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Review article

Systematization of studies on the utility of laterality in combat sports

Sistematización de estudios sobre la utilidad de la lateralidad en los deportes de combate

Sistematização de estudos sobre a utilidade da lateralidade nos esportes de combate

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ABSTRACT

The project "Study of laterality patterns of elite athletes in Cuba" has as its objective the diagnosis, characterization and assessment of laterality patterns of active and retired athletes with high sports results, but so far it lacks a deepening in the usefulness that laterality can have in the technical-tactical preparation in combat sports, so the objective of this article was to systematize the main researches related to the use of laterality in these sports. For this, the inductive-deductive, analysis-synthesis and bibliographic review methods were used in order to determine the background and interpret the main reference research on this subject. It was concluded that among the main aspects addressed were: the competitive advantages of left-handed athletes, the technical volume that was carried out

in competitions, the characterization of the athlete according to their lateral preferences and how they influence sports performance. However, no study was observed regarding the use of laterality patterns in technical-tactical preparation in combat sports, which became a lack, for the study of these sports disciplines.

Keywords: Laterality patterns, athletes, sports performance, combat sports.

RESUMEN

El proyecto "Estudio de patrones de lateralidad de atletas elites de Cuba" tiene como objetivo el diagnóstico, la caracterización y la valoración de los patrones de lateralidad de atletas activos y retirados con altos resultados deportivos, pero hasta el momento se adolece de una profundización en la utilidad que puede tener la lateralidad en la preparación técnico-táctica en los deportes de combate, por lo que el objetivo de este artículo fue sistematizar las principales investigaciones relacionadas con la utilización de la lateralidad en estos deportes. Para ello, se emplearon los métodos inductivosdeductivo, análisis-síntesis y revisión bibliográfica con el fin de determinar los antecedentes e interpretar las principales investigaciones referentes sobre esta temática. Se concluyó que entre los principales aspectos abordados estuvieron: las ventajas competitivas de los deportistas zurdos, el volumen técnico que se realizó en competiciones, la caracterización del deportista de acuerdo a sus preferencias laterales y cómo estas influyen en el rendimiento deportivo. Sin embargo, no se apreció estudio alguno referido a la utilización de los patrones de la lateralidad en la preparación técnico-táctica en los deportes de combate, lo que devino en carencia, para el estudio de estas disciplinas deportivas.

Palabras clave: Patrones de lateralidad, atletas, rendimiento deportivo, deportes de combate.

RESUMO

O projeto "Estudo dos padrões de lateralidade de atletas de elite em Cuba" tem como objetivo diagnosticar, caracterizar e avaliar os padrões de lateralidade de atletas ativos e aposentados com altos resultados esportivos, mas até agora não houve um estudo aprofundado da utilidade que a lateralidade pode ter na preparação técnico-táctica em esportes de combate, portanto o objetivo deste artigo foi sistematizar as principais pesquisas relacionadas com o uso da lateralidade nestes esportes. Para este fim, foram utilizados os métodos indutivo-deducativo, análise-síntese e revisão bibliográfica a fim de determinar os antecedentes e interpretar as principais pesquisas sobre este assunto. Concluiu-se que entre os principais aspectos abordados estavam: as vantagens competitivas dos atletas canhotos, o volume técnico realizado nas competições, a caracterização do atleta de acordo com suas preferências laterais e como estas influenciam o desempenho esportivo. Entretanto, não foi encontrado nenhum estudo sobre o uso de padrões de lateralidade na preparação técnico-táctica em esportes de combate, o que resultou em uma falta de estudo destas disciplinas esportivas.

Palavras-chave: Padrões de lateralidade, atletas, desempenho esportivo, esportes de combate.

INTRODUCTION

For Bejarano and Naranjo (2014), lateral preference must be taken into account in almost all sports and by attending to their training, lateral differences can be reduced and even made to disappear, thus allowing changes in performance. In this sense, it is important to note that:

> In sport, laterality plays a key role in motor skills and performance, being those that refer to the oculo-manual (dominant eye-dominant hand) and oculo-podal (dominant eye-dominant foot) relationship, the most determiners. However, we cannot forget the laterality in relation to the shoulder or waist (important due to the preference for the turning side), and those that refer to the dynamic leg (skillful) and the power leg (support in most of the cases), (Dorochenko, 2010, pp. 9-10).

In addition, it is considered that its application in the sports field contributes to improving the planning processes and the mental approach to face the sports preparation process, the competition, manage stress or choose a tactical or strategic option in a given situation, (Dorochenko, 2010).

The project "Study of laterality patterns of elite athletes in Cuba" carried out by the Cuban Sports Research Center (CIDC) with the participation of National Institute of Sports, Physical education and Recreation (INDER) and the University of Physical Culture and Sports Sciences (UCCFD) sets as objectives the diagnosis, characterization and assessment of laterality patterns of active and retired athletes, with high sports results that allow establishing comparisons and analyzing trends on genetic motor preferences and their feasibility for obtaining results. Combat sports athletes are part of the sample for this study.

The objective of the article presented was to systematize the main researches related to the use of laterality in combat sports and for this there were used the methods: bibliographic review, which allowed to know the antecedents of the use of laterality patterns in combat sports, the inductive-deductive and analysis-synthesis for the interpretation of the results obtained and for the elaboration of the conclusions.

DEVELOPMENT

Generalities about laterality

Rigal (1987) defines laterality as "(...) a set of particular predominance of one or another of the different symmetrical parts of the body at the level of the hands, feet, eyes and ears" . However, only with the study of these variables it is not possible to determine the lateral dominance of the subject, but the whole body must be considered, so it is a problem of body control and body awareness and spatial concept, (Dorochenko, 2010).

In Lerbert`s opinion (1977) there are three positions on the emergence of laterality:

1. The inborn or hereditary theory.
2. The environmentalist, Watsonian or society theory.
3. The mixed or double influence theory.

Meanwhile, Dopico (1998) agrees with Lerbet's classification and explains that the first cited theory states that laterality comes directly from hereditary transmission; while the second, the so-called environmentalist or Watsonian, argues that the subject is influenced by the educational system and the family. The third theory, on the origin of laterality, explains that this is the product of the interaction of the two factors previously explained.

The authors of this work agree with this last position since man is a biopsychosocial being and everything cannot be explained, neither through genetic inheritance, nor through learning during life in society, since both factors are of great weight; therefore, since this double influence is present in the emergence of laterality, this must always be seen as a learning or acquisition process, an aspect of much greater relevance and that could be optimally applied in the teaching of combat sports in which the action of both hemispheres is common and inevitable.

Types of laterality

Normal laterality, whether right or left, is determined at birth and is not a matter of education, according to Zazzo (1986); likewise, the fact of finding different laterality in identical twins (20 percent) tends to prove that the hereditary factor does not act alone.

On occasions, the concept of contrarian laterality is used to express that the child has inverted its natural tendency in one or more members (for example, a left-handed child who has been forced to learn to write with the right).

There are also other possibilities such as the so-called mixed laterality that is used to designate those individuals who present heterogeneity in some or all of the laterality (some activities are carried out with one hand and others with the opposite) or ambidexterity that indicates those subjects who are equally skilled with either of the two parts of the body (right-left) to carry out some activities.

According to Blázquez (1982) it depends on the lateral predominance that individuals present at the ocular, foot, auditory and manual level so that there are different types of laterality:

1. Dextrality: predominance of the right eye, hand, foot and ear.
2. Left-handedness: Predominance of the left eye, hand, foot and ear.
3. Ambidexterism: There is no manual manifestation or dominance. It usually occurs at the beginning of the acquisition of the lateralization process.

4. Crossed or mixed laterality: where the dominant hand, foot, sight or ear does not correspond to the same body side.

5. Inverted laterality: where the innate laterality of the child has been contradicted by learning.

This researcher explains that there is talk of homogeneous laterality when hand, foot, eye and ear offer dominance on the same side, whether on the right (right-handed) or left (left-handed) side, known as homogeneous dexterity, when the limbs of the arm are used preferentially. right side; homogeneous left-handedness, when the members of the left side are used and ambidexterity, when an element of the right side (for example the hand) and the other of the left side (for example the eye) are used as a priority.

There is also an annoyed left-handedness that occurs when a left-handed subject has been forced for social reasons to use the right-handed homologous limb, the clearest being that of the hand: on the other hand, we are dealing with a crossed laterality when there is a different laterality from the manual for feet, eyes or ears (for example right hand dominant with left eye dominance). In these cases, there is also talk of functional asymmetry. Hand-eye crossed laterality has been one of the most studied and is often synonymous with learning problems, especially in reading and writing processes.

For his part, Oberbeck (as cited in Weineck, 1988) in his studies on the typology of laterality differentiates between eight types of complexes and takes into account three factors: predominance of one hand, predominance of one foot, and laterality of turn; in short, as observed in this classification, only the manual-foot-rotary relationship is taken into account, so the participation in the phenomenon studied of the directing eye is ignored.

Castañer and Camerino (2006) define the types of laterality as: integral laterality, where there is an absolute predominance of one side of the body; non-integral laterality, divided into crossed and contrary. Crusade is when there is no uniformity on one side of the body and upset, when this has been changed by certain sociocultural learning; and finally, the ambidexterity that manifests itself when there is a very equal dominance of both sides.

It should be noted that there are different types of laterality: right-handedness, left-handedness, ambidexterity, crossed or mixed laterality, and inverted laterality. It is in the presence of right-handedness and left-handedness when there is a predominance of the right or left eye, hand, foot, and ear, in that order. Crossed laterality is when the right side predominates in one member of the body and the left in another (dominant left eye-dominant right hand). On the other hand, the contrary laterality is present in left-handed or right-handed people who, by imitation or obligation, use the other hand or foot and ambidexterity occurs, when there is no manifest manual dominance.

By indefinite laterality, the author refers that it is when one side or the other is used indifferently or there is doubt in the choice and it may or may not cause learning problems, since children who have this indefinite laterality are insecure and with very slow reactions. In another order of ideas, Dorochenko (2010) states that if the oculo-manual relationship is attended to, the subjects can be divided into homogeneous and crossed. It is in the presence of a homogeneous subject when he has the same eye and hand laterality and a crossed

subject when the eye and hand laterality are different. The present research adheres more to this last author, since this more general classification is considered.

Laterality in combat sports

With regard to combat sports, studies carried out mainly in judo and fencing sports stand out, although studies to a lesser extent have been observed in others such as karate, taekwondo, boxing, mixed martial arts and full contact.

In judo, authors like Tirp *et al.* (2014) examined the impact of lateral preferences (in this case left guard vs. right guard) on the success of different levels of judo competition. The results obtained indicated that the left guard-oriented subjects had an advantage over the right guard-oriented subjects. Also in this sport, Iglesias-Soler *et al.* (2018) carried out a study where they analyzed the effects of bilateral training, on the non-dominant side, in thirty novice subjects in the practice of judo, specifically in combat.

These researchers came to the conclusion that lateral preference can be modulated in the initial phase of learning by unilateral exercises on the non-dominant side, while bilateral exercises have the opposite result.

In another research carried out by Dopico *et al.* (2014), a classification and organization of specific judo skills based on the establishment of motor and tactical criteria is proposed. These authors are of the opinion that a classification based on common criteria and linked to motor control supports and strengthens the processes of learning, training and sports analysis in judo. In summary, they consider the twist of the body as a criterion to differentiate between judokas who perform techniques on one side or on the other.

To continue with the sport of judo, Solin (1990) proposes a test related to axial laterality (shoulder turn, hip turn), eye and distal hand and foot that try to show the innate lateral predisposition of the individuals studied and a questionnaire related to the functional and perceptual preference of the subjects in relation to the practice of this sport. The tests carried out were the following:

1. Preferential direction of shoulder rotation (clockwise/counterclockwise/ambidextrous): shoulder rotation from search position (legs open, trunk leaning forward). The clockwise direction is typical of left-handed people, while the anti-clockwise direction of rotation is typical of right-handed people.

2. Preferential direction of hip rotation (clockwise/counterclockwise/ambidextrous): jump and half turn in the longitudinal axis.

3. Preferred Eye (Right/Left/Ambidextrous): Eye used to aim at a target.

4. Preferred hand (right/left/ambidextrous): writing hand.

5. Preferred foot (right/left/ambidextrous): kicking foot.

Dopico (1998) in his doctoral thesis proposes two hypotheses:

1. The practice of high competition judo modifies the indices of morphological laterality in favor of functional laterality

2. Functional laterality of higher-level judo athletes is characterized by a symmetrical execution of specific skills, to the detriment of homogeneous execution.

This author concludes that there are no significant differences between the population of athletes with respect to others, in terms of hand and foot preference, that right-handed turn is more common than left-handed, and that there is homogeneity in the crossing formulas.

When dealing with functional laterality, he explains that there is a predominance of right-handed use with respect to the execution of specific Judo skills, that there is a relationship between the characteristics of execution of specific Judo skills with respect to lateral preference and the different weight categories; in addition, 50 percent of the population uses the same leg to execute three types of schemes, while nine percent do so for all schemes.

Regarding the relationship between morphological laterality and functional laterality in specific judo skills, he affirms that the preference regarding the laterality of execution in specific skills does not depend on morphological laterality and is much more evident in skills with twist than in skills without twist. Manual laterality is the one that manifests more functional dependencies by categories (sex and age) and if sporting success in judo is related to the type of laterality of execution and this does not depend on morphological or spontaneous laterality, then it is that this specific manifestation execution has been acquired.

In another doctoral thesis on this same sport, Iglesias (1999) contrasted the following hypotheses:

1. The functional laterality of the subjects that start in Judo is influenced by the execution side used in the training sessions, and therefore there is an acquisition component in said dominance.

2. The modifications induced by the training are different depending on whether the practice is carried out symmetrically (same volume of executions on both sides), or exclusively on the non-dominant side.

In this work, it is concluded that the lateral preference in the execution of specific judo skills is due to the exclusive training of the non-dominant side, the symmetrical or bilateral training does not present significant differences with other training and that the influence of training on lateral dominance specific to the experimental subjects allows us to deduce the existence of a high acquisition component in said factor.

Another research in judo, carried out by Idarreta and Gutiérrez (2005), it was stated to find out if there was a relationship between the functional laterality of a group of young elite judo athletes with innate lateral dominance, especially in five of its manifestations: ocular dominance, manual, foot, preferential direction of hip rotation and preferential direction of shoulder rotation.

In that research, it was concluded that the foot preference is related to the functional asymmetry of the judoka and that the preferential sense of rotation of the hips, the preferential sense of rotation of the shoulders, the manual preference and the ocular preference are not related to the functional asymmetry.

To address laterality in judo athletes Sogabe *et al.* (2015) stated as objectives to determine the preferred position in tachi-waza, to evaluate the effect of the dominant hemibody on the quality of execution in the special fitness judo test (SJFT) and to diagnose the special physical preparation of judo practitioners in Japan. They concluded that a large number of participants used the left position, the projections made in the SJTF corresponded mostly to the dominant side of the body, and that women felt more fatigue when using the non-dominant side of the body.

In the sport of fencing, research has also been carried out on this topic where it is analyzed whether there is a significant relationship between being a left-handed athlete and having greater chances of winning in this competition and it was found that as the competition progresses, the percentage of fencers Lefties present in each elimination round is increasing, so an increase in said percentage is observed over the years.

In this same sport, Azlmar *et al.* (1984) worked with ten fencers (five left-handed and five right-handed) on central visual-motor control processes and observed that subjects who combine right eye prevalence and the use of the left hand seem to obtain better results in visual detection tasks-space. Harris (2010) argues that left-handed fencers present an obstacle to right-handed fencers because most teachers do not frequently use their left hand to deliver individual lessons.

In more recent studies, Azémar (2016) covers other sports and not only fencing, in which he discovers how laterality is manifested in judo, boxing and fencing and emphasizes its importance in spatial orientation and the advantage of being left-handed in these specialties.

Also in fencing, Castañer *et al.* (2018) carried out a study which objective was to obtain the laterality profiles of young athletes, taking into account the synergies between the support and precision functions of the limbs and parts of the body in the performance of complex motor skills. In the same order, Sánchez *et al.* (2021) characterized the laterality patterns of elite Cuban fencers to discover trends, competitive advantages and improve the preparation process.

Recent researches of Guan *et al.* (2020) addressed bilateral asymmetry in lower extremity power and dynamic balance in child athletes in fencing and taekwondo and reported that child athletes in laterally dominant and non-laterally dominant sports showed interlimb asymmetry in lower limb power. legs and dynamic balance.

In another study entitled "Differences between three measures of reaction time based on hand laterality in individual sports", Badau *et al.* (2018) observed the best results in the dominant hand for the simple reaction time in boxing, in the reaction time for recognition the best times were obtained by taekwondo and the cognitive reaction was led by judo. The left hand was the most used in the simple reaction time, in the recognition reaction time the

right hand was used more, while in the cognitive reaction it was the right hand despite not being the dominant one.

On the other hand, in the sport of full contact Del Valle and De la Vega (2007) found in the analysis of the differences and similarities in terms of the evidenced use of a segment of the body on its symmetrical in tasks of daily life, in training and in competition that the right side predominates over the left in all cases.

The aforementioned authors argue that the results may be due to the fact that, in daily life and in sport, the predominance of a dominant part of the body makes it possible to be more skilful in performing tasks.

In addition, they verify the influence of training and explain that the relationships found are the product of the application of learning procedures for trend change and depend on the components of the tasks and the subjects; this reaffirms what was previously assumed by the authors in this same work, regarding the importance of learning in the establishment of laterality relationships in the subjects. To conclude, they state that the results obtained show a tendency to use both sides in combat, which seems to confirm the effectiveness of training and learning.

It should be noted that Weineck (2005) states that the preferred laterality of one hand plays a role of some importance in sport and explains that being left-handed is considered advantageous. On the other hand, Fischer (as cited in Weineck, 2005) explains that the high percentage of left-handed wrestlers and boxers in the world elite is a consequence of tactical advantages and the effect of surprise.

Also, Bisiacchi (as cited in Weineck, 2005) considers the faster reaction of left-handers to unknown situations to be an advantage. This author bases his postulate in anatomo - physiological terms , arguing that the control of reactive movements occurs in the right cerebral hemisphere that corresponds to the side of the motor cortical area of the left arm; continues that since the control instance is in the same cerebral hemisphere as the left hand in charge of the reaction, the change to the other side (as occurs when reacting with the right hand) is unnecessary and about four thousandths of a second can be saved in the reaction time.

Already in karate, as a fundamental study object of the present research, Patru *et al.* (2015) in a study conducted with kata (karate-do imaginary combat) competitors stated that the functional asymmetry of the cerebral hemispheres could be revealed when analyzing kinematic parameters, even if they are considered automatisms.

Also in karate and taekwondo Cingoz *et al.* (2018) carried out an research that aimed to determine if there were differences between the dominant hand preference and the success of adult karate and taekwondo athletes, with respect to gender and found a weak relationship between the dominant hand preference and the sporting successes of female athletes taekwondo and karate athletes, a non-significant relationship between dominant hand preference and both sports, a slightly significant relationship between dominant hand preference, medals obtained and karate and taekwondo athletes. It was determined that left-

handed karate and taekwondo athletes are slightly more successful than right-handed ones, while there was no such difference in the male.

In a more recent study, which objective was to obtain an overview of the treatment of laterality in karate training, from the point of view of the trainers and karate athletes, the following conclusions were reached:

1. That ambidexterity is the type of laterality that provides the most advantages at a competitive level
2. That the segment in which it is most common for karate athletes to suffer a change of laterality is the foot
3. That permanent laterality changes in karate athletes carried out by the intervention of their coaches are rare
4. The modality in which the change of laterality is sought to a greater extent is in kumite.
5. Karate coaches mainly use dissociation techniques and try to do equal work between the dominant and non-dominant side of their students, with the aim of changing laterality.

CONCLUSIONS

The reviewed publications on laterality in combat sports fundamentally addressed the following aspects: the competitive advantages of left-handed athletes over right-handed ones, the technical volume that they performed in competitions, the characterization of the athlete based on their lateral preferences and the influences that they can exercise the different laterality (acquired or genetic) in sports performance. However, no study was observed regarding the use of laterality patterns in technical-tactical preparation in combat sports, which became a problematic situation, if one takes into account the importance of this aspect for these sports.

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