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Original Article

Specific vs. non-specific performance tests in triathlon - swimming

JIŘÍ SEIDL [1], MARTIN PUPIŠ[2] , JIŘÍ SUCHÝ[3]
[1,3] Charles University in Prague, Faculty of Physical Education and Sport, Czech Republic
[2] Center of Sports, Department of the Interior, Czech Republic
[3] Department of Physical Education and Sports Faculty of ATS Matej Bel University Banská Bystrica, Slovakia

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Abstract:
Problem Statement: Must triathlon field performance tests reflect triathlon specificity? Approach: Seven female triathletes performed a standard swimming test (standalone 800 m free style) and a modified swimming test (i.e., 800 m free style 1 minute after 200 m freestyle) a week later. Purpose: To compare specific and non-specific field performance tests of swimming in triathlon. Results: Although the times achieved in both tests for 800 m swimming were significantly different, they were also very strongly correlated. Very strong correlation was also found between times for 200 m free style performed as a part of the modified test and personal best times for 200 m free style. Conclusions: Although the modified swimming test has been suggested to simulate specificity of triathlon (traditional rush to the first buoy) it provides equivalent information as the standard standalone test.
Key words: triathlon, swimming test, talent, development system, performance potential.

Introduction

In order to allocate funding and resources effectively, national sporting organisations generally implement comprehensive talent identification and development programs (Allen, Vandenbogaerde, Hopkins, 2014). A key element of all such programs is a set of benchmark performance tests used both for talent identification and selection, i.e., for monitoring the performance progress. The tests are thus a tool for pruning the pool of athletes into popular pyramidal shape of talent development systems through which the true talents ascend towards the pinnacle while hopefully allowing also the horizontal transfer of talents between sports (Gulbin, Weissensteiner, Oldenziel, 2013). For talent identification, especially for early ages, performance tests are combined with physiological, anatomical, and psychological tests in order to eliminate the effect of previous training or of the individual pace of growing up and to obtain information on genetically predetermined performance potential (Bottoni, Gianfelici, Tamburri, Faina, 2011). The performance tests become dominant as athletes become older. The reason is that the performance culminates at certain age window prior to which an athlete has to undergo certain volume of training in order to achieve maximum performance (Allen, 2014). "Late bloomers" must have trained in other sports; sole inherited talent is not enough (Gulbin, 2013).

Sophisticate laboratory tests combining performance with cardio-respiratory or biochemical indicators, resulting in various threshold or maximal values, seem to be the right choice for the benchmark tests since they provide more substantiated information (Pupišová et al., 2012). Nevertheless, their wide-spread application in talent identification and selection is prevented by several factors both practical ones, such as the use of necessary equipment or well-trained staff, and theoretical ones, such as dependence on a used protocol or lack of adequate theory for interpretation. Thus, for example in triathlon, which is investigated in this paper, the swim and run field tests are the key juvenile-athletes tests used by national triathlon organizations (Bottoni, 2011).

Triathlon is a sport in which swimming, cycling, and running legs are performed in a continuous fashion in that order. Lengths of individual legs vary. Olympic distance triathlon, which is of most interest for national triathlon organizations, consists of 1500 m swimming, 40 km cycling, and 10 km running. Sprint triathlon, comprising half of those distances is a standard for adolescents and is increasingly raced by adults as well. Competitive triathlon formats do not provide enough reproducible conditions for benchmark testing because they consist of open-water swimming and road cycling and running. Therefore adolescent benchmark tests consist usually from 200 to 800m swimming in a pool and from 2 km to 5 km running on a track (Schäfer, 2011). Cycling is usually omitted; it is more difficult to standardize and is believed to require general endurance already tested by running and to be possible well developed at later age. On the other hand, it is generally recognized that triathlon is not a simple sum of three independent sport performances (Bentley, Millet, Vleck, McNaughton, 2002).

Besides the basic fact that triathlon consist of three sports done in a succession connected by transitions, there are other specifics given by the triathlon rules and venues, such as use of swim-suites in cold water, legal drafting in cycling, strong variability of profile and technicality. In view of that the USA national triathlon

Corresponding Author: JIŘÍ SEIDL, E-mail: jiri.seidl@volny.cz

organization modified swim and run test administered to juvenile triathletes. The modified swimming test consists of 200m free followed by 800 m free after 1 minute rest. The rationale is that swim in sprint and standard triathlon starts traditionally by rush in order to achieve the best position possible and to get to the first buoy among first competitors and thus to avoid customary fight costing precious energy. In the modified run test, the run is preceded by 30 minutes of cycling in order to account for the effort that athletes have to put into the bike leg of a triathlon prior to the run (USAT, 2012).

There is little doubt that times for 800 m free swim after 200 m free will be significantly slower than in 800 m only. Similar consideration applies to the running test as well. This is, however, not enough to justify replacement of standard tests. In order for that, the modified tests have to bring different information than the standard tests, information more relevant to triathlon performance. Therefore we investigated the correlation between results in standard and modified swimming tests applied to a group of juvenile triathletes.

Material and methods

Subjects

Seven female subjects, students in a sport high school, all of them actively participating in triathlon competitions on a regional or national level, volunteered to take part in the study. Their swimming performance corresponded at least to an entry level to youth or junior female triathlon national teams of European countries. The purpose and organization of the study were explained to each subject before written informed consent was obtained. The protocol was approved by the ethics committee of Faculty of Physical Education and Sport, Charles University in Prague. Average values of relevant subject characteristics are given in Table 1.

Table 1. Characteristics of the 7 subjects that participated in the study

	Average	SD
Age (years)	17.71	3.15
Height (cm)	168	4.9
Weight (kg)	67.0	7.4
BMI (kg/m^2)	23.7	2.5
200 m -best time	2:23	0:10
800 m -best time	11:03	0:33

Experimental sessions

Each subject participated in two sessions separated by one week. Subjects were asked to refrain from strenuous physical activity for 24 hours prior to each session, otherwise to maintain their normal daily regime.
Session 1 *Modified swimming test.* After standard warm-up (500 m) and 10 minute rest, subjects executed 200 m free style swim with a dive start in a long-course pool trying to do that in the shortest time possible. While remaining in the pool, they rested for 1 minute then executed 800 m free style swim with a push start trying to do that in the shortest time possible. Both times were recorded.
Session 2 *Standard swimming test.* After standard warm-up (500 m) and 10 minute rest, subjects executed 800 m free style swim in a long-course pool trying to do that in the shortest time possible. Achieved times was recorded.

Results and discussion

Average times and standard deviations for standard and modified swim tests are given in Table 2. It is seen that the average time for 800 m freestyle was longer in the modified test than in the standard one. In order to find whether the difference is a statistically significant the pair t-test was used because both tests were applied to the same group of subjects. Indeed, it was found that the difference is statistically significant on the level 5%.
Table 2. Results of standard and modified swimming tests

	Average	SD
Standard test		
800 m	11:15.3	0:28.7
Modified test		
200 m	2:29.8	0:09.5
800 m	11:21.9	0:31.4

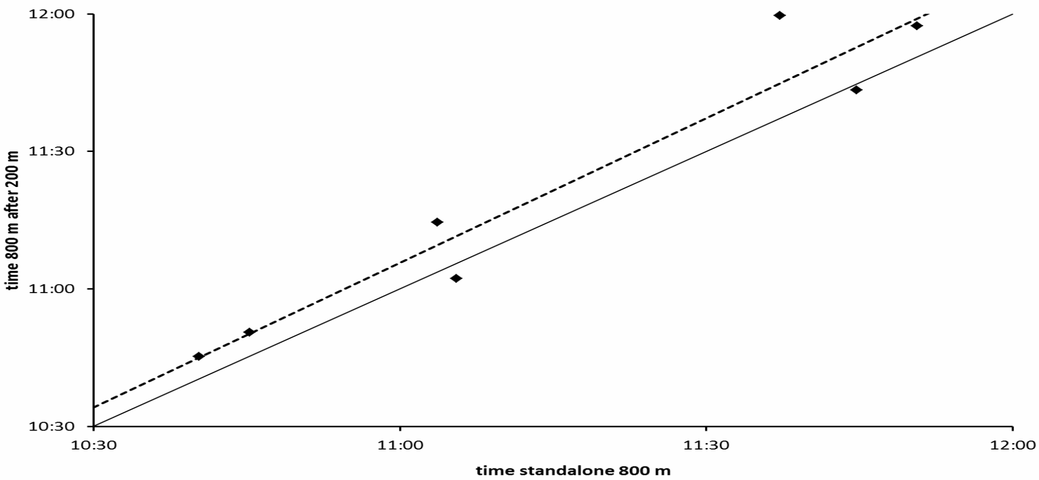

Fig. 1 Correlation between times for 800 m free style swam standalone and immediately after 200 m freestyle. Full line is an identity line; dotted line is a regression line

The times for 800 m obtained in standard and modified swimming may be significantly different and yet bear similar information if they are strongly correlated. The relation between times of 800 m swim alone and after 200 m swim is depicted in Figure 1. The value of the correlation coefficient is given in Table 3. Its interpretation can be based on standard categorization (Taylor, 1990) in which absolute values of correlation coefficient ≤0.35 are considered to represent low or weak correlations, 0.36 to 067 modest or moderate correlations, and 0.68 to 1.0 strong or high correlations. Absolute values of correlation coefficient above 0.90 then represent very high correlations. Thus the correlation between times for 800 m obtained in standard and modified swimming is very high, which means that in general standalone swimming 800 m gives similar information as swimming after 200 m sprint, of course after some rescaling.

Table 3. Correlation between various swimming times

		correlation coefficient
800 m standalone	800 m combined	0.964
800 m combined	200 m combined	-0.221
800 m standalone	200 m combined	-0.226
800 m best	200 m best	0.015
200 m best	200 m combined	0.983

The additional time is measured in the modified test, i.e., that for 200 m freestyle. Is it possible to get some additional relevant information from it, which is not already contained in the time for 800 m? The correlation between times for 200 m swim performed as a part of the modified test and for 800 m either performed either standalone or as a part of the modified test is very weak and thus some additional information should be conveyed by times for 200 m swim. But the correlation is not only very weak but also negative and that is surprising because swimmers usually are capable to perform well in a wide span of distances, much wider than for example runners. One explanation may be in motivation of subjects. Knowing that the 800 m swim follows 1 minute after 200 m, they may swim 200m slower to save energy, which then utilize in 800 m swim. Nevertheless, the correlation between 200 m of a modified test and standalone 800 m is almost identical to that for the modified test. The correlation coefficient between subjects' best times for 200 m and 800 m is negligible while the correlation between best times for 200 m swim and for 200 m modified test swim is very high. Thus the lack of correlation between times for 200 m and 800m is not related to the design of a modified test. In order to determine whether this is specific for the investigated group of subject, the correlation coefficient was calculated for the first sixty female swimmers listed in the year 2013 performance tables of the Czech Swimming Federation both for 200m and 800 m free style. A calculated value 0.599 indicates moderate correlation.

So, times for 200m swim carry somewhat different information than times for 800 m. The question is how to use this additional information. The authors of the modified test from USAT (2012) provided cut-off times defining various performance levels for both distances. The reason for their particular choice of cut-off values for 200 m is, however, somewhat obscure because according to them the introductory 200 m should be - on average - swum by the same speed as the following 800 m. For some performance levels, even 200 m slower than 800 m is required. Nevertheless, this glitch does not affect the general scheme of the modified test as is examined in this paper. It would be useful to aggregate these two times to one criterion. The simplest way is to sum these two times; however, a late arrival to the first buoy is strongly penalized in following swim – not only unnecessary fight on the first buoy costs time and energy but also the opportunity to draft behind a better swimmer is missed. Therefore, the 200 m time should be taken with weight greater than 1 or some other mathematical form of aggregation of these two times should be used. This is, however, beyond the scope of this paper to search for an appropriate multiplication factor or a mathematical form.

Conclusions

Very high correlation between times for 800 m swim achieved in the modified test and standard standalone tests shows that both tests are equivalent as far as endurance ability is concerned. Low correlation between times for 200 m swim as a part of modified test and times for 800 m indicates that times for 200 m swim may provide some new information; however, the time for 200 m needs not to be obtained from the modified test because of a very high correlation between times for 200 m swim achieved in the modified test and personal best times. Moreover, at this point of time it is not clear whether and how this additional information is related to the triathlon performance.

Thus although the rationale behind the modified swimming test appears sound and appealing the modified test does not provide any additional information than two standalone tests of 200 m and 800 m. Even though this conclusion cannot be generalize for other specific triathlon field performance tests such as running described above at the present moment, it is obvious that the superiority of any proposed performance test based on triathlon specifics should not be taken for granted and has to be verified independently.

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