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The transfer of strength exercises to the aquatic environment in the second stage of basic training in water polo

La transferencia de los ejercicios de fuerza al medio acuático en la segunda etapa de formación básica en el polo acuático

A transferência dos exercícios de força para o entorno hídrico na segunda etapa do treinamento básico de pólo aquático

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ABSTRACT

In sports training, having in mind how to develop strength on land and its transfer to the aquatic environment is of vital importance in the training of athletes who begin the practice of water polo. The present research had the objective of determining how the strength transfer exercises influence the motor actions of water polo, which would help in an adequate conduction of the sports training process of the female athletes studied. To achieve the proposed goals, the authors relied on theoretical and empirical methods, the descriptive statistics tool (percentage calculation) was used to process the information, taking as a sample athletes who were starting in water polo in the massive sports area of Water Polo. For this purpose, a survey was made to coaches and their opinions and criteria were analyzed during the conduction of this process. The final result is that there is insufficient knowledge of how to select exercises so that a positive transfer to the aquatic environment of strength exercises on land is developed. They do not master the methods, procedures, contents and methodologies, based on the research carried out on the principle and exercises of transfer. Among the most relevant conclusions of this research are the theoretical references on the transfer exercises from land to the aquatic environment, which will provide from the theory a solid argumentation for its application to practice.

Keywords: Transfer; Physical capacity strength; Sport initiation.

RESUMEN

En la formación deportiva, tener presente cómo desarrollar la fuerza en tierra y su transferencia al medio acuático es de vital importancia en la formación de los atletas que comienzan la práctica del polo acuático. La presente investigación tuvo como objetivo determinar cómo los ejercicios de transferencia de fuerza influyen en las acciones motrices del polo acuático, lo que ayudaría a una adecuada conducción del proceso de formación deportiva de las atletas investigadas. Para lograr las metas propuestas, los autores se apoyaron en métodos teóricos y empíricos, se utilizó la herramienta de la estadística descriptiva (cálculo porcentual) para procesar la información, tomando como muestra a atletas que se iniciaban en el polo acuático en el área deportiva masiva de Polo Acuático. Para ello, se realizó una encuesta a entrenadores y se analizaron sus opiniones y criterios durante la conducción de este proceso. El resultado final es que son insuficientes los conocimientos de cómo seleccionar los ejercicios para que se desarrolle una transferencia positiva al medio acuático de los ejercicios de fuerza en tierra. No dominan los métodos, procedimientos, contenidos y metodologías, a partir de las investigaciones realizadas sobre el principio y ejercicios de transferencia. Entre las conclusiones más relevantes de esta investigación, se encuentran los referentes teóricos sobre los ejercicios de transferencia de fuera en tierra al medio acuático, lo que aportará desde la teoría una argumentación sólida para su aplicación a la práctica.

Palabras clave: Transferencia; Capacidad física fuerza; Iniciación deportiva.

RESUMO

No treino desportivo, é de importância primordial ter em conta como evoluir a força em terra e a sua transferência para o meio aquático ou entorno hídrico, no treino dos atletas iniciantes na prática de pólo aquático. O objectivo desta investigação era descobrir como os exercícios de transferência de força influenciam as ações motoras no pólo aquático,



o que contribuiría para a correta condução do processo de treino desportivo dos atletas inquiridos. Para alcançar os objetivos propostos, os autores apoiaram-se em métodos teóricos e empíricos, recorrendo à ferramenta da estatística descritiva (cálculo de percentagens) para processar a informação, tomando como modelo os atletas que estavam a começar no pólo aquático no campo do pólo aquático de desportos coletivos. Para este efeito, foi realizado um inquérito com os treinadores e as suas opiniões e critérios foram analisados durante a realização deste processo. O resultado final é que não há conhecimentos suficientes sobre como escolher exercícios para desenvolver uma transferência positiva de força em terra, para o ambiente aquático. Não dominam os métodos, procedimentos, conteúdos e metodologias, com base na investigação efetuada sobre o princípio e exercícios de transferência. Entre as conclusões mais relevantes desta investigação figuram as referências teóricas sobre os exercícios de transferência da terra para o meio aquático, que fornecerão da teoria uma argumentação sólida para a sua aplicação à prática.

Palavras-chave. Transferência; Força da capacidade física; Iniciação desportiva.

INTRODUCTION

The practice of sports is a socio-cultural phenomenon, closely linked to scientific advances, research and the rational use of new technologies, as a requirement of the digital era and the scientific-technical revolution that currently prevails on the planet. It is indisputable that today, behind every result, are the advances of science, as well as the use of scientific research to respond to the demanding problems that emanate from the practice of sports in its diversity.

The reasons stated above point to the need to research the sports training process from Sport Initiation (SI) to high performance sport and high competition. In this case, it is about strength work on land and its transfer to the aquatic environment in polo women players during the ID stage; for this purpose, the postulates of the Charter of the International Olympic Committee (IOC), currently the Olympic Charter, a document dating back to 1908 and last updated at the Rio de Janeiro conference in 2016.

The principles and functions declared in the Olympic Charter are oriented to the organization of the international sports movement on the one hand and, on the other hand, make responsible to: International Federations of each sport and National Olympic Committees (Con) to establish strategies according to the demands of those sports and of each country.

In the specific case of Water Polo, it was possible to verify, by reviewing the reports of the International Federation of this sport in the 2016 Olympic cycle, the following elements: detention and selection of athletes, initiation from early ages, innovation from new models that optimize the preparation and guarantee insertion into the current competitive system, as well as obtaining a favorable physical condition for the successful performance of children, adolescents and young people.

Another reference is the International Sports Charter, adopted by the General Conference of the United Nations Educational, Scientific and Cultural Organization (Unesco) in December 2015, which constitutes a proclamation of the peoples for the practice and inclusion in sport. Article 9 of this document specifies the need to work on sports from an early age, focusing on free access, inclusion, enhancing the physical condition of children and adolescents as a determining element for sports performance,



as well as instructing techniques and forming values related to fair play, all in favor of human development.

In the bibliography consulted on the preparation of strength, they are linked to different sports disciplines and weight training in high performance: For the researcher, they constitute theoretical and methodological cores of great significance for their depth and scope, however, although they collect the work of strength, the studies and results are linked to high performance sport, the selected units of studies belong to other groups of sports that are distant from Water Polo in terms of training models, competitive dynamics, natural environment in which the training is developed and the competitive activity itself, the regulations and other elements.

Scientific results of doctoral theses, master's degrees and diploma works on the sport under research were consulted, [Carreño \(2016\)](#), [Zinner \(2015\)](#), [Ramos Veliz \(2015\)](#), [Torregrosa \(2016\)](#).

With adequate strength training, a greater response to physiological demands is achieved during all physical activity. The elements provided in their researches were the basis for several authors to conceptualize strength. [Román \(2015\)](#) defines strength as the capacity of man to overcome external resistance or to oppose it thanks to muscular efforts.

[Santana J.S. \(2018\)](#) is of the criterion that in the amount of strength that can be controlled and used in a sport skill (functional strength) that is trained and evaluated by the quality of the movement, not by the load that is applied. This is based on the movement patterns performed in a given motor action.

The author himself states that it is not always necessary to use weight machines. He states that the best equipment is the body itself, which allows the most practical condition is to repeat with greater power the movement to be simulated.

The most important thing would be to ask what it is transferred for and to understand which capacity is transferred in each motor action.

[Cappa. D. \(2018\)](#), the non-linear development of physiological processes such as stature and body mass during childhood and adolescence are elements to consider when working on strength.

[Heredia J.R \(2021\)](#), is of the opinion that strength training at this age, based on research carried out since the 1990s, has shown that it can improve health and physical performance. Strength is a determining capacity in the performance and effectiveness of motor responses. He also defines performance or result as the quantitative aspects of motor behavior and effectiveness as that which is achieved (the desired objectives).

In these two properties of motor behavior (performance and efficacy), the contribution of strength is vital when taking into account the sensitive phases and levels of physical condition.

For this reason, strength training is developed from its different manifestations, according to the demands and characteristics of each sport and offers, at the same time, the possibility of a correct dosage, with a wide range of exercises for the different muscular planes.



This article is based on defining how strength can be developed on land and transferred to the aquatic environment. For this reason, the authors understand that they must start from the concept of "transfer", issued by the Royal Academy of the Spanish Language, which expresses: "to transfer is to pass or take something from one place to another".

Magill (2018) defines transfer as the influence of a previous practical activity on the learning of a new skill; contextualized in that way, it is then expressed as the influence of one motor action (exercise) on the performance of a different motor action.

Mena (2018) posits that, "transfer is a term associated with motor development, specifically the qualitative leap between habit and skill, with the knowledge that habits are automated, stereotyped movements, not very operative and tend to repeat themselves, even if the situation in which they are performed is changing".

The skill is the superior expression of the motor habit, the harmonic conjugation of several habits and its improvement is the support for the formation of the skill, which is known as transference, since they make it an operative, dynamic and flexible element as a tool for athletes, which offers a solution to motor and sports tasks in varied and complex situations.

Novedillo (2019) claims that transfer exercises are used as a way to let the body know what the quality of strength is trained for and this is to be powerful and, in turn, apply it to the sport or activity. This author defines two ways to achieve a transfer in strength training: plyometrics and sport gesture.

The first is directly related to physical power, it is a specific form of strength training aimed at developing explosive muscular strength and the reactive capacity of the neuromuscular system. This is independent of whether the person is training for a specific sport, moreover, anyone who wishes to have intensified the motor qualities of his/her organism will benefit from this type of strength preparation, which allows to increase the mechanical performance of any motor action with demand of high strength impulse in minimum time; for this, the exercises for this objective must be chosen and developed very well.

The second path assumed in the research is related to transferring or applying that strength to the action of the sport itself, so that the body understands why that quality has been developed, that is, to optimize each technical gesture used by the discipline exercised.

If it is considered what is stated by **Novedillo (2019)**, which posits that muscular strength is an essential component of performance in motor skills, development of fitness and confidence, then, land-based strength exercises during childhood and adolescence can assume important implications in the athlete's sport performance in the aquatic environment.

Transfer takes place in dynamic systems spontaneously, so that the subject finds the most suitable adaptive responses and generates appropriate motor patterns.

Sports learning is based on some forms of transfers and what was learned in the past influences what is learned in the present, what is done and will influence what is learned in the future.



Transfer is considered as the influence of a previous practical activity on the learning of a new skill; contextualized in this way, it is expressed, then, as the influence of a motor action (exercise) on the performance of another different motor action.

Torregrosa (2016) expresses that,

"transfer is a term associated with motor development, specifically the qualitative leap between habit and skill, with the knowledge that habits are automated, stereotyped, not very operative movements that tend to be repeated, even if the situation in which they are performed is changing".

When making an analysis of what most concerns coaches of any sport structure today is how to transfer training loads to competition in conditional training.

Different criteria can be found in the survey of coaches regarding the concept of "transfer", which causes most coaches to use different strategies without knowing exactly their mechanisms of action. One of the causes of this lack of knowledge is that this mechanism involves especially the Central Nervous System.

For this reason, and to respond to these transfer needs, some trainers intuitively use the so-called transfer exercises, used primarily in strength training and allow to transfer the benefits obtained when performed by a generic work.

Boyer, M. (2016) posits that,

"to achieve an effective transformation of the quality, it must be started from a methodology that allows, gradually, to bring exercises for the development of isolated capacities such as: squats, throws, runs, jumps, etc., in integrative exercises, structured in chains, where physical and technical exercises are mixed, that demand from the organism an energy expenditure and power of execution very similar to competition exercises and develop them in execution time equivalent to that of the specialty to be modeled".

Muñoz (2019) claims that,

"transfer exercises are used as a way to let the body know what the quality of strength is trained for and this is to be powerful and, in turn, apply it to the sport or activity."

This author defines two ways to achieve a transfer in strength training: plyometrics and sport gesture.

The first is directly related to physical power, it is a specific form of strength training aimed at the development of explosive muscular strength and the reactive capacity of the neuromuscular system, this is independent of itself. The person is trained for a specific sport, in addition, anyone who wishes to have intensified the motor qualities of his/her organism will benefit from this type of preparation of strength, which allows to increase the mechanical performance of any motor action with demand of high impulse of strength in minimum time; for this, the exercises for this objective must be chosen and developed very well.



The second path assumed in the research is related to transferring or applying that strength to the action of the sport itself, so that the body understands why that quality has been developed, that is, to optimize each technical gesture used by the discipline exercised.

In any case, the exercises must be similar from a physiological, biomechanical and psychological point of view, which contribute to a better adaptation and are close to the technical gesture of the sport practiced.

It was assumed that, in order to apply these forms of transfer exercises, it is not necessary to have sophisticated technologies and equipment for strength training, if it is assumed that, at this age, working with exercises with one's own weight, with and without implements and with games that contribute to the development of strength, will improve this physical capacity and make a positive transfer to the aquatic environment.

This idea is highlighted, since it also constitutes the basis of the approach applied in the construction of the system of exercises and games proposed to be applied in the proposed solution to the research problem and has points of contact with the previous conceptualizations.

Muscle strength is an essential component of performance in motor skills, the development of fitness and confidence, the use of land-based exercises during childhood and adolescence. They can assume important implications in the athlete's sport performance in the aquatic environment.

Muñoz (2019),

"defines transfer as a principle of Physical Education and Sports Training, states that the paradigms of human development show that to reach the mastery of sports skills is necessary a long process, where, mainly the previous experiences in basic skills are of fundamental importance in the early stages of its development".

This position is highly considered, since it should not be forgotten that, at the ages alluded to, girls enjoy double influence in both systems, that is, Physical Education and Sports Training due to the characteristics of the Education and Sports systems in Cuba.

That is why the basic ideas of the transfer of different authors constitute the theoretical basis of the qualitative change of the strength developed on land and allow to successfully face the development of skills needed in the aquatic environment. In essence, they are defined as:

- The influence of one motor action (exercise) on the performance of a different motor action.

Another aspect to consider for the transfer is that the exercises are related to each other (element of the specific principles).

Thus, from the author's practical experience, the result of previous research, his theoretical reflections, as well as the empiricism developed in this initial stage in the province of Cienfuegos, it was found that there are insufficiencies in the knowledge of professionals in the sport of water polo. These limitations demand ways on how to act during the preparation of strength in the sport initiation and how to transfer it to the



aquatic environment, which requires theoretical and methodological knowledge to be able to develop this process fully with the athletic training process from the base.

Coaches show insufficiencies in the mastery of methods, procedures, contents and methodologies to conduct this process, besides not instilling in their athletes the vital importance of strength training for this sport.

Consequently, there are theoretical-methodological insufficiencies in the professionals who work in the sport of water polo to successfully conduct the process of strength preparation on land and its transfer to the aquatic environment. The objective of the present work is to determine the insufficiencies derived from the preparation of strength on land and its transfer to the aquatic environment to be able to successfully develop the motor actions in the aquatic environment, in the conduction of the athletic training process, in the base sport or Massive Sports Area, in Water Polo to be able to contribute to give solutions to the motor actions.

MATERIALS AND METHODS

In the research, different techniques and methods were used to support and direct the methodology used; among them, the theoretical methods that stand out are: the analytical-synthetic of all the material collected during the research work to arrive, from general conceptions, to the theoretical and methodological foundations that support the transfer of force to the aquatic environment, as well as to reach the conclusions of the research work. The inductive-deductive to establish characteristics, links and relationships in the composition of the methodology and to reach general conclusions.

The empirical methods used were: the review of documents such as the comprehensive program for the preparation of the athlete (Pipd in Spanish) of (2016-2020) in order to know whether methodological indications for the preparation of strength and its transfer to the aquatic environment in sports initiation have been established at present.

The interview, as a complementary empirical method consisting of a planned professional conversation between the interviewer and the interviewees, was carried out with the following objectives:

- Obtain reliable information on the sports detraining process.
- To enrich, complete or confirm the information obtained through the use of other research methods.

The interview was conducted with coaches, retired athletes and sports medicine professionals in Cienfuegos to learn how the process of transfer to the aquatic environment is developed, based on the following indicators: organizational methods and procedures and the fulfillment of the objectives that are drawn up to concretize this process in practice. The descriptive statistics tool was used (percentage calculation). In addition, official documents and methodological activities were analyzed.



National and international publications were reviewed to analyze the performance of the different processes, the particularities of the previously established programs and their shortcomings, in order to establish regularities and provide information in this regard.

In addition, visits were made to training units and methodological preparations of the group of Water Polo trainers to observe possible actions that favor the knowledge of the transfer of strength to the aquatic environment.

Analysis of the results of the coaches survey

The survey was applied to a total of 30 coaches from five (5) provinces that participated in the national zone of the West: Cienfuegos (14), Pinar del Río (3), Havana (3), Matanzas (1), Villa Clara (2), Sancti Spíritus (1) and from three provinces of the Eastern zone (3) that participated in the national final in the month of July 2016: Granma (1), Santiago de Cuba (3), Holguín (2), all with professional experience of working or having worked in those categories.

The 53.43 % of the respondents have more than 16 years of experience and work directly in the sport under studied, the 100 % have a degree in Physical Culture and of these, 4 have a master's degree and 3 are specialists, which represents only 23.33 %. Twenty-three percent have no postgraduate training. The selection was made intentionally. As a selection criterion, it is assumed that they have worked as water polo coaches for more than 10 years in the age groups under study.

In question number one: if the Pipd considers how to develop the physical capacity strength on land and its transfer to the aquatic environment in the ID, 16.16% answer affirmatively, and 83%, 74 negatively.

As additional arguments, the former state that it *appears in a not very explicit way and without specific guidelines* on how to perform this strength training on land and its transfer to the aquatic environment in the Pipd. The second ones express, that they perform strength training on land in an empirical way, and by experience on the job.

These responses indicate that the methodological treatment of this capacity in the Pipd for the orientation and preparation of teachers is weak, which coincides with the weak orientations in that document.

In the second question related to the knowledge of the types of strength that should be developed in the second stage of basic training in Aquatic Polo, female sex, responded as follows: Yes, 10 %, the rest (90 %) answered NO.

This is a negative result, which indicates the low level of knowledge regarding the strength training of teachers and its methodological treatment; in the specific case of the context where the research was conducted and, in particular, related to the female sex, two negative elements are reaffirmed; on the one hand, deficit in the preparation of coaches regarding the subject and on the other hand, the limited methodological orientations of the Pipd.

In question number three, on which of the components of the strength would work, they responded as follows:

- Rapid strength, 22.8%.
- Strength endurance, 11.3%.



- Maximum Strength, 43.0 %.
- Explosive strength, 32.9

It is striking how greater importance is given to the two ones that have less scientific justification to be worked at these ages, which presupposes a lack of information on the subject of coaches working in this category, in particular, the lack of knowledge of the new evidence on the work of strength at these ages and in the female sex, which results in insufficiencies in the preparation of strength on land and its transfer to the aquatic environment, not taking into account psychological and pedagogical factors.

When referring to question number four, 66.45 % answered NO, and stated that they do not have or do not know the main muscle groups and that the Pipd's methodological indications do not specify the muscle groups; 33.55 % answered YES, stating that they know the ways of how to prepare on land, but not how to transfer to the aquatic environment.

On the one hand, the lack of knowledge of the main muscle groups involved is a limitation, but, on the other hand, it is also relevant the lack of knowledge of how to cause strength transfer from one medium to another, hence, the problem, from where the study starts, shows the limitations in the aquatic medium, caused by weak force transfer, expressed in the limited control of the body in the water when performing basic actions.

In the answer to question number five, related to whether the sensitive phases for the development of strength on land and its transfer to the aquatic environment are considered in the conception of the preparation, 95 % answered NO, arguing that they do not know the sensitive phases in which their athletes are, so they do not have knowledge about the gradients of strength to be worked and its subsequent transfer to the aquatic environment in order to develop a good basic training in these athletes.

A total of 5% answered YES, which shows a lack of knowledge of this variable. It is evident the lack of knowledge of the sensitive phases of development for the methodological treatment of the capacities, this element related, in addition, to question three, is a weakness to conceive the methodological treatment of strength in a general sense, in addition, to evidence that in these conditions the possibility of transfer to the aquatic environment is slowed down.

Question number six (Table 1).



Table 1. - Results of the approaches concerning transfer to the aquatic environment

Number of coaches	%	Approach
15	50	They do not take into account any of the five aspects that must be taken into account for proper strength training on land that can be transferred to the aquatic environment.
8	26,7	Keeps the five aspects of the question in mind
3	10	They express to develop rapid strength
1	3,3	They express to develop strength endurance.
3	10	They develop rapid strength and strength endurance.

The answers to this question were almost expected if it is considered the weaknesses shown in previous answers, hence, it is almost normal a chaotic methodological treatment of the preparation of strength in these ages and sex, based on the experience of each coach, with the consequences shown in the behavior of girls in competitive stages, where serious weaknesses were shown when developing basic technical actions.

Question number seven, referring to whether there are exercises declared in the Pipd for the preparation of strength on land and its transfer to the aquatic environment, 90.32 % stated that there are no exercises declared for the different components of strength preparation, only the types of strength are declared, but not how to transfer them to the aquatic environment; only 10 % stated that strength exercises are generally declared, but not for which components of strength nor how to transfer them to the aquatic environment.

In question number eight, 60 % of the respondents answered that they had NO knowledge of any methodology for the preparation of strength on land and its transfer to the aquatic environment in school SI in this sport; 10 % answered that they have knowledge of methodologies for the preparation of strength in other sports in high performance and work with weights as an auxiliary sport, but not in SI.

In the analysis of the answers to know the assumptions of how strength is developed on land and its transfer to the aquatic environment at these ages, the following elements can be synthesized:

- It is not known how to transfer exercises on land to the aquatic environment; as far as strength training is concerned, what is known about transfer in this sport is about technical-tactical exercises in higher categories.
- It is not stated in the scientific literature an instituted procedure to guide the ways to transfer force on land to the special movements performed by the Water Polo player to develop the teaching process in these ages.
- Lack of specialized bibliography in Cuba.



- In Pipd, there is no methodological orientation on how to work this capacity on land and the ways to transfer it to the aquatic environment, according to the basic nuclei of strength in water polo (strength for displacements, strength for jumps, strength for throws, strength for swimming) and even less on how to evaluate it.

As it is recurrent, three factors are present:

1. Lack of knowledge of basic elements of strength training, age and sex.
2. Pipd's limited methodological orientations
3. Lack of knowledge of new discoveries of the last ten years, which allow coaches to work on this ability without fear of affecting the development of the girls.

Analysis of the review of official documents

The documents analyzed were: the Indications of the President of the National Institute of Physical Education, Sports and Recreation (Inder in Spanish) for the school courses from 2016 to 2020, the Athlete Preparation Program from 1987 to the 2016-2020 cycle, where the denomination of Integral Athlete Program (Pipd) appears and the teaching programs of the coaches of the sports areas of Cienfuegos since 2016, the Olympic charter of 1958 and its adjustments in Rio de Janeiro 2016, the congress of the International Federation of Aquatic Sports Beijing 2018.

The analysis of the documents was developed taking into account the following units of analysis:

1. Theoretical foundations that support the methodological proposal.
2. Determination of the content, time distribution and dosage of the exercises by muscle planes and type of strength.
3. The organization and treatment of individualization as an important aspect for its realization in practice.

From the analysis of the documents, the following is highlighted:

- Limitations in the theoretical and methodological foundations; there is no updated characterization of the context of strength training on land and its transfer to the aquatic environment and of the subject that will be the object of it, and they do not take into account the results of the diagnosis for the methodological treatment, according to the needs detected.
- There are inaccuracies in the determination of the contents, with little variety, their selection is not argued, they are used in the same way for all those involved without taking into account the individual characteristics of each subject.
- The analyzed methodological proposals on strength preparation are developed in high performance sports and not in SI.
- The structure that characterizes the methodological proposals analyzed is based on the preparation of strength with weights in high performance, in other sports and in higher school categories, but not in SI.



- The two stages of basic training and the sensitive phases established for strength work and the gradients that should be developed in them are not considered. The methodological indications that guide the trainer on how to work this capacity in the SI at the age investigated are insufficient.
- For the most part, they advocate converting the athletes, in the shortest possible time, with determined performances in order to obtain a sporting result.
- There is no precise system of exercises for the development of strength on land and its transfer to the aquatic environment, according to the ways of evaluating and controlling its development in the strength nuclei in the aquatic environment that orients the advances and allows evaluating the state of the subject, according to the objectives set.

It was found that there is no established methodology for the preparation of strength on land and its transfer to the aquatic environment.

When triangulating the methods used and contrasting the results of the survey and the review of documents as methods and research techniques used, the correspondence of the results is confirmed, which show limitations in the development of strength on land and its transfer to the aquatic environment; in the methodological treatment, neither its systematicity nor the work frequencies are guaranteed, in short, there is no scientifically based system of relationships that guarantees the logic of a methodological process in the treatment of strength capacity.

DISCUSSION

So far, the topic of strength preparation has been addressed in scientific articles published in indexed journals, databases, monographs, bibliographic repositories and proceedings of different scientific events, a recurring research topic in doctoral theses, master's theses, specialties and undergraduate work.

Until the end of the eighties of the twentieth century, it was possible to verify the resistance and caution when recommending strength training for the age groups that include childhood and adolescence, much more in the female sex. Regarding this approach, **Román (2015)** is of the opinion that strength work in children, adolescents and young people, with the supervision of qualified personnel, is efficient to improve health and physical performance.

It is why that muscular strength, in its various manifestations, is a determining physical capacity in the performance and efficacy of motor responses. By performance or result, it can be understood the quantitative aspects of motor behavior (higher, further) and by efficacy, that which achieves the desired objectives. In these two properties of motor behavior (performance and efficacy), the contribution of strength is vital when taking into account the sensitive phases and levels of physical condition.

The above is demonstrated in scientific studies that have indicated that various forms of strength exercise can produce significant improvements in the athlete's sports performance and physical condition (**Román, 2015**); its impact on the increase of muscle power, speed in changes of direction during the race and in the speed when executing the movements of a motor action has been proven.



Muscle strength development is a multidimensional component of physical fitness influenced by a combination of muscular, neural and biomechanical factors.

The non-linear development of physiological processes such as height and body mass during childhood and adolescence are elements to be considered when working on strength, even when the group is of the same age.

The aforementioned expresses the need to keep in mind the preparation of strength in these ages, as well as to transfer it to the aquatic environment.

It is also considered some aspects that, according to different authors, should be taken into account in relation to the expression of load indicators, which, in this work authors opinion, sport teachers who develop this process do not keep in mind.

Growth and maturation can mask the effects of training and often mask the potential effects of training load components.

Soto, C. A. and Andújar, C. (2018) state that there is no exact combination of load components for those ages, but they do provide guidelines that help to manipulate them, an important aspect that coaches should have.

CONCLUSIONS

Bearing in mind all that has been said about the preparation of strength in these ages, it is necessary to specify that the transfer of strength on land to the aquatic environment can only be established when a system of principles is applied, where the characteristics of the ages are taken into account from the psychological, pedagogical and physiological point of view and the interconnection with the principle of transfer so that there is an adequate level of performance of the motor actions in the aquatic environment and thus the athletes can be developed in a multilateral way from the basic training.

REFERENCES

- Boyer, M. (2016). El Entrenamiento Funcional aplicado al deporte. Barcelona. España
- Cappa. D. (2018) Fisiología del Entrenamiento Neuromuscular. Ciencia y deporte. Barcelona. España.
- Carreño Vega, J. E. (2016). *La iniciación deportiva en la práctica contemporánea del ejercicio físico*. Universidad de Matanzas. <http://monografias.umcc.cu/monos/2016/FCF/mo1698.pdf>
- Heredia. J.R. R. (2021) EL Entrenamiento de Fuerza para mejorar la condición física y la salud. Ciencia y deporte. Barcelona
- Magill (2018) Metodología general del entrenamiento infantil y juvenil Ejercicios de transferencia. Barcelona.



- Mena (2018) El desarrollo de las capacidades físicas a través del circuit- training. Cádiz: Industrias Gráficas LIPPER S.A.
- Muñoz Rivera, D. (2019). Capacidades físicas básicas. Evolución, factores y desarrollo. Sesiones prácticas. *EFDeportes.com, Revista Digital*, 14(131). <https://www.efdeportes.com/efd131/capacidades-fisicas-basicas-evolucion-factores-y-desarrollo.htm>
- Román Suárez, I. (2015). *Preparación de la fuerza, aspectos más polémicos*. Deportes.
- Santana. J.C. (2018). El Entrenamiento Funcional aplicado al deporte. Ciencia y Deporte. Barcelona España.
- Soto, C.A. y Andújar, C. (2018). Reflexiones acerca del entrenamiento en la infancia y la selección de talentos deportivos. *Revista Digital - Buenos Aires*, 5(21) <https://www.efdeportes.com/efd21/talento.htm>
- Torregrosa, M. (2016). El deporte de iniciación como base de la carrera deportiva de adultos activos y deportistas de elite. En *Psicología y Deporte*. Diego Marín.
- Zinner, C., Sperlich, B., Krueger, M., Focke, T., Reed, J., & Mester, J. (2015). Strength, Endurance, Throwing Velocity and in-Water Jump Performance of Elite German Water Polo Players. *J Hum Kinet*, 45, 149. <https://doi.org/10.1515/hukin-2015-0015>

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Authors' contribution:

Oscar Narciso Muñoz Hernández: Conception of the idea, literature search and review, instrument making, instrument application, compilation of information resulting from the instruments applied, statistic análisis, preparation of tables, graphs, and images, database preparation, drafting of the original (first version), review and final version of the article, authorship coordinator, review of the application of the applied bibliographic standard.

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