Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XXIII, ISSUE 2 Supplement, 2023, Romania
The journal is indexed in: ERIH PLUS, Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

**Science, Movement and Health, Vol. XXIII, ISSUE 2 Supplement, 2023**
**September 2023, 23 (2): 496-502**
**Original article**

# THE EVALUATION BY MODERN MEANS OF REACTION SPEED IN ELITE FENCING

**TĂTĂRAN AMALIA[1], TEODORESCU SILVIA[2], APOSTU MIHAELA[3], OANA MARIA BALTAG[4]**

**Abstract**

*Aim.* This study aims at designing and validating a training plan in order to increase the reaction speed for female epee fencers in the national team of Romania.

Methods of research: The evaluation of the reaction speed was done with the Witty device during an arm stretch from the guard position (simulation of the right blow), but also during the right fling attack. Two type of tests were applied: Witty Green test and Witty Red test. It is analyzed the moment of touch of the sensor and the duration of the stimulus. The data recorded include the temporal parameters of the reaction response, the speed of execution, the precision and coordination of the movement model. The research sample consists of 14 fencers, the average age at the time of the first test being almost 21 years.

*Results*. Statistical processing for Witty Green parameters: Time, Gap, Lap and GapLap were performed by applying the t test for pair variables, comparing the initial results with the final ones. For all these parameters, there were statistically significant differences between initial and final values. Thus, statistical t > t critical for pair variables, and p value<0.05.

Statistical processing for the parameters Witty Red Time, Gap, Lap and GapLap used the t test for pair variables. Statistically significant differences between initial and final values were achieved in the Gap and GapLap indicators; thus, statistical t > t critical for pair variables, and p value<0.05. The Gap average fell from 15.52 to 5.73, and the GapLap average fell from 1.69 to 0.87.

*Conclusions*. In tests carried out with Witty devices, the obtained values demonstrated statistically significant differences, thus, the result can be extrapolated to the entire statistical population.

*Key words:* fencing, witty test, reaction speed

## Introduction

Fencing involves a series of explosive attacks, characterised by low-intensity movements and periods of recovery, in which perceptive and psychomotor abilities predominate (i.e. the ability to respond quickly and appropriately to the actions of an opponent). There is a great need for defense and attack repeatedly and often engage in a perfect transition between the two (counter-attack). Due to the training process and characteristic movements during an assault, Czajkowski (2005) believed fencing is a sport in which reaction time plays an important role in achieving high performance. From a mechanical point of view, speed is manifested in a ratio between time and space, being a determining capacity in several sports, such as: sprint, judo, boxing, and fencing. Balko et al., (2016) says speed is the ability of an athlete to perform and complete a movement in the shortest possible time and that reaction speed is one of its decisive components. The rapid reaction is closely related to visual processing, muscle coordination during movement, sense of touch, technical-tactic abilities and optimal mental state, influences performance in fencing. To successfully complete an attack, the fencer must react as quickly as possible to the actions of the opponent (Milic & Jancievic, 2020). Fantasising attack is most commonly used in fencing, and Guan et al., (2018) mentions that its speed is considered critical for success.

Torun et al., (2012) stated that among all the forms of speed manifestations encountered in fencing (reaction, execution, displacement) it can be said that reaction speed and speed of execution prevail in published research. In the literature, there is a wide range of studies on the speed of reaction in fencing, but none confirm that a particular type of training program is the most effective for improving it, instead, Poenaru S. (2002) mentioned in a specialised book that changing the reaction time to one and the same athlete is an indicator of the appearance of mental or physical fatigue or, on the contrary, of the installation of the sporting form. A short reaction time is a sign of a good sporting form, and he also mentions that in a state of fatigue the reaction time decreases by 20 % — 30 %.

Reaction time can be defined as the time that passes from the onset of a stimulus to obtaining a response and it is considered a good measure to assess the cognitive system's ability to process the information (Jensen 2006; Kuang, 2017)".

1 National University of Physical Education and Sport, Bucharest, Romania
2 National University of Physical Education and Sport, Bucharest, Romania
3 National University of Physical Education and Sport, Bucharest, Romania
4 National University of Physical Education and Sport, Bucharest, Romania

**Objectives**

This study aims at designing and validating a training plan in order to increase the reaction speed for female epee fencers in the national team of Romania.

**Methods**

The evaluation of the reaction speed was done with the Witty device during an arm stretch from the guard position (simulation of the right blow), but also during the right fling attack. It is analyzed the moment of touch of the sensor and the duration of the stimulus. The data recorded include the temporal parameters of the reaction response, the speed of execution, the precision and coordination of the movement model.

The reaction time depends on the speed of the sensor motor cycle, consisting of the detection of the initial stimulus, the transfer of information through the related nerves, the generation of the response from the central nervous system and the final response (Adleman et al., 2016, Greenhouse et al., 2017).

**Description of the Witty — Green Test**

This test tracks the speed of reaction of athletes to visual stimulus from a guard position. The 10 cameras with photocells were mounted on individual stands at a relatively small distance from each other, on a surface of about 1 m².

At the start of the test, the athletes will sit in front of the stands, in the specific guard position with the unarmed handy arm and will spot the green LED that will appear on one of the 10 devices. When Witty displays the first LED, the athlete spots it and will point her arm that is in a sixt position (guard) towards the green light on one of the 10 stands. Once it is able to extinguish it by touching the photocell, another photocell will be greened randomly (**Figure.1. The Witty Green Test**). After touching the green photocell, another will automatically appear on another stand and so on until the sportsmen reach all 20 green LEDs. As a sport based on reaction speed, we will be interested in the duration of the test to be as short as possible. When one LED displays the green color, the other photocells show nothing, being black.


Figure 1. Witty Green Test

**Description of the Witty — Red Test**

This test tracks the speed of reaction and execution to visual stimulus by lunge attack from a guard position. The position of the 10 photocells remained the same, with differences in how the test was applied. When starting the test, the fencer will sit in front of the stands at a greater distance from the previous test, in the specific guard position with the unarmed handy arm. At the start of the test all stands will display different red symbols (e.g.: 9, c, 3, b, d, 5, 0, 1, a, 2). Athlete must always spot the photocell indicating the letter "a" by touching the attack with lunge. Once the athlete has reached the first photocell "a" in the lunge position, she will have to return to the guard position and re-identify the stand

indicating the first letter of the alphabet (Figure 2**. The Witty Red Test**). All stands will have different symbols and the order in which they appear will be random. The same will be repeated until the athlete is able to complete the test with the 20 stimulus.

Figure.2. Witty Red Test

The research sample consists of 14 fencers, the average age at the time of the first test being almost 21 years, which confirms the generational change and the desire to homogenize a new team of world-class Romania, with perspective for the Olympic Games in 2024 and 2028. All 14 fencers are awarded at national level in different age categories, while more than half of them are also awarded in European and/or world competitions. Teodorescu S. (2009) mentions that the age at which the great performance in fencing is reached is between 22 and 28 years.

The subjects were evaluated before the start of pre-competitive training (initial assessment) and during the competition period (final evaluation).

**Results**

Statistical processing for Witty Green parameters: Time, Gap, Lap and GapLap were performed by applying the t test for pair variables, comparing the initial results with the final ones. For all these parameters, there were statistically significant differences between initial and final values. Thus, statistical t > t critical for pair variables, and p value < 0.05.

The following is noted: average Time increased from 10.13 to 11.42, average Gap increased from 1.29 to 5.19, Lap average increased from 0.53 to 0.60, and GapLap average fell from 0.24 to 0.18, data presented in **Table 1. Statistical values Witty Green Time, Table 2. Statistical values Witty Green Gap, Table 3. Statistical values Witty Green Lap** and **Table 4. Statistical values Witty Green GapLap**

Table 1. Statistical values Witty Green Time

| *T test* | *TimeGreen1* | *TimeGreen2* |
|---|---|---|
| Mean | 10.13 | 11.42 |
| Variance | 1.41 | 3.86 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.77 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 3.74 | |
| P(T <=t) one-tail | 0.00 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.00 | |

Table 2. Statistical values Witty Green Gap

| *T test* | *GapGreen1* | *GapGreen2* |
|---|---|---|

| | | |
|---|---|---|
| Mean | 1.29 | 5.19 |
| Variance | 1.41 | 19.49 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.38 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | —2.92 | |
| P(T <=t) one-tail | 0.01 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.01 | |

Table 3. Statistical values Witty Green Lap

| *T test* | *LapGreen1* | *LapGreen2* |
|---|---|---|
| Mean | 0.53 | 0.60 |
| Variance | 0.00 | 0.01 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.77 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 3.74 | |
| P(T <=t) one-tail | 0.00 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.00 | |

Table 4. Statistical values Witty Green GapLap

| *T test* | *GapLapGreen1* | *GapLapGreen2* |
|---|---|---|
| Mean | 0.24 | 0.18 |
| Variance | 0.00 | 0.01 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.59 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 2.98 | |
| P(T <=t) one-tail | 0.01 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.01 | |

Statistical processing for the Witty Red parameters: Time, Gap, Lap and GapLap used the t test for pair variables. Statistically significant differences between initial and final values were achieved in the Gap and GapLap indicators; thus, statistical t > t critical for pair variables, and p value<0.05. The Gap average decreased from 15.52 to 5.73, and the GapLap average fell from 1.69 to 0.87.

For the Time and Lap variables the differences were very small and insignificant statistically, so we cannot extend the obtained result to the entire statistical population. When repeating the test under similar conditions, it is possible to obtain different results. Average Time decreased from 52.77 to 52.34, and Lap average dropped from 2.78 to 2.75. The results can be found **in Table 5. Statistical values Witty Red Time, Table 6. Statistical values Witty Red Gap, Table 7. Statistical values Witty Red Lap** and **Table 8. Statistical values Witty Red GapLap**

Table 5. Statistical values Witty Red Time

| *T test* | *TimeRed1* | *TimeRed2* |
|---|---|---|
| Mean | 52.77 | 52.34 |
| Variance | 65.97 | 77.43 |

| | | |
|---|---|---|
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.23 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 0.12 | |
| P(T <=t) one-tail | 0.45 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.91 | |

Table 6. Statistical values Witty Red Gap

| *T test* | *GapRed1* | *GapRed2* |
|---|---|---|
| Mean | 15.52 | 5.73 |
| Variance | 65.69 | 34.23 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.14 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 3.92 | |
| P(T <=t) one-tail | 0.00 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.00 | |

Table 7. Statistical values Witty Red Lap

| *T test* | *LapRed1* | *LapRed2* |
|---|---|---|
| Mean | 2.78 | 2.75 |
| Variance | 0.18 | 0.21 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.23 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 0.12 | |
| P(T <=t) one-tail | 0.45 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.91 | |

Table 8. Statistical values Witty Red GapLap

| *T test* | *GapLapRed1* | *GapLapRed2* |
|---|---|---|
| Mean | 1.69 | 0.87 |
| Variance | 0.18 | 0.12 |
| The Observations | 14.00 | 14.00 |
| Pearson Correlation | 0.19 | |
| Hypothesied Mean Difference | 0.00 | |
| DF | 13.00 | |
| t State | 6.16 | |
| P(T <=t) one-tail | 0.00 | |
| t Critical one-tail | 1.77 | |
| P(T <=t) two-tail | 0.00 | |

**Discussions**

Athletes training is a complex educational process due to the many required stages, which influence each other (Mihăilescu et al., 2018). Following the processing of the results, it can be stated that all the data obtained can be prerequisites for the establishment and structuring of training programs. The innovative Witty SEM system technology allows accurate measurement of an athlete's motor skills potential, thanks to the parameters assessed: running speed, reaction time and temporal space orientation. The system software allows the design of advanced tests with high efficiency, such as reacting to an external stimulus during an activity. Therefore, the system can be used during recruitment and selection, following the degree of management of individual motor skills, general training and specific training of the athlete. According to specialists, the Witty SEM system can be used both in individual sports and in team sports (football, ice hockey, volleyball, basketball, etc.). Authors Kolodziej E., Jaworski J., Tchorzewski D. (2018) highlight that the applicative value of the Witty SEM system in sports training practice confirms its high efficiency in evaluating, controlling and optimising the athlete's potential motor skills, as well as the possibility of using it as a precise measuring device during scientific research. The Witty SEM measurement system can be a useful device for assessing motor coordination skills during movements of any type. At the same time, Porcari J., Bryant C., Comana F. (2015) states that reaction time is defined as the time that has passed from the onset of the stimulus to the execution of movement or the application of specific force, and that it is strongly dependent on perception skills and the ability to make decisions quickly. In order to respond appropriately to stimulus, subjects need information collected from the environment with the help of auditory, visual and somatosensory systems.

**Conclusions**

In tests carried out with Witty devices, the obtained values demonstrated statistically significant differences, thus, the result can be extrapolated to the entire statistical population. The trend generated by the degree of load and fatigue persists, with the execution time of the samples registering minor increases. Given that in both tests (initial and final), the fencers were in the training camp and it can be considered that this level of physical training was similar due to minor statistical differences. For the Witty Green test, the following were found: average Time increased from 10.13 to 11.42, average Gap increased from 1.29 to 5.19, Lap average increased from 0.53 to 0.60, and GapLap average decreased from 0.24 to 0.18; statistically significant data at a p value<0.05.

In the Witty Red test, the average Gap value decreased from 15.52 to 5.73 and the average GapLap value decreased from 1.69 to 0.87, with data statistically significant, p value <0.05. On the other hand, in the Witty Red test, the average Time dropped from 52.77 to 52.34, and the average Lap dropped from 2.78 to 2.75, which was not statistically significant. For the test of reaction speed and visual stimulus performance, although the results on time evolution were not statistically relevant, it can be observed that the average execution time however slightly decreased.

**Authors contribution**

All authors have equally contributed to the study.

**References**

Turner, A., Miller, S., Stewart, P., Cree, J., Ingram, R., Dimitriou, L., Moody, J., & Kilduff, L. (2013). Stress and conditioning for fencing. *Stress & Conditioning Journal*, 35(1), 1-9. https://doi.org/10.1519/SSC.0b013e31826e7283

Czajkowski, Z. (2005). Understanding fencing: The unity and practice. *Ska Swordplay Books*.

Balkó, Š., Zbigniev, B., & Simonek, J. (2016). The influence of different performance level of fencers on simple and choice reaction time. *Brasileira Magazine of Cineanthropometry e Desempenho Humano*, 18(4), 391-400. https://doi.org/10.5007/1980-0037.2016v18n4p391

Milic, M., Janicijevic, D., Nedeljkovic, A., Cuk, I., Mudric, M., & García-Ramos, A. (2020). Optimal instructions to maximise attack efficiency in beginners and experienced fencers. *Motor Control*, 25(2), 153-166. https://doi.org/10.1123/mc.2020-0065

Guan, Y., Guo, L., Wu, N., Zhang, L., & Warburton, D. (2018). Biomechanical insights into the determinants of speed in the fencing long. *European Journal of Sport Science*, 18(2), 201-208. https://doi.org/10.1080/17461391.2017.1414886

Torun, V., Ince, G., & Durgun, B. (2012). The effects of basic fencing studies and velocity training on reaction time in the 9-12-year-old beginners of fencing. *Sports Science*, 5(1), 59-66.

Poenaru R.S.(2002). Write or the art of defeat. *It's Ed. Printech*, Bucharest.

Reigal R.E., Barrero S., Martín I., Morales-Sánchez V., Juárez-Ruiz de Mier R. and Hernández-Mendo A., **(**2019), Relationships Between Reaction Time, Selective Attention, Physical Activity, and Physical Fitness in Children. *University of Málaga*, Spain, DOI: https://doi.org/10.3389/fpsyg.2019.02278

Teodorescu S. (2009). Training and Competition, Alpha MDN Publishing House

Mihăilescu L., Mihăilescu L., Mihai I.(2018) The management of some objective parameters used in performance sports diagnosis. *Edu World* 2018. https://doi.org/10.15405/epsbs.2019.08.03.204

Kolodziej E., Jaworski J., Tchorzewski D. (2018**)** Possibilities for applying the Witty Sem System in the diagnosis, optimisation and control of athletic training. Anthropomotoryka. *JKES 84* (28): 63-68

J., Bryant C., Comana F. (2015). Exercise Physiology. *F.A. Davis Company*. Philadelphia, USA