Ratio Profile, an Indicator for the Detection of the Genetic Potential of Talents

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ABSTRACT

Introduction: The scientific community of taekwondo has made efforts to optimize the talent selection system, but they have failed to enhance the genetic indicators that cannot be changed with sports training.

Aim: To design the ratio profile as an indicator during the detection of the genetic potential of taekwondo talents.

Materials and methods: the population comprised the Cuban female selection. Theoretical and analytical-synthetic, inductive-deductive methods were used, in addition to measurements. The statistical and mathematical methods were included, then, the central trend measurements, and the correlation coefficient were determined.

Results: The biological indicators or markers that provide information about the genetic potential, and to differentiate the physical components include the finger-

length ratio.

Conclusions: the ratio profile can be used to detect talents during the selection process, which the users considered a viable proposal.

Keywords: ratio, profile, fingers, detection, selection, talents, taekwondo.

INTRODUCTION

Taekwondo is a martial art that relies on the philosophical conceptions that have accompanied the Korean people throughout their historic and social development. It manifests, mainly, through practice and demonstration of the traditional combat techniques barehanded, which have transcended and evolved through time, becoming a modern system of technical, tactical, and physical exercises that harmonize science, technology, pedagogy in sports with ancestral precepts and principles, which have also been contextualized in modern society to respond to physical, spiritual, and behavioral development of humans, inclusively, for all types of genera and/or religions (Fernández, R. 2016).

Achieving significant sports results in a sport like this relates to the innate potentialities of athletes, among other things, to be developed through training. Therefore, in the sports preparation process, coaches must pay special attention to the selection of the best talents for this activity.

Hence, combat sports, due to their own nature and implicit logic, require the implementation of scientific procedures in the search for talents, based on the scientific detection and high-performance reference profile construction, to ensure a more reliable process that takes place at early ages. Due to the complexity of competitive activity and the need to take advantage of development in the sensitive stages of learning (Lastres, A 2017).

Upon defining talent, Columbié, (2019) considered it as the set of specific psychic and psychical activities above the average people, to conduct an activity that manifests in a particular evolutionary stage, not as a finished process (Columbié, L. 2019).

Armentero, Y. J. (2021) highlighted that the definitions of sport talent are linked, as a common element, to the combination of capacities, possibilities, and potentialities for developing a sport, which belongs to a particular person that makes them different from others of the same age and sex.

This author thinks that humans are biopsychosocial beings defined by genetic and environmental factors, so there is a dialectic relation between the inborn and the acquired. Subjects are born with a genetic potential of their own for a given sport, and to achieve top development, they will require the proper environmental

conditions (socio-economic, nutritional, training, etc.) in order to develop such potentials (Armentero, 2021).

According to Fernandes, J. (1997) cited in Armenteros, Y. J. (2021), the discrimination of the influence of the genetic component as part of the phenotype context is relevant, as it would help establish the true ceiling concerning the functional possibilities of athletes, which is a step forward to accomplish more efficiency in the training process. It will permit coaches to discard future sports talents at an early stage, who could never reach that category, while detecting the real sports talents.

The scientific community of taekwondo has made efforts to optimize the talent selection system, but they have failed to enhance the genetic indicators that cannot be changed with sports training, and therefore offer valuable information about the potential of a possible talent. Among the biological indicators or markers that provide information on the potential of future athletes are the finger-length ratio.

It shows the index finger or D2:D4. It is the correlation between the length of the index (D2) and ring fingers (D4). The D2:D4 ratio shows the prenatal exposure to testosterone quantitatively, which is considered a biological indicator. This theory relies on the results of clinical-research results in fetuses, which have proven the existence of prenatal testosterone link to hand bone growth in a critical point of fetal development. This theory was suggested by Manning, J. *et al*. (1998), and reviewed in 2011, known as a biometric measurement of balance between the concentration of estrogens and prenatal testosterone (Lozada, E. *et al.* 1998 - 2010, cited in Ariza Cabrera, M. A, 2018).

Mońka, M., Pietraszewska, J. (2020) noted that the finger-length ratios of athletes have significantly lower mean values than the non-athlete males (0.9733 in the right hand, versus 0.9736 in the left hand). The non-athlete men showed 0.9931 in the right and 0.9875 in the left hand. Similarly, in women, the mean values of finger-length ratio within athletes were significantly lower than in the non-athlete group. In the right hand, the female athletes averaged 0.9735, whereas it was 0.9722 in the left. The non-athlete group of women showed 1.0025 in their right hands and 0.9945 in their left hands.

Regarding the indicators used in Cuba for talent selection in this sport, the Integrated Athlete Training Program stresses that new talented athletes must win provincial tournaments before joining the EIDE (Starter Sports School), also the first indicator to enroll in the High-Performance Training Facilities. However, a review of the official Cuban documents cited by Columbié, about the competitive results of the National School Student Games found that 72% of the taekwondo athletes with outstanding results in the junior categories, failed to succeed in the

senior categories, dropping out before becoming medalists in the most relevant competitions for Cuba, such as the multi-sport regional events, pan-Am games, or Olympic games (Columbie, L. (2019).

He states that the current system is deficient as a large number of false positives are detected, or true talents discarded. The reason is that there are not enough indicators for sports selection, according to Columbie, L. (2019).

In that sense, the Cuban Federation and the provincial commissions have stated the need to continue to search for more effective tools for the selection of sport talents.

The above evidences that the present system of taekwondo athlete selection has shortcomings in the detection or rejection of true talents, since it lacks enough genetic indicators for detection. Accordingly, the problematic to be addressed in this paper was the deficiencies in the current procedure to characterize talents multilaterally when recruiting Cuban taekwondo talents. Hence, the purpose of this study was to determine the finger-length ratio profile of high-performance female taekwondo athletes in Cuba, as the base to optimize the talent detection system.

MATERIALS AND METHODS

The research study was conducted to determine the finger ratio profile of high-performance female taekwondo athletes, through different stages that permitted the authors to use research methods and techniques to address the scientific problematic stated previously. At first, the existing problem was determined, then a theoretical review was done. The logical thinking processes, which are also the theoretical research methods, were used, with emphasis on analysis-synthesis, and induction-deduction. It led to an analysis of the theoretical and methodological referents associated with the process of talent selection and the finger-length ratio as the indicator included for selection, stressing on combat sports.

Then, the finger-length ratio profile of the high-performance female taekwondo athletes was determined. The study was done between June and September 2020, weighing measurements as the fundamental method to determine the D2-D4 equation, named ratio.

The procedure suggested by Mesa, L.; Aguilera, B. (2018) was used to perform measurements. It states that,

- The researcher asks the research subjects to open their hands.
- The hand is placed in supine anthropometric position.
- To take a photo of both hands, the subject must lay them on a flat surface, the fingers joined in normal position, open hands, and the third finger pointing to the same line as the longitudinal axis of the forearm.

- The teacher stands where they can see the two hands totally vertical. In this position, a photo is taken.
- Then software RATIO-V2 is opened.
- The screen is opened to input the data, including the photo of the hand.
- Length is determined using the first longitudinal fold of the palm, between the phalanx and the digital point in the distal part (tip of the finger).
- The mouse pointer is placed on the first inter-phalanx fold, or where the finger originates. It is held on and moved to the tip of the finger, determining the existing distance and finger length.
- The index is the first finger to be measured, then the ring finger.
- The software determines the ratio automatically.

Two statistical and mathematical methods are used. The principal trend measurements were determined through descriptive statistics. Besides, the ratio theories from different authors were included. Inferential statistics was used through the correlation coefficient to assess the finger-length ratio.

RESULTS AND DISCUSSION

The results were collected from the population (15 athletes), accounting for 100% of Cuban female taekwondo athletes in the national pre-selection, the strongest today (Graph 1).
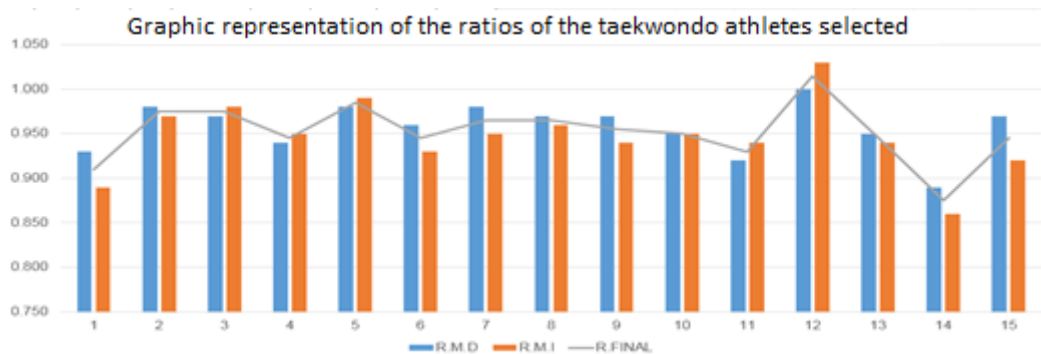
Graphic 1. Results of the finger-length ratio of the high-performance female taekwondo athletes

The graph shows the individual profile of the national female taekwondo athletes today, which is expected to be eligible for the new Olympic cycle. The first athlete has a right-hand ratio of 0.93, while the left hand shows 0.89. The final ratio, which was obtained from averaging the data from the two hands, was 0.91.

The second athlete had a right-hand ratio of 0.98, while the left hand showed a 0.97, with a final average of 0.98. In turn, the third athlete had a right-hand ratio of 0.97, while the left hand showed a 0.97.

The fourth athlete had a right-hand ratio of 0.94, while the left hand showed a 0.95, with a final average of 0.94. The fifth athlete had a right-hand ratio of 0.98, while the left hand showed a 0.99. The sixth athlete had a right-hand ratio of 0.96, while the left hand showed a 0.93, with a final average of 0.94.

The seventh athlete had a right-hand ratio of 0.98, while the left hand showed a 0.95, with a final average of 0.96. The eighth athlete had a right-hand ratio of 0.97, while the left hand shows a 0.96, with a final average of 0.96.

The ninth athlete had a right-hand ratio of 0.97, while the left hand showed a 0.94, with a final average of 0.95. The tenth athlete had a right-hand ratio of 0.95. In this case, the result was the same for both hands.

The eleventh athlete had a right-hand ratio of 0.92, while the left hand showed a 0.94, with a final average of 0.93. The twelfth athlete had a right-hand ratio of 1.00, while the left hand showed a 1.03, with a final average of 1.01.

The thirteenth athlete had a right-hand ratio of 0.95, while the left hand showed a 0.94, with a final average of 0.94. The fourteenth athlete had a right-hand ratio of 0.89, while the left hand showed a 0.86, with a final average of 0.87. The fifteenth athlete had a right-hand ratio of 0.97, while the left hand showed a 0.92, with a final average of 0.94 (Table 1).

Table 1. Group results of the finger-length ratio profile in the Cuban taekwondo selection

Finger profile ratio in the Cuban taekwondo selection.					
Stratigraphy	R.M. D	R.M. I	R. FINAL	C.R.M.D vs R.M. I	C.R.M.D vs R. Final	C.R.M.I vs R. Final
Medium	0.95	0.94	0.95	0.814	0.934	0.968
SD	0.03	0.04	0.03			
Maximum	1	1.03	1.01			
Minimum	0.89	0.86	0.87			

Legend: SD: standard deviation; C.R.M.D vs R.M.I: right-hand ratio correlation with the left hand; C.R.M.D vs R. Final: right-hand ratio correlation with the right-hand final ratio; C.R.M.I vs R. Final: left-hand ratio correlation with the final ration of the left hand.

Table 1 shows the profile ratio of the population studied. Accordingly, the right-hand ratio is 0.95, while the left hand shows a 0.94, with a final average of 0.95.

As shown in graphic 1, individual female taekwondo athletes in the national selection of Cuba today, athlete No. 1 had a lower value than the right hand. The tenth athlete showed both hands with the same values.

In turn, the twelfth athlete is an example of the non-athlete women.

Overall, the ratio profile of the female taekwondo athletes of the national selection did not show the features of non-athlete women (1.00), coinciding with the findings of Monka, who noted that women who do not take sports showed higher values of the finger proportion in the two hands, and the right hand showed one typically female ratio (1) (Monka, M., Pietraszewska, J. 2020); since the subjects of the study showed a common men's profile (below 1.00). The above indicates that the females with these ratio features have athletic potentialities that favor sport performance.

Table 1 shows the profile ratio of the population studied. The findings coincide with the results reported by Monka, who noted that women athletes have lower values than the finger-length ratio of other women who do not take sports. The athletes showed a typically male finger-length ratio, with significantly lower mean values than the average values of the men who do not take sports (Monka, M., Pietraszewska, J. 2020).

In that study, the author said that female athletes did not differ considerably as to the mean value of the finger-length ratio from male athletes, evidenced in their research. It may be assumed that women with a more male-like finger-length ratio are more prone to achieve higher results in sports.

The mean ratio values observed in the taekwondo population (0.96; 0.95) were lower than the ones found by (Giffin, N.A. *et al.,* 2012; cited by Mońka, M., Pietraszewska, J. 2020), who found that the finger-length ratio of a group of female athletes averaged 0.98, justifying the utilization of this profile as an indicator for talent selection.

The research study consulted in relation to the ratio reference values were 0.98±0.03mm, the cut off to determine the prenatal exposition to testosterone. The D2/D4 < 0.98±0.03mm values indicated a high prenatal exposure to testosterone, and the D2/D4 > 0.98±0.03mm indicated low exposure (López, S. 2016).

In that respect, and considering the results achieved for this sport, the cut off values of the right hand must be D2/D4 < 0.95±0.03mm, while the left hand must be D2/D4 < 0.94±0.04mm. If the coach decides to use the final ratio as an indicator, then D2/D4 < 0.95±0.03mm, as they indicate high prenatal exposure to testosterone, and consequently, positive aptitudes to develop strength, speed, and quickness of movements.

The results of this study differed from others, such as the research involving volleyball players with 2D:4D right hand average of 0.936, and 2D:4D of 0.952 in the left hand (cited by Acar, H; Tutkun, E. 2019).

The profile analysis did not tell if the values from one hand are enough to determine the athletic potential. As table 1 shows, the left and right-hand correlation, it is strong and positive (0,814). The same occurs when correlating the right hand with the final ratio (0,934) and the left hand with the final ratio (0,934), which suggests conducting a thorough analysis of both hands and the final ratio to make a decision of the athlete's potentialities for selection, based on the lowest value.

CONCLUSIONS

The analysis of the theoretical and methodological rationales for the talent selection process led to the conclusion that it is systematic, with the main objective of detecting, selecting, and following up individuals with enormous aptitudes for this sport, has a sociocultural character. The selection relies on the construction of a reference profile for the high level designed depending on the assessment of the important indicators for a particular activity, and then, the establishment of the required profiles for the sport. The discrimination of the influence of the genetic component within the phenotypical context to establish the true ceiling in relation to the functional possibilities of athletes. The biological indicators or markers that provide information about the genetic potential, and to differentiate the physical components include the finger ratio.

The finger-length ratio profile of the Cuban high performance women taekwondo athletes indicate high prenatal exposure to testosterone, and therefore, a positive aptitude toward strength, speed, quickness of movement development, which is within D2/D4 < 0.95±0.03mm for the right hand; whereas the values for the left hand are D2/D4 < 0.94±0.04mm.

BIBLIOGRAPHIC REFERENCES

Acar, H; Tutkun, E. (2019). Analysis of the 2D:4D Ratios of National and Amateur Football Players. International Journal of Applied Exercise Physiology 8 (1). 2322-3537.
https://www.researchgate.net/publication/331542496_Analysis_of_the_2D_4D_ratios_of_national_and_amateur_football_players

Ariza Cabrera, M. A. (2018). Perfil d2 y d4 como predictor genético para el deporte. Facultad Ciencias del Deporte y la Educación Física, Universidad de Cundinamarca. Available at: http://hdl.handle.net/20.500.12558/1164

Armentero-Vasconcelos, Y., Tamarit-Medrano, R., & Muñoz-Aguilar, I. 2021). Características dermatoglíficas en esgrimistas de iniciación desde el punto de

vista poblacional. *Ciencia Y Deporte*, *6*(3), 74 - 80. https://revistas.reduc.edu.cu/index.php/cienciaydeporte/article/view/3872

Fernández, R. (2016). Programa Integral de Preparación del Taekwondista. Federación Cubana de Taekwondo, La Habana, Cuba. http://www.inder.gob.cu

Lastres, A; & Sánchez, B. (2017). Aproximación a la teoría de selección de talentos de esgrima para el alto rendimiento. Lecturas: Educación Física y Deportes, Revista Digital. Buenos Aires, 22(227). https://efdeportes.com/efd227/aproximacion-a-la-seleccion-de-talentos-de-esgrima.htm

1. Lastres, A; et al. (2020). Orden metodológico para la confección de un modelo científico de selección de talentos en deportes de combate. La Habana. Centro de Investigaciones del Deporte Cubano. 1er Boletín.

López, S. (2016). Relación digital D2/D4 y VO2máx en estudiantes universitarios de educación física. Rev.salud.hist.sanid.on-line 2016;S:98-106 (diciembre). http://agenf.org/ojs/index.php/shs/article/view/24

Lozada, E.; Manrique, F; Bernal, M.; Mahecha, G. (2014). Índice D2:D4 y rendimiento deportivo. Rev.salud.hist.sanid.on-line 2014;9(1): 62-69 (enero-junio). http://agenf.org/ojs/index.php/shs/article/download/105/103

Mesa, L.; Aguilera, B. 2021). La ratio y su relación con las capacidades motrices en las judocas de Camagüey. Podium 16 (1). scielo.sld.cu/scielo.php?script=sci_abstract&pid=S1996-24522021000100233

Mońka, M., Pietraszewska, J. (2020). Digit Ratio in Groups of Sporting and Non-Sporting Women and Men and its Relations with Somatic Features and Motor Fitness. *Central European Journal of Sport Sciences and Medicine*, *1* (29),29–39. Disponible en: DOI: 10.18276/cej.2020.1-04. http://cejssm.usz.edu.pl/wp-content/uploads/04_monka.m-pietraszewska.j.pdf

Conflict of interests:

The authors declare the are no conflicts of interests whatsoever.

Author contribution statement:

Eugenio Enrique Capote Rios: Introduction, results, discussion, and references.

Luciano Mesa Sánchez: Methods and results

Beymer Aguilera Ramírez: Discussion and conclusions.