

# ADAPTATION ABILITIES OF THE CARDIOVASCULAR SYSTEM TO PHYSICAL LOADS BY MEANS OF BASKETBALL, SWIMMING AND TOURISM WITHIN THE CONDITIONS OF THE HIGHER SCHOOL

(Research note)

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## **Abstract**

*Sample of the study is 148 higher students entered into the profiled groups of the "Sport by choice – basketball, swimming or tourism" school disciplines at the Technical University (Sofia), distributed as follows: 54 – taking basketball, 54 – swimming and 40 – tourism. Considering the abilities of the contingent under study, the 3-minute step-test (YMCA step-test) has been chosen as most convenient. While evaluating the results of the study, a 7-mark scale is used pursuant to the sex of the persons under study. For the needs of the study alternative analysis, comparative analysis (by Student's t-criteria) and sigma method for evaluation are used. The results show that the students listed at the higher schools in Bulgaria, as a whole, have got very low abilities for adaptation of the cardiovascular system to physical loads and very low functional state and under the existing status quo, the physical education and sport teaching at the higher schools to not lead to increasing the adaptation abilities of the cardiovascular system nevertheless the nature of the motive activities applied.*

**Keywords:** *male, female, physical education, Step-test- YMCA, functional abilities, motor abilities, motor activity, Student's t-test*

## **INTRODUCTION**

The development of the civilization has its advantages of the human race. But, in the same time it has some negative influences, as a result of the inactive life and limited time for the children and young people to spend outdoors. All this provoke lowering in the development of the functional abilities and consequently causes the occurrence of diseases, mostly cardiovascular ones (Пеева, 2004; Zrnzević, Vidosavljević & Krulj-Prasković, 2010 and Църова-Василева, 2013).

To act more significantly on the anthropological status of children it is necessary to apply high intensity exercising (Мищенко, Лысенко & Виноградов, 2007), something which is hard to find in the real pedagogical practice. Inadequate volume of load will not contribute to the systematic changes of functional abilities of the individuals. That is why there is a need for more education contemporary and more efficient physical education, which will bring in the foreground more opportunities for the holistic development of the children and the young people. To successfully manage the process of physical exercising, the teachers should excel in their expertise knowledge directed at the application of adequate teaching methods, exercising, dosing of exercises

and methods to assess the obtained results, which should guarantee obtaining better results (Петков, Тотева, Мазнев & Димитрова, 2003 and Zrnzević, Vidosavljević & Krulj-Drasković, 2010).

As it is known, for determining of the possibilities of adaptation of the cardiovascular system to physical loads so-called tests of standard load are made use (Петков, Тотева, Мазнев & Димитрова., 2003 and Църова-Василева, 2013). The evaluation of the test results is made on the bases of the values achieved by the heart frequency during the application of standard load (similar for all persons under study as to the pace, amplitude and time duration).

The submaximal tests are widely used as a measure of cardiorespiratory fitness. Good knowledge of the specifics of these tests allows the tests to be applied competently on the individuals with different level of cardiorespiratory endurance and a state of health (Ward, Ebbeling & Ahlquist, 1995; Мищенко, Лысенко & Виноградов, 2007; Сомлев, Узунова & Павлова, 2010a; Carter, Brooks & Sparks, 2011).

The comparative analyses of the results of athletes in different sports discipline, as well as sportive and non-sportive, gives a possibility the specific peculiari-

ties in the development of the functional abilities to be reveal (Chatterjee, Chatterjee & Bandyopadhyay, 2005; Milenović & Mutavdrić, 2007; Дончева, Златев & Къчев, 2010 and Pavlova & Uzunova, 2010).

The *objective* of the present study is to make an evaluation of the high students' adaptation abilities of the cardiovascular system to physical loads by the means of basketball, swimming and tourism at non-specialized in sport higher schools in Bulgaria.

## METHODS

The present study has been made during the period September 2009 – November 2011.

*Subject* of the study is the physical development and the physical workability of the students in the basketball, swimming and tourism profiled groups at the higher schools in Bulgaria as well as the adaptation abilities of the cardiovascular system to physical loads by the means of the respective motive activity.

*Contingent* of the study is 148 higher students entered into the profiled groups of the "Sport by choice – basketball, swimming or tourism" school disciplines at the Technical University (Sofia), distributed as follows: 54 – taking basketball, 54 – swimming and 40 – tourism.

As it is known, the so-called tests of standard load are made use of for establishing the adaptation abilities of the cardiovascular system to the applied physical load. Considering the abilities of the contingent under study (higher students from non-specialized in sport higher schools in Bulgaria), the 3-minute step-test (YMCA step-test) has been chosen as most convenient.

The evaluation of the test results is made on the bases of the values achieved by the heart frequency during the application of standard load (similar for all persons under study as to the pace, amplitude and time duration) by climbing up a step of 30 cm height for 3 min. Logic while defining the evaluation, is based on the pulse magnitude directly after the load, i.e. as much lower is the heart frequency, the better are the adaptation of the cardiovascular system and the functional state of the person under study.

While evaluating the results of our study, a 7 mark scale is used pursuant to the sex of the persons under study (Петков, Тотева, Мазнев & Димитрова, 2012).

For the implementation of the objective and the

tasks of the research, the following *methods of study* are used: *overview study and theoretical analysis of specialized literature, sports-pedagogical test.*

For the needs of the study, the following *mathematical-statistical methods* are used: *alternative analysis, comparative analysis (by Student's t-criteria) and sigma method for evaluation.*

## RESULTS AND DISCUSSION

The analysis in *table 1* shows that at the beginning of the teaching in basketball, immediately prior the functional test, the average pulse at rest of the aggregate under study is 93,25 strokes/min. Such pulse, at first glance, is very high for 19-21 old youths, but here it is necessary to note that the 3 minute step test applied is done after covering a certain complex of tests for physical capability which most naturally suggests the implementation of the functional test to organism which is not completely recovered.

It can be seen from the table that following the application of the standard load, the average pulse of the basketball group (for the first minute of the recovery) is increased to 147,14 strokes/min. Something more – the pulse frequency measured at the end of the step test is average by 57,78% higher than the initial one.

The analysis of *fig. 1*, which allows disclosing the relative shares of the evaluations of the cardiovascular system abilities towards adaptation at the beginning of the teaching at the higher school, shows as a whole, that the evaluations are very low.

It is seen from the figure that the highest (82,36%) for the basketball players is the relative share of the very low individual evaluations. The low evaluations represent 11,76% from the total number, 1,96% receive evaluations under the average while only 3,92% of the students entered into the profiled groups for organized practicing of basketball have got average evaluations.

*Fig. 2* allows establishing the relative share of the changes in the pulse frequency (in zones) as compared to the initial pulse (at rest).

From the figure it is seen that the relative share of the students-basketball players where the standard load applied have led to an increase of the pulse frequency within the frames between 41% and 60% as compared to the initial one, is the greatest - 31,37%. For nearly ¼

*Table 1. Average results from the 3 minute step test for establishing the abilities of the cardiovascular system to adapt to the physical loads – beginning*

№	Indicators	Basketball	Swimming	Tourism
1.	P <sub>rest</sub>	93,25 str./min	89,84 str./min	91,64 str./min
2.	P <sub>after</sub>	147,14 str./min	135,68 str./min	146,30 str./min
3.	Amendment – %	57,78%	51,02%	59,54%
4.	Average evaluation	Very low	Very low	Very low

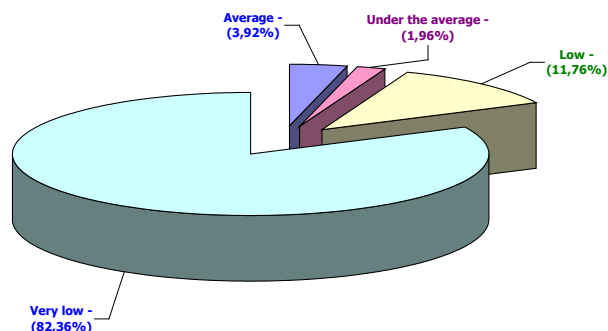


Fig. 1. Relative shares of the evaluations of the cardiovascular system of the students-basketball players for adaptation - beginning

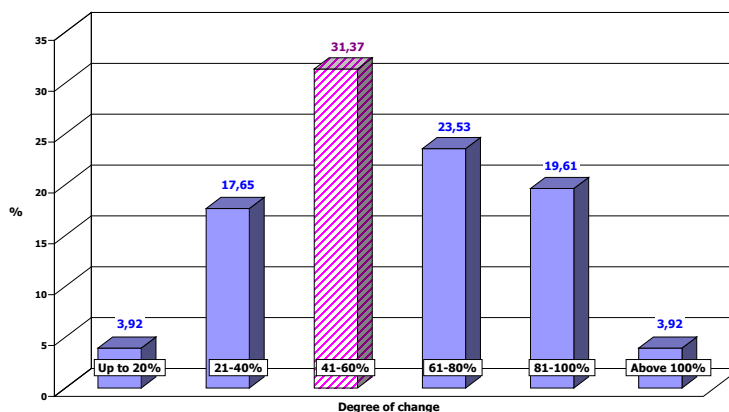


Fig. 2. Relative share (in %) of the changes in the pulse frequency of the basketball players

of the students (23,53%) the changes are between 61 and 80%, while for about 20% of them, the pulse is increased by 81-100%. The lowest is the relative share (3,92%) of the basketball players for whom the change is the lowest (up to 20%) or the highest (above 100%).

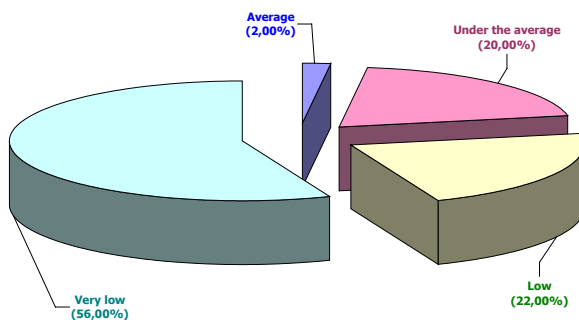
The ascertainties made up to here provide the reason to consider that at the beginning of the teaching at the higher school, the students from the basketball group as a whole have had very low abilities for adaptation of the cardiovascular system to physical loads by the means of that sport and very low functional state.

The state of the higher students from the profiled groups in swimming is a little bit better. The analysis of fig. 3 shows that a small number above the half (56%) of the higher students under study have got very low abilities to adaptation.

The smaller relative share of the swimmers with very low functional state in comparison with the basketball players is on the account mainly of the greater number of students with low (22%) and under the average degree of adaptation (20%).

The highest (34%) is the relative share of the higher students – swimmers where the changes of the pulse frequency is between 21 and 40% (fig. 4). The lowest (4 and 6%) are the relative shares of the students where the changes are within the frames respectively of 81-100% and up to 20%.

As it is seen from Table 1, the pulse frequency of the higher students-swimmers measured at the end of the step test is average by 51,02% higher than the initial one. That means that their abilities for adaptation of the



Фиг. 3. Relative shares of the evaluations of the abilities of the cardiovascular system of the higher students-swimmers for adaptation - beginning

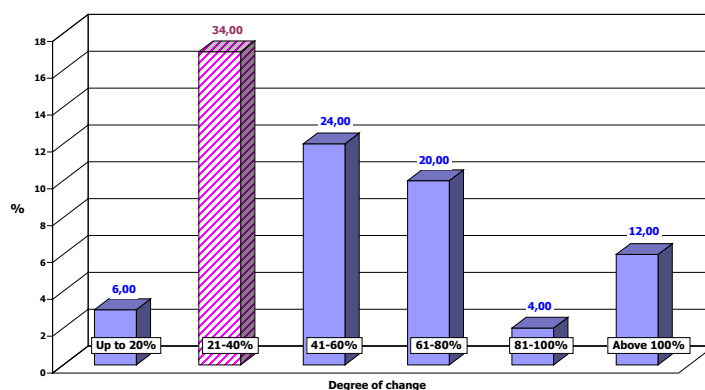
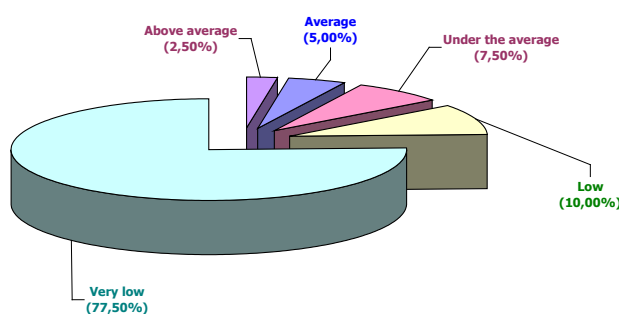


Fig. 4. Relative share of the changes (in %) of the swimmers' pulse frequency



Фиг. 5. Relative share of the evaluations of the abilities of the cardiovascular system of the higher students-tourists for adaptation - beginning

Table 2. Average results from a 3 minute step test for establishing the abilities of the cardiovascular system to adapt to physical load – end

№	Indicators	Basketball	Swimming	Tourism
1.	P <sub>rest</sub>	92,07 str./min	91,27 str./min	99,40 str./min
2.	P <sub>after</sub>	143,78 str./min	140,35 str./min	145,70 str./min
3.	Change – %	56,15%	53,78%	46,58%
4.	Average evaluation	Very low	Very low	Very low

cardiovascular system, as a whole, are better than those of the basketball players.

In conclusion, as a whole, the higher students entered into the profiled group in swimming have at the beginning of the teaching at the higher school, similar to the basketball players, very low evaluation about the functional abilities of the cardiovascular system for adaptation to the training loads by the means of swimming.

For the higher students-tourists, the general evaluation as a whole, is also very low (fig. 5).

Anyway, here it strikes that 2,50% of the students in that group have an evaluation above the average about the abilities of the cardiovascular system to adapt to the physical loads – something which is not observed for the other two aggregates.

It is seen from fig. 6 that the highest (25%) are the relative shares of the higher students-tourists where the changes of the pulse frequency are within the frames between 41 and 60%, as well as between 81 and 100%.

That means that for ¼ of the students practicing tourism, an increase of the pulse frequency within the frames of between 41 and 60% against the initial one is observed after the applied standard load, while for 22,5% of the students the pulse reaches up to 181-200% from the one measured at the start of the step test.

The analysis of Table 1 shows that the higher students-tourists as a whole react most obviously to the applied standard load. A proof about that is the pulse frequency which is by 60% higher than the initial one during the first minute after the impact.

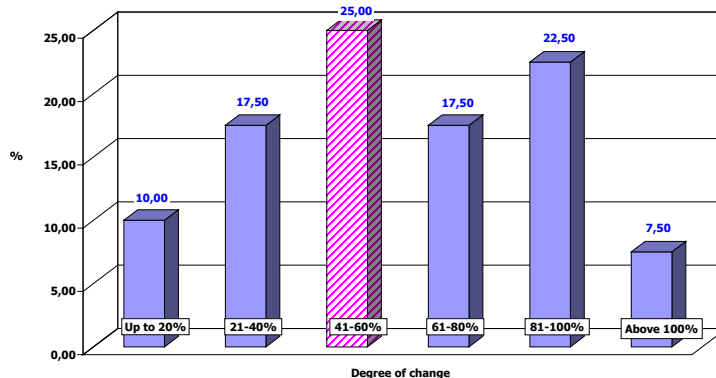


Fig. 6. Relative share of the changes (in %) of the tourists' pulse frequency

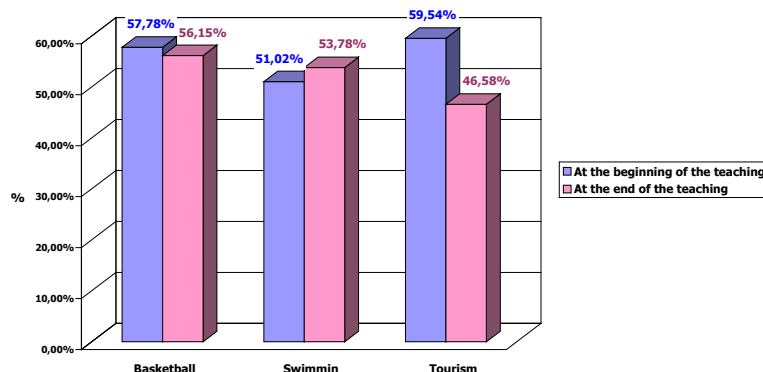


Fig. 7. Change (in %) of the pulse frequency after the application of a standard physical load (step-test)

The results of the step-test made at the end of teaching are presented in *table 2*.

The analysis of the table shows that the values of the pulse frequency after the step test at the end of the teaching are within the frames of 140-146 strokes/min. The highest is the pulse of the tourists (145,70 strokes/min) and the lowest one is of the swimmers (140,35 strokes/min).

It becomes clear from the table as well that the average pulse frequency measured at the end of the step test is between 46 and 56% higher than the initial one.

The graphics presented in *fig. 7* provides the possibility to make a comparative analysis of the changes (in %) occurred in the values of the pulse frequency for the three aggregates under study.

The analysis of the figure shows that for the basketball players and the swimmers no great differences are observed between the initial and the final test in relation to the percentage increase of the pulse frequency after the application of the standard physical load. Anyway, for the tourists an increase of the average pulse frequency is observed under load at the end of the teaching at the higher school by around 47% while at the beginning of the teaching the increase is around 60% of the initial pulse. That would mean an improvement of the adaptation abilities of the cardiovascular system but only at akin values of the initial pulse (measured prior the application of the step test). It is a pity the results

show that during the second test immediately prior the application of the standard load, the average pulse of the tourist group is by around 8 strokes for a minute higher, than the one measured prior the start of the test at the beginning of the teaching.

In order to check up that thesis, the comparative t-criterion of Student has been applied. The results show that for neither of the aggregates under study, there do not exist considerable differences between the values of the pulse frequency measured after the step test at the beginning and at the end of the teaching at the higher school (t equal respectively to 0,89 for the basketball players, 1,21 - for the swimmers and 0,13 - for the tourists).

**CONCLUSIONS**

1. The students listed at the higher schools in Bulgaria, as a whole, have got very low abilities for adaptation of the cardiovascular system to physical loads and very low functional state.

2. Under the existing status quo, the physical education and sport teaching at the higher schools to not lead to increasing the adaptation abilities of the cardiovascular system nevertheless the nature of the motive activities applied.

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