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Original article

Current state of explosive strength assessment in child karate practitioners

[*Estado actual de la evaluación de la fuerza explosiva en karatecas infantiles*]

[*Estado atual da avaliação da força explosiva em crianças praticantes de caratê*]

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ABSTRACT

Introduction: The physical capacity of explosive strength constitutes the basis for the execution of the vigorous and high-intensity technical actions of karate-do; therefore, this capacity is the one that is most manifested in this sport, and it is essential to evaluate its state.
Aim: To assess the state of the evaluation of explosive strength in children's karate practitioners in Cienfuegos.
Methodology: The study population consisted of 11 karate practitioners and 19 coaches, selected using specific criteria. The methodology employed was a quantitative approach, with a non-

experimental, descriptive, cross-sectional design. Structured surveys, semi-standardized interviews, measurements, and document analysis were used to collect data for the explosive strength assessment.

Results: The coaches lack standardized testing procedures for explosive strength, relying instead on empirical methods. The measurements taken determined that the karate practitioners in the study generally have a poor level of explosive strength.

Conclusions: There are deficiencies in the assessment of explosive strength in children practicing karate. Coaches lack methodological guidelines and indicators, measurement criteria, and indices that would allow them to evaluate this physical capacity.

Keywords: assessment, explosive strength.

RESUMEN

Introducción: la capacidad física fuerza explosiva constituye la base para la ejecución de las acciones técnicas vigorosas y de alta intensidad del karate-do, por ende, es esta capacidad la que más se manifiesta en este deporte y resulta imprescindible evaluar su estado.

Objetivo: valorar el estado de la evaluación de la fuerza explosiva a karatecas infantiles en Cienfuegos.

Metodología: la población estuvo compuesta por 11 karatecas y 19 entrenadores, seleccionados mediante criterios de selección. La metodología empleada fue el enfoque cuantitativo, con un diseño no experimental, transeccional descriptivo; se emplearon encuestas estructuradas, entrevistas semiestandarizadas, mediciones y se analizaron documentos para recopilar datos de la evaluación de la fuerza explosiva.

Resultados: los entrenadores no cuentan con normativas para evaluar la fuerza explosiva, realizándolo de manera empírica. Con las mediciones realizadas se determinó que los karatecas en estudio están evaluados de forma general de Mal.

Conclusiones: existen deficiencias en la evaluación de la fuerza explosiva a los karatecas infantiles. Los entrenadores carecen de orientaciones metodológicas y de indicadores, criterios de medidas e índices que permitan evaluar esta capacidad física.

Palabras clave: evaluación, fuerza explosiva.

RESUMO

Introdução: A força explosiva é fundamental para a execução de ações técnicas vigorosas e de alta intensidade no karatê-do. Portanto, essa é a capacidade mais evidente nesse esporte, tornando essencial a avaliação do seu estado.

Objetivo: Avaliar o estado atual da avaliação da força explosiva em crianças praticantes de karatê em Cienfuegos.

Metodologia: A população do estudo foi composta por 11 praticantes de karatê e 19 treinadores, selecionados por meio de critérios específicos. Foi empregada uma abordagem quantitativa, com delineamento descritivo transversal não experimental. Questionários estruturados, entrevistas semiestruturadas, medições e análise documental foram utilizados para a coleta de dados sobre a avaliação da força explosiva.

Resultados: Os treinadores carecem de diretrizes estabelecidas para a avaliação da força explosiva, baseando-se, em vez disso, em métodos empíricos. As medições realizadas demonstraram que os praticantes de karatê no estudo apresentaram, em geral, desempenho insatisfatório.

Conclusões: Há deficiências na avaliação da força explosiva em crianças praticantes de karatê. Os treinadores carecem de diretrizes metodológicas e indicadores, critérios de mensuração e índices que lhes permitam avaliar essa capacidade física.

Palavras-chave: avaliação, força explosiva.

INTRODUCTION

Contact sports, including karate, are characterized by intermittent bursts of high intensity followed by periods of lower intensity. These high-intensity bursts are what make the difference in terms of performance and competition results; they are based on explosive strength actions, expressed in the stretch-shortening cycle and constituted by the anaerobic alactic energy system (Markovic *et al.*, as cited in Baz, 2015).

In this martial art, the production of explosive force is necessary, as certified by Vargas *et al.* (2014), who state that explosive force is responsible for the execution of most of the movements of karate practitioners, especially those applied in kumite (combat).

According to Aguilar *et al.* (2022), explosive strength is the capacity of the neuromuscular system to perform explosive actions of a tonic or ballistic nature, using one's own body weight or an external object, and which are not preceded by any movement. Its fundamental characteristic is the explosiveness of the movements to be performed. It is a function of the anaerobic alactic system, and its duration should not exceed three seconds, as this function uses muscle adenosine triphosphate as energy.

For their part, Suárez *et al.* (2021) believe that the explosive power of karate practitioners is crucial, as it becomes decisive when generating an effective and powerful attack to destabilize the opponent; for this reason, it is necessary to have an adequate evaluation process that allows detecting deficiencies in physical abilities and, at the same time, in technical-tactical elements.

The evaluation of explosive strength, Suárez *et al.* (2022), guarantees good planning by coaches, ensuring that karate practitioners perform fast and explosive movements, since in karate-do the technical-tactical elements used in kumite depend largely on this ability to achieve good effectiveness, retreat in time to a leg technique of the opponent, perform a good defense or anticipate the action of the opponent.

In line with previous studies, the authors of this research believe that explosive power is one of the physical abilities that should be most frequently assessed in karate practitioners, due to the number of explosive actions performed in both kumite (hand-to-hand combat) and kata (simulated sparring). In this regard, the karate community agrees on the importance of evaluating explosive power; therefore, several studies related to this physical capacity have been conducted in recent years.

Such is the case of Cubillo (2018), who proposes a training program to improve explosive strength in karate, while Hellín *et al.* (2020) analyze weekly training hours and the results obtained in the vertical jump in youth karate practitioners. On the other hand, Fandos *et al.* (2021) examine the effects of two different strength training methodologies on the lower body and the correction of lower limb asymmetry in a group of competitors.

For their part, Suárez *et al.* (2021) assessed the explosive strength of child karate practitioners, while Encinas and Gavotto (2022) proposed a strength program based on the fundamentals of weightlifting and CrossFit to meet the specific needs of judo and karate teams. Pablo (2022) also investigated whether isolated plyometric training directly improved lower body explosive strength. Molina and Paula (2024) developed a guide to plyometric exercises to improve explosive strength in karate practitioners aged 11 to 13 years.

Based on the analysis of the criteria presented by the aforementioned authors, it is clear that they agree that explosive power is responsible for the execution of very rapid movements and explosive starts. Furthermore, almost all the technical and tactical elements in karate-do, especially those applied to kumite, are encompassed by explosive power. In fractions of a second, the brain must decide on the action to be performed and sends the information to the muscles so they contract and generate the movement. This capacity determines whether one can retreat in time to an opponent's leg technique, defend against a kick, or anticipate the culmination of an opponent's technique with an effective counterpunch. They also agree that explosive power should be systematically evaluated.

In the *Comprehensive Athlete Preparation Program* (PIPD) by Sánchez et al. (2021), it is proposed that, due to the duration of combat, the frequency of actions, and their volume, it is considered a speed-strength event; therefore, maintaining explosive strength levels is essential from the beginning to the end of the match, from the first bout to the last. This program recognizes the importance of this capacity but only specifies how to evaluate it through offensive and defensive movements to infer criteria regarding explosive strength in the study population.

As a consequence of the above, it is agreed that the evaluation of explosive strength is important, since it allows obtaining a valid point and avoiding a possible counterattack from the opponent, therefore deficiencies are observed in the evaluation of the explosive strength of the children karate practitioners of Cienfuegos and the objective of the research is to assess the state of the evaluation of explosive strength in children karate practitioners in Cienfuegos.

MATERIALS AND METHODS

This research was conducted using a quantitative approach, with a descriptive scope that allowed for the precise characterization of the phenomena studied. A non-experimental, cross-sectional descriptive design was used, which involved collecting data at a single point in time, without manipulating variables.

The study population consisted of 11 children's karate practitioners from the province of Cienfuegos and coaches who work with this category, who met the following requirements: that they worked at the base, with five or more years of experience, that they had practiced karate-do and worked as coaches at the base, with a belt level of 1st Dan or higher, mastery of the subject from the sports initiation, desire and willingness to participate in the research.

Thus, the study population consisted of nineteen (19) karate-do coaches working in sports initiation who met the inclusion criteria. Of these, two (2) were female (10.5%) and seventeen (17) were male (89.5%). Fifteen (15) (89.5%) held degrees in Physical Culture, and two (2) were activists (10.5%). The study population also included the karate-do sports commissioner and the two coaches from the Sports Initiation School (EIDE), all of whom have more than ten years of work experience, hold degrees in Physical Culture, have worked with the category under study, and possess second, sixth, and seventh Dan belt ranks.

The research employed various methods, including historical-logical, analytical-synthetic, inductive-deductive, document analysis, measurement, structured surveys, and semi-standardized interviews. Statistical-mathematical methods were also used to process the quantitative data. Frequency tables were used for each category to observe the percentage distribution of the results, and descriptive statistics were used to examine the characteristics of the collected data.

RESULTS AND DISCUSSION

Results of the documentary analysis

The analysis of the PIPD (Program for the Development of Children's Karate Training) confirmed the criteria of Suárez et al. (2021), which specifies, as one of its objectives, that children in karate should contribute to the development of explosive strength through general and specific jumping exercises that stimulate the vigorous and controlled application of the sport's technique under competitive conditions. It was observed that the objectives do not include an assessment of general physical conditioning abilities, nor of explosive strength in particular.

Upon reviewing the methods of evaluation and control of the level of content appropriation in this document, it was found that the evaluation of capacitive content (translational strength, planks, flexibility, running, jumping) is addressed, but explosive strength is not taken into account, even though it is one of the conditional capacities that should be most evaluated in karate practitioners, due to the number of explosive actions performed, both in kumite and kata.

The PIPD provides a test for evaluating explosive power in offensive and defensive movement. This program demonstrated that, for the evaluation of explosive power, a metric scale with values in centimeters is used for these types of tests, and the evaluation is conducted according to the guidelines established by the coach.

These documents form part of the official framework that organizes the activities of sports coaches. They outline the training and preparation of karate practitioners, guided by the guidelines established by the PIPD (Performance Sports Development Program) for each category and the grading programs of the national federations. The plan includes the evaluation of the different components of athlete preparation: physical, technical, tactical, psychological, and theoretical; the dates for the tests are specified in the designated space within the plan. However, this does not reflect how the tests will actually be conducted.

It was found in the regulatory documents that coaches do not have an instrument that contains methodological guidelines, procedures, indices and indicators that allows them to evaluate the conditional physical capacity of explosive strength.

Measurement results

To assess explosive strength in this study, a metric scale with values in centimeters was used and evaluated according to the standards established by Suárez *et al.* (2021), since the PIPD does not offer such an instrument. These authors established standards for evaluating the variables of defensive and offensive movements (Table 1).

Table 1. *- Evaluation scale*

B	R	M
+ 30 cm	30-35 cm	-30 cm

Source: own elaboration.

For the evaluation of the right offensive displacement variable, five ranges were established. The first range is between 18.85 cm and 20.04 cm, in which two karate practitioners were located, representing 18.2%. Between 21.23 cm and 22.42 cm, one karate practitioner was located, representing 9.1%. Between 22.42 cm and 23.61 cm, three

karate practitioners were located, representing 27.3%, and above 23.61 cm, five were located (45.5%).

In the evaluation of the left offensive movement variable, five ranges were established. The first range is between 13.61 cm and 14.18 cm, to which one karateka belongs (9.1%). In the ranges between 14.18 cm and 14.75 cm and between 14.75 cm and 15.32 cm, three karatekas (27.3%) correspond to each case. The values of the left offensive movement variable between 15.32 cm and 15.89 cm and above 15.89 cm include two karatekas respectively (18.2%).

In the evaluation of the right defensive displacement variable, it was observed that in the 9.50 cm–10.08 cm range, there were two karate practitioners, representing 18.2%. In the 10.08 cm–10.66 cm range, there were five karate practitioners, representing 45.5%. Between 11.24 cm–11.82 cm, there were three karate practitioners, representing 27.3%, and above 11.82 cm, there was one athlete, representing 9.1%.

In the evaluation of the left defensive movement variable, three karate practitioners fell within the 9.70 cm-10.26 cm and 10.26 cm-10.82 cm ranges, respectively, representing 27.3% in each case. Four practitioners fell within the 10.82 cm-11.38 cm range, representing 36.4%, and one practitioner fell within the 11.94 cm range, representing 9.1%.

When comparing these results with the standards established by Suárez et al. (2021), the karate practitioners in this study are generally rated as poor. Although the coaches take into account physical strength, specifically explosive strength, in their karate-do instruction planning, they need to deepen their work on this capacity, which is fundamental for karate practitioners when performing tsuki (punches) . waza (striking techniques with the arms), the geri waza (kicking techniques), blocks and slides.

Taking these values into account, it was necessary to apply the descriptive measures of position (arithmetic mean and mode) and those of dispersion (standard deviation), to analyze the state of the collected data.

A descriptive analysis was performed on the right offensive displacement variable, where the values ranged around 23.6 cm, with a dispersion of 3.1. For right defensive displacement, the values fluctuated around 10.8 cm, with a dispersion of 0.8. Regarding left offensive displacement, the values were around 15 cm with a dispersion of 0.8. For left defensive displacement, the values were around 9.6 cm, with a dispersion of 0.8.

Results of the structured survey

Based on the application of this method, it was found that 84.2% of the population, representing 16 coaches, consider their preparation for evaluating the explosive power of children in karate to be fair or poor. Meanwhile, only two coaches, representing 11% of the population, consider their methodological preparation for assessing the explosive power of children in karate to be good, while 89%, representing 17 coaches, consider it to be poor or fair.

Regarding the availability of any official document that guides the evaluation of explosive power in children karate practitioners, 94.7% (18 instructors) reported no such document, while 5.3% (one instructor) reported that they did. 78.9% (15 of the 19 coaches surveyed) stated they were unaware of any instrument for evaluating the explosive power of children karate practitioners, especially given the modifications to the competition system as outlined in the regulations. Therefore, they suggested that studies should be conducted on new approaches to evaluating explosive power.

When mentioning the three main weaknesses in the assessment of explosive strength in children karate practitioners, they state that: they lack indicators, measurement criteria, and indices to facilitate the assessment of explosive strength in the study population. They specify that the PIPD (Program for the Development of Explosive Strength in Karate) does not establish procedures, guidelines, or methodological indications for coaches to efficiently assess the explosive strength of the karate practitioners in the study. Furthermore, all 19 (100%) coaches recommend that indicators, measurement criteria, and indices be established for assessing explosive strength, but that these be tailored to the characteristics of children karate practitioners.

Standardized interview results

The interview revealed that one (1) respondent, representing 33.3%, stated that the assessment of explosive strength in children's karate students is fair, while two (2) respondents, representing 66.7%, rated this process as poor. The commissioner and both coaches from the EIDE (School for Sports Initiation) unanimously agreed that one of the coaches' weaknesses is their lack of methodological training on the subject. They stated that there are deficiencies in indicators, measurement criteria, and indices for evaluating explosive strength, and those that exist are not contextualized to the characteristics of the karate students under study. Furthermore, they indicated that the coaches work empirically.

All interviewees (100%) agreed that the test included in the PIPD does not meet the characteristics of children in karate. Furthermore, it does not offer any indices or evaluative scales that would allow coaches to make a judgment about the explosive strength of the children being studied. All interviewees (100%) also agreed that, to assess the explosive strength of children in karate, coaches use tests designed for athletes in other sports.

Based on the results described in previous paragraphs, we agree with Molina and Paula (2024), who stated that the karateka must have a process that complements physical development with sports technique, and that this must correspond to the anatomical and physiological characteristics of the athlete, and the level of competition.

When comparing the results obtained with the standards established by Suárez et al. (2021), it was observed that the karate practitioners in the study were generally rated poorly. This situation is concerning given that this sport involves explosive and rapid techniques to achieve its objectives. With these results, the coach should emphasize the planning and evaluation of explosive strength training, as it is essential in kumite.

Therefore, Bautista (2016) states that strengthening the capacity under study will allow for a more powerful initial attack, and when retreating during a counterattack, it will shorten the transition phase, preventing the opponent from being hit. For this reason, the authors of this research consider the evaluation of explosive strength from an early age to be crucial, as it guarantees future athletic performance.

CONCLUSIONS

Explosive strength is the foundation for the vigorous, controlled, high-intensity actions that characterize karate. However, the reviewed documents do not provide methodological guidance for evaluating general physical conditioning abilities, nor for specifically evaluating explosive strength.

Through the application of empirical and statistical methods, it was determined that there are deficiencies in the evaluation of explosive strength in children practicing karate, as they do not meet the standards established by coaches. Furthermore, it was found that coaches lack indicators, measurement criteria, and indices that would allow them to evaluate this physical capacity.

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***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.