and it was moderately expressed – in 19.4%. For 66.7% of women who were not exercising expression of anxiety was not detected, in 27.1% of women it was moderately expressed, and 6.3% of women had very expressed symptoms of anxiety.

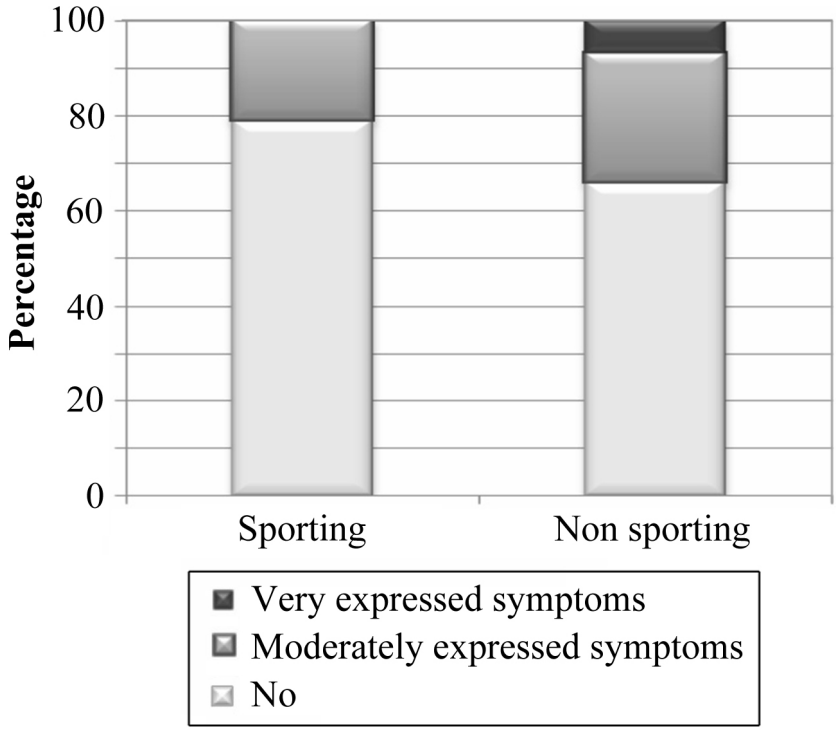

Fig. 2.3.1. *Distribution of the data of anxiety expression strength in relation to attendance at aerobic classes ($p<0.001$)*

Analysis of the strength of depression expression in the group of the women attending aerobic exercise and in the group of physicaly inactive women did not reveal statistically confident difference ($p>0.05$). Expression of depression in both groups was not found.

Mean score of expression of anxiety symptoms in sporting students (4.97 ± 0.27) was considerably lower, compared with non-sporting. (6.5 ± 0.38) ($p<0.05$).

Having compared the studied groups in terms of the attendance length of aerobic exercise, we indicated that the symptoms of anxiety expression statistically confidently did not differ ($\chi^2=0.073$, $p>0.05$). Moderate strength anxiety symptoms were found in 20.6 % female students in the first group and 17.9 % in the second group. Mean evaluation score of anxiety symptoms of students attending exercise for more than a year was 4.82 ± 0.41 and students attending exercise for less than a year – 5.09 ± 0.37, respectively, ($p>0.05$) (Table 2.3.1).

Mean evaluation score of depression symptoms of the sporting female students was 2.01 ± 0.20 and in the control group – 2.39 ± 0.16, respectively ($p>0.05$).

The analysis of the strength of anxiety symptoms did not reveal statistically confident difference between sporting and non-sporting studied

groups (χ^2=10.11, p>0.05). No moderate or severe symptoms of depression were found in both studied groups.

Table 2.3.1. *Symptoms of anxiety and depression expression (HADs point) in sporting and control groups*

Group / **HAD scale points**	**Sporting moor than one year $\bar{x}$ (CI 95%)**	**Sporting less than one year $\bar{x}$ (CI 95%)**	**Non-sporting $\bar{x}$ (CI 95%)**	Significan level, p
Anxiety symptom	4.82 (3.98–5.65)	5.09 (4.33–5.78)	6.5 (5.80–7.18)	< 0.05 1:3. 2:3
Depression symptom	1.82 (1.4–2.25)	2,03 (1.68–2.18)	2,39 (2.04–2.74)	> 0.05

It was determined that the possibility of an increase in anxiety is linked to age (for sporting: OR – 2.6, CI 95%, 1.44–4.67; p<0.001, for non-sporting: OR – 1.17 CI 95%, 0.46–2.96, p<0.05).

2.4. The results of the associations of the indicators of CVS and emotional state

The correlation analysis of the electrographical parameters and the indicators of emotional state (HAD scale of the study data) of the studied (n=115) (sporting and non-sporting) revealed the weak negative but statistically confident relationships between score evaluation of anxiety symptoms and JT interval duration in the morning (r = –0.27; p<0.05) and at night (r = –0.208; p<0.05). We also found the weak positive but statistically confident relationships between score evaluation of depression symptoms and R wave amplitude in the morning (r = 0.22; p<0.05), in the evening (r = 0.22; p<0.05) and at night (r = 0.19; p<0.05).

The correlation analysis of the data of the study of students (n=66) attending aerobic exercises showed the presence of the weak negative but statistically confident relationships between score evaluation of anxiety symptoms and JT interval duration in the morning (r = –0.25; p<0.05), at night (r = –0.25; p<0.05), RR interval duration in the morning (r = –0.28, p<0.05) and HR in the morning (r = 0.26, p<0.05). Statistically not confident the weak negative relationship between QRS complex duration registered in the evening and score evaluation of anxiety expression (r = –0.28; p>0.05) was found.

The analysis of the associations of the parameters of CVS and emotional state of sporting students showed the moderate weak negative relationship between score evaluation of depression symptoms and RR interval duration in the morning ($r = –0.306$; $p<0.05$) and in the evening ($r = –0.304$; $p<0.05$), but the weak negative relationship at night ($r = –0.26$, $p<0.05$). The weak positive statistically confident relationship between depression scores and R wave amplitude at night was determined ($r = 0.26$; $p<0.05$) as well as proportional repolarization (TT/RR) recorded at night ($r = 0.261$; $p<0.05$). The moderate positive relationship was determined between score evaluation of depression symptoms and HR registered in the morning ($r = 0.346$; $p<0.05$) and in the evening $r = 0.320$; $p<0.05$), as well as proportional repolarizations (JT/RR) in the morning ($r = 0.305$; $p<0.05$) and in the evening, respectively ($r = 0.354$; $p<0.05$).

The results of the study of non-sporting students (n=49) showed that statistically confident moderate positive relationship between score evaluation of anxiety expression and R wave amplitude registered at night ($r = 0.338$; $p<0.05$) was determined as well as moderate negative relationship between anxiety and duration of QRS complex registered in the evening ($r = 0.354$; $p<0.05$).

The correlation analysis demonstrated that for the studied of the control group statistically confident moderate relationship between score evaluation of depression symptoms and RR interval, registered in the morning ($r = 0.34$, $p<0.05$) and HR registered in the morning and at night ($r = –0.35$ ir $r = –0.33$, $p<0.05$) was determined.

The dispersive analysis revealed the different level of anxiety and depression expression in the sporting group dependently upon HR registerred in the morning (distribution of HR meanings into intervals by the quartilium): the smaller HR registered at rest, the lower values of the indicators describing emotional state were obtained. For the non-sporting group the dispersive analysis after distribution of HR values into intervals by the quartilium showed that the level of depression expression significantly differed in these subgroups ($p<0.05$).

CONCLUSIONS

1. The evaluation of the functional indicators of the cardiovascular system registered at rest during the 24 hours determined that female students attending aerobic classes show a better function of the

conductive system (associated with higher parasympathetic tonus), also higher activity of the cardiovascular system and metabolism, compared with non-sporting students.

2. The evaluation of the functional indicators of the cardiovascular system registered during low intensity phase revealed that in female students with less than a year level of training we observed a more significant intensity of the regulatory system and heart metabolism than the studied with a longer training. During the highest intensity phase we observed a significant activity of heart rate and the conductive system, metabolism intensity and speed indepedently upon the training length. During recovery a better function of the conductive system was indicated in female students with a longer training length, compared with the students with a shorter training length.

3. The strength of the expression of anxiety symptoms was significantly lower in female students attending aerobic exercise, compared with the non-sporting students.

4. The statistically confident relationship between the functional indicators of the cardiovascular system and the indicators of emotional state.

PRACTICAL RECOMMENDATIONS

The outcomes of the study offer a more comprehensive evaluation of the functional parameters of the cardiovascular system in younger women on typical physical exercion.

Observation of ECG during typical physical exertion demonstrated that the evaluation of JT interval change duration during aerobic exercise was taking place when the maximal activity of miocard metabolism was discovered during the phase of the highest intensity, and HR met the recommended limits (ACSM, 1998). If we considered only HR when choosing intensity of activity we would be able to conclude that the body still had its own reserves to increase this activity. However, established values of JT interval contradict to such conclusion. Thus, in higher intensity phase independently upon the length of training we recommend to observe the continuous HR and not to exceed 80% max rates and/or reserved HR.

We recommend to make physical exercion less intense in maximum intensity for the female students of higher physical capacity, because we indicated that sporting female students who had the lowest HR (44.3 to 5.37 t/min) in the morning during the maximum physical exercion reached too high intensity, which resulted in the significant shortening of JT interval (maximum intensity in heart metabolism).

The study indicated that the length of attending aerobic exercise was a significant factor influencing the parameters of the cardiovascular system and the evaluation of subjective physical capacity. Consequently, we recommend that the public health experts, trainers, aerobic instructors would emphasize this fact, because most people who start attending health-enhancing classes abandon them due to the failure to achieve health-enhancing effect shortly.

We think that the effect of aerobic exercise as a reglamented form of physical activity is significant for enhancing mental health in young age women, and may be recommended to female students with expression of anxiety symptoms.

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SANTRAUKA

Aerobikos pratybos pastarąjį dešimtmetį išlieka viena populiariausių studenčių fizinio aktyvumo forma. Daugelio autorių teigimu aerobikos pratybos yra sveikatinimo priemonė, kurios metu atliekami fiziniai pratimai turi daug privalumų: yra emocionalūs, prieinami, patrauklūs. Tačiau išlieka aktuali fizinio krūvio optimizavimo, individualizavimo problema, nes aerobikos pratybos yra grupinės ir jose dalyvauja skirtingo pajėgumo, treniruotumo merginos. Didesnį treniruočių stažą turinčios merginos turi didesnę patirtį: stebima geresnė bazinių žingsnių atlikimo technika, susiformavę judesių įgūdžiai, judesių ekonomiškumas, o tai leidžia išvystyti didesnį galingumą, pratimus atliekant didesniu intensyvumu. Mažesnę treniruočių patirtį turinčioms merginoms, neįvaldžius aerobikos pratybose atliekamų aciklinių žingsnių specifikos, stebima didesnė emocinė įtampa bei mažesnės apkrovos (amplitudės) judesiai. Treniruotėms ypatingą žavesį ir emocinį atspalvį suteikia muzika, kuri sukelia daugybę teigiamų emocijų ir taip tarsi „užtušuoja“ organizmo siunčiamus nuovargio signalus. Dažnai tokiuose užsiėmimuose viršijamos organizmo funkcinės galimybės, atsiranda sveikatos problemų. Todėl svarbu nustatyti, įvertinti tokių pratybų sukeliamus pokyčius žmogaus organizme, rengti metodines rekomendacijas. Naujų technologijų panaudojimas mūsų darbe leido fiksuoti ne tik ŠSD, bet ir elektrokardiografinius rodiklius tipinio krūvio – aerobikos pratybų metu. Manome, kad mūsų tyrimų rezultatai papildo žinias apie aerobikos pratybų poveikį ir optimalių fizinių krūvių parinkimą siekiant sveikatą stiprinančio efekto. Yra žinoma apie fizinio aktyvumo naudą psichinei sveikatai, tačiau pastebimas fizinio krūvio apimties, intensyvumo praktinių rekomendacijų stygius. Todėl manome, kad aerobikos pratybas lankančių studenčių emocinės būklės įvertinimas yra reikšmingas praktiniam pritaikymui. Tikimės, kad *aerobikos pratybas lankančios studentės pasižymi geresniais širdies ir kraujagyslių sistemos funkciniais rodikliais bei emocine būkle lyginant su nesportuojančiomis.*

Darbo tikslas – įvertinti aerobikos pratybas lankančių studenčių širdies ir kraujagyslių sistemos funkcinius rodiklius bei emocinę būklę.

Darbo uždaviniai:

1. Įvertinti aerobikos pratybas lankančių studenčių širdies ir kraujagyslių sistemos funkcinius rodiklius per parą ramybės būsenoje ir palyginti su nesportuojančiųjų.

2. Įvertinti studenčių širdies ir kraujagyslių sistemos funkcinius rodiklius aerobikos pratybų metu priklausomai nuo aerobikos pratybų lankymo trukmės.
3. Nustatyti ir palyginti aerobikos pratybas lankančių ir nesportuojančių studenčių depresijos ir nerimo simptomų pasireiškimo stiprumą.
4. Nustatyti studenčių širdies ir kraujagyslių sistemos funkcinių ir emocinę būklę nusakančių rodiklių sąsajas.

Tiriamąją imtį sudarė 115 Kauno medicinos universiteto studentės: lankančios sveikatingumo aerobikos pratybas (n=66, amžius 22,08±2,13 m., KMI 21,27±2,06 kg/m²) ir nelankančios bei nedalyvaujančios kryptingoje sportinėje veikloje studentės (toliau tekste – nesportuojančios) (n=49, amžius 21,7±1,83 m., KMI 20,9±2,26 kg/m²). Pagal aerobikos pratybų lankymo stažą sportuojančios merginos buvo suskirstytos dar į dvi grupes: 1 grupė (n=35) – lankančios pratybas mažiau nei vienerius metus ir 2 grupė (n=31) – daugiau kaip metus. Tiriamosios atrinktos dalyvauti tyrime pagal įtraukimo – atmetimo kriterijus.

Tyrimo organizavimas ir metodika. Ilgalaikis elektrokardiogramų registravimas atliktas naudojant „Cardio Scout“ aparatą su penkiais elektrodais. Buvo registruojamos dvi įprastinės EKG stebėsenos derivacijos. Kiekvienai tiriamajai aparatas buvo pritvirtinamas ant krūtinės ląstos ryte apie 8–9 valandą, ir elektrokardiogramos registracija vykdoma 24 valandas. *Protokolą*, skirtą EKG duomenų analizei**,** sudarė šešios dalys. Pirmose trijose dalyse buvo fiksuojami EKG parametrai registruoti per parą skirtinguose taškuose: ryte, vakare ir naktį ramybės sąlygomis. Kita protokolo dalis buvo skirta žymėti EKG parametrus, registruotus *aerobikos pratybų metu*, kuriuos analizavome trijose pratybų dalyse: įsidirbimo, didžiausio intensyvumo ir atsigavimo. Darbe nagrinėti šie rodikliai: širdies susitraukimų dažnis (ŠSD), JT intervalas ir QRS komplekso trukmė, R dantelio amplitudė, intervalų JT ir RR trukmių santykis (JT/RR). Atlikdami statistinę duomenų analizę, apskaičiavome kiekvienos tiriamosios nagrinėjamo rodiklio 10-ties vienas po kito fiksuojamų kardiociklų matavimo vidurkį ir standartinį nuokrypį (SD), visos grupės rodiklių statistinių duomenų analizė atlikta kompiuterinėmis *SPSS 10.0 for Windows ir Microsoft Exel XP* programomis.

Buvo matuotas tiriamųjų asmenų ūgis (cm), kūno svoris (kg), riebalinės odos raukšlės (ROR) ir arterinis kraujo spaudimas (AKS). Tiriamosioms buvo pateikta anketa, siekiant sužinoti jų amžių, pratybų lankymo trukmę, ir kitus veiksnius, galinčius turėti įtakos širdies ir kraujagyslių sistemai bei emocinei buklei. Taip pat tiriamosios dienoraštyje žymėjo savo fizinį

aktyvumą per parą bei subjektyviai įvertino savo fizinį pajėgumą. Fizinio aktyvumo lygis buvo įvertintas naudojant standartizuotą Baecke kasdieninio fizinio aktyvumo klausimyną (*Baecke Questionnaire of Habitual Physical Activity*). Emocinei būsenai vertinti naudota HAD skalė (*Hospital Anxiety and Depression Scale – HADS*).

Išanalizavus tyrimo duomenis buvo suformuotos šios **išvados**:

1. Įvertinus aerobikos pratybas lankančių studenčių širdies ir kraujagyslių sistemos funkcinius rodiklius, registruotus per parą ramybės sąlygomis, nustatėme kad jie yra normos ribose, tačiau sportuojančios studentės lyginant su nesportuojančiomis pasižymi geresne laidžiosios sistemos funkcija (sietiną su didesniu parasimpatiniu tonusu), didesniu širdies ir kraujagyslių sistemos aktyvumu bei metabolinėmis savybėmis.
2. Aerobikos pratybų metu registruotų širdies ir kraujagyslių sistemos funkcinių rodiklių įvertinimas parodė, kad mažiau nei vienerius metus sportavusioms studentėms įsidirbimo metu stebėjome žymesnį reguliacinės sistemos ir širdies metabolizmo intensyvėjimą lyginant su didesnį treniruočių lankymo stažą turinčiomis tiriamosiomis. Didžiausio intensyvumo krūvio metu stebėjome žymų širdies susitraukimų dažnio, širdies laidžiosios sistemos funkcijos aktyvėjimą, metabolizmo intensyvėjimą ir greitį, nepriklausomai nuo pratybų lankymo trukmės. Atsigavimo laikotarpiu daugiau nei vienerius metus sportavusios tiriamosios pasižymėjo geresne laidžiosios sistemos funkcija nei mažesnį pratybų lankymo stažą turinčios studentės.
3. Aerobikos pratybas lankančioms studentėms nerimo simptomų pasireiškimo stiprumas buvo reikšmingai mažesnis lyginant su nesportuojančiomis tiriamosiomis
4. Nustatėme, kad egzistuoja statistiškai patikima priklausomybė tarp tiriamųjų širdies ir kraujagyslių sistemos funkcinių rodiklių bei emocinę būklę nusakančių rodiklių.

Gauti tyrimo rezultatai leidžia išsamiau vertinti jaunesnio amžiaus moterų širdies ir kraujagyslių sistemos funkcinius rodiklius tipinio krūvio metu. Elektrokardiografinių parametrų stebėsena tipinio krūvio metu parodė, kad studentėms stebėtas maksimalus miokardo metabolizmo suaktyvėjimas didžiausio intensyvumo fazėje, o ŠSD atitiko rekomenduojamas ribas (ACSM, 1998). Jei nustatant krūvio intensyvumą atsižvelgtumėme vien tik į ŠSD, galėtume manyti, kad organizmas dar turi rezervinių galimybių jį didinti. Tačiau nustatytos JT intervalo reikšmės tam prieštarauja.

Todėl didžiausio intensyvumo laikotarpiu nepriklausomai nuo pratybų lankymo stažo rekomenduojame nepertraukiamai stebėti ŠSD ir neviršyti 80 proc. maksimalaus ir/ar rezervinio ŠSD.

Rekomenduojame didesnio fizinio pajėgumo studentėms mažinti krūvį didžiausio intensyvumo metu, nes nustatėme, kad aerobikos pratybų dalyvės, kurioms ryte registravome mažiausią ŠSD (44,3 iki 53,7 k./min.), maksimalaus krūvio metu pasiekia per didelį intensyvumą, kas pasireiškia žymiu JT intervalo sutrumpėjimu (maksimaliu širdies metabolizmo suintensyvėjimo lygiu).

Tyrimas parodė, kad stažas (aerobikos pratybų lankymo trukmė) yra svarus veiksnys turintis įtakos širdies ir kraujagyslių sistemos rodikliams bei subjektyviam fizinio pajegumo vertinimui. Todėl rekomenduojame visuomenės sveikatos specialistams, treneriams, aerobikos instruktoriams akcentuoti šį faktą, nes daugelis žmonių pradėjusių lankyti sveikatos stiprinimo užsiėmimus, juos meta nesulaukę greito sveikatą stiprinančio efekto.

Manome, kad aerobikos pratybos, kaip reglamentuota fizinio aktyvumo forma, tinkama studenčių psichinės sveikatos stiprinimui ir rekomenduojama merginoms, kurioms pasireiškia nerimo simptomai.

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