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Endurance control in 12- and 13-year-old sport walkers

Control de la resistencia en marchistas de 12 y 13 años

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ABSTRACT

For the process of effective control of endurance in cyclical disciplines, it has been suggested to determine parameters which consider the development of this capacity according to speed. This is one of the fundamental factors that influences its manifestation and that makes the level of information about this process depend on the result of the tests used. In addition to the particularities of these sports, the age and level of the athletes are also considered. This research is developed with the aim of proposing a specific maximum speed test for sport walking, according to the particularities of the ages between 12 and 13 years, based on the lack of references on specific speed tests for school walkers. It has an application and processing methodology for the determination of the endurance coefficient. The methods used were theoretical (analysis and synthesis, induction - deduction) and empirical (measurement, document analysis and statistical mathematics). It is started from a population made up of 8 athletes from "Ormani Arenado" Initiation Sport School (EIDE) in Pinar del Río, four of them women and 10 coaches as a source of information. As a proposal, in the 100 m sport walking test, compliance with the requirements of the competitive regulations to the correct technical execution is observed.

Keywords: endurance coefficient; control; sport walkers; test.

RESUMEN

Para el proceso de control efectivo de la resistencia, en las disciplinas cíclicas, se ha sugerido la determinación de índices que tengan en cuenta el desarrollo de esta capacidad respecto a la velocidad. Este es uno de los factores fundamentales que incide en su manifestación y que hacen que el nivel de información, sobre este proceso, dependa del resultado de las pruebas utilizadas. Se consideran, además, las particularidades de estas disciplinas deportivas, la edad y nivel de los deportistas. Se desarrolla esta investigación con el objetivo de proponer una prueba de velocidad

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máxima específica para la marcha deportiva, acorde a las particularidades de las edades entre 12 y 13 años, basada en la carencia de referencias sobre pruebas específicas de velocidad para los marchistas escolares. Esta posee una metodología de aplicación y procesamiento para la determinación del coeficiente de resistencia. Para ello se emplearon métodos del nivel teórico (análisis y síntesis, inducción deducción) y empírico (medición, análisis de documentos y matemáticos estadísticos). Se parte de una población conformada por los 8 atletas de la Escuela de Iniciación Deportiva Escolar (EIDE) Ormani Arenado de Pinar del Río, cuatro de ellos del sexo femenino y a 10 entrenadores como fuente de información. Como propuesta, la prueba de marcha sobre 100 m, se observa el cumplimiento de las exigencias del reglamento competitivo a la correcta ejecución técnica.

Palabras clave: coeficiente de resistencia; ***c***ontrol; marchistas, pruebas.

INTRODUCTION

The development of endurance is especially important for long-duration disciplines such as sports walking, also known as race walking, which includes the 50 km race, Sosa, J. and others (2017). García, M. and Leibar, X. (1997) point out that yields in resistance specialties are determined by the combination of resistance with other capabilities and rightly suggest that they are always in interrelation. "(...) resistance should be measured by considering the development of the other motor qualities", Godik, M. (1989; p. 241).

For cyclic disciplines, including sport walking, special importance is given to the relationship with speed as an indicator that characterizes the development of strength, coordination, mobility, anaerobic possibilities of the body, the work capacity of the central nervous system and technique. Godik, M. (1989).

According to Ozolin, N. (1989), after extensive research, it has been shown that athletes who are able to cover a short distance quickly find it easier to run a longer distance at a lower speed.

Consistent with that criterion, Ozolin himself. N. (1989) later García, M. and Leibar, X. (1997) and Navarro, F. (1998) stress the need for a good reserve of speed so that in the course of a greater distance the relative expense of muscular efforts is less and the regime of tension within the work decreases, especially in the central nervous system.

According to Navarro, F. (1998) there is a certain dependence between the maximum speed, in a short stretch and the average speed in the distance in which one is a specialist, even knowing that the power of the work decreases with its prolongation.

According to Godik, M. (1989), the processing of the data for the determination of this coefficient can be carried out by means of the following mathematical formula:

CR=TD:TDp [e1]

Where:

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CR is the endurance coefficient;
TD is the time in distance for aerobic performance;
TDp is the time in the standard distance (maximum or base speed).

When studying the behaviour of the resistance coefficient, a preponderant role is played by the observation of the specific biodynamic structure of the sport practised, so that the data referred to are related to the level of specialisation achieved through systematic training, Ozolin, N. G. (1989).

In line with these criteria, authors such as Zaporozhanov, V. Zirenko, V. and Yushko, B. (1992) argue that the contents of the forms of control should respect the following three requirements:

1. To respond to the particularities of the age and level of the practitioners;
2. To respond to the specific character of the sport specialization;
3. Satisfy the requirements of feasibility and information.

With respect to the requirement of correspondence with the particularities of the age and level of the athlete, it is appropriate to point out that, although children have the same adaptation mechanisms to face resistance training, Weineck, J. (2005), structural, functional, psychological and social changes occur at school ages, characteristic of the process of growth, development and maturation, which cause instability in the body dimensions of the child, as well as in the quality of physiological processes; hence this author's call to bear in mind that children are not miniature adults, for which reason it is necessary to differentiate the varied composition of exercises, both for training and for the control of physical-motor, functional, psychological and intellectual qualities.

In order to correspond with the particularities of the sport modality, it is necessary to bear in mind that in the sport walk the endurance and the speed are manifested in close connection with the technical mastery, which is judged by a body of referees, in charge of watching over the fulfillment of two requirements that distinguish it from the races and the natural walk:

1. Maintain uninterrupted contact with the ground.
2. Extend the advancing leg by the knee, from the moment in which the previous contact begins by the heel. Rius, J. (2007).

Although there is sufficient scientific knowledge, there is no evidence of references to tests of maximum speed of sport walking, as a comparative data necessary to determine the resistance coefficient of walkers aged between 12 and 13 years.

Therefore, this research aims to select a test that contributes to the determination of the resistance coefficient of walkers, consistent with the particularities of school athletes of 12 and 13 years.

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MATERIALS AND METHODS

For the study, the eight school athletes (12 and 13 years old) from the Escuela de Iniciación Deportiva Escolar (EIDE) Ormani Arenado of the province of Pinar del Río were considered, four of them women, all possessing more than one year of experience in the practice of this athletic discipline; the average chronological age at the time of application of the study was 12 and 61 years old.

As a source of information, 10 sports walking coaches who participated in the High Performance National School Games (JENAR-2016) were included.

The evaluations were made from the performances shown during the participation in preparatory competitions in the month of March, that is, six months after the beginning of the school year.

Among the methods used by this research for the diagnosis, there is a survey of ten Cuban national coaches of sports walking, with the objective of knowing criteria on the current state of the efficient control of the resistance coefficient of school walkers (12 and 13 years old). The documents of the Preparation Program of the Cuban Athlete of Athletics IV were also reviewed for the area of background, middle background and sport march (2013) and athletics. Comprehensive athlete preparation program (20172020) to investigate the guidelines for determining the resistance coefficient of marchers. Measurement was also used to determine physical performance (speed and special aerobic endurance).

Among the statistical mathematical methods, descriptive and inferential statistics for the processing of diagnostic data and to assess the empirical validity of the selected tests, the correlation coefficient, Bravais-Pearson linear pair, was used.

RESULTS

The review of documents revealed that they guide the tests and regulations for the control and evaluation of general and specific physical performance by age, sex and competitive modality of athletics.

In the Cuban athlete's preparation program for athletics IV for the bottom, middle bottom, and sports walking area (2013), guidelines are offered for the determination of the resistance coefficient and the results of the two race tests for endurance and speed are used as comparative data; but no sports walking exercises are oriented to measure these abilities at ages 12 to 13.

The Comprehensive Athlete Preparation Program (2017-2020) directs the 2000 m. sportive gait test to measure endurance from 12 to 18 years of age, but the absence of any test for maximum speed persists.

Figure 1 shows the results of the survey in terms of the importance given by coaches to the need to resolve the absence of specific gait tests for endurance and speed control, as comparative data for the determination of the endurance coefficient. In this sense, 75 % think that it is very important to solve this deficiency, 25 % see it as important, which evidences the relationship between theoretical criteria and practical experience. (Figure 1)

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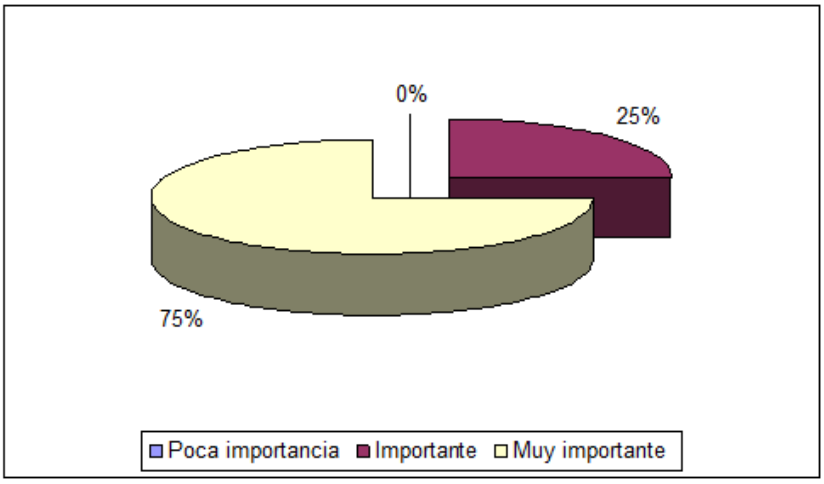

Fig. 1 - Criteria on the importance of addressing the lack of specific gait tests to measure endurance and speed in schoolchildren (12 and 13 years).

Figure 2 reflects the alternatives suggested by the coaches to replace the absence of specific tests for the control of the resistance coefficient. (Figure 2)

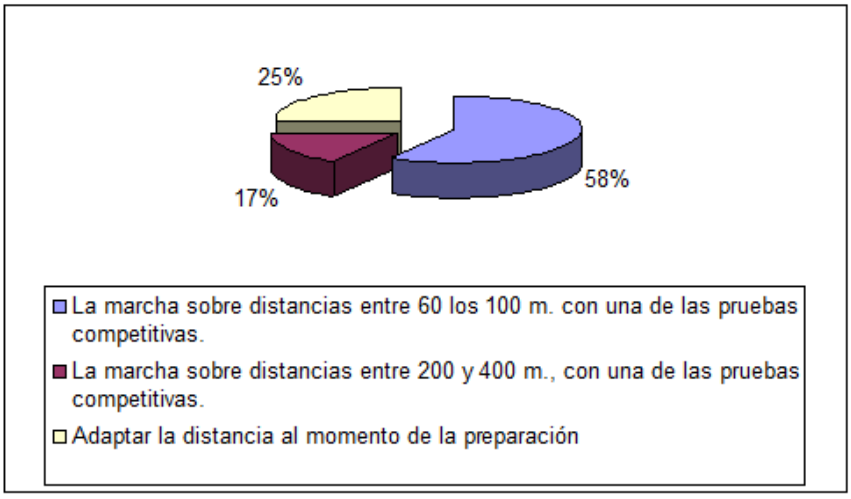

Fig. 2 - Alternatives to replace the absence of specific sportive gait tests in the determination of the resistance coefficient.

The 58 % inclined for distances between 60 m. and 100 m., for the speed and use of one of the competitive events; 25 % chose to adapt the distance at the time of preparation, while only 17 % chose the distances framed between 200 and 400 m. with one of the competitive events.

Based on the elements exposed and consistent with the primary and secondary selection criteria of the tests, they were chosen:

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To measure the specific endurance of the walkers:

- The competitive test of sportive walking on 3000 m.
- The competitive walking test over 5000 m.

The possible distances to use in speed control:

- The sport walk over 60 m. at maximum speed from the start.
- The sport walk on 100 m. at maximum speed from the start.

The values obtained in the study on the Bravais-Pearson linear torque correlation coefficient for the 60 m. and 100 m. tests, with respect to the competitive distances, are reflected in figure 3, where it is stated that the sportive gait, at maximum speed, over the distances of 60 m. and 100 m., shows strong correlations for all cases compared, with evident superiority for the 3000 m. (0,90 y 0,91). (Figure 3)

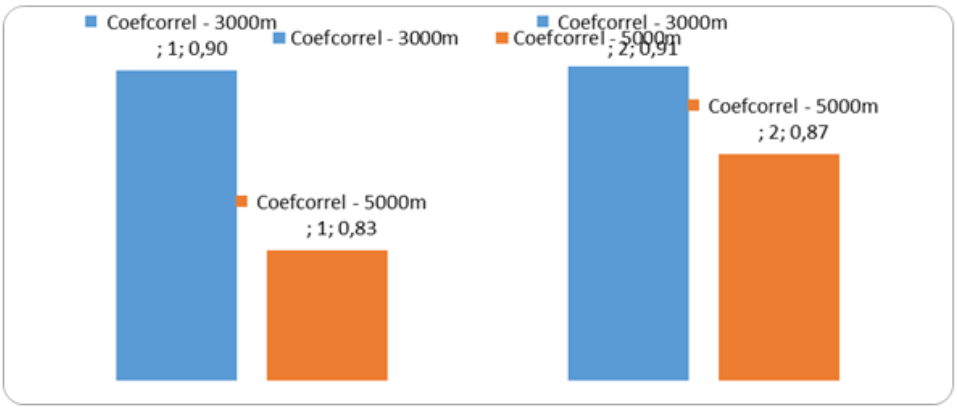

Fig. 3 - Values of the Bravais-Pearson linear torque correlation coefficient study as a scientific criterion for empirical validation in the selection of tests for the determination of the sports gait resistance coefficient

The results of the determination of the resistance coefficient are shown and the distances of 60 m. and 100 m. with respect to the competitive tests of 3000 m. and 5000 m. are used indistinctly. (Table)

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Table - Endurance coefficient using indistinctly the distances of 60 m and 100 m with respect to the competitive tests of 3000 m and 5000 m

Athletes	Sex	Endurance coefficient 60 m y 3000 m	Endurance coefficient 60 m y 5000 m	Endurance coefficient 100 m y 3000 m	Endurance coefficient 100 m y 5000 m
1	M	1,52	1,52	1,44	1,45
2	M	1,42	1,46	1,42	1,46
3	M	1,46	1,48	1,46	1,48
4	M	1,51	1,55	1,46	1,50
5	F	1,60	1,64	1,58	1,61
6	F	1,51	1,40	1,50	1,40
7	F	1,48	1,55	1,37	1,43
8	F	1,55	1,54	1,58	1,58
Arithmetic mean		1,51	1,52	1,47	1,49
Min.		1,42	1,40	1,37	1,40
Max.		1,60	1,64	1,58	1,61

DISCUSSION

The review of documents reveals that, in the official documents that guide the actions of the coaches of sports walking in Cuba, there is a lack of evidence that provides comparative data for the determination of the endurance coefficient of the walkers, in correspondence with the particularities of school athletes between the ages of 12 and 13.

In the opinion reflected by the coaches, the importance of resolving the absence of a specific test to measure the endurance and speed of school walkers between the ages of 12 and 13 is confirmed.

Among the options devised by coaches to help determine the endurance coefficient of walkers, the combination of competitive events and distances between 60 and 100 m stand out.

The distances of 60 and 100 m. show strong correlations with the performance in competitive tests, thus evidencing sufficient empirical validity for the determination of the resistance coefficient.

As shown in the chart, the value of the resistance coefficient increased as the difference with respect to the competitive distance increased, which corroborates Navarro's criterion, F. (1998) on the decrease of power, while the competitive distance grows.

According to the chart, the highest value of the Bravais-Pearson linear correlation coefficient is recorded in the comparison between 100m. and 3000m. (0.91); it was decided to propose these distances of tests for the determination of the endurance coefficient in school ages, since they respond to the biological possibilities that theoretically stand out for school ages, where the use of exercises with high anaerobic

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lactic components should be avoided, as pointed out by Platonov and Bulatova (2007); Zintl, F. (1991).

Bearing in mind that the lower the value of the endurance coefficient, the better the athlete's performance, the fact that boys show lower minimum and maximum values than girls shows that they are more resistant since they have a greater capacity to maintain for a long time a percentage of speed closer to the maximum.

After selecting the tests for the determination of the endurance coefficient, it is suggested to proceed as follows:

Instruments, means and spaces for the application of the tests

Semi-electronic stopwatch, manual, with measurement of hundredths of a second.

- Start-up table.
- Charts for warnings about violations of the rules of the sporting march.
- 400 m. athletics track, with its corresponding starting and finishing marks for the 100 m. and 3000 m.

Step 1: Determine the special base speed level of walkers.

- Test: 100 m. sportive gait at maximum possible speed from the start.

Methodological indications

- A previous warming up of 10 to 15 minutes is recommended.
- Up to two opportunities may be granted, with no less than five minutes of rest interval between attempts.
- Special attention will be paid to compliance with the provisions of the rules of the sporting walk (extension of the leg that advances from the beginning of the previous contact, until passing the vertical instant), for this, it is suggested the use of judges along the course, located on the outer edge of the track to have a better angle of observation.
- The time is measured after the acoustic signal given with the starting board and to cover the entire distance of test and pass through the goal.
- The start will be made individually or in duets, no more, to ensure compliance with the regulations by the assistant coach or marching judge.
- Each time the test is applied, standard conditions of application must be maintained (time, order, space, location of the judges, starting signal, type of stopwatch).
- The data is initially recorded in a spreadsheet.

Methods

- Measerument.

Second step: determine the level of special aerobic endurance of school walkers.

- A sport walk that tries to cover the distance of 3000 m. in the shortest time possible.

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Methological indications

- For its realization, it can be placed in the last order of application of a battery of tests within a single day of training or in the last day ready for the application of performance controls.
- In case of applying the test in a day where others have already been applied, no less than 15 minutes of rest interval will be granted.
- Special attention will be paid to compliance with the provisions of the rules of the sporting walk (extension of the leg that advances from the beginning of the previous contact, until passing the vertical instant), with the use of at least four gait judges or other auxiliary coaches, located about 80 to 100 m. between them and at the outer edge of the track to have a better angle of observation.
- The time is taken after the acoustic signal given with the starting board and to cover the entire distance of test and pass through the goal.
- It is important to standardize the conditions for carrying out the tests at all times of the annual preparation cycle, so it is suggested that the tests be applied in the same order and at the same time of day for all athletes.

Methods

- Measurements.

Theoretical references suggest the use of corresponding tests with particularities of the sport discipline, the age and condition of the sportsmen for the determination of the coefficient of endurance of the school male sport walkers.

In order to contribute to the determination of the endurance coefficient of school walkers, specific tests were selected to measure endurance and speed, over distances of 100 m. and 3000 m., with the indication of supervising compliance with the technical requirements established in the competitive athletics regulation for sport walking, which favours a determination of the endurance coefficient.

BIBLIOGRAPHIC REFERENCES

García-Verdugo, M., & Leibar, X. (1997). *Entrenamiento de la resistencia de los corredores de medio fondo y fondo*. Madrid: Editorial Gymnos. Recuperado de https://www.casadellibro.com/libro-entrenamiento-de-la-resistencia-de-los-corredores-de-medio-fondo-y-fondo/9788480131124/571169

Godik, M. (1989). Fundamentos metrológicos del control del nivel de preparación física de los deportistas. En. Zatsiorski, V. M Metrología deportiva (pp.217 251). La Habana: Editorial Pueblo y Educación.

Latorre Román, P. Á., & Soto Hermoso, V. (2000). Economía en la carrera de resistencia. *Apunts. Medicina de l'Esport*, *35*(134), 25-35. Recuperado de https://doi.org/10.1016/S1886-6581(00)75971-8

Mac Beath, R. (2013). Programa Integral de Preparación del Deportista Atletismo (Medio Fondo, Fondo y Caminata). Comisión Nacional de Atletismo.

ISSN: 1996–2452 RNPS: 2148
May – August. 2019 Vol. 14(2): 262-273

Navarro, F. (1998). *La resistencia*. Editorial Gymnos Madrid. Recuperado de https://www.casadellibro.com/libro-la-resistencia/9788480131148/625712

Ozolin, N. (1989). *Atletismo (tomo1)*. La Habana: Editorial Científico Técnico.

Platonov, V. N. (1998). El entrenamiento deportivo. Editorial Teoría y metodología. Barcelona: Editorial Paidotribo.

N. Platonov, V., & M. Bulatova, M. (2007). *La preparación física* (3ª edición). Editorial Paidotribo, Barcelona, España. Recuperado de https://es.scribd.com/document/357310639/LIBRO-La-Preparacion-Fisica-Platonov-V-N-Bulatova-M-pdf

Rius, J. (2007). *Metodología y técnica del Atletismo*. Barcelona, España: Editorial Paidotribo.

Sosa, J. et. al. (2017). Evaluación Cineantropométrica en deportistas de marcha atlética varonil: mexicanos vs internacionales. *Revista Mexicana de Investigación en Cultura Física y Deporte*, *6*(8), 145-161. Recuperado de: http://revista.ened.edu.mx/index.php/revistaconade/article/view/119

Weineck, J. (2013). *Entrenamiento total*. Barcelona, España: Paidotribo.

Zaporozhanov, V. A., Zirenko, V. A., & Yushko, B. N. (1992). *La carrera atlética* (2ª ED.). Editorial Paidotribo, Esspaña, Barcelona ISBN, 978-84-86475-92-5 Recuperado de https://www.libreriadeportiva.com/libro/la-carrera-atletica_17659

Zintl, F. (1991). *Entrenamiento de la resistencia. Fundamentos, métodos y dirección del entrenamiento.* México: Martínez Roca.