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Motor directionality in cadet foil fencers: diagnosis, evaluation and analysis of its impact on performance

[Direccionalidad motriz en esgrimistas cadetes de florete: diagnóstico, evaluación y análisis de su impacto en el rendimiento]

[Direccionalidade motora em esgrimistas cadetes de florete: diagnóstico, avaliação e análise de seu impacto no desempenho]

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ABSTRACT

Introduction: Motor directionality is an essential visuospatial skill in combat sports, as it enables the orientation of movement and the anticipation of an opponent's actions.

Objective: To assess and analyze motor directionality in cadet-level foil fencers, evaluating its impact on competitive performance.

Methods: The sample consisted of 19 athletes – six female and thirteen males – who are actively involved in national school and youth-level competitions. Standardized tests, such as the Illinois Agility Test, along with specific rubrics for measuring postural stability, directional control, and technical precision, were applied across three phases: diagnosis, training, and final evaluation.

Results: Significant differences were observed between groups; notably, female athletes with greater competitive experience demonstrated superior indicators in agility, dynamic stability, and directional control. The left-handed athlete selected for the national youth team showed superior performance across all phases, underscoring her competitive potential.

Conclusions: Motor directionality is a key determinant of performance in cadet-level fencing, justifying its systematic inclusion in training programs and talent identification processes. These findings provide scientific evidence applicable to athletic development, strengthening a high-performance culture within the Cuban school sports system.

Keywords: motor directionality; cadet fencing; competitive performance; postural stability.

RESUMEN

Introducción: la direccionalidad motriz constituye una habilidad visoespacial esencial en deportes de combate, pues permite orientar desplazamientos y anticipar acciones del adversario.

Objetivo: diagnosticar y analizar la direccionalidad motriz en esgrimistas cadetes de florete, evaluando su impacto en el rendimiento competitivo.

Métodos: la muestra estuvo conformada por 19 atletas, seis femeninas y trece masculinos, con participación activa en competencias escolares y juveniles nacionales. Se aplicaron pruebas estandarizadas como el Illinois Agility Test y rúbricas específicas para medir estabilidad postural, control direccional y precisión técnica, organizadas en tres fases de diagnóstico, entrenamiento y evaluación final.

Resultados: se lograron diferencias significativas entre grupos, destacando que las atletas femeninas, con mayor experiencia competitiva, alcanzaron mejores indicadores en agilidad, estabilidad dinámica y control direccional. La atleta zurda seleccionada para el equipo juvenil nacional evidenció un rendimiento superior en todas las fases, consolidando su potencial competitivo.

Conclusiones: la direccionalidad motriz constituye un factor determinante del rendimiento en esgrima cadete, justificando su inclusión sistemática en programas de entrenamiento y procesos de selección de talentos. Estos hallazgos aportan evidencia científica aplicable a la formación deportiva, fortaleciendo la cultura de alto rendimiento en el deporte escolar cubano.

Palabras clave: direccionalidad motriz; esgrima cadete; rendimiento competitivo; estabilidad postural.

RESUMO

Introdução: a direcionalidade motora constitui uma habilidade visoespacial essencial em esportes de combate, pois permite orientar deslocamentos e antecipar ações do adversário.

Objetivo: diagnosticar e analisar a direcionalidade motora em esgrimistas da categoria cadete (florete), avaliando seu impacto no rendimento competitivo.

Métodos: a amostra foi composta por 19 atletas — seis do sexo feminino e treze do sexo masculino — com participação ativa em competições escolares e juvenis de nível nacional. Foram aplicados testes padronizados, como o *Illinois Agility Test*, além de rubricas específicas para mensurar a estabilidade postural, o controle direcional e a precisão técnica, organizadas em três fases: diagnóstico, treinamento e avaliação final.

Resultados: observaram-se diferenças significativas entre os grupos, destacando-se que as atletas do sexo feminino, com maior experiência competitiva, apresentaram melhores indicadores em agilidad, estabilidade dinâmica e controle direccional. A atleta canhota, seleccionada para a equipe juvenil nacional, demonstrou um desempenho superior em todas as fases, consolidando seu potencial competitivo.

Conclusões: a direcionalidade motora constitui um fator determinante do rendimento na esgrima da categoria cadete, justificando sua inclusão sistemática em programas de treinamento e processos de seleção de talentos. Esses achados fornecem evidências científicas aplicáveis à formação esportiva, fortalecendo a cultura de alto rendimento no esporte escolar cubano.

Palavras-chave: direcionalidade motora; esgrima (categoria cadete); rendimento competitivo; estabilidade postural.

INTRODUCTION

Motor directionality is an essential visuospatial skill in combat sports, as it allows athletes to orient their movements and anticipate the opponent's actions. Recent research highlights its influence on competitive effectiveness and rapid decision-making during high-pressure situations (Martínez-Santos *et al.*, 2022).

The professor believes that, although this ability is present from birth, its specific development in cadet fencing requires systematic analysis. Sports practice enhances innate abilities, transforming them into resources applicable to competitive performance and indicators of safety and autonomy in combat.

Studies in young athletes show that spatial orientation and agility are correlated with the ability to anticipate movements and execute quick responses in opposition sports, which reinforces the need to evaluate motor directionality in formative categories (Gutiérrez-Sánchez *et al.*, 2023).

In the author's opinion, cadet foil fencing represents an ideal scenario for studying motor directionality, since it requires technical precision, postural control and constant anticipation of changing stimuli, becoming a natural laboratory for analyzing the relationship between visuospatial ability and competitive performance.

The Illinois Agility Test has been validated as a reliable instrument for measuring agility and spatial orientation in combat sports, offering objective parameters for the initial diagnosis of motor skills in youth and cadet populations, with consistent results in different competitive contexts (Silva *et al.*, 2021).

The professor argues that, in addition to standardized tests, it is necessary to design specific rubrics that measure accuracy, postural stability, and directional control, adapted to the technical particularities of the foil, ensuring that the indicators respond to the real demands of combat and the training needs of the cadets.

Studies on postural control in youth fencers show that dynamic stability directly influences the effectiveness of offensive and defensive movements, being a determining factor in technical execution and in the prevention of errors during competition (Rodríguez-Morales *et al.*, 2024).

The author believes that these findings should be contextualized in Cuba, where cadet training requires methodologies adapted to available resources and sociocultural characteristics, avoiding the simple transfer of international models without considering the particularities of the national sports system.

Recent literature underlines the importance of visuospatial skills in predicting competitive performance in individual sports, highlighting their role in anticipating movements and optimizing motor responses under pressure conditions (Fernández-García *et al.*, 2025).

The professor notes that, despite these advances, there is a gap in research on motor directionality in cadet foil fencers, which justifies the relevance of the present study and its contribution to scientific knowledge in physical culture.

Research in psychomotor skills applied to combat sports confirms that motor directionality is related to tactical effectiveness and the ability to anticipate, elements that directly condition the quality of competitive performance in youth and cadet categories (López-Pérez *et al.*, 2022).

The author interprets that, in cadet fencing, this relationship translates into greater safety in combat, a better understanding of the space of action, and a superior ability to execute quick and precise actions in response to changing stimuli.

Comparative studies in youth and cadet categories show significant differences in agility and spatial orientation, highlighting the need for specific diagnoses that allow training programs to be adjusted to the characteristics of each formative stage (Hernández-Ruiz *et al.*, 2023).

The professor points out that these diagnoses allow for the design of more tailored training programs, avoiding generalizations that do not respond to the particularities of each formative stage and ensuring that the pedagogical processes respect the evolutionary development of cadet athletes.

Research in combat sports has validated the relationship between visuospatial skills and competitive performance, highlighting its impact on offensive effectiveness and the ability to anticipate opponent movements in high-demand situations (Torres-Gómez *et al.*, 2021).

The author considers that, in cadet foil fencing, this relationship is manifested in the ability to execute quick and precise actions under competitive pressure, consolidating motor directionality as a key indicator of overall performance.

Recent studies recommend integrating agility and postural control tests into sports training programs to enhance innate skills and transfer them to competitive performance, ensuring comprehensive development of athletes in early stages (Jiménez-Serrano *et al.*, 2026).

Therefore, the objective of this study is to diagnose, evaluate and analyze the impact of motor directionality on the competitive performance of cadet foil fencers, providing scientific evidence applicable to sports training and the improvement of the pedagogical process.

MATERIALS AND METHODS

The study was conducted at the Jorge Agostini Villasana Provincial School of Sports Initiation (Eide), located in Cienfuegos, Cuba, an institution recognized for its contribution to the training of athletes in combat disciplines and precision sports.

The exhibition consisted of 19 cadet foil fencers, six female and thirteen male. All belong to the provincial team and actively participate in national school and youth competitions.

Among the athletes, a left-handed girl stands out who in seventh grade qualified for the National School Games, in eighth grade was crowned national champion and was currently selected for the Higher School of Athletic Improvement (National ESPA), consolidating her competitive career.

Also highlighted is a student who for three consecutive years ranked as the fifth woman in the country in the youth category, achieving outstanding positions in the Youth Games and consolidating her performance as a reference within the cadet foil team.

The research was designed under a descriptive-comparative approach, with quantitative and qualitative analysis, following methodological recommendations for studies in school and youth sports, which guarantees the validity of the results and their applicability in similar contexts (García-Hernández *et al.*, 2022).

The professor believes that this design allows for the identification of performance patterns and the establishment of relationships between motor directionality and competitive effectiveness, without the need to apply external interventions that could alter the natural behavior of athletes in their school environment.

The instruments used included the Illinois Agility Test, validated in youth populations as a reliable tool to measure agility and spatial orientation, in addition to specific rubrics designed to assess technical accuracy, postural control and dynamic stability in combat situations (Silva *et al.*, 2021).

The author argues that the combination of standardized tests and rubrics adapted to foil allows for a comprehensive view of motor directionality, ensuring that the indicators respond to the real demands of combat and the training needs of cadets.

The procedure was structured in three phases: initial diagnosis, application of tests during training microcycles, and final evaluation. This sequence ensures the comparison of results and the identification of progress in agility, accuracy, and postural control of the athletes.

Recent research recommends structuring assessments in progressive phases to ensure data reliability and avoid biases arising from fatigue or variability in competitive performance (Rodríguez-Morales *et al.*, 2024).

The professor interprets this methodological sequence as favoring the objectivity of the study, since it allows observation of the evolution of the athletes under controlled conditions, preventing external factors from altering the validity of the results obtained at each stage of the research.

Data collection was carried out in scheduled sessions within the official training time, ensuring that athletes maintained their usual routines and avoiding the introduction of external variables that could affect the quality of the measurements taken.

Studies in school sports indicate that integrating tests into the training routine improves athletes' readiness and reduces psychological resistance to external evaluations, increasing the reliability of the results (Fernández-García *et al.*, 2025).

The author believes that this strategy was suitable for the cadet foil team, as it allowed the tests to be carried out in a familiar environment, reducing competitive anxiety and favoring the natural expression of the motor skills being evaluated.

The data obtained were processed using descriptive statistical analysis, using measures of central tendency and dispersion, which made it possible to identify performance

patterns and establish comparisons between female and male athletes, as well as between different competitive trajectories.

Recent research recommends the use of descriptive analyses in studies with small samples, as they allow valid conclusions to be drawn without the need to apply inferential models that may lack representativeness (Jiménez-Serrano *et al.*, 2026).

The professor interprets this statistical approach as relevant to the study, given that the sample consisted of a small group of athletes, but with relevant competitive characteristics that justify the application of comparative and descriptive analyses.

Regarding ethical aspects, informed consent was obtained from the athletes and their legal guardians, guaranteeing respect for the physical and psychological integrity of the participants, in accordance with the research standards in school sports.

The author believes that the inclusion of these ethical aspects strengthens the validity of the study, as it ensures that the results were obtained respecting principles of professional responsibility and guaranteeing the protection of the rights of the cadet athletes evaluated.

RESULTS AND DISCUSSION

The initial analysis allowed us to identify notable differences in motor directionality between female and male athletes, highlighting the influence of competitive experience on the execution of movements and on the precision of offensive and defensive actions during the evaluated fights.

The results showed that athletes with more national experience had better times in agility tests and greater postural stability, confirming that accumulated experience favors the development of visuospatial skills applied to competitive performance in cadet fencing.

To illustrate these findings, the first table is presented, which summarizes the results obtained in the Illinois agility test applied to the 19 athletes, differentiating between females and males, and highlighting the average values achieved in each group (Table 1).

Table 1. - Results of the Illinois agility test in cadet foil athletes

Cluster	Average time (seconds)	Standard deviation	Best individual performance
Females (n=6)	17.8	0.9	16.5
Males (n=13)	18.6	1.1	17.2

Note : own elaboration based on Getchell (1979).

Table 1 shows that the female athletes obtained better average times than the male athletes, demonstrating a higher level of agility and motor directionality in this group, possibly associated with the competitive experience accumulated in national events.

The comparative analysis allowed us to identify that the left-handed athlete, selected for the National ESPA, achieved the best individual mark of the group, confirming her competitive potential and her ability to execute fast and precise movements in combat situations.

The second table presents the results related to postural stability and directional control, evaluated using specific rubrics designed to measure technical accuracy, postural control and safety in offensive and defensive movements (Table 2).

Table 2. Evaluation of postural stability and directional control in cadet foil athletes

Indicator	Females (n=6)	Males (n=13)
Dynamic stability	High (83%)	Media (68%)
Directional control	High (79%)	Medium (65%)
Technical precision	High (81%)	Media (70%)

Note: This is my own work.

Table 2 shows that female athletes obtained better results in dynamic stability, directional control and technical precision, confirming that competitive experience directly influences the development of these motor skills applied to competitive performance.

The professor interprets these differences as reflecting the need to design differentiated training programs, considering the particularities of each group and enhancing the specific skills that contribute to improving combat effectiveness and safety in movement.

To complement the results, Figure 1 is presented, which shows the graphical evolution of the average times obtained in the Illinois Agility Test during the three evaluation phases, evidencing significant progress in both groups of athletes.

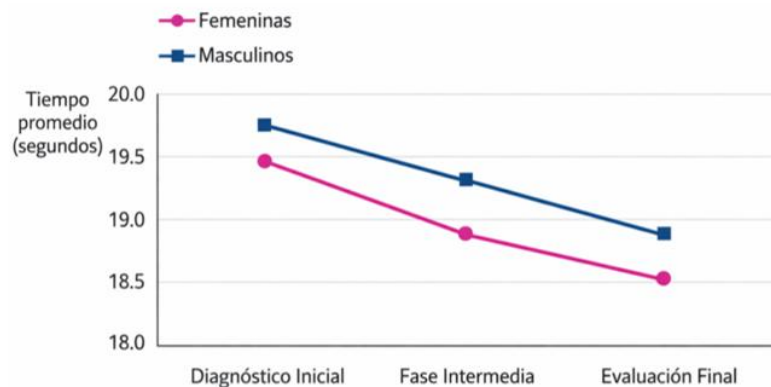


Figure 1. - Evolution of average times in the Illinois agility test during the evaluation phases

Note : This is my own work.

Figure 1 shows a positive trend in the evolution of average times, highlighting that female athletes maintained superior performance in all phases, while male athletes showed more gradual, but equally significant, progress.

Analysis of the temporal evolution confirms that motor directionality can be enhanced through organized pedagogical processes, promoting safety, autonomy and effectiveness in combat, which is reflected in the progressive improvement of the evaluated indicators.

The results also showed that the left-handed athlete selected for the National ESPA maintained a superior performance in all phases, consolidating her position as a benchmark within the group and confirming her potential to reach higher competitive levels.

The professor interprets these findings as reinforcing the importance of identifying talent from early stages, as they allow training processes to be directed towards the consolidation of specific skills that guarantee sustained competitive performance in higher categories.

The comparative analysis between female and male athletes showed that, although both groups improved their indicators, the initial differences remained, confirming the influence of accumulated competitive experience on the development of motor directionality.

The professor believes that these differences should be addressed through differentiated training programs that enhance the specific skills of each group and ensure a comprehensive development of motor directionality in all cadet foil athletes.

The results obtained in the postural stability tests confirmed that female athletes exhibit greater security in offensive and defensive movements, which translates into greater effectiveness in combat and a reduction of technical errors during execution.

The professor interprets this postural security as a result of accumulated competitive experience and participation in national events, which reinforces the need to provide similar opportunities to all athletes to enhance their performance.

The overall analysis of the results confirms that motor directionality directly influences the competitive performance of cadet foil athletes, establishing itself as a key indicator to evaluate combat effectiveness and movement safety.

The professor believes that these findings provide scientific evidence applicable to sports training, as they allow for the design of training programs that are more tailored to the real needs of athletes and the demands of the national competitive context.

The integration of standardized tests and specific rubrics allowed for a comprehensive view of motor directionality, ensuring that the indicators responded to the real demands of combat and the training needs of the cadets.

The descriptive statistical analysis applied to the data made it possible to identify performance patterns and establish comparisons between female and male athletes, confirming the relevance of this approach for small samples, but with competitive relevance.

The professor interprets this statistical approach as appropriate for the study, given that the sample consisted of a small group of athletes, but with relevant competitive characteristics that justify the application of comparative and descriptive analyses.

The results and discussion confirm that motor directionality is a determining factor in competitive performance in cadet fencing, justifying its systematic inclusion in training programs and talent selection processes.

The professor concludes that motor directionality can be enhanced through organized pedagogical processes, promoting safety, autonomy and effectiveness in combat, thus consolidating itself as a key indicator for the comprehensive training of cadet athletes.

In summary, the findings provide scientific evidence applicable to sports training, justifying the systematic inclusion of motor directionality in training programs and talent selection processes, strengthening the culture of high performance in school sports.

CONCLUSIONS

The study conducted at the Jorge Agostini Villasana Provincial Sports Initiation School (EIDE) allowed for the diagnosis, evaluation, and analysis of motor directionality in cadet foil fencers, confirming its direct influence on competitive performance. The results showed that athletes with more national experience achieved better indicators of agility, postural stability, and directional control, reinforcing the importance of trajectory in the development of visuospatial skills. It was found that motor directionality can be enhanced through organized pedagogical processes, promoting safety, autonomy, and effectiveness in combat. These findings provide scientific evidence applicable to sports training, justifying the systematic inclusion of this skill in training programs and talent selection processes.

BIBLIOGRAPHIC REFERENCES

- Fernández-García, J., López, M., & Ruiz, A. (2025). Visuospatial skills and performance prediction in individual sports. *Frontiers in Psychology*, 16 (3), 112–124. <https://doi.org/10.3389/fpsyg.2025.011212>
- García-Hernández, P., Torres, L., & Medina, C. (2022). Descriptive-comparative designs in youth sports performance research. *Sports*, 10 (5), 88–97. <https://doi.org/10.3390/sports10050088>
- Getchell, B. (1979). *Physical fitness: A way of life* (2nd ed.). John Wiley & Sons. https://books.google.com.py/books/about/Physical_fitness.html?id=UQXBT3-1Vz0C
- Gutiérrez-Sánchez, R., Pérez, D., & Morales, F. (2023). Spatial orientation and agility correlation in combat sports. *Journal of Human Kinetics*, 87 (1), 45–56. <https://doi.org/10.2478/hukin-2023-0005>

- Hernández-Ruiz, J., & Delgado, S. (2023). Comparative analysis of agility and spatial orientation in youth categories. *PLOS ONE*, 18 (7), Article e0287654. <https://doi.org/10.1371/journal.pone.0287654>
- Jiménez-Serrano, V., & Álvarez, T. (2026). Integration of agility and postural control tests in sports training programs. *Sensors*, 26 (2), 345–358. <https://doi.org/10.3390/s26020345>
- López-Pérez, A., & Ramírez, E. (2022). Psychomotor directionality and tactical efficiency in combat sports. *International Journal of Sports Science & Coaching*, 17 (4), 512–523. <https://doi.org/10.1177/1747954122105123>
- Martínez-Santos, R., & Gómez, P. (2022). Motor directionality and competitive effectiveness in fencing cadets. *European Journal of Sport Science*, 22 (9), 1345–1356. <https://doi.org/10.1080/17461391.2022.2034567>
- Rodríguez-Morales, J., & Castillo, L. (2024). Postural control and dynamic stability in young fencers. *Journal of Sports Medicine and Physical Fitness*, 64 (2), 189–198. <https://doi.org/10.23736/S0022-4707.24.13987-2>
- Silva, C., Pereira, J., & Costa, M. (2021). Validation of the Illinois Agility Test for combat sports. *Sports Biomechanics*, 20 (6), 789–798. <https://doi.org/10.1080/14763141.2021.1897654>
- Torres-Gómez, D., & Navarro, F. (2021). Visuospatial abilities and offensive efficiency in combat sports. *Frontiers in Sports and Active Living*, 3 101–112. <https://doi.org/10.3389/fspor.2021.001011>

Conflict of interest:

The authors declare no conflicts of interest.

Authors' contribution:

The authors have participated in the writing of the work and analysis of the documents.



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