Comparison of the results of the 15-meter sprint swimming (TT-15) with the results of the hundred-meter race for professional swimmers: potential and limits of applicability of the assessment at short distance

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V.S. Zaitsev[1]
I. Molina[2]
[1]State Budgetary Educational Institution of the City of Moscow "Center of Sports and Education 'Sambo-70' of the Moscow Sports Department", Moscow, Russia
[2]"DCS Swimming", Douglasville, GA, USA

Corresponding author: ztsvlad@gmail.com

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Abstract

Objective of the study. The present study focuses on analyzing the correlation between the results of the TT-15 test (the speed of overcoming 15 meters after pushing off the wall) and the time shown by high-class swimmers when swimming 100 meters crawl in a short 25-meter pool. TT-15 is a method of measuring the time it takes for an athlete to cover a 15-meter distance after completing a turn. The initial hypothesis was that the use of TT-15 in the training process could become an effective way to assess the physical fitness of swimmers, predict their results at a distance of 100 meters and make the necessary adjustments to training plans.

Methods and structure of the study. The study involved 30 qualified swimmers whose results in the 100-meter freestyle in a 25-meter pool corresponded to 800 or more points according to the World Aquatics Point Scoring 2024 rating system.

Results and conclusions. The results of the analysis revealed a statistically significant positive relationship ($r = 0.65$, $p < 0.001$) between the time spent on the 15-meter segment after the turn and the total time of the 100-meter swim. This allows us to consider TT-15 as an easily applicable tool for tracking swimmers' fitness levels, predicting competitive results, and optimizing the training process. TT-15 can be especially useful during the competitive period, when operational monitoring of physical condition and timely adaptation of the training program are crucial. However, the limitations of the study, such as the small sample size, lower relevance for long-distance swimmers, and the lack of research in the 50-meter pool, indicate the need for further research in this area.

Keywords: *correlation, TT-15 test, high-class swimmers, time measurement method, physical fitness, prediction of results.*

Introduction. In swimming, especially in the 100-meter freestyle, athletes do not have time to recover from ineffective turns, making high-quality turns and the subsequent 15 meters of the distance crucial [4, 8]. This is confirmed by research indicating that an effective turn can compensate for the natural decrease in speed during surface swimming. Swimmers who can maintain high speed after a turn demonstrate better results at international competitions [3]. However, athlete training does not always include accessible and objective methods for assessing and monitoring athlete readiness.

This study aims to identify the opportunities and limitations of using the 15-meter Turn Test (TT-15) to predict results and improve the quality of swimmer training. The data obtained have the potential for practical application in the sports training system and may be useful for further research in the field of sports physiology and swimming methodology.

Methods and Organization of the Study

Participant Selection. The study involved 30 highly qualified swimmers specializing in the 100-meter freestyle. The selection criterion was achieving a result of 800 points or more according to the World Aquatics Point Scoring 2024 classification in the 100-meter freestyle in a 25-meter pool. Furthermore, the swimmer had to have achieved or exceeded a time equal to 800 points in this distance at least four times

in the last two years. For each participant, only results from official competitions using an electronic timing system were considered (from official competition protocols).

Experimental Procedure. The swimmer approached the turn freestyle at competitive speed and performed a tumble turn. Timekeeping began the moment their feet touched the wall. The swimmer then performed a push-off and a standard underwater breakout for a distance of no more than 15 meters (according to World Aquatics competition rules). If the breakout was shorter than 15 meters, the swimmer continued swimming freestyle at maximum speed to the 15-meter mark. Time was stopped as soon as the swimmer crossed the 15-meter mark. This constitutes the essence of the 15-meter Turn Test (TT-15).

Each participant performed 3 attempts with a 20-minute interval of active rest (low-intensity swimming) to minimize the influence of fatigue. The average time across 3 attempts was used for analysis.

After completing the TT-15, the results were processed and then compared with existing data on the time spent on the 100-meter freestyle distance.

Condition Control. Participants in the experiment were familiarized with the essence and rules of the test (in oral and written forms). All tests were conducted under identical conditions in a 25-meter pool: the water temperature was maintained at 27°C, and before the start of the test, each participant performed a standard warm-up on land and in the water for 20 minutes each. Time was monitored by 3 researchers with identical Seiko S141 electronic stopwatches for accurate recording of the 15-meter split time. All data were recorded on tablets with subsequent electronic processing, which eliminated the possibility of human error during recording.

For the accuracy of measurements at the 15-meter mark, markers were installed at the bottom of the pool and along the pool wall. The markers were brightly colored and visible to both the swimmer and the researcher, which contributed to the accurate tracking of progress in the underwater phase.

Data Analysis Methods. To assess the relationship between the TT-15 time and the 100-meter distance results, the following were used: average time in the 15-meter segment after the turn, standard error, Pearson correlation coefficient, significance test, regression analysis, graphical analysis, and residual analysis.

Research Results. Data analysis showed a statistically significant positive correlation between the 15-meter Turn Test (TT-15) time and the final time over the 100-meter distance ($r=0.65$, $p<0.001$). It was also revealed that athletes who demonstrated the best time in the 15-meter segment also showed higher results over the 100-meter distance. This confirms the hypothesis that a short distance test can serve as an indicator of the current physical shape and readiness of athletes for competitions.

Data on 100-meter Distance Results and the TT-15. Results for the 100-meter distance ranged from 45.97 to 48.30 seconds, with an average time of 47.64 seconds (*Fig. 1*). Results for the TT-15 ranged from 6.78 to 7.46 seconds, with an average time of 7.24 seconds (*Fig. 1*). The standard error was 0.10 seconds.

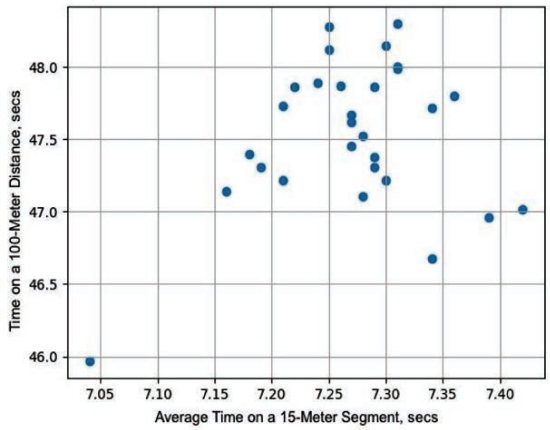

Fig. 1. Average Time on a 15-Meter Segment and Time on a 100-Meter Distance

Pearson Correlation Coefficient. The coefficient between the average time in the 15-meter segment and the 100-meter distance time was $r=0.65$. This indicates a moderate positive correlation between these indicators.

Significance Test. The test results showed a p-value < 0.001. This allows us to conclude that the observed relationship is statistically significant and not random.

Regression Analysis. Multiple linear regression showed that the time in the 15-meter segment after the turn has a significant impact on the final result over the 100-meter distance. The linear regression model confirmed that an improvement in the 15-meter segment time correlates with an improvement in the overall 100-meter distance time (*Fig. 2*).

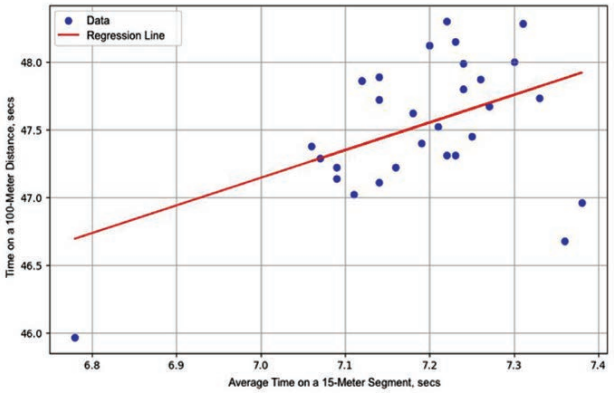

Fig. 2 Linear Regression

Graphical Analysis. Scatter plots clearly demonstrate the trend of positive correlation between the average time in the 15-meter segment and the 100-meter distance time. This is a visual confirmation of the numerical analysis.

Residual Analysis. Residual analysis of the regression model showed that the model adequately describes the data without systematic deviations, which confirms the reliability and accuracy of the results obtained.

Discussion. The results obtained emphasize the importance of the 15-meter Turn Test (TT-15) as a tool for monitoring swimmers' readiness. The statistically significant positive correlation between the TT-15 time and the 100-meter distance result indicates that this test allows for predicting competitive results and adjusting the training process.

A simple and accessible test was chosen to evaluate the effectiveness of the turn, which allows for assessing the quality of the turn without the use of complex equipment. The test also allows for comparison of all participants without considering differences in approaches to the turn, which is especially important since athletes can perform the approach to the turn, tumble turn, and push-off at various speeds and at different distances from the wall, depending on their anthropometric data.

The effectiveness of the turn is assessed through the speed of covering 15 meters after the turn. The higher the quality of the turn, the higher the speed over the entire segment after the turn. In this study, the approach speed to the turn, the distance at which the swimmer performs the tumble turn, and the speed of the tumble turn itself played a less significant role, as the main focus was on the speed of covering the 15-meter segment after the turn.

However, the study has several limitations. Firstly, a short distance test may be less informative for distance swimmers, where endurance and distance pacing tactics may become key factors. Secondly, the study sample consisted of 30 swimmers (due to the rigor of selecting highly qualified participants), which may limit the generalization of the results to a broader sample. Thirdly, the informativeness of the test for distances in a 50-meter pool has not been investigated.

Despite these limitations, the results of the study confirm the feasibility of including the TT-15 in the swimmer training system, which can significantly improve their competitive effectiveness and the quality of the training process.

Conclusions

1. The study confirmed a statistically significant positive correlation between the time in the 15-meter segment and the 100-meter distance time ($r=0.65$, $p<0.001$). This allows the TT-15 to be used as a tool for monitoring swimmers' readiness.
2. The TT-15 can serve as an effective indicator of physical shape and the quality of turn execution and the underwater phase.
3. Incorporating the TT-15 into the training process will enable coaches to promptly identify changes in athletes' condition and adjust training plans [6, 8].
4. The limitations of the study (small sample size, lower informativeness for distance swimmers, lack of investigation in a 50-meter pool) necessitate further research.
5. The results emphasize the importance of developing methods for monitoring swimmer readiness using short distance tests to improve their competitive effectiveness [2, 7].

References

1. Barbosa A.C., Valadão P.F., Wilke C.F., de Martins F., Silva D.C.P., Volkers S.A., et al. The road to 21 seconds: a case report of a 2016 Olympic swimming sprinter. Int. J. Sport Sci. Coach. 2019. No.14(3). C. 393–405.
2. Marinho D.A., Barbosa T.M., Neiva H.P., Silva A.J., Morais J.E. Comparison of the start, turn and finish performance of elite swimmers in 100 m and 200 m races. J. Sport Sci. Med. 2020. No.19(2). C. 397–407.
3. Morais J.E., Barbosa T.M., Arellano R., Marinho D.A. Start and turn performances of elite sprinters at the 2016 European Championships in

swimming. Sport Biomech. 2019. No.18(1). C. 100–114.
4. Morais J.E., Barbosa T.M., Forte P., Bragada J.A., Flávio A., Castro D.S., et al. Stability analysis and prediction of pacing in elite 1500 m freestyle male swimmers. Sport Biomech. 2020. DOI: 10.1080/14763141.2020.1810749.
5. Morais J.E., Barbosa T.M., Neiva H.P., Marinho D.A. Stability of pace and turn parameters of elite long-distance swimmers. Hum. Mov. Sci. 2019. No. 63. C. 108–119.
6. Muniz-Pardos B., Gomez-Bruton A., Matute-Llorente A., et al. Swim-specific resistance training: a systematic review. J. Strength Cond. Res. 2019. №33(10). C. 2875–2881. PubMed ID: 31343554. DOI: 10.1519/JSC.0000000000003256.
7. Nicol E., Ball K., Tor E. The biomechanics of freestyle and butterfly turn technique in elite swimmers. Sport Biomech. 2019. DOI: 10.1080/14763141.2018.1561930.
8. Schumann M., Notbohm H., Bäcker S., Klocke J., Fuhrmann S., Clephas C. Strength-training periodization: no effect on swimming performance in well-trained adolescent swimmers. Int. J. Sports Physiol. Perform. 2020. No.15(9). C. 1272–1280.
9. World Aquatics. Competition Regulations February 2025 [Electronic resource]. URL: https://resources.fina.org/fina/document/2025/02/20/1ca1fb93-2f58-4b21-a790-9374c51bfdca/Competition-Regulations_February-2025_Clean-Updated-on-20.02.2025-.pdf (date of request: 14.03.2025).
10. World Aquatics Point Scoring Classification 2024 [Electronic resource]. URL: https://www.worldaquatics.com/swimming/points (accessed: 14.03.2025).