

# Effects of a warm up integrated with core stability exercises on the motor abilities in young soccer players

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## Abstract

**Background and Study Aim** The warm-up phase in youth soccer can be used to introduce drills that do not find space within the training session. Core district exercises give stability to the trunk and hips, allowing for increased performance and reducing the risk of non-contact injuries. This study aims to test the effects of a warm up integrated with core stability exercises on the motor abilities in young soccer players.

**Material and Methods** Young soccer players (n=32, 12.45±0.52 years, 1.49±0.05 m, 44±2.90 kg) were randomly divided into two groups: experimental (EG=17) and control group (CG=15). The EG performed an integrated warm-up with core stability tasks for 6 weeks (12 sessions). The CG followed the usual training schedule based on technical tactical and physical drills. Performance was assessed through broad jump, Hop test, Side Hop test, 10-meter sprint and 10x5-meter shuttle test.

**Results** Data analysis returns some statistically significant differences in intergroup comparison (T1): for broad jump (p = .008), for left limb Hop test (p = .02), for right limb Hop test (p = .02), for left limb Side Hop (p = .03), for right limb Side Hop (p = .04), for sprint 10-meters (p = .002), for shuttle run 10x5-meters (p = .03).

**Conclusions** The core stability exercises in the warm up seems to increase some performance correlated with the motor abilities stressed in the soccer. The warm up through appropriate modifications can represent, a useful and integrative moment to elicit more factors of performance and prevention.

**Keywords:** trunk stability, young soccer players, strength, sprint, shuttle run, youth soccer

## Introduction

Soccer is one of the most popular sports in the world and played by a large number of men and women of all age groups. For this reason, technical staffs are constantly searching for training methodologies and organizational aspects that can improve performance in both the adult and young soccer player [1]. Research is mainly directed toward investigating training methodology that develops strength, speed, and aerobic power, along with technical and tactical skills [2, 3]. However, while training methodologies allow for increased performance by making use of new exercises and new ways of stressing the player, effective organization of the training session allows for better capitalization of the time available for training [4, 5, 6].

Within training sessions, the warm-up phase [7, 8, 9] plays a significant role. In fact, among the phases of the training session that can be used to greater advantage is definitely the warm-up [4, 10]. The warm up is a phase performed before sports performance, whether training or competition, to enable the body to be able to cope with the motor load in the best possible condition and reduce

the risk of injury. The warm-up usually consists of a succession of Research attention toward this important phase has its roots since the early 2000s, when, however, the focus was mainly on the acute effects of warm-up on subsequent performance [11, 12, 13].

Along with this purpose, in recent years, the opportunity to use pre-training warm-ups to introduce injury risk reduction exercises has also emerged [14, 15]. Aerobic exercises aimed at increasing body and muscle temperature followed by joint mobility exercises and ends with sport-specific exercises in preparation for the start of the training session [10].

Thus, the literature has highlighted the effectiveness of these warm-up protocols for injury prevention and has established minimum levels of compliance for them to be effective [15]. These protocols also include drills for the anatomical district of the core as it is considered an element of the kinetic chain of utmost importance for controlling the lumbar stability and technical skills of the soccer player [16, 17].

Some authors recognize core strength as having an influence not only in the coordination and hip control aspects, but especially an influence in lower limb strength [18, 19, 20]. So far, core training has

been organized in specific sessions devoted mainly to this aspect of performance: in these sessions, drills have been aimed at neutral alignment of the lumbar spine [21, 22] to allow optimal load transfer along the different kinetic chains [23, 24, 25].

Generally, these sessions require additional commitment from the players who have to attend them at times other than the technical session and often on an individual basis. In contrast, in organizing the training of young soccer players, it is often not possible to implement the number of sessions or the duration of individual training sessions for school, personal, logistical, etc. reasons so this intervention is often left out.

While evidence emerges in specific core training with elite [26, 27, 28] and professional soccer players [29, 30, 31], an open problem in the literature remains that of evaluating the effectiveness of core training with young soccer players. In fact, among the issues referred to youth sports and soccer in particular is the issue related to the volume and time to be devoted to the weekly sessions offered in the different sports, including soccer [5]. Often the sessions and durations of training sessions do not allow for the solicitation of all functional motor skills for the young soccer player. Therefore, technical staffs prefer to identify priority goals in the training of the young soccer player that are often limited to technical-tactical ones. It is for this reason that in recent years some authors are suggesting to supplement the initial warm up with core stability exercises to optimize the time available and to activate a muscle district that is advantageous for the control of technical skills performed in one-leg support [32, 33, 34].

Therefore, this study aims to verify the effects of a warm up integrated with core stability exercises on motor skills in young soccer players.

## Material and methods

### Participants

Young soccer players (n=32) whose age, stature and weight were (mean ± ds) 12.45±0.52 years, 1.49±0.05 meters, 44±2.90 kg, respectively, were involved. The sample was randomly assigned in a 1:1 ratio to a one experimental (EG=17) and one control (CG=15). All participants were informed about the purpose of the study and the usefulness of the proposed exercises. Informed consent was acquired from parents, and the study received approval from the Soccer Federation's regional ethics committee (FIGC, n.134/2023) because the procedures were in accordance with the standards set forth in the Declaration of Helsinki.

### Procedure

The experimental group performed warm-up integrated with core stability tasks for 6 weeks, with two sessions per week for a total of 12 sessions.

In contrast, the control group followed the usual training schedule based on technical tactical and physical drills.

The integrated warm up program was divided into two interventions: the first was organized in weeks n1, 2 and 3, structuring predominantly static drills (Table 1); the second was introduced in weeks n.4, 5 and 6 involving predominantly dynamic drills (Table 2).

**Table 1.** Training assigned to each group in weeks 1-3

| Group | Week 1   | Week 2 | Week 3 |
|-------|--|--------|--------|
| EG    | Warm up with core stability tasks in predominantly static form + technical-tactical training |        |        |
| CG    | Traditional warm up + technical-tactical training  |        |        |

**Table 2.** Training assigned to each group in weeks 4-6.

| Group | Week 4  | Week 5 | Week 6 |
|-------|---|--------|--------|
| EG    | Warm up with core stability tasks in predominantly dynamic form + technical-tactical training |        |        |
| CG    | Traditional warm up + technical-tactical training   |        |        |

The Table 3 details the exercises scheduled for the 6 weeks of monitored training.

**Table 3.** Exercises scheduled over the 6 weeks of integrated warm-up.

| Core stability exercises in predominantly static form (weeks 1-3)   | Core stability exercises in predominantly dynamic form (weeks 4-6)   |
|---|--|
| Plank (static): 3x20 sec  | Mountain climber: 3x20 sec   |
| Spiderman plank:3x20 sec  | Plank in pairs: each player perturbed the partner with a touch on the body, 4x15 sec   |
| Side plank in pairs: each player, imitated the upper limb movements performed by the partner, taking care to maintain the correct position: 2x20 sec/side | Plank in pairs: in the plank position, each kicker had to move (toward the partner) the color marker indicated by the strength and conditioning coach: 3x6 reps/side |
| Reverse plank: 2 x20 sec  | Reverse plank in pairs: each player, moved sideways, taking care to maintain correct position, 2 x 20 sec  |

In total, the warm-up phases lasted about 18 min and included an aerobic phase of running at an

intensity between 50 and 60 percent of maximum heart rate (4-5 min), joint mobility drills (4-5 min), special runs (running drills) and 30-meter progression runs.

In the two sessions prior to the introduction of the integrated warm-up and in the two following the end of the program, assessments were conducted. The tests were presented in random form.

The following assessment tests were presented:

- broad jump, two-leg jump for evaluation of explosive strength (horizontal vector); measurement was performed with metric caster;
- Hop test, for right and left limb, for evaluation of explosive strength of each limb in the sagittal plane; measurement was performed with metric wheel;
- Sidehop test, for right and left limb, for evaluation of explosive strength of each individual limb in the frontal plane; measurement was performed with metric wheel;
- 10-meter sprint, for evaluation of acceleration measured through the photocells, (Globus, Treviso, Italy);
- Eurofit 10x5-meter shuttle test for the assessment of lactic acid anaerobic capacity measured through the photocells (Globus, Treviso, Italy); the young soccer player sprints 10 x 5-meter stretches at the highest possible speed while touching the lines delimiting the 5-meter stretch.

*Statistical analysis*

Descriptive statistics (mean, standard deviation, confidence interval) were determined for all test data. The Shapiro-Wilk test was first used to determine the normality of the data distribution. Then, to test for within-groups (T0 vs T1) and between groups differences (EG vs CG in T1), the T-test was used, with significance set at  $p < 0.05$ .

The statistical package SPSS 22.0 for Windows (SPSS Institute, Chicago, IL) was used to analyze all data.

**Results**

No significant between-group differences were shown at baseline. The results showed an increase in values (pre-intervention, post-intervention) for EG in the standing long jump (135.8±33.1 cm vs 158.7±28.4cm,  $p < 0.001$ ), left limb hop test (114.5 ± 26.1 cm vs 134.2 ± 24.3 cm,  $p < 0.001$ ), in the right limb hop test (116.7±26.9 cm vs 133.7± 24.1 cm,  $p < 0.001$ ), in the left limb side hop test (89.6±11.2 cm vs 105.4±16.6 cm,  $p < 0.001$ ), in the right limb side hop test (88, 1±21.1 cm vs 113.1±18.4 cm,  $p < 0.0005$ ), in the 10 x 5 meter shuttle test (18.44±1.88 sec vs 17.01±1.26 sec,  $p < 0.05$ ) and in the 10 meter sprint (2.31±0.30 sec vs 2.03±0.18 sec,  $p < 0.01$ ).

The CG showed no statistically significant differences when comparing baseline and post values.

In the comparison at T1 between the two groups EG vs. CG, statistically significant differences were observed in the standing long jump ( $p < 0.01$ ), left limb hop test ( $p < 0.05$ ), right limb hop test ( $p < 0.05$ ), left limb side hop test ( $p < 0.05$ ), right limb side hop test ( $p < 0.05$ ), 10x5 meter shuttle test ( $p < 0.05$ ) and 10 meter sprint ( $p < 0.01$ ).

The results obtained in the two groups and the two assessments are summarized in Table 4.

**Discussion**

The aim of the study was to test the effects of a warm up supplemented with core stability exercises on motor skills in young soccer players.

In the pre-post test comparison in the EG, the results showed statistically significant percentage increases in the long jump from a standing position (+15.5%), left limb hop test (+14.7%), right limb (+12.8%) left limb side hop test (+15.1%), right limb (+22.2%), and in the 10 m sprint (-13.7%) and 10x5 m shuttle (-8.1%) speed tests. It would seem that the introduction of exercises aimed at core activation allowed performance gains in some sport-specific

**Table 4.** Changes in the EG and CG at T0 and T1. Legend: SLJ, standing long jump; EG, experimental group; CG, control group

| Variables                  | EG (n=17)   |             | p value (T0 vs T1) | CG (n=15)  |             | p value (T0 vs T1) | p value (group) |
|----------------------------|-------------|-------------|--------------------|------------|-------------|--------------------|-----------------|
|                            | Pre         | Post        |                    | Pre        | post        |                    |                 |
| SLJ (cm)                   | 135.8±33.1  | 158.7±28.4  | 0.0004             | 128.1±7.2  | 131.36±6.28 | 0.11               | 0.008           |
| Hop test left (cm)         | 114.5 ±26.1 | 134.2±/24.3 | 0.0003             | 114.5±10.3 | 117.82±8.54 | 0.14               | 0.02            |
| Hop test right (cm)        | 116.7±26.9  | 133.7±24.1  | 0.0003             | 116.7±8.6  | 117.27±6.75 | 0.32               | 0.02            |
| Side test left (cm)        | 89.6±11.2   | 105.4±16.6  | 0.0002             | 87.4±15.9  | 92.09± 7.82 | 0.13               | 0.03            |
| Side test right (cm)       | 88.1±21.1   | 113.1±18.1  | 0.0003             | 92.4±16.9  | 99.1 ±8.6   | 0.09               | 0.03            |
| 10m. sprint (sec)          | 2.31±0.30   | 2.03±0.18   | 0.007              | 2.22±0.16  | 2.19±0.13   | 0.11               | 0.005           |
| 10 x 5 m shuttle run (sec) | 18.44±1.88  | 17.01±1.26  | 0.02               | 18.57±1.14 | 18.22±0.79  | 0.21               | 0.03            |

gestures. In this regard, the literature points out that jumping performances, with particular reference to those performed on a single limb, as well as sprinting performances, are affected by the control of the trunk and pelvis; in fact, these districts confer stability to the extensor muscles of the lower limb and hip, which are mainly involved in jumping and sprinting performances [17, 23, 25].

When comparing EG and CG in T1, statistically significant differences in favor of EG emerged in the assessments related to long jump from a standing position ( $p < 0.01$ ), right and left hop test ( $p < 0.05$ ), right and left side hop test ( $p < 0.05$ ), 10-meter sprint ( $p < 0.01$ ) and 10 x 5-meter shuttle test ( $p < 0.05$ ).

The CG, which used only sport-specific exercises, showed no statistically significant results at the end of the observed training period in the motor skills assessed.

The results of this study referring to jumping performance return higher percentage increases than similar studies [1, 17] that have described the effects of core training on jumping performance in young soccer players [36, 37] and in young athletes [38]. Probably the observed sample had higher potentials since they had never introduced core stability exercise into their weekly training.

Another explanation may be attributable to the differences in the age of the participants involved in the studies.

The percentage results obtained in this study are also higher than those verified in female futsal soccer players who stressed the core through exercises performed using stable and unstable surfaces [35].

In addition, core activation conditions the ability to stabilize when the individual or athlete is in one-leg landing; this muscle synergy could allow the athlete to better harness the lower limb explosive strength to rely on safer control during ground contact [28, 35, 38].

The results obtained in speed tests are in line with other similar studies that have verified the effects of core training in soccer players [1, 36, 39].

The data obtained from EG at the end of the observation period seems to confirm the effectiveness of core stability exercises on speed and jumping performance [17, 35] as well as indicated in the literature even with different samples [35, 37, 40].

The core district through hip stabilization seems to be an effective support for effectively transferring forces between the athlete and the ground [39, 40].

However, the study has some limitations and did not clarify whether the training age of the participants or the time of the season may have influenced the results.

Moreover, the study that used both static and dynamic core exercises fails to identify which of the two types is more effective.

Further research on the topic may bring new perspectives for practical application by investigating whether (a) different levels of youth sports qualification may return different results or (b) the same results can also be observed in young female soccer players.

## Conclusions

The study makes it possible to suggest to technical staffs targeting youth soccer players to introduce core stability exercises in the warm up phase in order to effectively activate the kinetic chains that play the role of stabilizers during the execution of sport-specific skills such as jumps, leaps, in-line sprints and sprints with changes of direction.

The organization of warm ups through integrated motor tasks referable to multiple functional assumptions seems to be adequate (also in duration) to the needs and objectives of youth soccer training sessions. The use of integrated warm ups also allows time to be devoted to the preventive aspects, which, in this way, can be solicited in the activation phase: sometimes, in fact, in youth soccer, the short duration of training sessions undermines the introduction of motor tasks with preventive purposes.

## References

- Luo S, Soh KG, Soh KL, Sun H, Nasiruddin NJM, Du C, Zhai X. Effect of Core Training on Skill Performance Among Athletes: A Systematic Review. *Front Physiol.* 2022;13:915259. <https://doi.org/10.3389/fphys.2022.915259>
- Atli A. The effect of a core training program applied on football players on some performance parameters. *J Educ Issues.* 2021;7(1):337–50. <https://doi.org/10.5296/jei.v7i1.18493>
- Afyon YA, Mulazimoglu O, Boyac A. The effects of core training on speed and agility skills of soccer players. *Int J Sports Sci.* 2017;76:239–44.
- Sannicandro I, Cofano G, Piccinno A. Can the Core Stability Training Influences Sprint and Jump Performances in Young Basketball Players? *Adv Phys Educ.* 2020;10:196–206. <https://doi.org/10.4236/ape.2020.103017>
- Zemková E, Hamar D. Sport-Specific Assessment of the Effectiveness of Neuromuscular Training in Young Athletes. *Front Physiol.* 2018;9:264. <https://doi.org/10.3389/fphys.2018.00264>
- Ramirez-Campillo R, Moran J, Oliver JL, Pedley JS, Lloyd RS, Granacher U. Programming Plyometric-Jump Training in Soccer: A Review. *Sports (Basel).* 2022;10(6):94. <https://doi.org/10.3390/sports10060094>
- Brighenti A, Noé F, Stella F, Schena F, Mourot L. Warm-Up Improves Balance Control Differently in the Dominant and Non-Dominant Leg in Young Sportsmen According to Their Experience in

- Asymmetric or Symmetric Sports. *Int J Environ Res Public Health*. 2022;19(8):4562. <https://doi.org/10.3390/ijerph19084562>
8. Hernandez-Martinez J, Ramirez-Campillo R, Vera-Assaoka T, Castillo-Cerda M, Carter-Truillier B, Herrera-Valenzuela T, López-Fuenzalida A, Nobari H, Valdés-Badilla P. Warm-up stretching exercises and physical performance of youth soccer players. *Front Physiol*. 2023;14:1127669. <https://doi.org/10.3389/fphys.2023.1127669>
  9. Silva N, Travassos B, Gonçalves B, Brito J, Abade E. Pre-match Warm-Up Dynamics and Workload in Elite Futsal. *Front Psychol*. 2020;11:584602. <https://doi.org/10.3389/fpsyg.2020.584602>
  10. Tsurubami R, Oba K, Samukawa M, Takizawa K, Chiba I, Yamanaka M, Tohyama H. Warm-Up Intensity and Time Course Effects on Jump Performance. *J Sports Sci Med*. 2020;19(4):714–720.
  11. Docherty D, Hodgson MJ. The application of postactivation potentiation to elite sport. *Int J Sports Physiol Perform*. 2007;2(4):439–44. <https://doi.org/10.1123/ijsp.2.4.439>
  12. Till KA, Cooke C. The effects of postactivation potentiation on sprint and jump performance of male academy soccer players. *J Strength Cond Res*. 2009;23(7):1960–7. <https://doi.org/10.1519/JSC.0b013e3181b8666e>
  13. Blazevich AJ, Babault N. Post-activation Potentiation Versus Post-activation Performance Enhancement in Humans: Historical Perspective, Underlying Mechanisms, and Current Issues. *Front Physiol*. 2019;10:1359. <https://doi.org/10.3389/fphys.2019.01359>
  14. García-Luna MA, Cortell-Tormo JM, García-Jaén M, Ortega-Navarro M, Tortosa-Martínez J. Acute Effects of ACL Injury-Prevention Warm-Up and Soccer-Specific Fatigue Protocol on Dynamic Knee Valgus in Youth Male Soccer Players. *Int J Environ Res Public Health*. 2020;17(15):5608. <https://doi.org/10.3390/ijerph17155608>
  15. Asgari M, Alizadeh MH, Shahrbanian S, Nolte K, Jaitner T. Effects of the FIFA 11+ and a modified warm-up programme on injury prevention and performance improvement among youth male football players. *PLoS One*. 2022;17(10):e0275545. <https://doi.org/10.1371/journal.pone.0275545>
  16. O'Brien J, Young W, Finch CF. The delivery of injury prevention exercise programmes in professional youth soccer: Comparison to the FIFA 11. *J Sci Med Sport*. 2017;20(1):26–31. <https://doi.org/10.1016/j.jsams.2016.05.007>
  17. Afyon YA. Effect of core training on 16 year-old soccer players. *Educ Res Rev*. 2014;23:1275–9.
  18. López-de-Celis C, Labata-Lezaun N, Román-Sánchez S, Gassó-Villarejo S, Garcia-Ribell E, Rodríguez-Sanz J, Pérez-Bellmunt A. Effect of Load Distribution on Trunk Muscle Activity with Lunge Exercises in Amateur Athletes: Cross-Sectional Study. *Healthcare (Basel)*. 2023;11(6):916. <https://doi.org/10.3390/healthcare11060916>
  19. Sasaki S, Tsuda E, Yamamoto Y, Maeda S, Kimura Y, Fujita Y, Ishibashi Y. Core-Muscle Training and Neuromuscular Control of the Lower Limb and Trunk. *J Athl Train*. 2019;54(9):959–969. <https://doi.org/10.4085/1062-6050-113-17>
  20. Reed CA, Ford KR, Myer GD, Hewett TE. The Effects of Isolated and Integrated 'Core Stability' Training on Athletic Performance Measures: A Systematic Review. *Sports Medicine*. 2012;42(8):697–706. <https://doi.org/10.1007/BF03262289>
  21. Suchomel TJ, Nimphius S, Bellon CR, Stone MH. The Importance of Muscular Strength: Training Considerations. *Sports Med*. 2018;48(4):765–785. <https://doi.org/10.1007/s40279-018-0862-z>
  22. Bauer J, Muehlbauer T. Effects of a 6 week core strengthening training on measures of physical and athletic performance in adolescent male sub-elite handball players. *Front Sports Act Living*. 2022;4:1037078. <https://doi.org/10.3389/fspor.2022.1037078>
  23. Luo S, Soh KG, Zhang L, Zhai X, Sunardi J, Gao Y, Sun H. Effect of core training on skill-related physical fitness performance among soccer players: A systematic review. *Front Public Health*. 2023;10:1046456. <https://doi.org/10.3389/fpubh.2022.1046456>
  24. Huxel Bliven KC, Anderson BE. Core stability training for injury prevention. *Sports Health*. 2013;5(6):514–522. <https://doi.org/10.1177/1941738113481200>
  25. Oliva-Lozano JM, Muyor JM. Core Muscle Activity During Physical Fitness Exercises: A Systematic Review. *Int J Environ Res Public Health*. 2020;17(12):4306. <https://doi.org/10.3390/ijerph17124306>
  26. Hsu SL, Oda H, Shirahata S, Watanabe M, Sasaki M. Effects of core strength training on core stability. *J Phys Ther Sci*. 2018;30(8):1014–8. <https://doi.org/10.1589/jpts.30.1014>
  27. Afyon YA. The Effect of Core Training on Some Motoric Features of University Footballers. *J Educ Train Stud*. 2019;7:79. <https://doi.org/10.11114/jets.v7i3.3885>
  28. Belli G, Marini S, Mauro M, Maietta Latessa P, Toselli S. Effects of Eight-Week Circuit Training with Core Exercises on Performance in Adult Male Soccer Players. *Eur J Investig Health Psychol Educ*. 2022;12(9):1244–56. <https://doi.org/10.3390/ejihpe12090086>
  29. Ozan S, Erdal Z. Comparison of effect of static and dynamic core exercises on speed and agility performance in soccer players. *Isokinet Exerc Sci*. 2018;26(1):1–8. <https://doi.org/10.3233/IES-171120>
  30. D'Isanto T, D'Elia F, Raiola G, Altavilla G. Assessment of sport performance: Theoretical aspects and practical indications. *Sport Mont*. 2019;17:79–82. <https://doi.org/10.26773/smj.190214>
  31. Doğanay M, Bingül BM, Álvarez-García C. Effect of core training on speed, quickness and agility in young male football players. *J Sports Med Phys Fitness*. 2020;60(9):1240–6. <https://doi.org/10.23736/S0022-4707.20.10999-X>
  32. Silvers-Granelli H, Mandelbaum B, Adeniji O,

- Insler S, Bizzini M, Pohlig R, Junge A, Snyder-Mackler L, Dvorak J. Efficacy of the FIFA 11+ Injury Prevention Program in the Collegiate Male Soccer Player. *Am J Sports Med.* 2015;43(11):2628–37. <https://doi.org/10.1177/0363546515602009>
33. Chang NJ, Tsai IH, Lee CL, Liang CH. Effect of a Six-Week Core Conditioning as a Warm-Up Exercise in Physical Education Classes on Physical Fitness, Movement Capability, and Balance in School-Aged Children. *Int J Environ Res Public Health.* 2020;17(15):5517. <https://doi.org/10.3390/ijerph17155517>
34. Tong TK, Baker JS, Zhang H, Kong Z, Nie J. Effects of Specific Core Re-Warm-Ups on Core Function, Leg Perfusion and Second-Half Team Sport-Specific Sprint Performance: A Randomized Crossover Study. *J Sports Sci Med.* 2019;18(3):479–89.
35. Lago-Fuentes C, Rey E, Padrón-Cabo A, Sal de Rellán-Guerra A, Fragueiro-Rodríguez A, García-Núñez J. Effects of Core Strength Training Using Stable and Unstable Surfaces on Physical Fitness and Functional Performance in Professional Female Futsal Players. *J Hum Kinet.* 2018;65:213–24. <https://doi.org/10.2478/hukin-2018-0029>
36. Harries SK, Lubans DR, Buxton A, MacDougall THJ, Callister R. Effects of 12-Week Resistance Training on Sprint and Jump Performances in Competitive Adolescent Rugby Union Players. *J Strength Cond Res.* 2018;32(10):2762–9. <https://doi.org/10.1519/JSC.0000000000002119>
37. Hoshikawa Y, Iida T, Muramatsu M, Ii N, Nakajima Y, Chumank K, Kanehisa H. Effects of stabilization training on trunk muscularity and physical performances in youth soccer players. *J Strength Cond Res.* 2013;27(11):3142–9. <https://doi.org/10.1519/JSC.0b013e31828bed36>
38. Sannicandro I, Cofano G. Core Stability Training and Jump Performance in Young Basketball Players. *Int J Sci Res.* 2017;6:479–82.
39. Brull-Muria E, Beltran-Garrido JV. Effects of a Specific Core Stability Program on the Sprint and Change-of-Direction Maneuverability Performance in Youth, Male Soccer Players. *Int J Environ Res Public Health.* 2021;18(19):10116. <https://doi.org/10.3390/ijerph181910116>
40. Guoxia Z, Ming Z, Chaohu H. Core muscle strength training of young soccer players. *Rev Bras Med Esporte.* 2022;28(6):1590–517. [https://doi.org/10.1590/1517-8692202228062022\\_0109](https://doi.org/10.1590/1517-8692202228062022_0109)

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