NEW POSSIBILITIES OF DIAGNOSTICS OF PHYSICAL FITNESS IN DEEP WATER

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ABSTRACT

The aquatic environment due to its specific characteristics appears to be appropriate for diagnosing not only the swimming performance, but also the physical fitness of the population. The aim of this study is to determine the time duration and the body response to the load in the new 100 Steps test in deep water. We assessed the impact of the environment on heart rate. The results of comparison of the heart rate values measured in a sitting position on land and in deep water did not show statistically significant differences. Changes in heart rate before and immediately after the test, as well as changes immediately after the test and 3 minutes after the test were statistically significant in all groups of subjects. We note that the heart rate after a 3-minute rest did not fall to its initial level. On the basis of our results and in accordance with other authors we believe that the new test can be recommended as an appropriate means for monitoring physical fitness of the population in the aquatic environment.

Key words: physical fitness, deep water, diagnostics, heart rate

INTRODUCTION

The word condition involves a complex of physical abilities, personal predispositions, motivation and will. The level of condition is dependent on age, sex, genetic suppositions especially organism's adaptability, mechanisms of CNS, mental features but also on the length of condition training (Šimonek, 2003).

Physical fitness means also general fitness, condition or just fitness. Physical fitness changes during life time and it shows itself in certain level of physical abilities, skills and mental features of a person. Kasa (1995) understands physical fitness as a complex of person's predispositions for optimal reaction to any kind of physically demanding activity and to impacts of external environment. Physical fitness is a qualitative parameter of organism's state and health, it is a result of non-specific human adaptation to physical, functional, motor and psychic level, which is an effect of motor impulses. Physical fitness is a required supposition for physical and mental performance, it affects health condition, it has also preventive function against risk of hypokinesis and also environment. The level and parameters of physical fitness can be observed by motor and functional tests in laboratory or terrain conditions. The organism's condition can be monitored by simple functional tests especially in untrained people, rehabilitants, chronically ill people, old people but also sportsmen. Nowadays there are tendencies to use battery of motor tests for monitoring physical fitness. Physical fitness evaluation in water environment is dependent on the level of individual's swimming capability (Labudová, 2005, Hines, 2008; Čechovská et al. , 2012). Authors (Macejková a kol., 2005; Benčuriková, Masaryková – Nemčeková 2011) agree, that a person can swim, when swimming the distance of 200 m by any stroke without break and using all swimming skills (swimming breathing, floating, gliding, diving and falling into water, orientation in water). The most common tests of aerobic endurance as a basis for physical fitness in swimming for population are the 5- minutes swimming test (population swims a distance between 100 m and 300 m, professional swimmers usually 400 m), Cooper 12-minutes swimming test (good swimmers swim from 650 m to 700 m, professional swimmers about 800 m). In case the level of swimming performance is not satisfactory, there are offered other diagnostic methods for measuring physical fitness in water environment e.g. walk test in shallow water - Water walk test 500 yards (457 metres). The norms for population under 30 years are presented in Tab. 1 (AEA, 2006).

Tab. 1 Norms for physical fitness of population under 30 years

Performance	very good	good	average	poor	very poor
Men/time [min]	< 6:47	6:48 - 7:26	7:27 - 8:05	8:06 - 8:44	> 8:45
Women/time[min]	< 7:56	7:57 - 8:37	8:38 - 9:18	9:19 - 9:59	> 10:00

The evaluation of organism's reaction to changes of environment was observed by Alberton et al. (2002) and Chewning et al. (2009). They monitored changes in heart rate in various water depths. Currently a new 100 Step test in deep water for evaluating physical fitness is being validated. We are also participating in the project of AEA Research Committee (**100 Step Assessment Data Collection Project, Sponsored by Dr. Mary Wykle, MW Associates,** 2011). In our research we wanted to find out the reaction of heart rate to intensity of that test and to evaluate the influence of environment on its changes. We also wanted to measure the time of the test on a sample of adults.

METHODS

In the research group there were 32 students of the Faculty of Physical Education and Sport (FPES) in the age of 22-26 years. One group involved men (n=14), the second group was built of women (n=18). The measurements took place in the swimming pool of FPES in Bratislava. The air temperature was 30 °C and the water temperature was 28 °C.

Test description: 100 Step test deep water – the tested person warms up shortly in deep water, to prepare for the test (vertical body position, all segments are in one line – head, shoulders, hips, heels), straightening knees, foot to pool bottom, active work of arms. At the start the person performs running steps, whilst 1 step means lifting knee of one limb to angle of 90° followed by straightening leg down and the same movement with other limb. After 100 steps the time is stopped and it represents the time needed for performing the test.

Equipment needed for test performance: aquajogger, hanging elastic rope (stabilization of space movement), stopwatch, and the test is performed without water shoes. The heart rate (HR) was measured by palpation during 30 seconds.

The process of measurement:

1.) HR after 3 minutes of sitting on land,
2.) HR after entering water in vertical position,
3.) Measuring time needed for 100 step test deep water performance,
4.) HR immediately after 100 step test deep water performance,
5.) HR 3 minutes after finishing the test in vertical position.

All data were analysed with respect to given tasks by mathematical – statistical methods (non-parametric Wilcoxon T-test) and then we used relation and logic analysis.

RESULTS

Reaction of HR on changes of environment in men's and women's groups is shown on figures 1 and 2. After entering water the HR decreased in men by 0.6 bpm. In women's group there was a slight increase in HR by 4.9 bpm. The monitored results were not statistically significant.

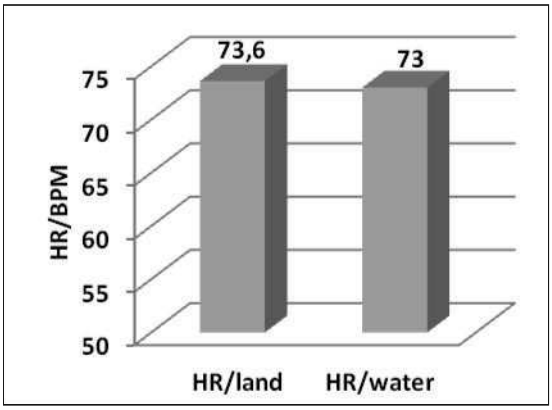

Figure 1
Reaction of HR to a change of environment (men)

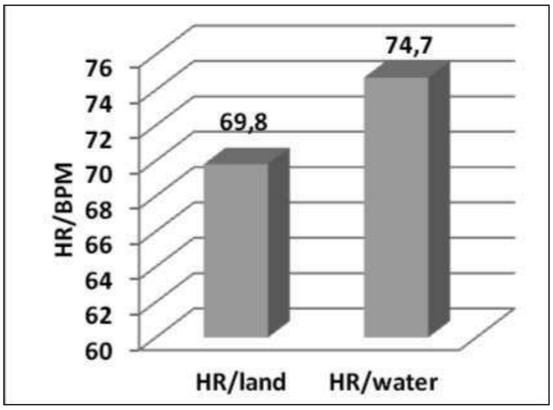

Figure 2
Reaction of HR to a change of environment (women)

After the test the average HR increased in men to 139.1 bpm. In comparison with HR measured after entering water it increased by 66.1 BPM and this difference was statistically significant ($p < 0.01$) (Fig. 3). In the group of women the average HR was 134.4 bpm after the test and in comparison with the starting HR in water it increased by 59,7 BPM ($p < 0,01$) (Fig. 4).

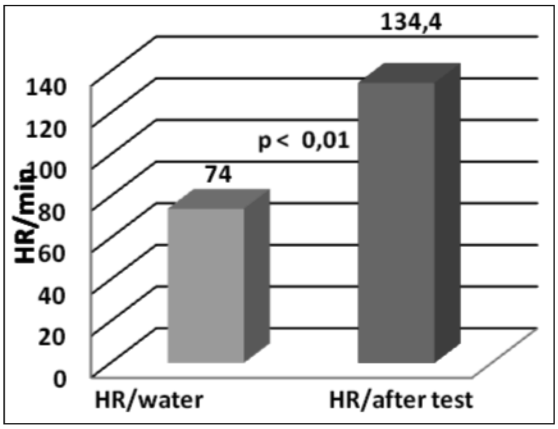

Figure 3
Changes in HR after the test (men)

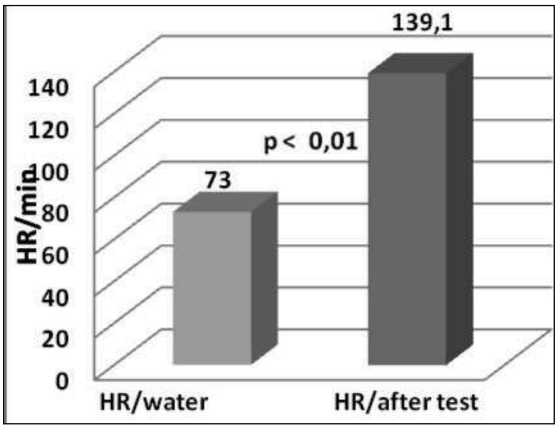

Figure 4
Changes in HR after the test (women)

A significant increase of HR suggests higher difficulty of the test. According to the average HR, the test was performed by most of the participants in aerobic zone of intensity. Some participants were performing in the mixed zone of intensity (Moravec et al., 2007; Perič - Dovalil, 2010; Gaines, 1993).

When we compared average values of HR immediately after the test and then after three minutes of rest we monitored a decrease of HR in men by 44, 8 bpm and in women by 50,5 bpm. The changes of values were statistically significant in both groups ($p < 0.01$) (Fig. 5 and 6).

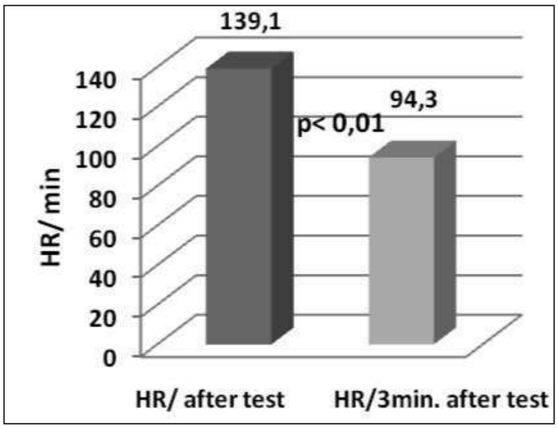

Figure 5
Changes of HR after a 3 min. rest (men)

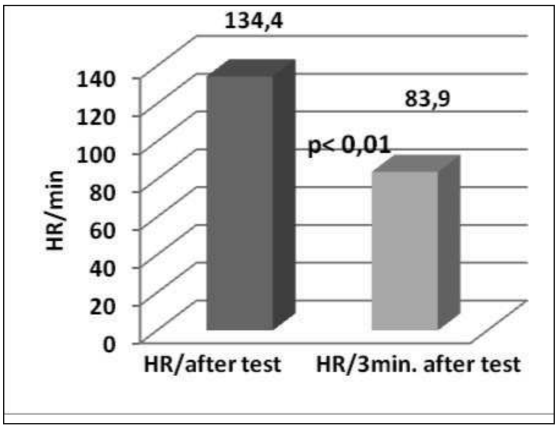

Figure 6
Changes of HR after a 3 min. rest (women)

A significant difference of values in HR immediately after the test and after 3 minutes rest shows the process of regeneration and reflects the fitness level of participants. For evaluation of suitable time of rest after the test we compared average values of HR in water before starting test and after the rest (Fig. 7 and 8).

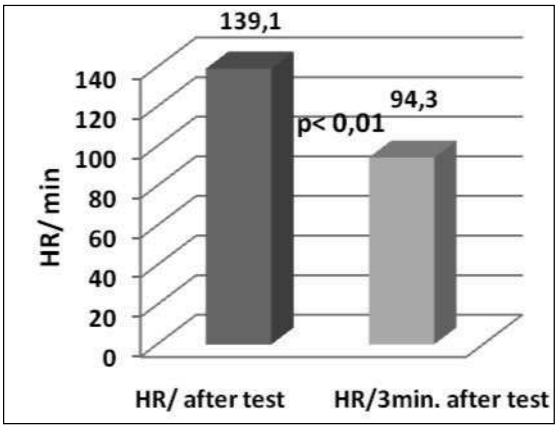

Figure 7
Changes of HR before test and after rest (men)

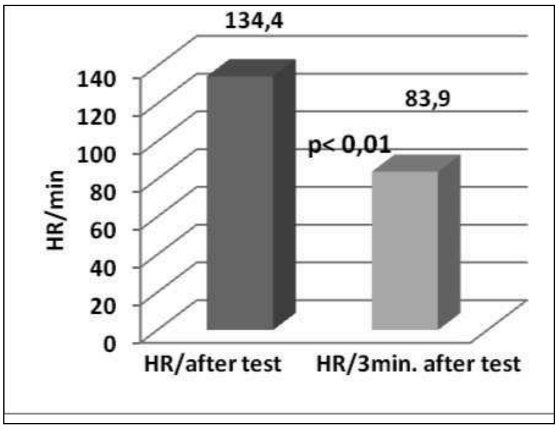

Figure 8
Changes of HR before test and after rest (women)

We found that in the men's group there was a stronger significant difference of average values before the test and after the rest ($p < 0.01$) than in the women's group ($p < 0.05$). Regarding our results we suppose that the group of men had higher level of fitness than women and in general the time of rest was not sufficient to achieve the same HR as at the beginning of the exercise. The average time needed for performing the test was in men 68.9 s and in women 72.46 s. In comparison to the results of study in American adult population (AEA, 2010), that presents time of the test 70 – 90 s, we can conclude a better performance in our monitored groups.

CONCLUSION

The intensity of the test caused significant changes in HR and represented aerobic or mixed character of intensity for the participants. The decrease of HR after resting period was significant in both groups and was higher in men than in women and it suggests a better fitness level of men. We did not find significant influence of the environment on HR, what could have been caused by similar difficulty of positions in which we measured the HR (sitting on land and hanging in water) regarding the cardiovascular system, time interval during which the participants could not manage to adapt to water environment or with certain sign of prestart stress. The time achieved in the test was in our group better in comparison to American population. Following our research results we consider the 100 Step test deep water suitable for monitoring physical fitness in water environment of various population groups.

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