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Original Article

## Methodological alternative for the physical diagnosis of the blind schoolchild from the context of Physical Education

### Alternativa metodológica para el diagnóstico físico del escolar ciego desde el contexto de la Educación Física

### Alternativa metodológica para o diagnóstico físico da criança cega do contexto da Educação Física

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## ABSTRACT

Studies are limited in terms of assessing the physical component at early ages of development and focusing on blindness. Most of the studies related to blindness were carried out in order to contribute to the development of motor skills and not to the study of the physical component. Therefore, the research evolved from a current physical diagnosis of the blind student, the selection of methods and functional tests with their adaptations, as well as the assessment of the viability of their application in special education. It was found that the comprehensive pedagogical diagnosis has limitations, since it does not include aspects of the physical component, which hinders the adequate direction of the pedagogical process of Special Physical Education. In this study, methods from both the empirical and theoretical levels were used, with the case studies being of great significance. In general, it has been observed that the Centros de Diagnóstico y Orientación do not apply tests to evaluate the physical component of blind schoolchildren, which affects the quality of the physical education teaching process.

**Keywords:** Physical diagnosis; functional tests; Special Physical Education.

## RESUMEN

Son limitados los estudios realizados en función de valorar el componente físico, en edades tempranas del desarrollo y enfocados a la ceguera. La mayoría de los estudios relacionados con la ceguera se realizaron con el fin de contribuir al desarrollo de la motricidad y no al estudio del componente físico; es por ello que, la investigación



transitó desde el diagnóstico físico actual del escolar ciego, la selección de métodos y pruebas funcionales con sus adaptaciones, así como la valoración de la viabilidad de su aplicación en la enseñanza especial. Se constató que el diagnóstico pedagógico integral posee limitaciones ya que no incluye aspectos del componente físico, lo cual entorpece la adecuada dirección del proceso pedagógico de la Educación Física Especial. En este estudio, se utilizaron métodos del nivel empírico y del nivel teórico, alcanzando una gran significación el estudio de casos. De manera general, se constata que no se aplican, desde los Centros de Diagnóstico y Orientación, pruebas que permitan evaluar el componente físico de los escolares ciegos, lo cual atenta contra la calidad del proceso docente de la Educación Física.

**Palabras clave:** Diagnóstico físico; pruebas funcionales; Educación Física Especial.

## SÍNTESE

Os estudos são limitados em termos de avaliação do componente físico em idades precoces de desenvolvimento e focando a cegueira. A maioria dos estudos relacionados com a cegueira foi realizada com o objectivo de contribuir para o desenvolvimento das capacidades motoras e não para o estudo da componente física. Assim, a investigação partiu do diagnóstico físico atual do aluno cego, da seleção de métodos e testes funcionais com as suas adaptações, bem como da avaliação da viabilidade da sua aplicação na educação especial. Verificou-se que o diagnóstico pedagógico abrangente tem limitações, uma vez que não inclui aspectos do componente físico, o que dificulta a direção adequada do processo pedagógico da Educação Física Especial. Neste estudo, foram utilizados métodos a partir do nível empírico e do nível teórico, tendo o estudo de caso alcançado grande significado. Em geral, verificou-se que os centros de diagnóstico e orientação não aplicam testes para avaliar o componente físico dos alunos cegos, o que prejudica a qualidade do processo de ensino da Educação Física.

**Palavras-chave:** Diagnóstico físico; Testes funcionais; Educação Física Especial.

## INTRODUCTION

In the process of physical activity, the practice of Physical Education (P.E.) for schoolchildren with visual impairment and blindness is included. Cuba adopts the definition of blindness in accordance with the Tenth Edition of the International Classification of Diseases (ICD10) and, in addition, takes into account the International Code of Diseases, which considers that, in order to speak of blindness, one must have an acuity of less than 0.05 and a visual field of less than 10 degrees (Pascual, 2007).

Those people who have a complete absence of light perception or color differentiation are then considered blind. In the literature related to blindness, it is alleged that, "blind school children...generally present delays in physical development...", (Pascual, 2007, p. 24), so it is necessary to work on the physical component, from the early ages of their development. As a starting point, the adaptations to the Physical Education (P.E.) programs for blind and low vision students, made by Junco y col and Ramírez, (2007), must be taken into account. In this, it is declared as a transversal objective of the program, in the first cycle of primary education, (1st-4th grade) that of contributing to the achievement of compensation and correction of



sensory defects and physical development of the students. In this official document, the only tests to be applied are the postural test and the physical efficiency test, and not other complementary tests that allow the diagnosis of the physical component in these schoolchildren to be analyzed from a qualitative and quantitative point of view.

On the occasion of exploring different bibliographical settlements on the object of study, the author found some works referring to the blind and the visually impaired, (Ramos, M. de los Ángeles, et al., 2015; Castillo, S. G., et al., 2016; García Cedeño, M. et al., 2016; Inga Arias, P. D., 2017; Ramírez-Soria, A. L. y Guerra, G., 2018; González Nocedo, E., et al., 2018; Santana Quinto, N. E., 2018 y Martínez Chocano, G., 2019). These works deal with the treatment of these subjects in the educational context, from the health perspective. Articles referring to inclusion, rehabilitation and environmental education have also been consulted. In all these works, the author found very useful experiences that form a starting point for a possible methodological proposal.

Studies are limited in terms of assessing the physical component, at this stage of development, focused on blindness. Most of the studies related to blindness are carried out in order to contribute to the development of motor skills and not to the study of the diagnosis of the physical component (morpho-functional). In this sense, authors like Valdés, Godoy and Herrera, (2014) carry out a study in Chile, where they take into account kineantropometry to evaluate physical development and tests to evaluate the physical condition of blind people aged 40-50 who practice Goalball. The research is of great interest since it allows to determine, from the anthropometric magnitudes, the body composition and, therefore, to evaluate the nutritional state of these athletes and the maintenance of the physical capacities in this stage of the life. On the other hand, Medina, (2015) carries out a study of the physical development in children and adolescents, with hearing deficiencies, in the ages 8-14 years. The author determines the decimal biological age as a criterion for evaluating physical development and establishes a comparison with the Cuban norm for the general population of the age groups studied. Both works refer to the study of physical development in populations with special needs, taking as a common element the analysis of physical capacities and what is related to body dimensions, anthropometric magnitudes and decimal biological age. The studies carried out, although they refer to the diagnosis of the physical component, are carried out at different times and in different populations. The first of the studies is carried out in the adult stage (40-50 years) and the second study focuses on the school age of 8-12 years, but on a deficiency that, although sensory, is not precisely blindness. Furthermore, in this last study the analysis of decimal age is included, however, it is only recommended to take it into account in pre-school children. So far, there are no references to research related to the study of the physical component diagnosis (morpho-functional) in school age from 6 to 9 years old, at a national and international level, in blind schoolchildren.

To go towards the conditioning of the E.F. class, from having defined how to make the diagnosis of the physical component in the school blind, is a pending and complex task and it must be done with the rigor that it deserves. It is important to mention that the diagnosis received by the teacher of Physical Education in Cuba is given by the Centro de Diagnóstico y Orientación (Cdo). This psycho-pedagogical diagnosis is carried out based on a report adapted from López (n.d.) which, within its aspects, includes what is related to health, depending on the deficiency that produces the disability and the evaluation of motor skills. This has as its main limitation that it does not take into account qualitative and quantitative aspects that include the physical component (morpho-functional), and that is extraordinarily necessary to



achieve planning of the physical education class of the blind schoolchild in primary education, in terms of the development of physical abilities and capacities. In view of the above, working to establish and adapt tests for the diagnosis of the physical component (morpho-functional) is fundamental to increasing the dynamic culture in these schoolchildren, which is a challenge for specialists and researchers in this area. All of this background leads us to believe that there are insufficient methods and tests for diagnosing the physical component in blind schoolchildren, which makes it difficult to provide individualized attention to these subjects in physical education classes. This leads us to ask ourselves the following question: how to contribute to the diagnosis of the physical component in school-age blind children? The research assumes as purposes: to diagnose the current physical component of school-age blind children, based on the selection of methods, functional tests and their corresponding adaptation, as well as the assessment of the viability of the tests proposed as alternatives for the diagnosis of the physical component, from the context of Physical Education.

## **MATERIAL AND METHODS**

The research was carried out through a unique case study and took place in the Special School for the visually impaired, deaf and hearing-impaired "Fructuoso Rodríguez Pérez" in the municipality of Santa Clara. The subject was an eight-year-old blind schoolchild, diagnosed by the CDO. Two key informants were considered: the subject's mother, who was asked for written consent to carry out the research, and the teacher of the school. The latter was given an in-depth interview to find out about the diagnosis of the current physical component of the blind schoolchild and the usefulness of the selected methods and tests.

The investigation went on for three moments. In the first moment, the diagnosis of the current physical component of the blind schoolchild was made. In the second moment, the methods to evaluate the physical component (body composition) and functional tests to evaluate the energetic possibilities under field conditions, as well as, to evaluate the posture, were selected.

In this sense, the selected tests can be carried out in the context of the Special F.E. and in the General Education; they are a complement to the physical efficiency test. Functional tests applied to blind schoolchildren require few resources, although the Provincial Institute of Sports Medicine (IMD) of Villa Clara province was called upon to help measure anthropometric magnitudes. Then, in the third moment, the in-depth interview was applied again to the teacher of the Physical Education School, in order to evaluate the usefulness and viability of the method and the selected tests for the diagnosis of the physical component in the blind schoolchild.

In the investigation, methods of the theoretical level are applied, among them: analytical-synthetic, this method facilitated the analysis on the physical aspect, related to blindness, valuing it both in its parts and in its totality. In addition, it allowed to know the theory that supports the investigation, as well as to process the scientific information, to select the data until arriving at the conclusions of the study. The inductive-deductive allowed to establish the generalization from the results of the application of the method and selected tests to reach the regularities of the physical component in the blind schoolchild.

Within the empirical methods, document analysis was used, used in the foundation of the diagnosis, the characterization of the current physical component of the school-blind, and even for the selection and adaptation of the tests. The in-depth interview



was carried out with the teacher of Physical Education, with the objective of verifying the treatment of the physical component, from the diagnosis and to know about the utility and viability of the selected tests for the physical diagnosis in the blind schoolchild. The measurement was used for the determination of the podalic deformity (Plantogram) and together with the results of the postural test it allowed to make a better evaluation of the deformities of the spine and lower limbs, as well as to obtain the anthropometric magnitudes to carry out the study of the body composition. Meanwhile, the test allowed to quantify the value of the measured powers through the energetic possibilities, applied in field conditions. Finally, the singular case study allowed to arrive, through a synthesis process, to the physical diagnosis and to guide the decision-making about the case. Descriptive statistics are used for the interpretation of the results (mode)

### **Methodology of selected functional tests for the diagnosis of the blind schoolchild**

Field tests carried out to measure anaerobic alactacid potency (AAP) (creatine phosphokinetics).

Sergeant jump test (lower limb muscle power) = Lewis equation (Equation 1).

$N = 4.9 \times pc \text{ (kg)} \times \text{height of jump (m)}$  (kgm/s)  $N = \text{power}$ ,  $pc = \text{body weight}$

### **Non-significant curricular adaptation made to the test for measuring anaerobic alactacid potency (AAP) in the context of Special Education**

In the case of the blind schoolboy, it is necessary for the teacher to stand next to him (back), he will make a brief, summarized and as simple as possible explanation about the movement to be made (pedagogical adaptation), he will place his hand and ask the schoolboy to make contact with it (proprioceptive method). Later, he will ask the student to make a jump as high as possible, to the sound of the whistle (adaptation of the materials). The movement should be repeated three times and the best result will be taken.

### **Methodology for anthropometric measurements**

Body dimension indicators: body weight (kg) and height (cm): was performed with a verified 2T Health Scale. Skin folds: tricipital (pt) and subscapular (pse), were measured with a Horpend brand fat gauge. The skin fat was calculated by the Holtain method.

From these measurements, mixed indicators of body composition could be determined; among them: percentage of body fat (%G), using Lohman's equations for the non-sporting population, body fat weight (BW) =  $BW \times \%G / 100$ , active body mass (ABM) =  $BW - PCG$ , as well as, the robustness index:  $\text{weight index } IP = T(\text{cm}) / 3 P_c(\text{Kg})$ .

In addition, the Adequate Weight (AP) was determined according to Rodríguez, (2000); with this indicator, the degree of relative fatness in non-sporting population is evaluated, through the diagram proposed by the author mentioned above (Equation 2).

Male sex (8-10 years): (Equation 2).



BP=MCAx1.142

## RESULTS AND DISCUSSION

### Characterization of the current physical component of blind schoolchildren under study

The blind schoolboy presented bilateral retinal dysplasia without useful vision, has preserved intelligence and from the documents consulted there is no evidence of data related to the physical component. After an in-depth interview with the teacher of physical education, it was found that, from the teaching program for blind schoolchildren, only postural and physical efficiency tests are declared to be the only ones to be taken into account. With respect to the integral pedagogical diagnosis carried out by the GDAs, it has limitations, even when health-related aspects are taken into account. It does not refer to the use of methods and tests to diagnose the physical component necessary to achieve the direction of the pedagogical process in the subject of Physical Education (Table 1).

**Table 1.** - Physical Efficiency Test for the schoolchild blind

P.C (kg)	T. (cm)	Flex (cm)	Nv. II	Speed. (s.)	Nv. IV	Push ups	Nv. I	Abd. Nv.	16	I	Jumps. (cm.)	Nv. III	Resist (Min.).	Nv. S/N
39	123	23	II	8.1	IV	13	I	16	I	80	III	3.30	S/N	

With regard to the results of the physical efficiency tests, carried out on the blind schoolchild, it was found that, in the case of the push-ups and flexibility, he has good results, considering that they are in levels I and II respectively, but not in the case of speed, jumping (level III) and endurance (no level), whose results are well below the values of the national average (Table 2).

**Table 2.** - Results of the postural test

Sex	Knees			Back			Thorax			Buttocks		
	1	2	3	1	2	3	1	2	3	1	2	3
	x				x			x				x
<b>M</b>												

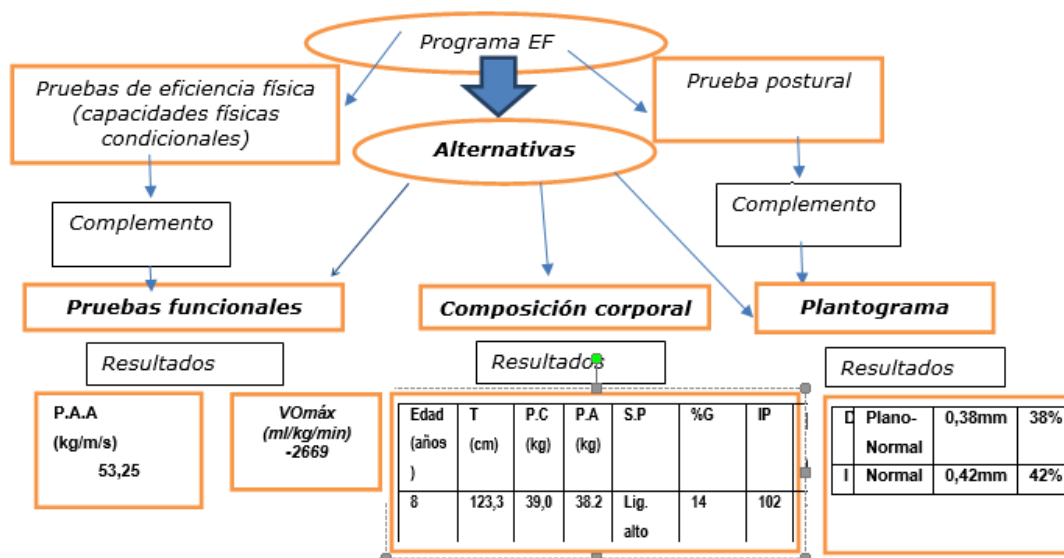
#### Symbols

Knees:	1- Normal	2- hyperextended	3-Slightly bent
Back:	1- Normal	2- Kyphotics	3- Lordotica
Thorax:	1- Normal	2- Slightly sunken	3- Prominent
Buttocks:	1- Normal	2- Prominent	3- flattened



In the postural test, the greatest difficulties were in the sagittal plane, where it was found that the head was forward, the scapula were winged and the shoulders were forward, the thorax was slightly sunken and the buttocks were normal, so we distinguish posture alterations with increased dorsal curvature of the spine, related to a kyphotic back (Figure 1).

Methodological alternative for the diagnosis of the physical component (morpho-functional) of the blind schoolchild.



**Fig. 1.** - Methodological alternative for the diagnosis of the physical component (morpho-functional) of the blind schoolchild

**Symbols:** P.A.A: anaerobic alactacid power, VO2 maximum oxygen consumption, T: size, P.C: body weight, P.A: adequate weight, S.P: overweight, % G: percentage of fat, I.P: weight index.

As results of the method and tests selected to diagnose the physical component in the schoolchild under study, the following regularities were reached: blind schoolchild with normal size for his age, but with a high body weight for his age, with predominance of his body development at the expense of overweight (a slightly high fat tendency) and a scarce muscular development and power of the lower limbs, with a kyphotic back and normal flat right foot.

**Results of the in-depth interview with the teacher of Physical Education about the viability of the method and the tests selected for the diagnosis of the physical component**

The teacher of F.S. considered that the tests are useful and viable since they evaluate what is related to the physicochemical-functional component. He considers them to be a complement, and declares them to be in accordance with the current programme, and provides tools to achieve better planning of the teaching process for this type of schoolchild. He claims that, in fact, they are a complement to those established in the teaching programme for blind schoolchildren and could be included in the diagnosis carried out by the CDO, so that it can provide the elements to be able to plan and make the necessary adaptations to achieve the physical development that is demanded as a requirement in the E: F. programme and, furthermore,



contribute to its inclusion and future standardisation in General Education. He also considered that the tests are applicable because they require very few resources, although the study of body composition requires the collaboration of the IMDs.

## DISCUSSION

With regard to the results obtained in the functional tests, it can be seen that there is poor development of the conditional capacities of speed, jumping and resistance, evaluated through the physical efficiency tests, established by the National Institute of Sport, Physical Education and Recreation (INDER). The results are compared with those established with the national average for schoolchildren of the same age, height and weight. The values obtained in the tests applied to blind schoolchildren (53.25 kg/m/s) are well below the average in the regular context, in the case of males, whose range is between 164.75 kg/m/s and 199.11 kg/m/s. It is appropriate to take up again the criteria of Collazo, (2007) in this regard. The author refers to the fact that, from a biochemical perspective, an incipient development of the key enzymes of anaerobic metabolism takes place during the early ages of development, and these accompany, in this case, the least deposit of phosphates at a muscular level.

Taking into account the indications of the Ministry of Public Health (MINSAP) for the evaluation of the development and growth of the age under study, the following indicators should be considered: weight for height (from 0 to 9 years), height for age (from 0 to 19 years) and weight assessment in accordance with national guidelines for the medical control of the healthy non-sporting population. At present, studies of physical development in healthy non-sporting and special populations at the Institutes of Sports Medicine (IMD) are limited. According to IMD guidelines, the percentage of fat in this schoolchild behaves in a normal way (it ranges between 12 and 15 percent of fat). The ratio of height to age is normal, but the ratio of weight to height is not, as it was found to be above the 97th percentile, so he is considered obese. He is a schoolchild with an apparently normal nutritional status. Between this last indicator of development and growth in the schoolchild and that of the evaluation of relative fatness, an apparent contradiction could be given by the values of the percentage of fat.

Taking into account the results of the evaluation of relative fatness by Rodríguez, (2000) and the rest of the anthropometric indicators mentioned above, we are in the presence of a blind schoolboy with a high body weight for his age, with predominance of his body development, at the expense of overweight, with a slightly high tendency to fat and with a normal size, which indicates poor muscle development. However, in the opinion of the researcher, from the biochemical and morphofunctional perspective, the increase in adipose tissue does not provide the metabolic resources necessary for movement, which is a threat to the displacement and functionalism of the hip, which ossifies between 15 and 18 years of age. Furthermore, muscle weakness, confirmed through the postural test and plantogram, conditioned the appearance of postural alterations (kyphotic back, sunken chest and flattened buttocks) that attempt against the adequate locomotion of the blind schoolchild.

In related studies, Valdés, (2014) assesses the morphological profile according to the protocol of the International Society of Kineanthropometry, while tests used in the System for Measuring the Quality of Education (Simce) for the Physical Education sector, proposed by the Chilean Ministry of Education, were used to assess the functional profile. For the assessment of physical condition, tests are applied to the abdomen, flexibility, cardiorespiratory resistance, jumping length of feet together, elbow flexo-extension and anterior trunk flexion. These have a common aspect with





Medina, (2015), with respect to the approach to the study of physical condition, except that this researcher carries it out based on the physical efficiency tests, established in Cuba, in correspondence with the periods of development of 8-14 years. However, this new research takes into account the morpho-functional profile, which is evaluated by applying body composition to assess the degree of relative and nutritional fatness of the schoolchild, posture test with the complement of the plantogram to detect postural alterations that must be corrected at this stage of development so that they do not become true orthopedic deformities and functional tests that measure the energetic possibilities of the student under the sport field conditions.

The study led to the following conclusions: no tests are applied by the Diagnostic and Orientation Centers to evaluate the physical component of blind schoolchildren, which undermines the quality of the physical education teaching process. A tool is provided so that the Physical Education teacher can give individualized attention and achieve the correction and compensation of physical development; the selection of the method and the tests are made from those established in the context of Physical Education to measure the energetic possibilities in field conditions; the body composition and the plantogram as a complement to the postural test with the corresponding non-significant curricular adaptations, which is very useful for the Physical Education teacher. The proposal takes into account the morpho-functional profile, evaluated from the application of the body composition to measure the degree of relative and nutritional fatness of the student, posture test with the plantogram complement to detect postural alterations, which must be corrected at this stage of development.

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#### **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.



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