PODIUM
Journal of Science and Technology in Physical Culture

EDITORIAL LIBERCIENCIA

Volume 18
Issue 2
2023

University of Pinar del Río "Hermanos Saíz Montes de Oca"

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, May-August 2023; 18(2): e1472

PODIUM
REVISTA DE CIENCIA Y TECNOLOGÍA EN LA CULTURA FÍSICA

Translated from the original in spanish

Original article

Performance profile of the pole vaulters of the Cuban national team

Perfil de rendimiento de las pertiguistas del equipo nacional cubano

Perfil de desempenho dos saltadores com vara da equipe nacional cubana

Rolando Palacios Pulgarón[1*], *Magda Mesa Anoceto*[2], *Yusimil Ramos Quian*[2]

[1]Higher School for the Training of Athletes. Havana Cuba.

[2]University of Sciences of Physical Culture and Sports "Manuel Fajardo ". Havana Cuba.

[*]Corresponding author: rolapa1970@gmail.com

Received:2023-01-31.
Approved:2023-04-10

ABSTRACT

The research was carried out with the objective of proposing a variant of performance profile or deportogram for the female pole vault, based on the behavior of the main physical-technical performance indicators of this test, for the Cuban national team. A bibliographic review of the main antecedents of deportograms previously used for pole vaulting and the indicators that comprised them was carried out. Quantitative measurements were made to 11 physical-technical indicators that were correlated with the result of the pole vault in a

study group made up of 14 pole vaulters from the Cuban national team, with an age range between 15 and 32 years (mean ± standard deviation: 25.20 ± 3.5). Theoretical methods such as analysis-synthesis and induction-deduction were used; as empirical methods, the review of documents, the interview, the measurement and, statistical-mathematical that facilitated the research process. The results provided a new performance profile or deportogram for the female pole vault with a significant correlation between the new proposed indicators and the pole vault result.

Key words: Profile, pole vault results, performances.

RESUMEN

La investigación fue realizada con el objetivo de proponer una variante de perfil de rendimiento o deportograma para el salto con pértiga femenino, a partir del comportamiento de los principales indicadores de rendimiento físico-técnico de esta prueba, para el equipo nacional cubano. Fue realizada una revisión bibliográfica de los principales antecedentes de deportogramas empleados previamente, para el salto con pértiga y los indicadores que los conformaron. Se realizaron mediciones de tipo cuantitativo a 11 indicadores físico-técnicos que fueron correlacionados con el resultado del salto con pértiga en un grupo de estudio integrado por 14 pertiguistas de la selección nacional de Cuba, con un rango de edad entre los 15 y los 32 años (media ± desviación típica: 25,20 ± 3,5). Se utilizaron métodos teóricos como el análisis-síntesis y la inducción-deducción; como métodos empíricos, la revisión de documentos, la entrevista, la medición y, estadístico-matemáticos que facilitaron el proceso investigativo. Los resultados aportaron un nuevo perfil de rendimiento o deportograma para el salto con pértiga femenino con una correlación significativa entre los nuevos indicadores propuestos y el resultado en salto con pértiga.

Palabras clave: Perfil, resultados del salto con pértiga, rendimientos.

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, May-August 2023; 18(2): e1472

RESUMO

A pesquisa foi realizada com o objetivo de propor uma variante de perfil de desempenho ou esportograma para o salto com vara feminino, com base no comportamento dos principais indicadores de desempenho físico-técnico desse evento, para a equipe nacional cubana. Foi realizada uma revisão bibliográfica dos principais esportogramas utilizados anteriormente para o salto com vara e dos indicadores que os compunham. Foram realizadas medições quantitativas de 11 indicadores físico-técnicos que foram correlacionados com o resultado do salto com vara em um grupo de estudo formado por 14 saltadores com vara da equipe nacional de Cuba, com uma faixa etária entre 15 e 32 anos (média ± desvio padrão: 25,20 ± 3,5). Foram usados métodos teóricos como análise-síntese e indução-dedução; como métodos empíricos, revisão de documentos, entrevista, medição e métodos estatístico-matemáticos que facilitaram o processo de pesquisa. Os resultados forneceram um novo perfil de desempenho ou esportograma para o salto com vara feminino com uma correlação significativa entre os novos indicadores propostos e o resultado do salto com vara.

Palavras-chave: Perfil, resultados do salto com vara, desempenhos.

INTRODUCTION

The performance profile as a methodological instrument

In long-term preparation, the construction of the reference profile for high sports performance is important (Filgueira, 2016; Matutano, *et al.*, 2019; Enciso and Lago, 2020). This model, in the old European socialist countries, was called deportogram (García, *et al.*, 2003).

Accurate knowledge of the conditional profile of the sport discipline and that of each athlete is essential for training planning. Until about 10 or 15 years ago, the profiles of some sports specialties were poorly defined, imprecise and little scientifically based; therefore, it is considered to study and define, with greater precision, this area of knowledge.

In this sense, it is necessary to differentiate the conditional motor factors that intervene in the sporting result, those that have a presence in it, in one way or another, and those that are relevant because they contribute decisively to competitive performance in it (Montealegre and Vidarte , 2019; Mcguigan, 2020; Salido, *et al.*, 2020; Montoya, 2023).

Bishaeva (2015) emphasizes that, based on the most cardinal functions of the personality and motor skills, the increase in demands is established and the selection of the most effective means and methods of physical culture is developed and within it, of the different sports and their elements, so the level of functionality of the load in the work process is decisive. Siris *et al.* (1988) propose obtaining data from two sources:

- The first is to locate the requirements of the modality of the sport that represent the athlete, it refers to the main qualities and capacities inherent to outstanding athletes, in a specific sport modality that constitute the information on the objective contents of the sport (Simpson, *et al.*, 2019; Haycraft, *et al.*, 2019 and Suárez, *et al.*, 2023).

- The second is the information from technology, factor analysis, correlation and regression (García, *et al.*, 2019; Schärerm *et al.*, 2019; Iglesias and De la Villa, 2021; Singh and Daudayal, 2022 and Garcia, *et al.*, 2022). In addition to, the degree of conditioning of the sporting result by the level of development of the different qualities and capacities (Cui, *et al.*, 2018 and Grammaticos, *et al.*, 2022).

For their part, Volkov and Filin (1989) correct the utility of the deportogram that determines not only the most substantial indicators, but also the possible threshold of deviations from the ideal; as well as to stipulate the changes as a result of the supposed growth of the sports skill.

These authors consider that not only age and level of results should be taken into account, but also establish the reference profile of athletes in a certain specialty and include quantitative aspects such as morphological, conditional, biomechanical, energetic and hereditary aspects.

For Melnikov and Iurov (2013) the deportogram is a scientific evidence, where the integral conditions, the objectives, the norms, the tasks, the demands of the sport, the personal qualities of the athlete and the main characteristics of the sport activity are generalized. Bishaeva (2015) suggests that it combines motor activities aimed at improving motor skills in professions and the most important psychophysiological functions for the formation of personality qualities in athletes. Meanwhile, Garcia *et al.* (2011) defines it as:

> An instrument that allows federation technicians and personal trainers to determine the level of an athlete at the time of carrying out the set of tests with respect to an "ideal" level of physical-technical condition for their age group and test. (...) Its use serves to see the evolution of the athlete with respect to the model and determine the possible potential it may have to reach high performance. (p.160)

In summary, the correct conception of a deportogram makes it possible to compare an athlete with the corresponding performance model and provides information on the possible individual potential for the test that he/she performs and on the possible training strategies to follow, in his/her long-term training.

The pole vault is a highly complex athletic event where physical, technical and psychological indicators play a vital role in the control of preparation (Gross, et al., 2019; Cassirame, et al., 2019; Pavloviæ, et al.., 2019; Butler, 2020 and Brazo, 2022).

The line of study of sports performance in the pole vault test initiated by Nikonov (1982) and (1995) takes into account the relationship between the result and the strength, running and jump indicators; in addition, it provides a deportogram for the female pole vault (Figure 1).

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, May-August 2023; 18(2): e1472

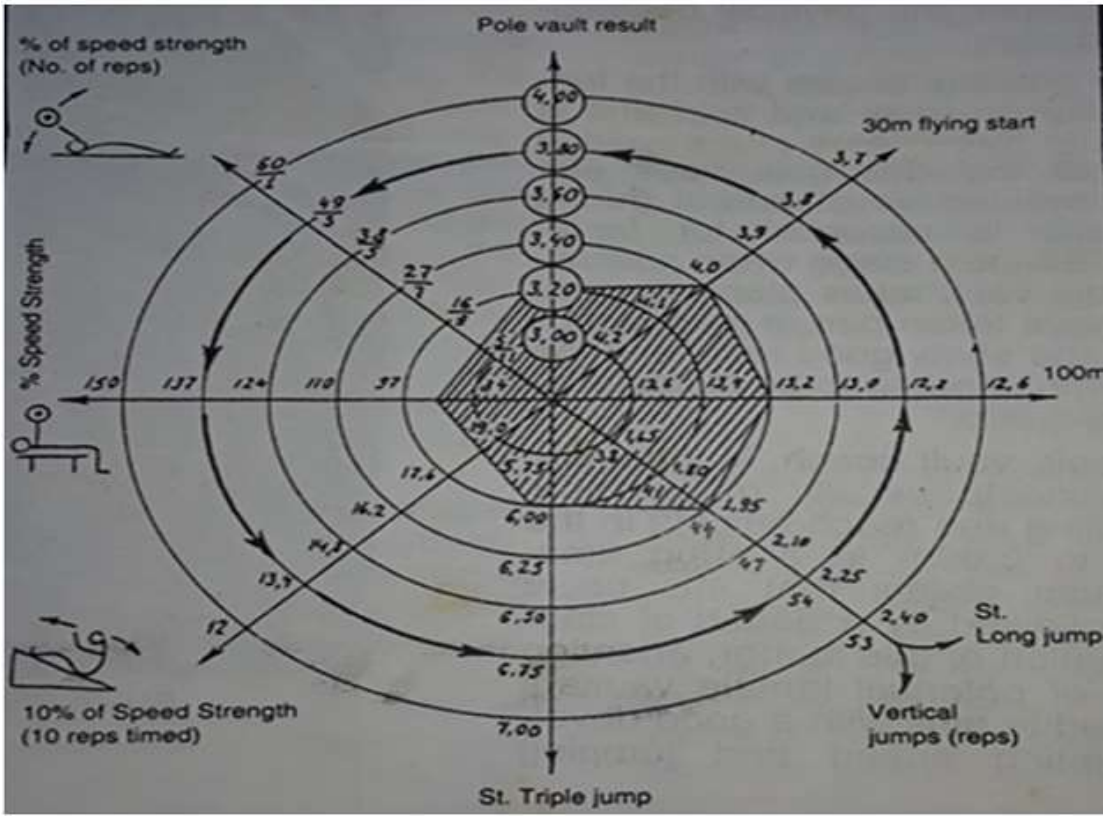

Fig. 1. *- Deportogram for the women's pole vault (Nikonov, 1995)*

This instrument has an integrating character, since it takes into account the technical result of the test and the level of physical performance of the athletes in each of the indicators, thus providing an opportunity for comprehensive pedagogical control. Indicators are: 30-meter fly, 100-meter-long jump without sprinting, vertical jump (Abalakov), alternating triple jump from place, trunk crunches (ten repetitions for time with 10 kg behind the neck), lying strength, pullover and the result in the pole vault.

According to Nikonov and Nikonov (2016) the results in the pole vault depend on the level of development of certain muscle groups participating in the execution of the technique; these authors recommend, for the evaluation of the functional possibilities and the planning of the training process, the use of performance control indicators, by calculating the regressions in relation to the results obtained.

This scientific result constituted an advance from the methodological point of view for the athletic discipline of pole vaulting, since the correlations make it possible to know the degree of dependence that an indicator has in relation to others, and to know which ones have the most influence on preparation of athletes. Other researches confirmed the usefulness of this result, such as those carried out by Ursino and Barrios (2019) and Gómez *et al*. (2019), in others.

Zatko (1988) provided one of the most inclusive and comprehensive deportograms for the male branch. It was made from the measurements of the best pole vaulters of the former Union of Soviet Socialist Republics (USSR). He related 16 indicators: ten physical and six technical.

What is interesting about this proposal is that the author assumed the physical indicators provided by Nikonov (1982), but included other technical indicators, related to the use of the implement, such as the height of the grip, the hardness of the pole and the 20 meters thrown with pole; for this sample, there is no information on the level of correlation of these physical and technical indicators.

Pereira (1999) presented a deportogram specifically for the women's pole vault with nine indicators. The introduction of the shot put backwards with 3 kg, the clean and the quintuple jump with five steps are novelties of this proposal, as well as the incorporation of the margin of error for each indicator. For his part, Bondarchuk (2000), in his reference table for women's pole vault, provided the correlation coefficients of various performance indicators for women's pole vault (14 in total) and highlighted the indicators with the highest correlation: pole vault with sprint and the 60-meter dash.

Maksimenko and Grebenkin (2000) designed a deportogram for the selection of talents for the male branch, based on a sample of school and youth athletes with 14 indicators: four morphological, three technical and five physical; as a novel element, he highlighted the use of morphological indicators, in this case: weight, height, reach (height with arms raised up) and the weight-height index.

Garcia et al. (2003) present a deportogram for 12-year-old male pole vaulters, for sports initiation and are of the opinion that these should be generalists and oriented towards the chosen sport modality; it was made up of 10 morphological and physical indicators that vary according to age and years of training, which sometimes makes it necessary to modify the control test used to evaluate the same indicator.

Garcia *et al*. (2011) presented a deportogram for the selection of talents with a sample of Spanish athletes, made up of 12 physical, technical and morphological indicators; as an element to highlight in this work is the comparison of the means of the results of the Spanish athletes with the world ones and the non-inclusion of strength indicators.

Hommel (2014), at the world conference for youth coaches, addressed the problem of multilateral preparation at an early age for the practice of athletics. He presented a series of 16 physical and technical indicators for the women's pole vault, of which nine were technical and seven were physical. The most striking thing about this proposal was the relationship with other athletics tests, such as the hurdles race, the javelin throw and the long jump with a complete impulse race; which shows the multilateral character of the preparation, the inclusion of the technical index and different execution variants of the quintuple jump.

Ritter (2016) proposed a triple deportogram, with the main indicators of pole vaulter preparation in well-defined groups of strength, jumping and running with 23 indicators in total; these indicators allow to illustrate the state of preparation of the athletes in a global way and uses an indicator of abdominal and shoulder strength. In the same way, it establishes five classifications or regulations for the evaluation in each deportogram.

For Palacios (2020) the Cuban female pole vault has stood out in this specialty at the international level despite the material limitations and average height of its athletes, a technical style of strength has been evidenced in most of them according to the Nikonov & Chesnokov (2012) postulates.

For this reason, the need arises to establish a performance profile or sportogram for Cuban pole vaulters appropriate to the technical style used, the characteristics and working conditions where they are developed. It is then established, as a general objective of the

research, to propose a variant of performance profile or deportogram for the female pole vault, based on the behavior of the main physical-technical performance indicators, in this test of Cuban athletes.

MATERIALS AND METHODS

Fourteen pole vaulters who made up the Cuban national team at some point during the last 15 years were considered as a sample. This period was taken because the training systems and methodologies used in the preparation of the athletes were similar. The inclusion criterion in the study group was the possession of a minimum personal best of 3.30 meters. The means of age, height and body weight were 24.20 ± 3.5 years; 161.5 ± 2.14 centimeters and 60.83 ± 4.26 kilograms.

Theoretical methods such as the historical-logical one were used for the determination and analysis of the background of the training process and, in particular, of the performances in the pole vault. The analysis-synthesis method was used to break down the training process, determine the essential aspects of physical-technical performance, the performance profile and the main performance indicators in the female pole vault.

From the work with the theoretical-methodological referents of the performance indicators in the pole vault, it was moved from the general to the particular and vice versa; during the research, the induction-deduction method made it possible to reach generalizations about the process under study. The systemic-structural approach was used as an orientation for the knowledge of performance profiles, performance indicators and current trends in the training process of pole vaulters and in the development of new performance profiles.

As empirical methods were used:

Documentary review, for the analysis of documents such as the Comprehensive Program for the Preparation of the Cuban Athletics Athlete for jumpers (2001), normative documents, the training plans of the Cuban national women's pole vault team, training units, national

and international ranking, pole vault performance profiles and other bibliographical sources that delve into sports performance, especially for this test.

Interview was used to verify the level of updating of the coaches in the knowledge of performance profiles in pole vault, its main indicators and the importance of their knowledge for the control of sports performance.

Measurement, for measurement, all participants were instructed in the possible risk of participating in this study and signed their consent, according to the review board of the institution. They are healthy subjects, free of any injury and without any physical problem.

Eleven performance indicators of the physical and technical dimension were measured and for this, whistles, set of Olympic weights, cones, chalks, poles, mattress, sheets of paper to collect the results and Excel calculation sheets or records for the calculation data analysis were used. The indicators that were the object of measurement are the result in the pole vault 30 meters from a standing position, 100 meters, long jump, vertical jump (Abalakov), triple jump from a standing position, trunk abdominal on a 45-degree inclined plane (10 repetitions with time measurement), strength lying down (pron), pullover and two new indicators are included, the start and the return, handstand and rod pass (Z).

The measurements were carried out at the facilities of the ESFA "Giraldo Córdova Cardín " Higher School for Athlete Training in the Habana del Este Municipality, Havana province, during different moments of the macrocycle and the minimum control tests were applied at least three times in the macrocycle, in the stages of general, special and competitive preparation.

The general methodological indications that were established were the following:

- Define the facilities, premises and places to perform the tests, these must have the minimum essential conditions for their performance.
- Have the materials, instruments and means for measurement.
- Have the appropriate clothing and footwear for each activity.

- Perform a general warm-up of all muscle planes and joints, with the execution of a specific warm-up, depending on the activity to be carried out.
- Plan the place, application time, rest intervals, order, continuity of the tests and days on which they will be applied.
- Select in advance the personnel who will apply the tests and collect the data (they must be prepared and trained to carry out the activity).

The selection process of the performance indicators with the highest correlation was carried out in three stages or filtered from the studies by Carretero and Pérez (2005).

First filtering, the indicators with the lowest correlation in the sample were eliminated from the total number of indicators.

1. Based on the indicators known for the male branch, the same indicators were chosen to apply to the female branch.
2. All indicators are correlated comprehensively. To analyze the level of correlation of the indicators, in general, depending on the result.

Second filtering: New additional indicators were incorporated for each dimension that made it possible to replace the indicators with the least correlation and met the requirements for superior functioning (axes, planes and muscles involved, movements and forms of execution that are most similar to the technical gesture of the test). In this case, two indicators were incorporated: the (Z)-Back turn, handstand and rod pass and the hanging start with assault or scissors.

1. The indicators were divided into the physical and technical dimensions.
2. New indicators were added for each dimension separately.
3. Both dimensions were correlated with the already established indicators.

Third filtering: The indicators were integrated and grouped, based on the level of correlation they had with the result in an integrated dimension (physical-technical), which led to the elaboration of the integral deportogram.

1. The indicators with the highest correlation for the two dimensions were selected.
2. The indicators with the highest correlation were grouped and the integral deportogram was made.

As statistical-mathematical methods, those of descriptive statistics were used that allowed organizing, presenting and summarizing the information through tables, graphs and statisticians. The regression and correlation analysis was used for the sport performance indicators in the Cuban pole vaulters and the processing was carried out by the statistical program Stat-Graphics Plus 5.1.

RESULTS

The Comprehensive Program for the Preparation of the Cuban Athletics Athlete, for jumpers and the normative documents for the training of the Cuban national jump team, performance profiles and other bibliographic sources that delve into sports performance in pole vaulting were analyzed.

The results obtained from the review of the Comprehensive Program for the Preparation of the Cuban Athletics Athlete for the jumpers, verified that contents referring to the pole vault of both sexes are not addressed and in the normative documents of the training of the Cuban national team of jump, there were not evidences either of the application of performance profiles for training control.

Among the different documentary sources on performance profiles there was a variety of criteria, but studies on physical and technical performance indicators prevail, for the pole vault and performance indicators that affect the sporting result that vary depending on the source. From all this analysis, it was inferred the need to develop performance indicators that have a greater impact on the result based on the conditions, the characteristics of the

athletes and the technical model adopted, to establish performance profiles according to these criteria.

From the interview carried out with the eight coaches, it was obtained the information that they are all university graduates. Of them, six have more than 20 years of experience and the others two have 10 years. The eight coaches identified the main performance indicators that affect the result, but only three had notions of the performance indicators that have the highest correlation with the final result in the pole vault. Four coaches recognized what a performance profile is and its importance for performance control and prognosis.

With the results obtained in the diagnosis on the current situation of the studied process, it was determined the need to develop a new performance profile for the control and prognosis of the sports performance of the pole vaulters and They were the following ones:

The highest correlation among all performance indicators measured was between Z (handstand backhand and pole pass) and pole vault performance. This was one of the new indicators evaluated, it is considered a very complete exercise that requires skill and coordination, where a greater number of segments, muscle planes of the arms, legs and trunk are involved, which is adapted to the material conditions where it is performed and is very similar to the technical execution in the phase of passing the rod and the position in I, at the end of the extension phase.

More athletes had the chance to perform it, no additional weight was needed and as a basic exercise in the gymnast's arsenal it can be performed in all categories, from the floor position to on top of a raised table (more than 1 m high).

The correlation between Z and the result in the pole vault was strong ($r = 0.95$; $p = 1.8 E - 07$), which evidenced the importance of incorporating this new indicator for control in this athletic event and the indicators with the highest correlation with each other were between Z and starting ($r = 0.94$; $p = 4.7 E - 07$).

The hanging scissor snatch indicator was executed from the starting position with legs and trunk flexed, feet hip-width apart, back hyperextended, arms straight with a wide grip and hook hold. The crowbar was raised from below knee level to full extension of the arms overhead and the movement was completed with a deep scissor slide, then finished with the recovery. This indicator showed three of the highest values of the general correlation with the result ($r = 0.93$; $p = 2.1 E - 06$), with Z ($r = 0.94$; $p = 4.7 E - 07$) and with the alternate triple jump ($r = 0.90$; $p = 9.3 E - 06$).

The study found that the pullover indicator had a lower correlation and significance ($r = 0.69$; $p = 0.01$) with respect to the result in the pole vault, the pullover was performed from the initial position of lying on the parallel bench down; it is a localized exercise to strengthen the shoulder region that, by increasing the weight of the load in each execution of the exercise, loses the dynamic character of its execution and can cause injuries to the shoulders of athletes.

The hanging snatch with scissors presented a strong correlation ($r = 0.93$; $p = 0.000021$), it is a faster and more powerful execution that can be performed continuously and with greater weights, a greater number of groups are worked, muscle planes, joints, in addition to the fact that the work of the shoulders, arms and chest in this exercise is similar to the technical gesture that is executed in the entry phase with the pole.

The indicator of execution time of the trunk abdominal in a 45-degree inclined plane, the 10 repetitions with 10 kg behind the neck had less correlation and significance with the result in the pole vault ($r = -0.71$; $p = 0.004$) than the indicator of Z ($r = 0.95$; $p = 0.00000018$) (Table 1).

Table 1. *- Correlation of indicators for the female pole vault*

	Results	30m/v	100m	Salt. Y Mar	LongS/I	3ple	pron	Pullover	Abdominal	Z	Arranque
Results	1,00	100E-02	6,3E-04	3,6E-04	3,2E-05	1,7E-05	8, =E-05	0,01	4,0E-03	1,8E-07	2.1E-05
30m/v	-0,69	1,0	7,0E-06	0,01	0,03	0,02	6,3E-04	0,01	0,01	5,2E-04	4,8E-03
100m	-0,80	0,91	1,00	0,01	0,01	0,01	1,8E-04	0,01	2,8E-03	3,2E-05	1,7-E03
Salt. Y Mar	0,82	-0,69	-0,69	1,00	0,01	5,5E-05	9,5E-04	0,05	4,4E-03	1,5E-03	2, E-04
LongS/I	0,88	-0,59	-0,67	0,66	1,00	2,5E-04	2,6E-03	0,08	0,02	7,1E-05	4,3E-04
3ple	0,89	-0,59	-0,65	0,87	0,83	1,00	1,1E-03	0,05	0,02	5,0E-05	9,3E-04
pron	0,86	0,8	-0,84	0,78	0,74	0,78	1,00	0,01	1,5E-03	1,4E-05	4,4E-04
Pullover	0,69	-0,66	-0,64	0,53	0,48	0,53	0,68	1,00	0,03	2,8E-03	1,9E-03
abdominal	-0,72	0,70	0,73	0,73	-0,61	-0,61	-0,76	-0,58	1,00	0,01	0,02
Z	0,95	-0,8	.0,88	-0,88	0,86	0,87	0,90	0,73	-0,68	1,00	4,7E-07
Arranque	0,93	-0,71	-0,75	-0,76	0,81	0,90	0,81	0,75	-0,62	0,94	1,00

From the data of this correlation matrix, a performance profile or physical-technical deportogram was obtained for the female pole vault (Figure 2), which included indicators with a higher level of specialization, taking into account the characteristics of Cuban athletes, as it is considered more appropriate to the context under study and according to the technical model used for female pole vault athletes who have performances from 3.30 m to 4.90 m (Figure 2).

ISSN: 1996–2452 RNPS: 2148
PODIUM Journal, May-August 2023; 18(2): e1472

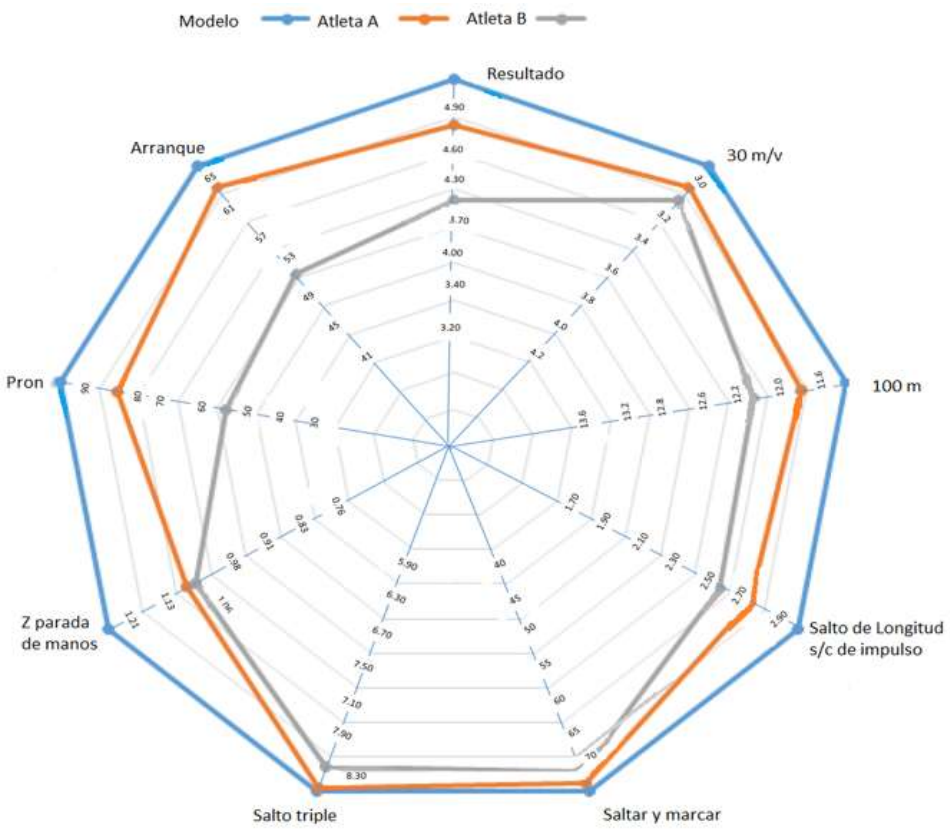

Fig. 2. *- Deportogram for the female pole vault*

Nikonov's deportogram proposal with indicators of high correlation with the result in the study group used, in a multiple regression analysis, had a value of r = 0.93; p = 0.0037 and the new deportogram for the same study group, with the new bootstrap and Z indicators, had a correlation r = 0.94; p = 0.0024. It was shown that both deportograms are consistent with the requirements of control of the preparation of pole vaulters and that the new proposed deportogram can be inserted as another alternative to measure and control the main performance indicators in pole vault.

DISCUSSION

When analyzing the results of this research, a comparison was made regarding the performance profiles used by different authors. The most current studies on performance in the pole vault present a greater number of performance indicators in the physical-technical

dimension, which are the ones that most affect the result in the pole vault and, due to their incidence, technical indicators, strength, jump and speed (Cassirame, *et al.,* 2019; Vorovenci, 2019 and Xiayuan, *et al.,* 2020).

The continuous evolution of research on the test is denoted with the introduction of new performance indicators with a higher correlation with the result and the importance of correlations and regressions for the control and forecast of future performance and results is assumed (Schärer, *et al.,* 2019; Örs, *et al.,* 2021 and Enoki, *et al.,* 2022).

Interest continues in the selection of talents and performance profiles with morphofunctional indicators that affect the pole vault result. Current studies take up new indicators of morphofunctional performance that give a new dimension to these investigations (Singh and Daudayal, 2022). The current trend in research is to increase with other performance indicators in training and in high-level competitions, on a regular basis and that affect the result in a multilateral way (Örs, *et al.*, 2021).

Other emerging development pathways are the use of non-classical forecasting methods with the application of neural networks, such as the research by Yuhan (2023) and the incorporation of psychological performance indicators in research, according to Ursino et al. (2019) due to the importance they have in achieving better results that denote their little incorporation, which is why it is considered a pending subject for those who study the test.

CONCLUSIONS

The theoretical and referential background studied on the pole vault training process and, specifically, its performance profiles, allowed the elaboration of a new performance profile for the female pole vault, based on the studies analyzed, the accumulated experience of years, the sports results achieved in our country, the study of other performance profiles for pole vaulting in the international literature, as well as the incorporation of new performance indicators with greater correlation. with the result in the pole vault.

REFERENCES

Bishaeva, A. A. (2015). *Libro de texto para los estudiantes de los centros de enseñanza media de Cultura Física*, Centro Editorial "Academia". p.46.

Bondarchuk, A. (2000). *Transfer of training in sport*. Ultimate Athlete Concepts, 2007. Pp. 218. ISBN 0981718019 https://books.google.com.cu/books/about/Transfer_of_Training_in_Sports.html?id=o5bmPQAACAAJ&redir_esc=y

Brazo-Sayavera, J. (2022). *Manual didáctico para la docencia universitaria del atletismo: Universidad de la República.* Comisión Sectorial de Enseñanza, 134 p. Montevideo. ISBN: 978997401971. https://www.cse.udelar.edu.uy/wp-content/uploads/2022/09/Manual-Atletismo.pdf

Butler, D. (2020). *The Pole Vault, A Violent Ballet*, Houston Texas, www.herringdesign.com. ISBN 978-0-917001-31-4. https://books.google.com.cu/books/about/The_Pole_Vault.html?id=RR1AzQEACAAJ&redir_esc=y

Carretero-Dios, H., y Pérez, C. (2005). Normas para el desarrollo y Revisión de estudios instrumentales. *International Journal of Clinical andHealth Psychology*, 5(3), 525 - 551. https://www.redalyc.org/pdf/337/33705307.pdf

Cassirame, J., Sanchez, H., Garnier, A., & Frere, J. (2019). How pole vaulters from different levels deal with speed to perform, [conferencia] *44th Congress of the Société de Biomécanique, Computer Methods in Biomechanics and Biomedical Engineering*, DOI:10.1080/10255842.2019.1668135: https://doi.org/10.1080/10255842.2019.1668135.

Cui, Y., Gómez, M.A., Gonçalves, B., y Sampaio, J. (2018). Performance profiles of professional female tennis players in grand slams. *PLoS ONE*, 13 (7): e0200591. https://doi.org/10.1371/journal. pone.0200591

Enciso-Motta, R., y Lago-Peñas, C. (2020). Perfiles de rendimiento en los delanteros de la liga española de fútbol. *Revista de Preparación Física en el Fútbol*. ISSN: 1889-5050. https://futbolpf.org/wp-content/uploads/2020/12/3.-PERFILES-DE-RENDIMIENTO-EN-LOS-DELANTEROS -DE-LA-LIGA-ESPANOLA-DE-FUTBOL.pdf

Enoki S, Kuramochi R, Nakayama K., & Takigawa H. Acute .(2023). Effect of Improved Hip Range of Motion on Maximum Hip Angle in Pole Vaulting: A Pilot Study. *Asian J Sports Med*, 14(1): e124582. https://doi.org/10.5812/asjsm-124582.

Filgueira, Á. (2016). Percepción de los entrenadores de alto rendimiento de atletismo: caracterización de su perfil polifacético. *Revista Retos,* 29, pp. 42-47, ISSN: 1988-2041. https://dialnet.unirioja.es/servlet/articulo?codigo=5400841

García, J., Sainz, A., y Durán, J.P. (2011). *Análisis estadístico de jóvenes atletas de 14 a 17 años en el periodo 1997 - 2008.* Edita Real Federación Española de Atletismo, p.160. ISBN.84-87704-96-4. https://altorendimiento.com/analisis-estadistico-de-jovenes-atletas-de-14-a-17-anos-en-el-periodo-1997-2008/

García, J.M., Campos, J., Lizaur, P., y Abella, C. P. (2003). *El Talento deportivo, Formación de élites deportivas*, Editorial Gymnos, Madrid. España. https://www.researchgate.net/publication/259466501_El_talento_deportivo_Formacion_de_elites_deportivas

García-Ramos, A., Ulloa-Díaz, D., Barboza-González, P., Rodríguez-Perea, A., Martínez García, D., Quidel-Catrilelbun, M., Guede-Rojas, F., Cuevas-Aburto, J., Janicijevic, D., & Weakley, J. (2019*).* Assessment of the load-velocity profile in the free-weight prone bench pull exercise through different velocity variables and regression models. *PLoS One*, 14, e0212085. https://researchers.unab.cl/en/publications/assessment-of-the-load-velocity-profile-in-the-free-weight-prone-

García-Roca, J.A., García-Manso, J.M., Fuentes-García, J.P., Martínez-Patiño, M.J. (2022). Performance analysis of the events groups as a predictor of high-level decathletes. *Cultura, Ciencia y Deporte*, 17(52), pp. 179-187. http://doi.org/10.12800/ccd.v17i52.1789

Gómez, M.A., Ruiz, L. M., Rivas, F., Sampaio, J., y Douro, A. (2019).*Estudio de los complejos de juego y los perfiles de rendimiento en bádminton de élite* COMPLEXBAD. Grupo de Investigación Psicosocial en el Deporte FCAFYD (INEF) UPM. https://www.investigacionsocialdeporte.com/actividaddestacada/estudio-de-los-complejos-de-juego-y-los-perfiles-de-rendimiento-en-badminton-de-elite-complexbad?elem=195469

Grammaticos, B; Meloun, J., & Purdy, G. (2022). Distribution of performances and scoring in athletics. *Journal Mathematics and Sports*, 3(1). http://libjournals.unca.edu/OJS/index.php/mas/article/view/22

Gross, M., Greeley, N.B., & Hübner,K. (2019).Prioritizing physical determinants of international elite pole vaulting performance, *Journal of Strength and Conditioning Research, Section for Elite Sport, Swiss Federal Institute of Sport, Magglingen, Switzerland*,00(00)/1-10. https://pubmed.ncbi.nlm.nih.gov/30688866/

Haycraft, J. A. Z., Kovalchik, S., Pyne, D. B. & Robertson, S. (2019). Relationships between physical testing and match activity profiles across the Australian football league participation pathway. *Int J Sports Physiol Perform*, 14, 771 - 8. https://research-repository.griffith.edu.au/bitstream/handle/10072/395586/Pyne246688Accepted.pdf?sequence=2

Hommel, H. (2014). Training of Elite Athletes Build Up Phase I (15 y-16 y); II (17 y-19 *y)* [Coaches Conference].*1 st IAAF World Junior Eugene (USA) - 28 july.* https://revistas.udca.edu.co/index.php/rdafd/article/view/368.

Iglesias, C., y de la Villa, M. (2021). Rendimiento deportivo en atletas federados y su relación con autoestima, motivación e inteligencia emocional.*Investigación aplicada en Psicología del Deporte.* Vol. 6. Núm. 2. Diciembre. https://doi.org/10.5093/rpadef2021a15.

Maksimenko, G.N y Grebenkin, B.C. (2000). *El sistema moderno de entrenamiento de atletas*. Editorial Conocimiento, Lugansk. Ucrania. https://web.archive.org/web/20090221093125/softacademy.impu.edu.ua:80/sport.htm.

Matutano-Fernández, F.A. Jiménez-Sáinz, S., y Lago-Peñas, C. (2019). Un análisis del perfil de rendimiento de los mediocentros defensivos en el fútbol de elite. ¿En qué se diferencian los mejores del resto? *Revista de Preparación Física en el Fútbo*l. ISSN: 1889-5050
https://www.researchgate.net/publication/351066077_UN_ANALISIS_DEL_PERFIL_DE_RENDIMIENTO_DE_LOS_MEDIOCENTROS_DEFENSIVOS_EN_EL_FUTBOL_DE_ELITE_EN_QUE_SE_DIFERENCIAN_LOS_MEJORES_DEL_RESTO

Mcguigan, M. (2020). Testing and evaluation of strength and power. *Taylor & Francis* group. ISBN: 978-0-367-13705-2. https://pdfcoffee.com/mike-mcguigan-testing-and-evaluation-of-strength-and-power-routledge-2020-3-pdf-free.html.

Melnikov, B.M.,yIurov, I.A. (2013). Enfoques teóricos para la construcción del modelo psicológico, El deportista «ideal». *Revista - El psicólogo deportivo*, 1(28), pp.18.

Montealegre. D, P., y Vidarte, J.A. (2019). Perfil antropométrico, somatotipo y condición física de niños patinadores de Neiva. *Revista digital - Acción Motris*, nº 22 enero / junio / Asociación Científico Cultural en Actividad Física y Deporte (ACCAFIDE). Las Palmas de Gran Canaria, ISSN 1989-2837. https://dialnet.unirioja.es/servlet/articulo?codigo=6920315

Montoya, C. (2023). Predisposición psicológica de heptatletas y decatletas cubanos, evidencias de su asociación con el rendimiento competitivo. *Revista Podium. Revista de Ciencia y Tecnología en la Cultura Física,*18,(1). http://scielo.sld.cu/scielo.php?pid=S1996-24522023000100002&script=sci_abstract&tlng=pt

Nikonov, I.I. (1982). La relación entre la capacidad condicional y la técnica (un ejemplo en el salto con pértiga). *Revista Atletismo Ligero*, N.8.URSS.

Nikonov, I.I. (1995). Mujeres, Bienvenidas al salto con pértiga. *Revista Atletismo Ligero*, 6, junio, Rusia.

Nikonov, I.I., y Nikonov. V.I. (2016). *El entrenamiento en el salto con pértiga*, Recomendaciones metodológicas para los estudiantes matriculados en la dirección de la preparación, Universidad Estatal Rusa de Cultura Física, Deporte, Juventud y Turismo (GTSOLIFK)" "Cultura Física" Moscú.

Nikonov, V.I., & Chesnokov, N.N. (2012). Comparative analysis of the pole vault performance by girls aged 17-19 years and women, *Scientific articles of the university P. F. Lesgafta*, (91), p. p122-126. DOI: 10.5930/issn.1994-4683.2012.09.91.

Örs, T., Bayraktar, I., & Yýldýz, M. E. (2021). The examination of jumping events athletes' competition season performance variables during the 2019 world championships. *Herkes için Spor ve Rekreasyon Dergisi*, 3(2), pp. 64-72. https://dergipark.org.tr/en/pub/jsar/issue/67665/994835.

Palacios, R. (2020). Procedimiento metodológico para determinar la dinámica de rendimiento competitivo de los saltadores cubanos, *Revista Acción*, 16 ISSN: 1812-5808, http://200.14.49.137/index.php/accion/article/view/101

Pavloviæ, R., Vrciæ,M ., Saviæ, V., Skrypchenko, I., Németh, Z., & Khafagy, A.(2019).The differences of kinematic parameters pole vault between male and female finalists world championship in Daegu, 2011, *European Journal of Physical ducation and Sport Science*. ISSN: 2501 1235,

https://www.researchgate.net/publication/330183083_THE_DIFFERENCES_OF_KINEMATIC_PARAMETERS_POLE_VAULT_BETWEEN_MALE_AND_FEMALE_FINALISTS_WORLD_CHAMPIONSHIP_IN_DAEGU_2011

Pereira, A. (1999). *Saltos - controle e avaliação do treino dos saltadores.* Federação Portuguesa de Atletismo, Lisboa. Portugal.

Ritter, S. (2016). *Stabhochsprung in Potsdam*, 7th European Pole Vault and High Jump Conference Cologne, November pp. 11-13.

Salido, O, J, Ortiz O.R,Mogue, K. D, Lugo, R, Gumaro, R, Islas, S.A, Chávez, A. I. (2020).Perfil Fisiológico y Rendimiento Deportivo en Jugadoras de Baloncesto Universitario, *European Scientific Journal*, https://doi.org/10.19044/esj.2020.v16n26p11

Schärer, C, Haller N, Taube W., & Hübner, K. (2019). Physical determinants of vault performance and their age-related differences across male junior and elite top-level gymnasts, *PLoS ONE.* 14(12): https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0225975

Simpson, M. J., Jenkins, D. G., Leveritt, M. D. & Kelly, V. G. (2019). Physical profiles of elite, sub-elite, regional and age-group netballers. *J Sports Sci*, 37, pp. 121-219. https://www.tandfonline.com/doi/abs/10.1080/02640414.2018.1553269?journalCode=rjsp20

Singh. J & Daudayal. (2022). Correlation of BI-acromial, BI-iliocristal and BI-epicondylar breadths of Indian elite male high jumpers with their performance. *International Journal of Sports, Health and Physical Education*; 4(2): pp. 19-21. https://www.physicaleducationjournal.in.

Siris, P. Z., Gaidarska, P.M., y Rachev, K.I. (1988*). Selección y pronóstico de las facultades en el atletismo.* Editorial Fiscultura y Sport. Moscú.

Suárez Calderón, A., Terry Rodríguez, C. E., & Stable Bernal, Y. (2023). Fundamentación teórica sobre el control y la evaluación de elementos técnico-tácticos en karatecas 11-12 años. *Revista Científica Cultura, Comunicación Y Desarrollo*, *8*(1), pp. 12-18. https://rccd.ucf.edu.cu/index.php/aes/article/view/415.

Ursino D, J Abal F J P: Cirami, L: Raúl M. Barrios, R.M. (2019). La evaluación del rendimiento deportivo en psicología del deporte: una revisión sistemática. *Anuario de Investigaciones*,24, pp. pp. 413-425.https://www.redalyc.org/journal/3691/369163433045/html/

Ursino, D., y Barrios, R.M. (2019). *El estudio del rendimiento deportivo: Una revisión sistemática*. XI Congreso Internacional de Investigación y Práctica Profesional en Psicología. XXVI Jornadas de Investigación. XV Encuentro de Investigadores en Psicología del MERCOSUR. I Encuentro de Investigación de Terapia Ocupacional. Encuentro de Musicoterapia. Facultad de Psicología - Universidad de Buenos Aires, Buenos Aires: https://www.aacademica.org/000-111/88.

Volkov, V. M., y Filin, V. P. (1989). *Selección deportiva*. Fisicultura y Sport.

Vorovenci, C.M. (2019). Study Regarding the Evolution of the Performances in Women's Pole Vaulting, Nationally and Internationally. *Journal Gymnasium,* 20(1), DOI: https://doi.org/10.29081/gsjesh.2019.20.1s.13

Xiayuan, Li., Zhengliang, X., Feiliang, L., Jinzhong, G., Xie, W., y Yu. L. (2020). Factor analysis of the biomechanical parameters of pole vault run-up and takeoff: exploring sports performance. *Journal Sports Biomechanies.* https://doi.org/10.1080/14763141.2022,2080104

Yuhan, N. (2023). Construction of an efûcient evaluation model for athletic athletes' competitive ability based on deep neural network algorithm. 3C Empresa. *Revista Investigación y pensamiento crítico*, 12(1), pp. 111-131. https://doi.org/ 10.17993/3cemp.2023.120151.111-131

Zatko, R. (1988). *Cuadernos de atletismo. Barcelona, carreras y marcha*, Real Federación Española de Atletismo. Escuela Nacional de entrenadores, Números 26 - 27. ISBN 8450098475 9788450098471. https://www.libreriadeportiva.com/libro/cuaderno-de-atletismo-n-26-barcelona-carreras-y-marchas_13271

Conflict of interests:

The authors declare not to have any interest conflicts.

Authors' contribution:

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