

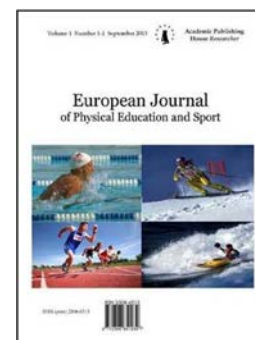
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Published in the Russian Federation
European Journal of Physical Education and Sport
Has been issued since 2013.
ISSN: 2310-0133
Vol. 9, Is. 3, pp. 151-155, 2015

DOI: 10.13187/ejpe.2015.9.151

www.ejournal7.com



UDC 612

Comparative Estimation of Physical Development and Functional State of the Cardiovascular System of Athletes Engaged in Cyclic and Acyclic Sports

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Abstract

The article presents the examination results of 44 students engaged in cyclic (athletics) and acyclic (wrestling, weightlifting) sports. We studied anthropometric characteristics, conducted Ruffier-Dickson test, defined weight and growth, Quetelet index and adaptive capacity of the cardiovascular system. The analysis of the above indicators was conducted. The study revealed a higher efficiency of the cardiovascular system in athletes engaged in cyclic sports compared to athletes in acyclic sports.

Keywords: students, athletes, adaptive capacity, cyclic and acyclic sports.

Introduction

Physical working capacity is one of the most important components of athletic success. This quality is also a determinant in many types of production activity, necessary in daily life, susceptible to trainings and indirectly reflecting the state of the physical development and health [1, 2, 3, 4]. Physical working capacity of a body is largely determined by capabilities of cardiovascular system, functional state of which affects all types of organism's activities. In their turn, sports training loads have a significant impact on the morphofunctional development of the circulatory apparatus, as well as the usefulness of the mechanisms of its regulation [5, 6, 7, 8, 9]. The focus of the training process is a major factor in the organization of the functioning of the circulatory apparatus [10, 11, 12, 13]. In this regard, the study of functional capabilities and physical working capacity of students, involved in various sports, is important. Objective of this research: to provide a comparative assessment of physical development and functional state of the cardiovascular system of athletes involved in cyclic and acyclic sports.

Materials and methods

The study involved 50 male students of average age 20 ± 2 years who were regularly engaged in cyclic and acyclic sports; the duration of participation in sports was ranging from 2 up to 5 years. Students were divided into groups according to the specific sport. The first group (n = 15) included students which were engaged in athletics. The second group consisted of wrestlers and weightlifters (n = 17). The last group consisted of students not involved in sports systemically (n = 18). To determine the level of physical development and features of CVS athletes while in rest were measured anthropometric measures - height (cm), weight (kg), chest circumference (WGC cm). Body mass index was calculated (Quetelet index, kg / m^2). Physical working capacity was evaluated by the index Ruffier-Dickson. Adaptation potential (AP) of cardiovascular system of students was calculated with the following formula:

$$AP = (0,011 \cdot HR + 0,014 \cdot SBP + 0,008 \cdot DBP + 0,014 \cdot A + 0,009 \cdot W - 0,009 \cdot H) - 0,27$$

Where HR – heart rate; SBP – systolic blood pressure; DBP – diastolic blood pressure; A – age; W – body weight (kg); H – height in cm.

Students' AP was evaluated according to the Table 1:

Table 1: The range of values of adaptation potential

Satisfactory adaptation	Stress of adaptation mechanisms	Poor adaptation	Failure of adaptation
2,1 points and lower	2,11 – 3,20 points	3,21 – 4,30 points	4,30 points and higher

Statistical analysis was performed using Microsoft Excel.

Results and their discussion

Assessment of physical working capacity was carried out using physical loads, followed by the study of the speed of heart rate recovery, first of all, taking into account the standard reaction of the organism to the load: the reaction efficiency and fast recoverability.

A satisfactory physical working capacity of the body after carrying out Ruffier-Dickson test was not found at athletes, while in the control group it was found in 29% ($11 \pm 1,008$) (Figure 1). The average physical performance was found in 44% ($6 \pm 0,8$) of students engaged in cyclic sports and in 50% ($7 \pm 1,06$) of students engaged in acyclic sports while in the control group it was found in 59% ($8 \pm 1,15$). The good performance was observed in 56% ($4 \pm 0,7$) of athletes in cyclic sports and 50% ($3 \pm 1,16$) of athletes in the acyclic sports. In the control group, a good performance was found in 12% ($2 \pm 0,8$). Poor physical performance was not detected in any group.

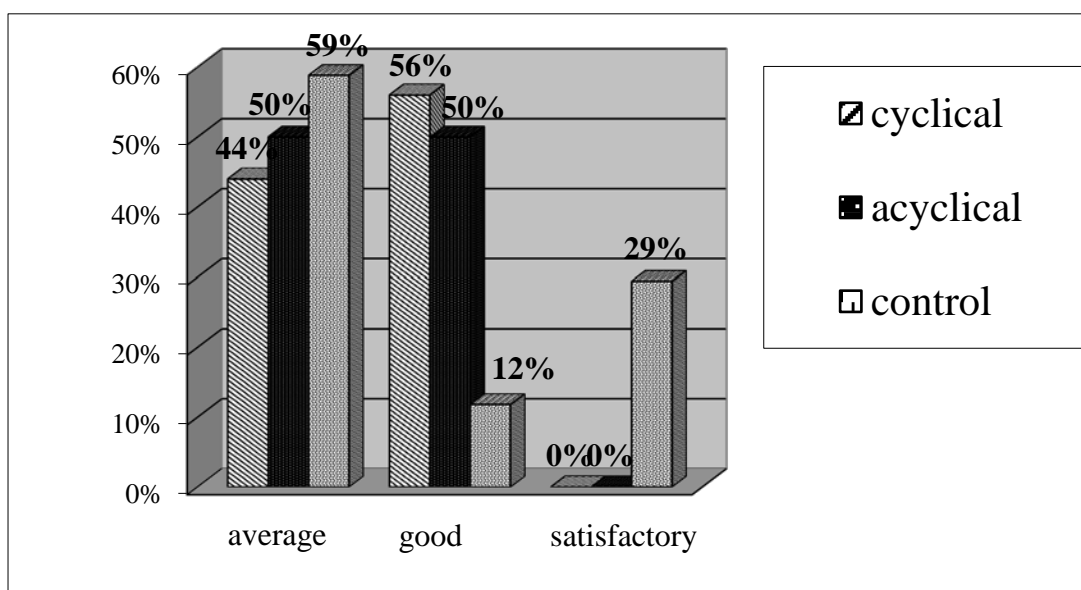


Figure 1. Index of physical working capacity (Ruffier-Dickson) of students engaged in cyclic and acyclic sports

Thus, satisfactory evaluation of physical working capacity by the Ruffier-Dickson index in the control group indicates insufficient level of adaptation reserves of the cardiovascular and respiratory systems what limits physical capabilities of students' bodies.

One of the important characteristics of the physical working capacity is to definition of the characteristics of the overall size, body proportions and the constitution. However, for an objective assessment of physical working capacity it is important to make a comparison of different anthropometric characteristics, and therefore we defined overall weight and growth rate (Quetelet index), which revealed differences in the physical development of students in the surveyed groups. Deficiency of weight in the control group was in 29% ($18,66 \pm 0,76$), and students involved in cyclic and acyclic sports were not found to have deficiency of weight (Figure 2). Normal weight was observed in all the students involved in cyclic sports, and was found in 100% ($21,6 \pm 0,76$), and in 75% of students engaged in acyclic sports ($22,4 \pm 1,21$). In the control group normal weight was recorded in 59% ($21,46 \pm 0,87$) of students. Overweight was detected in 25% ($27,01 \pm 1,57$) of students engaged in acyclic sports. In the control group overweight was observed in 12% ($25,66 \pm 0,82$) of students.

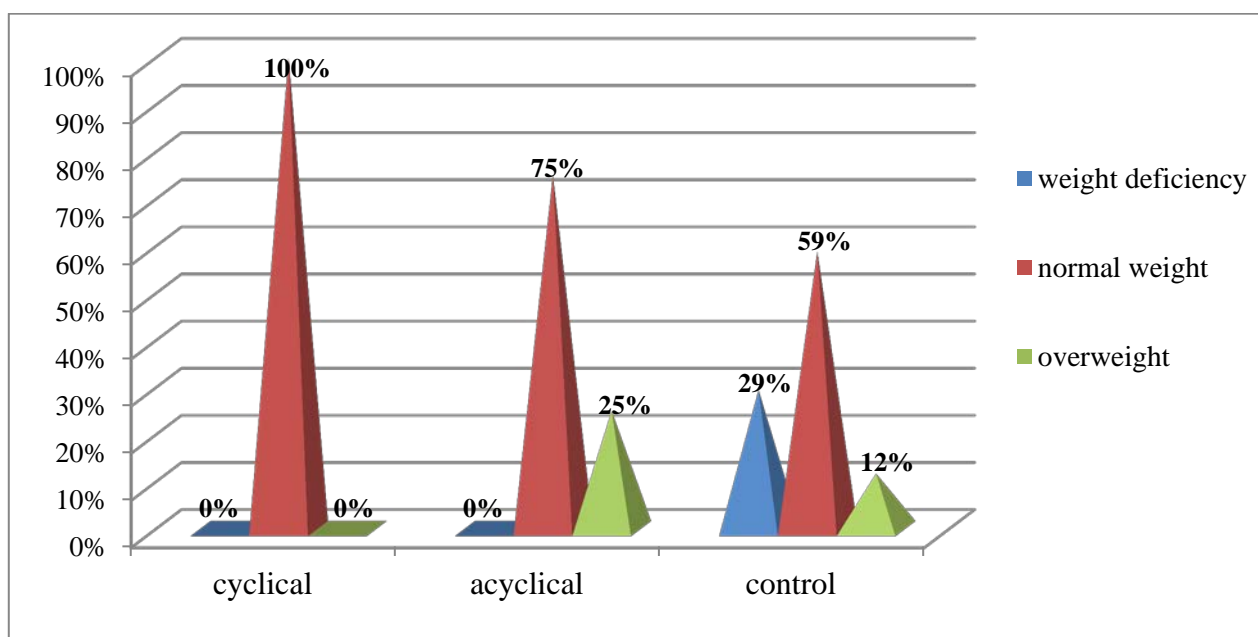


Figure 2. Index Quetelet indicators of students involved in different sports

Thus, anthropometric research has revealed a number of differences in physical development of athletes, depending on the type of physical loads. There were noted a higher rates of body mass at athletes involved in acyclical sports compared with a group of athletes involved in cyclical types. The found differences in the groups can be explained by anthropometric characteristics of athletes and specificity of selection athletes depending on sports. It is well known that high - static exercises, aimed at development of strength, contribute to an increase in muscle mass. In this regard, the wrestlers and weightlifters were found to have higher levels of body mass index. This caused a higher index of body weight as well as Quetelet Index at athletes involved in acyclic sports. Indicators of weight deficiency and overweight were observed at students in control group, what can testify malnutrition or weak development of muscles, either the threat of obesity.

At the students there were observed indicators of adaptive capacity of the circulatory system, which revealed a level of adaptive responses of the cardiovascular system to physical and mental stress.

Indicators of satisfactory adaptation were prevalent at 63% of athletes involved in cyclic sports (Fig. 3), while the percentage of athletes involved in acyclic sports was 13% less. Indicators with a satisfactory adaptation in the control group were observed at 71% of students. Stress of adaptation mechanisms was observed at 37% of the athletes in the cyclic species and 44% - in that of the acyclic sports and in control group they were found only at 29% of students.

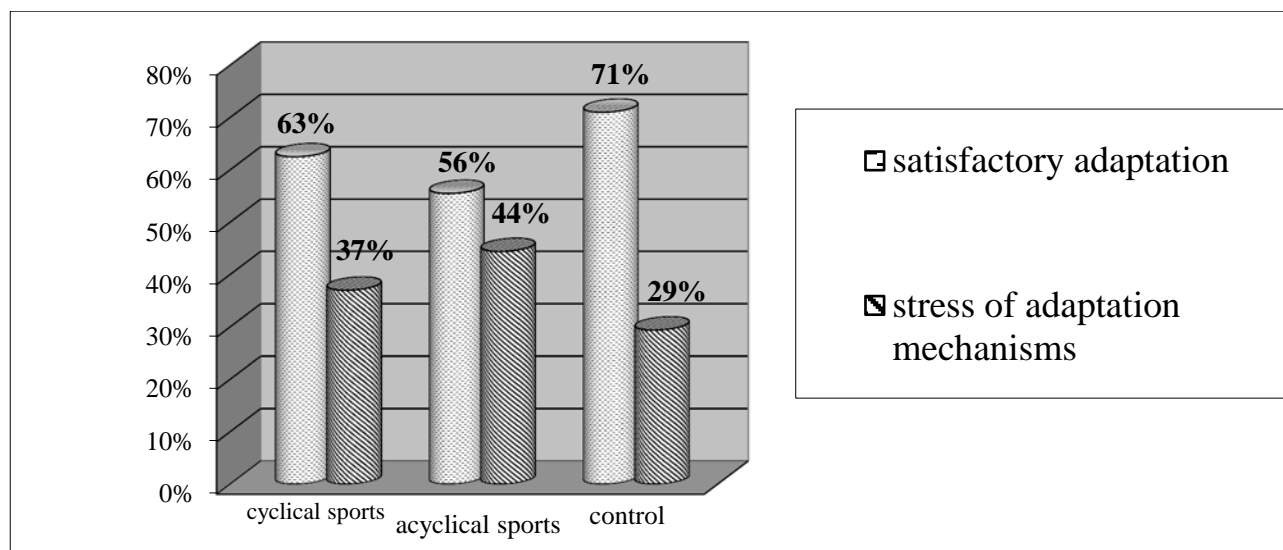


Figure 3. AC of cardio-vascular system of students involved in cyclical and acyclical sports

Thus, the state of the circulatory system at more than half of the athletes involved in acyclic and cyclic sports and the control group was assessed as satisfactory, which is evidence of satisfactory functioning of the students' organism. The stresses of adaptation mechanisms of the circulatory system were found at athletes of the first and the second groups, at 37 % and 44 % respectively, reflecting the reduction of existing functionality of the body. Such a state of adaptive responses is explained by intense physical and mental stress.

Conclusion

The results of our studies have shown that adaptation to physical stress depends on the focus of the training process and has its own specifics due to the type and intensity of physical loads. If the training process in cyclic sports is dominated with a combination of high dynamic and medium – static exercises, the training in acyclic types are dominated with exercises with mostly high-static loads and low-intensity dynamic, what as appears is a cause of a higher efficiency of the CVS at athletes involved in cyclic sports.

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УДК 612

Сравнительная оценка физического развития и функционального состояния сердечно-сосудистой системы у спортсменов, занимающихся циклическими и ациклическими видами спорта

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Аннотация. В статье представлены результаты обследования 44 студентов, занимающихся циклическими (легкая атлетика) и ациклическими (борьба, тяжелая атлетика) видами спорта. Были изучены антропометрические показатели, проведена проба Руфье-Диксона, определены весо-ростовой индекс Кетле и адаптационный потенциал сердечно-сосудистой системы. Проведен анализ вышеизложенных показателей. Выявлена более высокая эффективность работы сердечно-сосудистой системы у спортсменов, занимающихся циклическими видами спорта по сравнению со спортсменами в ациклических видах спорта.

Ключевые слова: студенты, спортсмены, адаптационный потенциал, ациклические и циклические виды спорта.