

Science, Movement and Health, Vol. XXIV, ISSUE 2, 2024
June 2004, 24 (2): 167- 172
Original article

IMPORTANCE OF THE INDIVIDUAL LESSON IN THE TECHNICAL-TACTICAL IMPROVEMENT OF FENCING ATHLETES

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Abstract

Aim. Technical-tactical improvement of the actions preferred by fencers in the individualized lesson for an efficient use in competitions.

Methods. 8 female fencers aged 14-16 years participated in the research. Physical test batteries were conducted at the beginning and at the end of the competitive year 2021-2022. Fitness tests included: *physical training* tests: SL - Standing long jump (cm); D - Spring; FA - Abdominal strength (reps / 1 minute); FG – Squat to lunge (reps/1 minute). *Technical-tactical training* tests: A.D. - Direct attacks (straight); A.C. - Compound attacks (intention 2), P.R. - Parry and Riposte. *Performance level* tests (indices): V.T. - Group stage victories; T.D. - Touches scored; T.P. - Touches received; V.E.D. - Direct elimination victories; R. - Direct result in competitions (C1) - Romanian Cup 2021; C2 - Satu Mare Cup 2022; C3 - Cadet Championship 2022. The coaches focused on 4 models of individual lessons, strongly customizing the reps number and the movement types percentage (offensive or defensive) for each subject. In order to check the evolution of athletes and their technical-tactical progress, 4 competitions were used as fitness tests.

Results. The comparative analysis results of physical preparation highlight an increase of 4.25 cm in SL ($p>0.05$) and 1.37 cm in vertical jump height ($p<0.05$), an increase by 2 reps in abdominal strength ($p<0.01$) and an improvement by 1.75 reps in squat to lunge ($p<0.05$). Comparative analysis of technical-tactical preparation indices across the three competitions reveals a decrease by 2.37 reps in A.D. at C2 and 0.38 reps at C3 ($p>0.05$), a decrease by 2.37 reps in A.C. at C2 and an increase by one A.D. at C3 ($p>0.05$), a decrease by 5 reps in parry and riposte at C2 and 3 reps at C3. Performance level results show equal victories in group stages ($p>0.05$), a decrease by 1.25 points in T.D. ($p>0.05$) and an increase by 6.62 points in T.P. ($p<0.05$). Regarding VED, there is an increase by 0.75 points in T.D. and 1.87 points in T.P. There are 62.12 points - total direct eliminations, variation of homogeneity ($p<0.001$) and between indices ($p>0.05$). Direct competition results show an increase by 4.58 points at C2 and a decrease by 11.98 points at C3, variation of homogeneity ($p<0.01$) and between competitions ($p>0.05$).

Conclusions. The results highlight the positive impact of specific training methods and the necessity for a personalized approach in fencers' training, emphasizing continuous adaptation and monitoring to optimize performance.

Keywords: Foil, technical-tactical actions, competitions, offensive and defensive movements, performance.

Introduction

Fencing, with a long and noble history, had a substantial evolution from basic forms of duelling and self-defence to a sophisticated and competitive sport. Recent research focused on this transformation, highlighting the importance of continuous training and extensive participation in competitions in order to develop and enhance the skills required in fencing (Alia et al., 2019). Fencing is a sport characterized by fast and intense movements. Therefore, it involves high demands regarding coordination, strength and precision due to its asymmetrical nature, an aspect revealed by recent studies that have demonstrated the impact of these requirements on the musculoskeletal system (Chen et al., 2017; Aresta et al., 2023).

The unique aspect of fencing lies in the direct confrontation with the opponent and the importance of tactics in the course of the bout. These elements distinguish this sport from others in terms of the technical and tactical skills that are essential for success (Czajkowski, 2011). The importance of tactics is supported by the complex sensorimotor skills required in fencing, which imply intuitive motor responses and rapid adaptation to the movements of the opponent (Czajkowski, 2012). Thus, the synthesis of recent research reveals that fencing represents a domain of sport where the development of sensorimotor and tactical skills is crucial for success in individual encounters.

Individual lessons in fencing constitute an essential component in the training of athletes. They provide a concentrated and personalized environment for the development of technical-tactical skills and psychological aspects of performance in this sport (Potop et al., 2020). This approach allows coaches to focus on the individual needs and styles of athletes, tailoring instruction to maximize the potential of each individual (Borysiuk & Waskiewicz, 2008). Through individual lessons, technical errors can be identified and corrected, personalized tactical strategies can be developed and the performance of athletes can be improved (Lavrenteva, 2017).

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In the context of modern competitions, where details make the difference between victory and defeat, individual lessons become crucial for perfecting movements and making quick and efficient decisions during the bout (Zadorozhna et al., 2020). This aspect is supported by the constant need to adapt training systems for meeting the evolutions in fencing and optimizing the performance of athletes (Semeryak et al., 2013).

Moreover, the psychological approach is an important element of preparation, and individual lessons provide a safe space for exploring and overcoming mental blocks and for developing the self-confidence of athletes (Roi & Bianchedi, 2008). Ultimately, the use of technology for analyzing and improving technical-tactical movements can effectively complement individual lessons. This contributes to the optimization of competitive performance in fencers (Campaniço, 2019).

The purpose of this work is to analyze and highlight the role of individual lessons in perfecting the technical-tactical skills of female fencers.

Methods

A number of 8 female foil fencers aged 14-16 years took part in the research. They had 6-7 years of experience in national competitions; they participated in 12-16 international competitions at least, out of which 2-3 participations in European and World Cadet and Junior Championships.

Batteries of physical fitness tests (Table 1) were conducted at the beginning and at the end of the competitive year 2021-2022 (the first test in July 2021 - the final test in April 2022, after the European Cadet and Junior Championships).

Physical fitness tests used:

Physical training tests: SL - Standing long jump (cm); D - Spring; FA - Abdominal strength (reps/1 minute); FG – Squat to lunge (reps/1 minute).

Technical-tactical training tests: A.D. - Direct attacks (straight); A.C. - Compound attacks (intention 2), P.R. - Parry and Riposte.

Performance level: V.T. - Group stage victories; T.D. - Touches scored; T.P. - Touches received; V.E.D. - Direct elimination victories; R. - Direct competition result. Competition (C1) - Romanian Cup 2021; C2 - Satu Mare Cup 2022; C3 - Cadet National Championships 2022.

Training program carried out:

During preparation, it was established that in the fundamental part of the training, besides the technical-tactical elements taught/executed/consolidated, the defining element should be the emphasis on individualization. The percentages of actions worked on in the lesson for consolidation, improvement, maximum utilization should be higher, while the new and less frequently used actions should have lower percentages. Throughout the research, the coaching team focused on 4 models of individual lessons, strongly personalizing the number of repetitions and the percentage of actions types (offensive or defensive) for each and every subject. To track the evolution of the athletes and their technical-tactical individual progress, the following competitions were used as fitness tests: C1 - competition 1 (Romanian Cup 2021); C2 - competition 2 (Satu Mare Cup 2022); C3 - the third competition (Cadet National Championships 2022).

Statistical analysis

The statistical analysis was carried out by means of the KyPlot software, using the following descriptive indices: mean, S.E.M. (standard error of the mean), S.D. (standard deviation), C.L.M. (confidence level of the mean) at 0.95, t-Test for paired comparison of means, ANOVA, t - Bartlett's Test for Homogeneity of Variance, F - Single Factor Analysis of Variance (Completely Randomized Design).

Results

The results of the physical training are presented in Table 1, highlighting the differences in descriptive indices and the comparative analysis of means between tests.

Table 1. Results of physical training (n =8)

Statistical indices	SL (cm)		D (cm)		FA (no. of reps)		FG (cm)	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
mean	194.5	198.75	29.25	30.62	21.62	23.62	24.37	26.12
S.E.M.	1.76	2.45	1.29	1.44	1.10	1.31	0.90	0.81
S.D.	4.98	6.94	3.65	4.07	3.11	3.70	2.56	2.29
C.L.M.	4.17	5.80	3.05	3.40	2.60	3.09	2.14	1.92
t	-2.39		-2.43*		-4.32**		-3.13*	
P _{value}	0.055		0.045		0.003		0.017	

S.E.M. – standard, error of mean; S.D. – standard deviation; C.L.M. - Confidence Level of Mean (0.95); t-Test - Paired Comparison for Means; SL – Standing long jump; D – Spring; FA – Abdominal strength; FG – Squat to lunge; * p<0.05; ** - p<0.01

The comparative analysis results show an increase in the length of the standing long jump by 4.25 cm in the final test, with no significant differences between tests at $p>0.05$ and a significant increase in vertical jump height by 1.37 cm ($p<0.05$). There was also an increase by 2 reps in abdominal strength ($p<0.01$) and the improvement of squats to lunge by 1.75 reps ($p<0.05$). These significant differences underscore the influence of specific means on the physical training of foil fencers within the individual lesson. In table 2 are listed the results of the technical-tactical tests of the fencers recorded in three competitions.

Table 2. Results of the technical-tactical training (n=8)

Statistics indices	A.D. (executions no.)			A.C. (reps no.)			P.R. (reps no.)		
	C1	C2	C3	C1	C2	C3	C1	C2	C3
mean	25.37	23.00	22.62	16.87	14.50	15.50	25.50	20.50	17.50
S.E.M.	2.19	1.99	2.59	1.74	1.54	1.21	2.57	2.09	1.87
S.D.	6.20	5.63	7.34	4.94	4.37	3.42	7.27	5.92	5.29
C.L.M.	5.19	4.70	6.14	4.13	3.65	2.86	6.07	4.95	4.42
t; P _{value}	0.48; 0.784			0.87; 0.645			0.69; 0.706		
F; P _{value}	0.43; 0.656			0.62; 0.548			3.38; 0.053		

S.E.M. – standard error of mean; S.D. – standard deviation; C.L.M. - Confidence Level of Mean (0.95); t - Bartlett's Test for Homogeneity of Variance; F - Single Factor Analysis of Variance (Completely Randomized Design); AD –direct attacks (straight); AC – compound attacks (intention 2) , PR – parry and riposte; C1 - Romanian Cup 2021; C2 - Satu Mare Cup 2022; C3 - Cadet Championships 2022.

The comparative analysis results of the technical-tactical training indices during the three competitions show a reduction of 2.37 repetitions in direct attacks at C2 and 0.38 repetitions at C3, with non-significant differences at $p>0.05$, a decrease in the number of compound attacks by 2.37 repetitions at C2 and an increase by one direct attack at C3 ($p>0.05$). There was also a decrease in parries and ripostes by 5 repetitions at C2 and 3 repetitions at C3. From the recorded technical-tactical actions, variations in compound attacks and reductions in direct attacks and parry-ripostes are observed, demonstrating the effectiveness of using specific means within individual lessons. Table 3 presents the performance levels obtained at the initial and final testing, for the three competitions.

Table 3. Performance level (n=8)

	V.T.G		T.D.		T.P.		V.E.D.			R				
	Initial	Final	Initial	Final	Initial	Final	Initial	TP	Final TD	TP	T.T.D.	C1	C2	C3
mean	3.87	3.87	21.75	20.50	7.75	14.37	38.00	27.50	38.75	29.37	62.12	15.25	19.83	7.85
S.E.M.	0.54	0.47	1.91	2.02	0.61	2.68	6.32	1.85	5.37	1.48	7.18	9.03	2.72	2.68
S.D.	1.55	1.35	5.41	5.73	1.75	7.59	17.8	5.23	15.2	4.20	20.3	25.5	6.67	7.10
C.L.M.	1.29	1.13	4.52	4.79	1.46	6.35	14.96	4.37	12.70	3.51	17.0	21.3	7.01	6.57
t; P _{value}	0.00; 1.00		1.13; 0.292		-2.95; 0.021*		148.2; 0.001***			12.76; 0.002**				
F; P _{value}	-		-		-		0.66; 0.623			0.84; 0.442				

S.E.M. – standard error of mean; S.D. – standard deviation; C.L.M. - Confidence Level of Mean (0.95); t-Test - Paired Comparison for Means; t - Bartlett's Test for Homogeneity of Variance; F - Single Factor Analysis of Variance (Completely Randomized Design); *- $p<0.05$; **- $p<0.01$; ***- $p<0.001$; V.T. – group stage victories; T.D. – touches scored; T.P. – touches received; V.E.D. - Direct elimination victories; R. - Direct result in competitions; C1 - competition 1 (Romanian Cup 2021); C2 - ("Satu Mare" Cup 2022); C3 - (National Championships for Cadets and Juniors 2022) .

The results of the comparative analysis between tests show an equality of group stage victories ($p>0.05$), a decrease in touches scored by 1.25 points ($p>0.05$) and an increase in touches received by 6.62 points ($p<0.05$). Regarding direct elimination victories, there is an increase by 0.75 points in touches scored and by 1.87 points in touches received, as well as by 62.12 points in direct eliminations, with significant differences in homogeneity variation ($p<0.001$) and non-significant differences between compared indices ($p>0.05$). As for the direct competition result, there was an increase by 4.58 points at C2 and a decrease by 11.98 points at C3, with significant differences in homogeneity variation ($p<0.01$) and non-significant comparative differences between competitions ($p>0.05$).

Discussions

The purpose of this study was to analyze and highlight the role of individual lessons in improving the technical-tactical skills of the female fencers.

The analysis of the results obtained from the initial and final tests shows the positive effects of using specific training methods within individual lessons for foil fencers. The detailed interpretation of the results for each test shows that although an increase in the length of the jump was recorded, it is not statistically significant enough to conclude

that the improvement is due to specific training. More training sessions or program modifications may be necessary to achieve noticeable results. The important increase in vertical jump height suggests that the training methods used had a positive effect on the explosive power of fencers. The important improvement of abdominal strength indicates that specific exercises to strengthen the abdominal muscles were effective. This improvement may contribute to better stability and control during sports performance. The greater number of lunges proves that fencers have developed better muscular resistance and technique in executing lunges, a crucial aspect of their performance.

The comparative analysis of the technical-tactical indices between the three competitions (C1, C2, C3) reveals changes in the technical-tactical approaches of the fencers. The analysis emphasizes the effectiveness of the specific methods used in individual lessons. The thorough interpretation of the results points out a reduction in the number of direct attacks that is observed in competitions C2 and C3. However, this decrease is not sufficient in terms of statistics to draw definitive conclusions. The decreasing trend may indicate a modification in attack strategy, perhaps to diversify the techniques used in competition. Variability in compound attacks, with a diminution in C2 and a slight increase in C3 reveals an adjustment of tactical strategies depending on the evolution of competitions and opponents. Even though these changes are not statistically significant, they reflect the adaptability of athletes to different combat situations. The reduction in the number of parries-ripostes in the competitions C2 and C3 could reflect an increased preference for proactive attacks rather than defensive responses. While these differences are not statistically significant, they suggest an approach change in the defensive tactics.

As for the comparative analysis of the technical-tactical performances and competitive results, it highlights significant and non-significant variations depending on the different aspects evaluated. No significant differences were recorded in the number of victories obtained in the group stage in the analyzed tests; this fact proves that there is consistency in the performances of fencers in this stage of the competitions. Although a slight decrease in the number of touches scored was observed, this one is not important in terms of statistics. This could indicate either normal variation or a slight decrease in the effectiveness of attacks, but not sufficiently strong to be statistically relevant. The noticeable increase in the number of touches received suggests a possible issue in the defense of fencers or a higher difficulty of the competition. This may indicate the need to improve defensive techniques. The slight increase in touches scored and touches received in direct eliminations is not statistically significant, but the variation in homogeneity indicates greater variability in performances. This shows that even if there are some improvements, performance consistency can vary significantly among fencers. Competitive results highlight improvement at C2 and a significant decrease at C3, indicating performance variability. The non-significant differences between competitions suggest that the observed variations have not sufficient significance to draw definitive conclusions about the overall effectiveness of the training program.

Following the analysis of specialized literature, several research directions and concerns regarding skills transfer in competitions, where developing the capacity to transfer skills from training sessions to competitions is essential, have been identified. This involves combining technique, rapid reactions, agility, tactics and psychological processes to build autonomy and quick decision-making (Szajna et al., 2019). As for the unconscious reactions and anticipation, experienced fencers unconsciously react to initial stimuli, so coaches should focus on anticipation to reduce muscle tension and enhance motor action efficiency (Borysiuk et al., 2024).

In terms of new technologies and simulators, the use of the "TTT" simulator for tactical thinking is proposed. There shall be also used the device for technical and tactical training and the device for improving the specific sense of the weapon (Briskin et al., 2014). Three multifunctional devices ("TTT," "Cub," and "Fencers' technical training device") are designed to enhance the technical, tactical and theoretical skills of the fencers through real-time feedback (Zadorozhna et al., 2020).

Concerning advanced techniques of analysis and prediction, it has been shown that the analysis of 2000 executions using Dynamic Time Warping has generated models with high prediction rates, indicating that the improvement of data sources can reduce future errors (Campaniço, 2019). Moreover, studies show that elite fencers have superior neuromuscular coordination, recommending to focus the training on explosive power. However, specific evaluation by gender and equipment remains inadequately researched (Chen et al., 2017). Another study deals with the identification of biomechanical indicators meant to improve the technical training of fencers. The study also analyzes the importance of personalized physical and technical preparation and the development of algorithmic diagrams for more efficient technical training (Pavel et al., 2023).

The relationship between metacognitive thinking and tactical performance in male and female fencers demonstrated that there are no significant differences between genders. An important correlation between metacognitive thinking components and tactical performance was found out (Hijazi & Ahmed, 2018). The effects of training by means of the ten-week S.A.Q. program improved the performance level of sabre fencers and their physical variables, revealing the importance of implementing these concepts in training (Mohamed & Larion, 2018; Nesen & Klimenchenko, 2022). In this regard, technical-tactical and physical training in young fencers led to the improvement of physical and technical-tactical indicators and competition performance in 8-10-year-old fencers, confirming the importance of physical and technical-tactical training and its influence on the results (Pavel et al., 2019; Potop et al., 2020). The influence of individualized training increased the technical-tactical and competitive performances of 16-19-year-old foil fencers,

with significant correlations between training and performance (Pavel et al., 2021). Other specialists identified relevant physical characteristics for fencing performance and evaluated the effectiveness of the periodized training programs to optimize these characteristics (Zadorozhna et al., 2018). It was also studied the importance of psychomotor factors, such as reaction time. In comparison with the somatic and psychophysiological factors, these factors have higher influence on sports mastery and success in competitions (Zbigniew & Dariusz, 2008).

Conclusions

In conclusion, the obtained results highlight several important aspects:

The significant differences observed in vertical jump height, abdominal strength and the number of squats to lunge underline the positive influence of specific training methods integrated into individual lessons. These findings point out the importance of a well-structured training program that includes specific exercises for developing essential skills in fencing.

Variability in the number of compound attacks and a diminution of direct attacks and parries-ripostes indicate an adaptation and optimization of the technical-tactical strategies of fencers. These adjustments can be considered effective within the context of specific training and individual preparation.

Comparative analysis of performances in fencers reveals variability in results and uneven improvements in different areas. This variability suggests the need for a more personalized approach to training to ensure consistent and balanced improvements for all athletes.

To maximize the performance of athletes, continuation of monitoring and constant adaptation of training programs are essential. Further studies with larger samples and long-term monitoring could contribute to confirming the effectiveness of these methods and optimizing competitive performance.

Acknowledgment

This study is part of the content of the doctoral thesis that aims to investigate the technical preparation of elite fencers based on biomechanical criteria. Additionally, we extend our gratitude to those who supported us in conducting this research: Coaches Sălișcan Virgil and Ana Pavel, Mr. Florea Marius - President of the Romanian Fencing Federation and Mrs. Roxana Bârlădeanu - General Secretary of the Romanian Fencing Federation, and last but not least, to the participating athletes.

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