# A systematic review of intervention programs that produced changes in speed and explosive strength in youth footballers

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***Abstract***

A soccer player should possess a reasonable level of different skills and abilities, so the playing position, level of training, style of play, physical and physiological demands can influence his performance. The objective was to identify the intervention programs that have been applied in search of generating positive effects on explosive strength and speed in young soccer players, as well as to identify the percentage of improvement among soccer players. A bibliographic study of systematic review was carried out. Following the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement, bibliographic searches were performed in the PubMed database. The following descriptors were used: Explosive Strength, soccer players, jump performance, CMJ, SJ, VJ, Plyometrics, power, speed, sprint, kicking speed, change of direction speed, soccer player, football and training, intervention. Articles were included only if they were original articles, studied populations of young soccer players and showed an intervention program related to explosive strength and speed. Six studies were identified that applied intervention programs to look for changes in speed and explosive strength in young soccer players. In the 5m speed tests, significant changes were observed, improving from (0.26 to 0.53m/s), 10m speed (0.07 to 0.27m/s), 20m speed (0.08 to 1.92m/s) and 40m speed (0.25 to 0.62m/s). In explosive strength, performance in the test squat jump SJ (4.1 to 8.6cm), countermovement jump CMJ (1.0 to 8.8cm), horizontal jump HJ (12.17 to 24.4cm) and vertical jump VJ (5.0 to 11.0cm). Speed and explosive strength are relevant components of athletic performance and can be improved through training programs that include 20 to 40min sessions, training two to five times per week over a period of approximately 6 to 9 weeks.

**Key Words**: Training; speed; explosive strength; soccer; youth.

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Soccer is a collective sport that reaches great popularity in the world, where it has about 200 million practitioners.[1] It is characterized as a sport of intermittent efforts, in which sudden variations in both the intensity of the game and the type of actions or motor tasks occur continuously.[2] The ability to produce varied effective actions during a 90-minute game is associated with aerobic and anaerobic capacity. For example, performance in a soccer match depends on a variety of factors such as skills, tactical and physiological, physical and mental capacity of the players.[2,3] In general, although the work in soccer is low intensity, a substantial amount of work is performed at high intensity, well known as maximal action. This work is often of great relevance to the performance of young soccer players.[4] For example, plyometric training has been recommended in sports that require explosiveness, because it can increase skills such as vertical jumping ability and speed.[5] In the specific case of Soccer, speed is of great importance, and includes

changes of direction, acceleration and jumps.[6] Also, explosive strength is one of the essential factors, since, strength training seems to be appropriate to improve ballistic movements in youth soccer players, reflecting in the performance of jumps, turns and speed runs.[7,8] In fact, explosive strength, speed and agility are fundamental aspects for the performance of the soccer player, as they are the fundamental basis for performing different actions in matches, such as high-speed and short-duration movements, including, sudden or abrupt jumps, changes of direction, accelerations and decelerations Köklü et al.[9-11] In this regard, in youth soccer, several studies have recently given emphasis on proposing and developing intervention programs with the purpose of improving performance in young soccer players.[12-15] So studying the positive effects of training to improve explosive strength and speed in young soccer players is relevant. In fact, strength training and plyometrics are ways to seek the improvement of explosive strength and speed in a short time, aiming to increase explosive force production in athletes. This component is mainly determined by the strength and speed involved in the stretch-shortening cycle.[16] Therefore, from this systematic review, we intend to answer the following question: What percentages of increase have been observed in speed and explosive strength from training programs in young soccer players?

## Materials and Methods

A systematic study was performed according to the Preferred Reporting Items for Systematic Reviews and MetaAnalyses (PRISMA) statement that was developed to ensure the completeness of systematic reviews.[17]

*Eligibility criteria*

To achieve relevance in this systematic review, articles should include the following keywords: 1) Explosive strenght or strenght training or power or jump

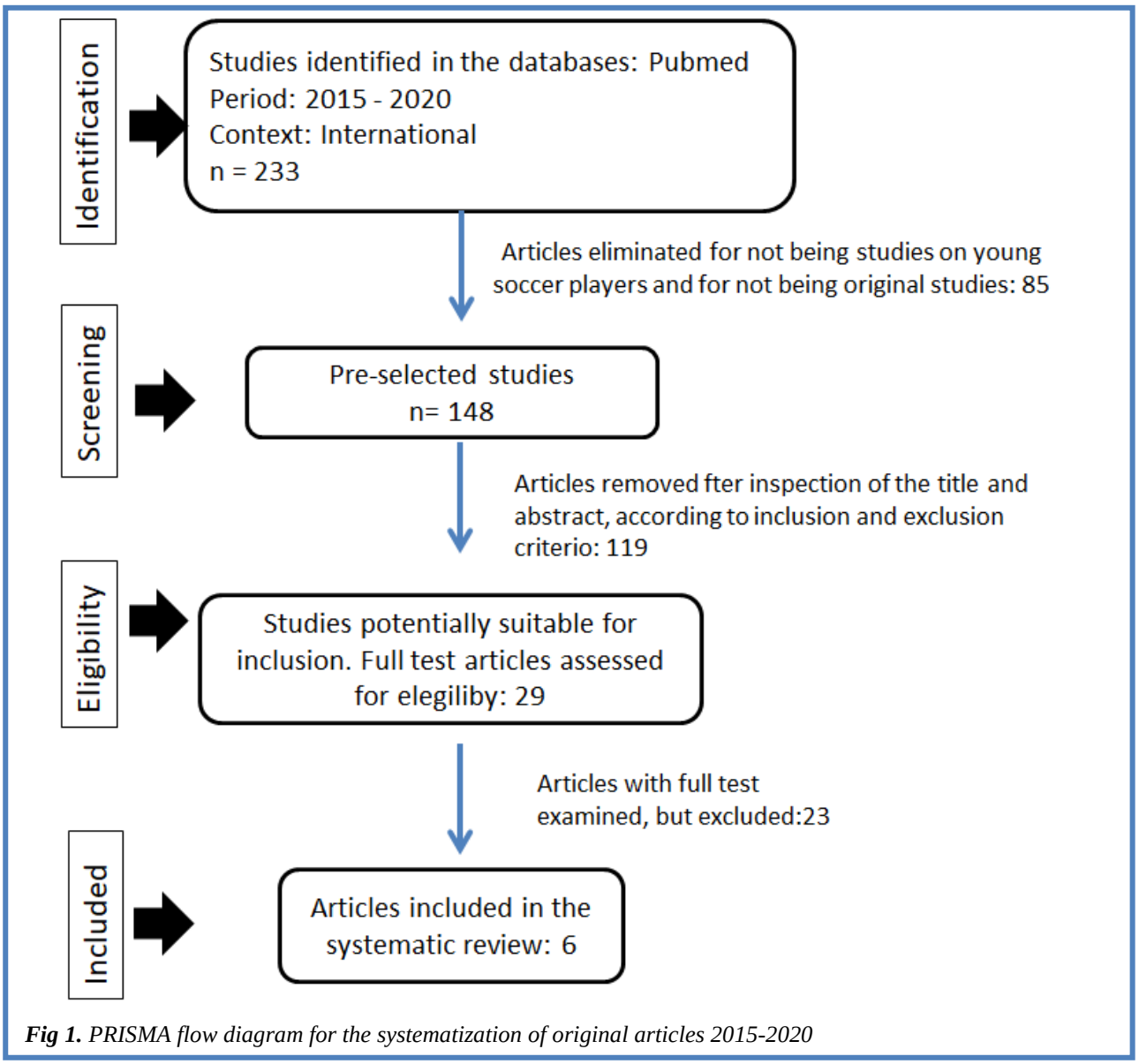


***Fig 1.*** *PRISMA flow diagram for the systematization of original articles 2015-2020*

***Table 1.*** *Methodological characteristics of systematized experimental studies*

| N | Author(s) | Years | Type of study | Sample (group) | Age (years) |
|---|---|---|---|---|---|
| 01 | Styles, et al. [12] | 2015 | Experimental | EG: (n=17) | 16-20 y |
| 02 | Otero-Esquina et al.[13] | 2017 | Experimental | EG1: (n=12),EG2: (n=12), CG:(n=12) | 17 y |
| 03 | Loturco et al.[20] | 2015 | Experimental | EG1: (n=12), CG2: (n=12) | 18y |
| 04 | Saez De Villaroel et al.[21] | 2015 | Experimental | EG: (n=13), CG: (n=13) | 14-15 y |
| 05 | Asadi et al.[14] | 2018 | Experimental | EG: (n=30), CG: (n=30) | 11 y |
| 06 | Hammami et al.[15] | 2019 | Experimental | EG1: (n=14), EG2: (n=12), CG: (n=12) | 15 y |

*Legend: EG: experimental group, CG: control group*

perfomance or CMJ or SJ or Plyometrics or power or speed or sprint or kicking speed or change of direction speed 2) Soccer player or football or professional soccer player or youth; 3) Training or Intervention. Initially, all these keywords were used together, using "and" and "or" to order them. These words were then grouped into two or three, for example, explosive strenght and soccer player and intervention, and a new search was performed. In addition, the search strategy terms were also matched, e.g., explosive strenght or intervention. These terms were searched in the title, abstract and keywords of the manuscripts. A manual search was also performed for

***Table 2.*** *Analysis of the methodological quality of the articles selected for this systematic review*

| | Styles, et al.[12] | Otero-Esquina et al.[13] | Loturco et al.[20] | Saez De Villaroel et al.[21] | Asadi et al. [14] | Hammami et al.[15] |
|---|---|---|---|---|---|---|
| Randomization sequence generation | No report | No | Yes | Yes | No | Yes |
| Allocation Secrecy | No report | No | Yes | Yes | No | Yes |
| Adhesion of the endorsed | No report | No | Yes | Yes | No | Yes |
| Attachment of the professionals who applied the intervention | No report | No report | Yes | Yes | Yes | No report |
| Blindness of the assessors of the waste | No report | No report | Yes | No report | No report | No report |
| Similar groups in the initial evaluation | No report | Yes | Yes | Yes | No | Yes |
| Criteria for selection of participants | Yes | Yes | Yes | Yes | Yes | Yes |
| Analysis by intention to treat | Yes | Yes | Yes | Yes | Yes | Yes |
| Static comparison between groups | Yes | Yes | Yes | Yes | Yes | Yes |
| Description of losses and exclusions | No report | No report | No report | No report | No report | No report |
| PEDro scale scoring | 3 | 3 | 9 | 8 | 4 | 7 |

***Table 3.*** *Intervention programs used to improve speed and explosive strength in young soccer players*

| n | Author(s) | Year | Activities | Intensity | Frequency x Week | Session/day (min) | Duration (weeks) |
|---|---|---|---|---|---|---|---|
| 1 | Styles, et al.[12] | 2015 | Maximum strength exercises, squats and sprints | 85-90% 1MR | 2 | NS | 6 |
| 2 | Otero-Esquina et al.[13] | 2017 | Maximal strength, squats, plyometrics, sprints | 40-50% 1RM | 2 | NS | 7 |
| 3 | Loturco et al.[20] | 2015 | Vertical jump and horizontal jump | NS | 4-5 | 20min | 3 |
| 4 | Saez De Villaroel et al.[21] | 2015 | Squats, lunges, jumping hurdles, sprints, dribbles | NS | 2 | 40min | 9 |
| 5 | Asadi et al.[14] | 2018 | Plyometrics, deep box jumps | NS | 2-3 | 30-40min | 6 |
| 6 | Hammami et al.[15] | 2019 | Maximum strength, plyometrics, jumps with fall | 70-90% 1RM | 2 | 40min | 8 |

articles that were not in the database searched, e.g., studies cited by other manuscripts. In the case of some studies that included systematic reviews, they were excluded from the analysis. The search was limited to articles that investigated young soccer players. In addition, articles that fit the eligibility criteria of this study, but that could not be accessed in full (because they were not available electronically or in hard copy or were requested from the authors but not submitted) were also excluded.

*Search Strategy*

The initial search strategy was to identify articles investigating the effects of intervention programs on youth soccer players. An electronic search was conducted in the database: PubMed. The electronic search was conducted over a period of four weeks from January 13 to February 07, 2020. Targeted searches in the most cited journals and authors and in the reference lists of the articles ensured that all relevant articles were located. The basis for the search strategy was considered using the components of the PICOS (Population, Interventions, Comparators, Outcomes, and Study design) tool. Being P: Young soccer players participating in intervention programs; I: Intervention programs that seek to generate effects on explosive strength and speed; C: Present an experimental group or two experimental groups subjected to different types of activity, which can be compared before and after, with or without control group; O: Have an evaluation before and after the period elapsed with the intervention to demonstrate the efficacy and applicability of the program on explosive strength (CMJ, HJ and VJ) and speed (5 m, 10 m, 20 m and 40 m); S: experimental studies. Studies were evaluated according to defined criteria for inclusion or exclusion from the review.

*Methodological quality*

Methodological quality was assessed independently by two reviewers (MC, RG) who analyzed the studies selected for this systematic review and resolved disagreements in the analysis by consensus. The methodological quality of the studies was reviewed using the PEDro scale based on the Delphi list. [18,19] This scale has 10 scoring questions, and each criterion is scored according to its presence (one point) or absence (zero points) in the study in question. To assess the methodological quality of the selected studies, the following items were considered: generation of the randomization sequence; confidentiality of the allocation; blinding of those evaluated; blinding of the professionals and evaluators who applied the intervention/evaluation; blinding of the evaluators of the study results; similar groups at baseline; participant selection criteria; intention-to-treat analysis; statistical comparison between groups; description of losses and exclusions.

*Data extraction and analysis*

Data from the articles were extracted in their entirety using a structured script that included the following items: sample (age of study participants), research design, duration and type of intervention performed in the study, effects (positive or not) found, limitations and recommendations. Data extraction was performed by one reviewer, and the second reviewer checked the data extraction to ensure that the data collected were accurate and complete. The results of the articles were presented descriptively using means, standard deviations and

percentages (%). These indicators allowed quantifying in a descriptive way the % increases in explosive strength and speed.

## Results

In the study selection process observed according to the PRISMA flowchart in Figure 1, the process developed. A total of 233 studies were identified worldwide, which were considered as possible potential studies for systematization. After being reviewed, 148 studies were eliminated because they were not original studies and were not on young soccer players. In the next stage, the titles and abstracts were read according to the inclusion and exclusion criteria, and 119 articles were eliminated. In the third stage, of the 29 eligible studies that were read in their entirety, 23 that were not experimental were eliminated, leaving 6 articles that were finally considered in this review. After careful reading of the articles in their entirety, 6 studies (Table 1) were selected to compose this systematic review that met all the criteria determined by the study. The six studies were designed as experimental studies (with and without experimental group). Table 2 shows the results of the quality analysis of the articles. All the studies selected for this systematic review presented participant selection criteria and included statistical comparison between groups. However, only 50% of them presented blinding of the evaluated, showing confidentiality in the allocation of participants. Likewise, only one study (16.7%) considered blinding of the professional who applied the intervention, hiding the identity of the group assignments from the researchers who collected and analyzed the variables of interest. Regarding the evaluation of methodological quality through the PEDro scale,[18] the studies that showed the highest scores Loturco et al.[20] (9 points), Saez De Villaroel et al.[21] (8 points) and Hammami et al.[15] (7 points) on this scale. Thus, although the studies in this review present consistent and positive results on the effect of the intervention on explosive strength and speed, they should be interpreted with caution due to the limitations presented by the methodology of the studies in this systematic review according to the PEDro scale.[18] The intervention programs applied by the six studies are shown in Table 3. All the studies applied intervention programs based on maximal strength, plyometric and sprint exercises. The intervention programs generally performed their interventions 2 to 5 times per week, with an approximate duration of 20 to 40min per session and with a duration of 6 to 9 weeks of intervention. Tables 4 and 5 show the changes observed in speed and explosive strength in young soccer players. In general, positive changes were observed in all speed tests, except in the study by Otero-Esquina et al.,[13] where there was no change in the 10m speed test. For example, in the 5m speed test there was an increase from 5.7 to 11.9% (0.26 to 0.53m/s), in the 10m speed test performance increased from 0.52 to 5.05% (0.03 to 0.27m/s), in the 20m speed from 0.44 to 36.7% (0.03 to 1.92m/s) and in the 40m speed improved from 3.59 to 9.19% (0.25 to 0.62m/s), respectively. In the case of the studies that had a control group, minimal variations were observed and in some even a decrease in speed, as in the Saez De Villaroel study (from -1 to -3.82%). In explosive strength, the five studies showed significant changes and gains in the groups subjected to the intervention program, in four explosive strength tests. For example, in the SJ they increased from 11.1 to 25.4% (4.1 to 8.6cm), in the CMJ they increased from 2.3 to 23.03% (1.0 to 8.8cm), in the VJ they improved from 15.15 to 27.09% (5.0 to 11.0cm) and finally, in the HJ, they increased 4.9 to 9.9% (12.17 to 24.4cm). In the case of the CMJ, in the control groups of the studies by Otero-Esquina et al.[13] and Loturco et al.[20], no changes were observed in the post-test. In the case of the other studies with a control group, the variations observed were 3.86% and 1.84% for the SJ and CMJ in the study by Hammami et al.[15] and 3.23 to 6.09% for the VJ in the study by Asadi et al.[14]

## Discussion

The results of the systematization have shown that there were positive changes in speed and explosive strength tests in young soccer players. The intervention programs were generally applied to youngsters from 11 to 20 years old, whose training activities were based on maximum strength, plyometric and sprint exercises. These programs were carried out between 2 to 5 times per week, with an approximate duration between 20 to 40min per session and between 3 to 9 weeks of intervention. After systematization of the six studies, positive effects on speed and explosive strength were observed. For example, in the 5m speed tests, significant changes were observed, improving from (0.26 to 0.53m/s), 10m speed (0.03 to 0.27m/s), 20m speed (0.03 to 1.92m/s) and 40m speed (0.25 to 0.62m/s). In explosive strength, the results of the studies have shown positive changes in the four tests. Performance in the SJ squat jump test improved from 4.1 to 8.6cm, in the CMJ countermovement jump (1.0 to 8.8cm), in the HJ horizontal jump (12.17 to 24.4cm) and in the VJ vertical jump (5.0 to 11.0cm), respectively. In fact, the training of sprints (at high speeds), maximum strength exercises and plyometrics seem to be crucial to obtain positive adaptations in the performance of young soccer players, since systematized studies have evidenced positive changes in the improvement of speed and explosive strength tests. In general, explosive strength is necessary to accelerate and maintain a maximum speed in sprint performance, for this purpose a great rigidity in the legs is required to produce a high running speed[7]. This is achieved during training due to a variety of motor actions involving propulsive force, forms of muscle contraction, speed changes, agility, among others. In terms of performance, greater tendon stiffness plays a fundamental role in the rapid transmission of force from the muscles to the skeletal system,[22] and consequently allows greater velocity of the muscle-tendon units, positively

influencing stretch-shortening exercises.[23] Although in general, these results depend on many factors, due to the large number of variables that have to do with the quantity and quality of the training load,[24] as well as the degree of motivation of the players. In general, most scientists who analyze and design intervention programs

***Table 4.*** *Changes observed in speed tests (5m, 10m, 20m and 40m), according to intervention programs applied*

| Author(s) | Groups | Evaluation | V 5m | | V 10m | | V 20m | | V 40m | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | X±SD | % | X±SD | % | X±SD | % | X±SD | % |
| Styles, et al. [12] | EG | Pre-Test | 4.50±0.04 | 0.26 (5.77%) | 5.46±0.05 | 0.15 (2.74%) | 6.47±0.07 | 0.08 (1.23%) | -- | -- |
| | | Post-Test | 4.76±0.03 | | 5.61±0.05 | | 6.55±0.05 | | -- | |
| Otero-Esquina et al.[13] | EG1 | Pre-Test | -- | -- | 5.88 ± 0.06 | 0.00 (0.0%) | 6.68 ± 0.07 | 0.03 (0.44%) | -- | -- |
| | | Post-Test | -- | | 5.88 ± 0.05 | | 6.71 ± 0.08 | | -- | |
| | EG2 | Pre-Test | -- | -- | 5.84 ± 0.05 | 0.07 (1.19%) | 6.71 ± 0.09 | 0.11 (1.61 %) | -- | -- |
| | | Post-Test | -- | | 5.91 ± 0.05 | | 6.82 ± 0.11 | | -- | |
| | CG | Pre-Test | | | 5.74 ± 0.04 | 0.00 (0.0%) | 6.57 ± 0.05 | 0.00 (0.0%) | -- | -- |
| | | Post-Test | | | 5.74 ± 0.05 | | 6.57 ± 0.05 | | -- | |
| Loturco et.al.[20] | $GE1_{VJ}$ | Pre-Test | -- | -- | 5.73±0.21 | 0.03 (0.52%) | 6.69±0.27 | 0.09 (1.30%) | -- | -- |
| | | Post-Test | -- | | 5.76±0.24 | | 6.90±0.23 | | -- | |
| | $GE2_{HJ}$ | Pre-Test | -- | -- | 5.67±0.20 | 0.13 (0.52%) | 6.64±0.20 | 0.05 (0.74%) | -- | -- |
| | | Post-Test | -- | | 5.80±0.21 | | 6.69±0.23 | | -- | |
| Saez De Villaroel et al.[21] | EG | Pre-Test | 6.17±0.1 | 0.58 (9,4%) | 5.34± 0.1 | 0.27 (5.05%) | -- | -- | -- | -- |
| | | Post-Test | 6.75±0.1 | | 5.61±0.1 | | -- | | -- | |
| | CG | Pre-Test | 6.25±0.10 | 0.23 (-3.82%) | 5.23±0.10 | 0.05 (-1.0%) | | | | |
| | | Post-Test | 6.02±0.10 | | 5.18±0.10 | | | | | |
| Asadi et al.[14] | EG1 PrePHV group | Pre-Test | -- | -- | -- | -- | 4.46 ± 0.85 | 0.19 (4.26%) | -- | -- |
| | | Post-Test | -- | | -- | | 4.65 ± 0.75 | | -- | |
| | EG2 Mid PHV group | Pre-Test | -- | -- | -- | -- | 5.23 ± 0.48 | 0.43 (8.2%) | -- | -- |
| | | Post-Test | -- | | -- | | 5.66 ± 0.45 | | -- | |
| | EG3 Post PHV group | Pre-Test | -- | -- | -- | -- | 5.22 ± 0.52 | 1.92 (36.7%) | -- | -- |
| | | Post-Test | -- | | -- | | 7.14 ± 0.4 | | -- | |
| | CG1 PrePHV group | Pre-Test | -- | -- | -- | -- | 4.23±0.77 | 0.02 (0.47%) | -- | -- |
| | | Post-Test | -- | | -- | | 4.25±0.80 | | -- | |
| | CG2 Mid PHV group | Pre-Test | -- | -- | -- | -- | 5.31±0.37 | 0.08 (1.48%) | -- | -- |
| | | Post-Test | -- | | -- | | 5.39±0.33 | | -- | |
| | CG3 Post PHV group | Pre-Test | -- | -- | -- | -- | 6.47±0.68 | 0.10 (1.52%) | -- | -- |
| | | Post-Test | -- | | -- | | 6.57±0.59 | | -- | |
| Hammami et al.[15] | EG1 | Pre-Test | 4.42±0.04 | 0.53 (11.9%) | -- | -- | -- | -- | 6.74±0.22 | 0.62 (9.19%) |
| | | Post-Test | 4.95±0.17 | | -- | | -- | | 7.36±0.17 | |
| | EG2 | Pre-Test | 4.62±0.05 | 0.38 (8.22%) | -- | -- | -- | -- | 6.95±0.26 | 0.25 (3.59%) |
| | | Post-Test | 5.00±0.09 | | -- | | -- | | 7.20±0.26 | |
| | CG | Pre-Test | 4.85±0.06 | 0.23 (4.74%) | | | | | 6.84±0.32 | 0.11 (1.60%) |
| | | Post-Test | 4.62±0.04 | | | | | | 6.95±0.33 | |

*Legend: EG: experimental group, CG: control group, V: Velocity, HJ: Horizontal Jump, VJ: Vertical Jump, PHV: peak height velocity, SD: Standard deviation*

***Table 5.*** *Changes observed in explosive strength (SJ, CMJ, SV and SH), according to intervention programs applied*

| | Groups | aluation | SJ (cm) | | CMJ (cm) | | VJ (cm) | H.J (cm) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | ℄±SD | % | X±SD | | X±SD | X±SD | % |
| Otero-Esquina et al.[13] | EG1 | | -- | -- | 34.48 ± 3.82 | 3,48 (10%) | -- | -- | -- |
| | | | -- | | 37.96 ± 2.74 | | -- | -- | |
| | EG2 | | -- | -- | 36.29 ± 4.21 | 3,03 (8,3%) | -- | -- | -- |
| | | | -- | | 39.32 ± 4.84 | | -- | -- | |
| | CG | | -- | -- | 34.89 ± 3.07 | 0.28 (0.08%) | -- | -- | -- |
| | | | -- | | 35.17 ± 4.22 | | -- | -- | |
| | GE1 | | -- | -- | 42.25 ± 4.31 | 2,55 (6,0%) | -- | 47.08 ± 16.42 | 12.17 (4.9%) |
| | | | -- | | 44.80 ± 3.87 | | -- | 59.25 ± 19.76 | |
| | GE2 | | -- | -- | 43.09 ± 3.53 | 1.01 (2.3%) | -- | 46.33 ± 16.18 | 24.34 (9.9%) |
| | | | -- | | 44.10 ± 5.01 | | -- | 70.67 ± 17.41 | |
| aez De Villaroel et al.[21] | GE | | -- | -- | 31.8±3.2 | 0.30 (0.9%) | -- | -- | -- |
| | | | -- | | 34.8±3.5 | | -- | -- | |
| | CG | | -- | -- | 30.09 ± 3.80 | | -- | -- | -- |
| | | | -- | | 31.2 ± 3.90 | | -- | -- | |
| Asadi et al.[14] | EG1 PreP | Pre-T | | | -- | -- | 33 | 146 ± | 11.3 (7.73%) |
| | | Post- | | | -- | | 38 | 157.3 ± | |
| | EG2 Mid I | Pre-T | | | -- | -- | 33. | 174.8 ± | 16.2 (9.26) |
| | | Post- | | | -- | | 39. | 191 ± | |
| | EG3 Post I | Pre-T | | | -- | -- | 40. | 199 ± | 11,0 (5,52%) |
| | | Post- | | | -- | | 51. | 210 ± | |
| | CG1 PreP | Pre-T | | | -- | -- | 33. | -- | -- |
| | | Post- | | | -- | | 34. | -- | |
| | CG2 Mid I | Pre-T | | | -- | -- | 34 | -- | -- |
| | | Post- | | | -- | | 35. | -- | |
| | CG3 Post I | Pre-T | | | -- | -- | 40. | -- | -- |
| | | Post- | | | -- | | 42. | -- | |
| Hammami et al.[15] | GE1 | | 36.8±2 | 8,6 (23,369 | 38.2±2.1 | 8,8 (23,03%) | -- -- | -- | -- |
| | | | 45.4±3 | | 47.0±5.9 | | -- | -- | |
| | GE2 | | 36.9±4 | 4,1 (11,119 | 36.9±3.9 | 5,2 (14,09%) | -- -- | -- | -- |
| | | | 41.0±5 | | 42.1±6.0 | | -- | -- | |
| | CG | | 36.2±3 | 1.4 (3.86% | 37.9±5.4 | 0.7 (1.84%) | -- -- | -- | -- |
| | | | 34.8±4 | | 37.2±4.5 | | -- | -- | |

*Legend: EG: experimental group, CG: control group, V: Velocity, HJ: Horizontal Jump, VJ: Vertical Jump, PHV: peak height velocity, SD: Standard deviation*

to improve the physical performance of young soccer players have proposed short-term programs of 4 to 8 weeks with a frequency of 2 x weekly,[7,21,25] and even up to 12 weeks.[26] These proposals appear to be consistent with systematized studies, since they are within the parameters established by previous studies. Therefore, the training of youth physical performance capabilities promotes neuro-muscular development and adequate muscular adaptation not only to avoid the risk of sports injuries, but also to create a solid foundation for athletes to achieve high performance in the future. In that sense, in an attempt to provide relevant information for professionals working with young soccer players, this systematic review provides significant elements to

propose and develop intervention programs to improve speed and explosive strength in young soccer players from 11 to 20 years of age. The increase and improvement observed in the systematized studies can also serve as a reference and as a model for proposing new intervention programs. The intervention programs analyzed in this study are directly applicable to youth soccer categories of clubs in general. This implies that young soccer players should use submaximal loads according to their growth and biological maturation process to develop form and technique in a variety of exercises during training.[27] For example, the American Academy of Pediatrics does not endorse the use of continuous maximal lifts for strength training in youth[28], so all programs involving the use of weight lifting and plyometrics should be individualized based on age, maturity status, personal goals and objectives.[28] Consequently, this study presented some limitations related to systematized research, given that not all reported the time (minutes) used to develop the intervention programs, as well as the frequency per week and the intensity at which they trained. In addition, the protocols used to evaluate speed and explosive strength vary among studies, which may bias the results obtained, and most studies do not describe the sociodemographic characteristics of each country (country where the study was conducted). This information is relevant, since coaches working with youth training programs can consider these indicators derived from these populations to approximate the generalization of the results to other contexts. This is because in countries where there is no mass soccer practice it may not be relevant for other populations. The information provided in this study can serve as a baseline for future comparisons, for implementing future training programs in youth soccer players, and as evidence for researchers to contrast with future studies. This systematic review compiled scientific evidence that can help professionals working in youth soccer, since speed and explosive strength are relevant components of athletic performance, reaching percentage increases in speed tests from 1.19 to 36.7m/s and in explosive strength from 2.3 to 27.0%. The results suggest to developing training programs in young soccer players with a frequency of 2 to 5 times per week, with sessions of 20 to 40 minutes and in a period of approximately 3 to 9 weeks.

## List of acronyms

CMJ – Counter Movement Jump
PEDro - Physiotherapy Evidence Database
PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-analyses
SJ – Squat Jump
VJ – Vertical Jump

## Authors contributions

MCB, DLP, RGC: conception, design, drafting of the manuscript, analysis and interpretation of the data, critical review and final approval of the version to be published, agreement to be responsible for all aspects of the work to ensure that issues related to the accuracy or completeness of any part of the work are adequately investigated and resolved; MCB, RGC, JMC, JFL: critical review of important intellectual content; and final approval of the version to be published; RVE, SVN, JMC, JFL: systematization of the studies, critical review and final approval of the version to be published.

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## Conflict of Interest

The authors declare no competing interests.

## Ethical Publication Statement

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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