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Original article

Validation by specialists of a reactive-strength plyometric exercises group for U-14 Soccer players

Validación por especialistas de un grupo de ejercicios pliométricos de fuerza-reactiva para futbolistas de la categoría sub-14

Validação por especialistas de um grupo de exercícios pliométricos de força-reactiva para jogadores de futebol sub-14

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ABSTRACT

Plyometry is a training method designed to reproduce fast explosive and powerful movements, it improves strength and speed in different muscle planes, which is why it is usually very useful to improve certain physical skills in sports such as soccer. The objective of this research is to theoretically validate, through consultation with specialists, a group of plyometric strength-reactive exercises for U-14 soccer players. This is a qualitative and correlational descriptive-explanatory research. Twenty-one soccer specialists classified into two independent groups were surveyed, theoretically validating the scope and limitations of a plyometric exercises proposal for lower limbs adapted to U-14 soccer players. The averages that describe the scores achieved were higher in the post-test, with significant differences when evaluating each group studied (Group 1: "I" $r=0.004$, "A" $r=0.005$, "P" $r=0.003$, "V" $r=0.003$ and "EP" $r=0.003$; Group 2: "I" $r=0.002$, "A" $r=0.003$, "P" $r=0.001$, "V" $r=0.003$ and "EP" $r=0.002$), there is not significant differences when comparing the results between each independent group as



part of the pretest "I" ($p = 0.973$), "A" ($p = 0.756$), "P" ($p = 0.426$), "V" ($p = 1.000$) and "EP" ($p = 0.468$), and as part of the post-test "I" ($p = 0.223$), "A" ($p = 0.973$), "P" ($p = 0.173$), "V" ($p = 0.918$) and "EP" ($p = 0.918$). With this work, the intervention proposal is theoretically improved, concerning 25 plyometric exercises applied to lower limbs of U-14 soccer players, in addition, five analysis indicators are taken into account. It is recommended to carry out a practical validation that focuses future research, with a type of experimental or quasi-experimental research.

Keywords: Plyometry; Explosive strength; U-14 Soccer.

RESUMEN

La pliometría es un método de entrenamiento diseñado para reproducir movimientos rápidos, explosivos y potentes; mejora la fuerza y la rapidez en distintos planos musculares, por lo cual suele ser muy útil para mejorar ciertas habilidades físicas en deportes como el fútbol. El objetivo de esta investigación es validar teóricamente, mediante consulta por especialistas, un grupo de ejercicios pliométricos de fuerza-reactiva para futbolistas categoría sub-14. Esta investigación es de tipo descriptiva-explicativa, de orden cualitativa y correlacional. Se encuestan a 21 especialistas de fútbol, clasificados en dos grupos independientes, se validan teóricamente alcances y limitaciones de una propuesta de ejercicios pliométricos para miembros inferiores, adaptados a futbolistas sub-14. Los promedios que describen los puntajes alcanzados fueron mayores en el postest, existen diferencias significativas al evaluar indistintamente cada grupo estudiado (Grupo 1: "I" $r=0.004$, "A" $r=0.005$, "P" $r=0.003$, "V" $r=0.003$ y "EP" $r=0.003$; Grupo 2: "I" $r=0.002$, "A" $r=0.003$, "P" $r=0.001$, "V" $r=0.003$ y "EP" $r=0.002$), no existen diferencias significativas al comparar los resultados entre cada grupo independiente como parte del pretest "I" ($p=0.973$), "A" ($p=0.756$), "P" ($p=0.426$), "V" ($p=1.000$) y "EP" ($p=0.468$) y como parte del postest "I" ($p=0.223$), "A" ($p=0.973$), "P" ($p=0.173$), "V" ($p=0.918$) y "EP" ($p=0.918$). Con este trabajo, se mejora teóricamente la propuesta de intervención, concerniente en 25 ejercicios de pliometría aplicada a miembros inferiores de futbolistas sub-14, además, se tienen presente cinco indicadores de análisis. Se recomienda realizar una validación práctica que enfoque la investigación a futuro, con un tipo de investigación experimental o cuasi-experimental.

Palabras clave: Pliometría; Fuerza-explosiva; Fútbol U-14.

RESUMO

A Pliometria é um método de treino concebido para reproduzir movimentos rápidos, explosivos e poderosos; melhora a força e a rapidez em diferentes planos musculares, pelo que é normalmente muito útil para melhorar certas capacidades físicas em desportos como o futebol. O objetivo desta investigação é validar teoricamente, através da consulta por especialistas, um grupo de exercícios pliométricos de força reativa para jogadores de futebol sub-14. Esta investigação é descritiva-explicativa, qualitativa e correlacional. Vinte e um especialistas em futebol, classificados em dois grupos independentes, foram inquiridos. O âmbito e as limitações de uma proposta de exercícios pliométricos para membros inferiores, adaptados aos jogadores de futebol sub-14, foram teoricamente validados. As médias que descrevem as pontuações obtidas foram mais elevadas no pós-teste, existem diferenças significativas ao avaliar indistintamente cada grupo estudado (Grupo 1: "I" $r=0.004$, "A" $r=0.005$, "P" $r=0.003$, "V" $r=0.003$ e "EP"



$r=0,003$; Grupo 2: "I" $r=0,002$, "A" $r=0,003$, "P" $r=0,001$, "V" $r=0,003$ e "EP" $r=0,002$, não há diferenças significativas ao comparar os resultados entre cada grupo independente como parte do "I" ($p=0,973$), "A" ($p=0,756$), "P" ($p=0,426$), "V" ($p=1,000$) e "EP" ($p=0,468$) e como parte do pós-teste "I" ($p=0,223$), "A" ($p=0,973$), "P" ($p=0,173$), "V" ($p=0,918$) e "EP" ($p=0,918$). Com este trabalho, a proposta de intervenção é teoricamente melhorada, relativamente a 25 exercícios pliométricos aplicados aos membros inferiores dos jogadores de futebol sub-14, além disso, são tidos em conta cinco indicadores de análise. Recomenda-se a realização de uma validação prática que focalize a investigação futura, com um tipo de investigação experimental ou quase-experimental.

Palavras chave: Pliometria; Força explosiva; futebol U-14.

INTRODUCTION

Physical capacities are qualities directly related to motor movement, (Márquez & Celis, 2016; Morales & González, 2014; Morales & González, 2015) given that the skills acquired through sports training, denoted as technical gestures, are based on the proper foundation of physical qualities; therefore, the higher the level in physical qualities, the greater the results in a specific sport modality.

For the specific case of strength development, this is usually one of the most important for sports training, considered as the capacity to overcome the opposition of an endurance; (Correa Bautista & Diego Ermith, 2009) it is conditioned by several variables, among them the anatomical and physiological structures, as well as the kinesiological dimensions.

Strength as a physical capacity is normally subclassified in the international literature as maximum, explosive and endurance type; (Raposo, 2012) however, other literature evidences the existence of other types of strength, including reactive strength, classified as the muscular performance that generates an impulse within a stretching-shortening cycle, (Martin, Carl, & Lehnertz, 2007; Rojas, Eras, Jácome, Enríquez, & Chicaiza, 2020; Gamble, 2013) widely used to enhance the specific performance in numerous sports.

For the specific case of soccer, the study of reactive strength levels is usually an indicator of comparison with other modalities of soccer, such as futsal, (Flórez, Osorio, & Cely, 2020) or as an indicator to assess the performance of agility in high performance soccer players, (Zouhal *et al.*, 2019) among others.

The strength-reactive evidences a high and relative importance in the process of sports training direction of the soccer player, for which different types of training have been developed for its enhancement, as is the case of the multidirectional sprint to improve the speed of change of direction and reactive agility in highly trained soccer players, as evidenced in Born, Zinner, Düking, & Sperlich (2016) or as would be the case of specific plyometric training that uses the strength-reactive index as an indicator for the study of strength, (Ramirez-Campillo, *et al.*, 2018) or simply as another element in integrated models of sports training for the soccer player (Torres, Coca, Morales, García, & Cevallos, 2015).



For the specific case of plyometric training, the literature evidences its numerous positive effects on the potentiation of strength performance in different sports, (Frometa, Aymara, & Rojas, 2020) including soccer, (Wang & Zhang, 2016; Negra, et al., 2017) among them, the effects on lower body power in female soccer players, using the strength-reactive index, (Garavito Betancourt & García Zúñiga, 2019) or the incidence on other associated variables such as speed and speed-strength in female soccer players (Yépez & Ramírez, 2019).

Since soccer is the sport with the greatest international projection in the country, it becomes a research priority in the area of sports training, from early ages. The knowledge of the specific aspects of strength is key for the development of a successful training process, aimed at increasing the result of the competition, in addition to sports performance. The present research will allow us to have exercises aimed at enhancing reactive strength in soccer players, based on the plyometric method, but these will only be analyzed by specialists as a preliminary part of the research, where through various quality indicators they will evaluate the scope and limitations of a proposal for future intervention, theoretically validating the present research.

In addition, the theoretical validation carried out by a group of specialists will have greater pertinence and viability, given that the practical implementation of a group of plyometric exercises to improve reactive strength in soccer players is not currently possible, given the pandemic process that Ecuador is going through. On the other hand, the consultation of national literature does not address many works related to the field of action studied, an aspect that would generate originality in solving a problem of the theory and methodology of sports training of U-14 soccer players.

The results to be obtained will be of direct benefit to the athletes of the mentioned selection (U-14), who, with the application of a validated system of exercises, based on the model of stretching and shortening (plyometrics), will manage to improve their reactive strength and, therefore, the capacity to dominate the ball and approach more effectively to the goal with the intention of placing it as a goal. The improvement in the results of the competition, in addition to having a direct impact on sports performance, has an influence on the mood of the players, team unity, among other psychological aspects, which are also recognized as important in the development of soccer as a team sport (Reina & Hernández, 2012).

On the other hand, the research will indirectly benefit the soccer coaches of this team, at the Sociedad Deportiva la Merced del Valle Soccer School, who will have a methodological tool that will allow them to optimize the sports training process, especially oriented to reactive strength. All this will allow the selection of the mentioned school to raise the results in competition and to ascend in the level of local and regional recognition among the schools of similar category. In this sense, the purpose of the research is to theoretically validate, through consultation with specialists, a group of plyometric exercises of reactive strength for U-14 soccer players.

MATERIAL AND METHODS

Descriptive-explanatory, qualitative and correlational research. Twenty-one soccer specialists in the category of interest were surveyed, divided into two independent groups (group 1: national specialists-11 subjects; group 2: international specialists-10 subjects), theoretically validating the scope and limitations of a proposal of plyometric exercises for lower limbs, adapted to U-14 soccer players.



The inclusion assumptions for the selection of the specialists were:

1. Demonstrable experience of at least ten years as soccer coaches in the category of study.
2. Third level degree in Physical Activity and Sport Sciences or related field.

Five indicators were studied to validate in two moments the proposal of intervention with plyometric exercises that enhance the reactive strength in the lower limbs, in soccer players of the U-14 category. The analysis indicators were:

1. Comprehensiveness (I): that the exercises include various training elements in an integrated manner, allowing to respond to the principle of multilateralism.
2. Affordability (A): that the exercises are designed to effectively meet the training objectives according to the age range studied, responding to the principle of affordability.
3. Progression (P): that the exercises can be classified by groups of increasing complexity, allowing to comply with the principle of progression in sports training.
4. Variety (V): that the exercises are varied, allowing to adapt them to the needs and individualities of each soccer player and to respond to the principle of general multilateralism.
5. Progressive Specialization (EP): that the exercises have a consecutive complexity that allows, in stages, to adapt to the principle of sport specialization during the whole macrocycle of training.

The evaluation indicators of the intervention proposal, mentioned above, were studied through a questionnaire applied to the specialists mentioned in two moments of the proposed design; the first, when the author proposed 13 exercises, recording the shortcomings detected by the specialists and the recommendations issued by them and, in a second moment, to 25 refined exercises that made up the final intervention proposal.

A five-level Likert-type scale was used to evaluate the above-mentioned indicators, described as follows:

- Level 1: (1 point) insufficient.
- Level 2: (2 points) poor.
- Level 3: (3 points) fair.
- Level 4: (4 points) good.
- Level 5: (5 points) excellent.

The data obtained at the two moments of study of the intervention proposal were subjected to a normality test (Shapiro Wilk test), the non-existence of a normal distribution of the data was determined, for which the Mann-Whitney U test ($p \leq 0.05$) will be applied as a correlational statistic. For two independent samples and for two related samples, the Wilcoxon test ($r \leq 0.05$), making a correction for missing data in subject 11 of Group 1.



RESULTS AND DISCUSSION

The evaluations issued by each specialist are shown, according to the level at which the indicators described in the material and methods section were classified (Table 1).

Table 1. - Data from the evaluation carried out by the specialists. Pretest

No	I		A		P		V		EP	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
1	2	2	3	3	1	1	1	1	1	1
2	2	2	3	3	2	1	1	1	2	1
3	2	3	4	3	1	1	1	1	1	1
4	3	3	3	4	2	1	1	1	1	1
5	2	2	3	4	2	1	1	1	1	1
6	1	2	3	5	2	2	1	1	2	1
7	2	2	4	3	1	2	1	1	1	1
8	2	2	3	3	1	1	1	1	1	1
9	3	2	3	3	1	1	1	1	1	1
10	2	2	3	3	1	1	1	1	1	1
11		1		3		1		1		1
□	2,1	2,1	3,2	3,4	1,4	1,2	1,0	1,0	1,2	1,0

As part of the data collected in the first moment or pretest, Table 1 shows the scores obtained in the five indicators that evaluate the intervention proposal from the theoretical point of view, obtaining in all cases an average score between insufficient and poor, with the exception of the affordability indicator (A), which obtained an average score of Good (≈ 3). The scores obtained as part of the second moment of the proposal evaluation or post-test (Table 2).

Table 2. - Data from the evaluation carried out by the specialists. Posttest

No	I		A		P		V		EP	
	Group1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
1	4	3	5	4	3	3	3	3	2	3
2	3	3	4	4	3	3	4	4	3	3
3	3	4	4	4	4	3	4	5	3	3
4	4	4	4	4	4	3	4	4	3	3
5	4	4	4	5	4	3	3	3	2	2
6	3	3	5	5	4	4	3	3	3	2
7	4	3	4	4	4	5	3	3	3	3
8	4	3	4	4	4	3	4	4	2	2
9	3	3	4	4	3	3	5	4	3	3
10	4	3	4	4	3	3	4	4	3	3
11		3		4		3		4		3
□	3,6	3,3	4,2	4,2	3,6	3,3	3,7	3,7	2,7	2,7

In the case of the evaluation carried out by the specialists at a second stage, after correcting the shortcomings detected and incorporating the most important recommendations pointed out, the average scores increased in all the theoretical indicators studied, obtaining an average qualitative score between fair and good (≥ 3), the highest score was reached in the "Affordability" indicator (A: ≈ 4 points).



On the other hand, the comparison of the scores for related groups (Wilcoxon), which were evaluated in their two moments, showed positive results for the two independent groups studied. In the case of the Ecuadorian national specialists (group 1), the data obtained in the two moments of the evaluation of the proposal of plyometric exercises to enhance the reactive strength in the lower limbs of U-14 soccer players showed significant differences in favor of the posttest in the indicator "Comprehensiveness" ($r=0.004$), as well as the "Affordability" indicator ($r=0.005$), the "Progression" indicator ($r=0.003$), the "Variety" indicator ($r=0.003$) and the "Progressive Specialization" indicator ($r=0.003$), with notable theoretical improvements in all cases in the second design of the intervention proposal mentioned above.

In the case of the correlations established in the group of international specialists (group 2), in the two moments of evaluation of the proposal, improvements were noted in favor of the post-test in the means of the scores recorded and are, for all cases, significant in the second moment of evaluation of the intervention proposal in the indicator "Comprehensiveness" ($r=0.002$), the "Affordability" indicator ($r=0.003$), the "Progression" indicator ($r=0.001$), the "Variety" indicator ($r=0.003$) and the "Progressive Specialization" indicator ($r=0.002$), which shows that the international specialists consulted evaluated the final intervention proposal notably and positively.

When comparing the scores made by the two independent groups consulted (Table 2), assessing the significant existence or not in the criteria expressed theoretically by each type of specialists, the Mann-Whitney U Test obtains, as part of the pretest, non-significant differences, "Comprehensiveness" ($p=0.973$), "Affordability" ($p=0.756$), "Progression" ($p=0.426$), "Variety" ($p=1.000$) and "Progressive Specialization" ($p=0.468$) and, as part of the post-test, also non-significant differences, "Comprehensiveness" ($p=0.223$), "Affordability" ($p=0.973$), "Progression" ($p=0.173$), "Variety" ($p=0.918$) and "Progressive Specialization" ($p=0.918$).

The above analyzed evidences that there is concordance among the independent groups of specialists, regardless of the characteristics and pedagogical approaches that could exist among them on the theoretical improvements achieved in the final design of the intervention proposal, an aspect that establishes reliability in the analysis of the data. Therefore, it will be possible to improve in praxis the reactive strength in the lower limbs of U-14 soccer players, a variable of notable importance in the soccer player's training, as indicated by authors such as Rojas, Eras, Jácome, Enríquez, & Chicaiza, 2020; Gamble, (2013), in Zouhal, *et al.*, (2019), in Born, Zinner, Düking, & Sperlich, (2016), in Ramirez-Campillo *et al.*, (2018) and in Torres, Coca, Morales, García, & Cevallos, (2015), among others.

CONCLUSIONS

In conclusion, it is stated that: based on the results issued by the specialists, it has been possible to theoretically improve the intervention proposal concerning 25 plyometric exercises, applied to lower limbs of soccer players of the U-14 category, in addition, 5 indicators of analysis are present. It is recommended to carry out a complete validation of the present research, with emphasis on the practical aspect, focusing it in the future, with a type of experimental or quasi-experimental research.



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Conflict of interests:

The authors declare not to have any interest conflicts.

Authors' contribution:

Wilson Fernando Téquiz Rojas: 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, general advice on the topic addressed, drafting of the original (first version), teview and final version of the article, article correction, authorship coordinator, translation of terms or information obtained, review of the application of the applied bibliographic standard



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