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Original article

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The effect of calisthenics training on physical fitness parameters and sports specific skills of soccer players: A randomized controlled trial

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Abstract

Introduction: Calisthenics are resistance exercises that manipulates one's body weight for resistance and performed without using any equipment. These exercises are aerobic and dynamic exercises consisting of various movements to increase body flexibility and strength. The purpose of the study was to find out the efficacy of calisthenics training on performance of soccer players.

Material and methods: Forty healthy soccer players aging between 18–25 years who actively participating in soccer were randomly assigned to 2 groups. Group-A followed regular soccer training and Group-B received calisthenics training along with regular soccer training for 3 days/week for 8 weeks. The outcome measures were 30-yard dash test, Illinois agility test, Sit and reach test, Vertical jump, Star excursion balance test and SAI soccer skill tests (30-m running with ball test, kicking test and juggling).

Results: The between group results for 30-yard dash test, Illinois agility test, vertical jump, sit and reach test, 30-m running with ball test, juggling and anterior reach in star excursion balance test were found statistically significant ($p < 0.05$).

Conclusions: Calisthenics training with regular soccer training improves overall performance of the soccer players by achieving more speed, agility, flexibility, kicking accuracy and control on ball.

Keywords: exercise, balance, speed, flexibility, agility

Introduction

Soccer is one of the most popular games worldwide [1]. It is a fast-moving and high-intensity sport that requires the players to engage in longer periods of continuous activity i.e. 90 minutes consisting of two 45-minute halves. Although it demands a range of motor skills, such as running, jumping, speeding up and down, dribbling, kicking the ball and changing direction [2], the most basic skill is the use of the feet and legs to control and pass the ball. Optimum performance also requires speed, power, balance, agility and flexibility [3]. Soccer players frequently perform passing, shooting and dribbling activities during the match, and have to maintain their balance while running, changing direction rapidly and kicking the soccer [4]; therefore, to ensure optimum performance while moving and shooting, it is vital that the supporting foot is well balanced. Finally, pushing

an opponent, dribbling and passing the ball, particularly on slippery grass require effective balance control, and this can be measured by the star excursion balance test [4−7].

Soccer requires repetitive motions involving intense hamstring extension and contraction, which can lead to overuse injuries and impaired performance [8]; hence, it is important to maintain hamstring flexibility, which can be measured by the sit-and-reach test [2]. Agility consists of two components: perceptual decision making and directional speed control. The goal for developing agility in soccer is to develop sound movement techniques e.g. slowing and accelerating [9], and it can be measured by Illinois agility test [10].

One key prerequisite is speed, i.e. to be able to perform motor actions as quickly as possible, under certain conditions. As the power output in sprinting activities is impaired by fatigue, soccer-specific speed training tends to focus on anaerobic conditioning, resistance training and the biomechanics of running [9,10]. Another important parameter is power, defined as the capability of a muscle or group of muscles to move an object. High power output is required for sprinting and jumping movements, and therefore these are essential elements for athletic performance in soccer [2].

In addition, the most important motor skills in soccer, such as dribbling, shooting and passing, can be evaluated by using various sports-specific skill tests, such as the Sports Authority of India (SAI) football test, McDonald football skill test and Mitchell football test. The sports-specific skill and battery tests developed by the SAI to evaluate the performance of soccer players consist of three separate tasks: 30m run with a ball, kicking accuracy and juggling [11].

While various training protocols have been implemented for preventing injuries and improving the physical performance of soccer players [12,13], limited literature exists on the effect of calisthenic exercises on the performance of soccer players. Calisthenics exercises are aerobic and dynamic resistance exercises that manipulate body weight to provide resistance, and which can be performed without using any equipment. A calisthenic programme consists of a variety of movements involving swinging, twisting, jumping, kicking and bending, with gymnastic movements, push-ups, shuttle, pull-ups, lunges, planks, squats, step-up, crunches, dips, plyo-jack, burpees, and mountain climber exercises being included in calisthenics routines [14,15]. These exercises has been reported to be beneficial in improving flexibility, strength, agility, muscle endurance, cardiovascular fitness, balance, coordination, personal vitality and overall preparedness for life. In addition, as the proprioception and coordinative movements can be enhanced by activating different muscle groups, they can be beneficial for both rehabilitation and sports training programs [6,14,16].

Calisthenics has been reported to improve speed, agility, strength, body composition, power, balance and coordination in athletic populations ranging from swimmers [17] and tennis players [6] to kabaddi players [18]. However, the effectiveness of calisthenic exercises in training soccer players has only been studied with regard to body composition [14]. Therefore, the aim of the present study was to investigate the efficacy of calisthenics training and exercises on various physical components such as speed, agility, flexibility, power and balance, as well as sport-specific skills, in soccer players.

Material and methods

Study Design

The study was designed as a randomized, controlled and single-blinded (participant blinded) clinical trial. Ethical approval was obtained from the Institutional Ethical Committee, Department of Physiotherapy, Guru Jambheshwar University of Science and Technology, Hisar (letter no. PTY/2021/42). The trial was also registered under the Clinical Trials Registry-India (CTRI), registration number CTRI/2021/08/035554. The study was conducted in accordance with the ethical standards of the Helsinki Declaration. Informed consent was obtained from all participants before inclusion in the study.

Participants

A total of 40 elite soccer players (30 males, 10 females) were recruited from Royal Ranger Academy, Gurugram. The inclusion criteria comprised good health, age between 18 to 25 years, and active participation in soccer at least three days per week for at least two years. Both female and male soccer players were included in the study. Participants were excluded if they had not been involved in any soccer match with in the previous 6-8 weeks, or if they had any recent history of injury to the lower limbs, any history of neurological, musculo-skeletal disorders or systemic disease, were uncooperative, or had any other condition that could affect participation in the study.

The sample size was calculated with G* Power 3.1 software based on the pilot trial of this study. The level of significance (α) was 0.05, power (1-α) was 95% and effect size was 2.11. The calculations indicated a minimum group size of six participants [15].

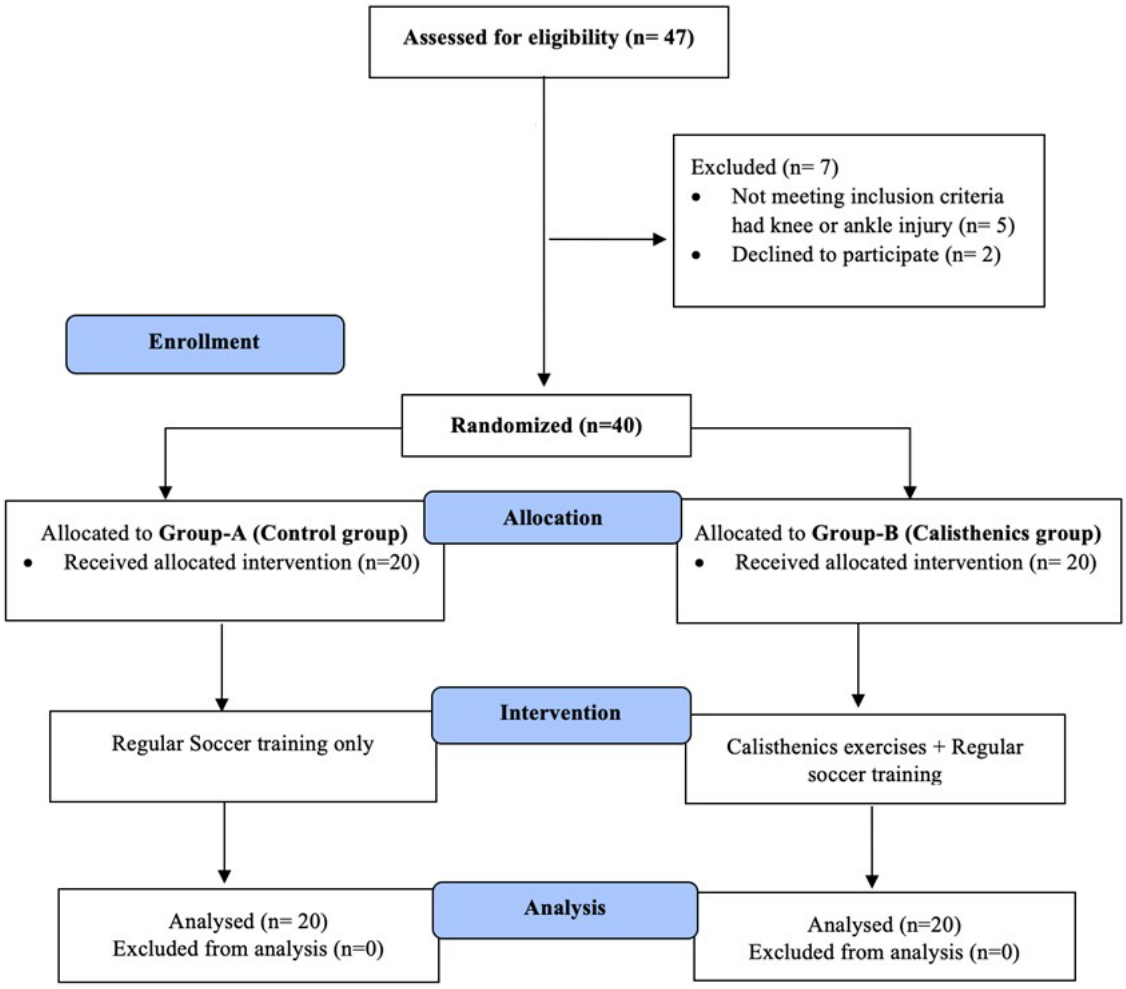

Fig. 1. CONSORT 2010 Flow Diagram

Procedure

Forty-seven soccer players were initially screened for inclusion. Of these, only forty participants who fulfilled the inclusion criteria were selected for the study. The selected players were then randomly allocated into two groups of 20 players, *viz.* Group-A (Control group) and Group-B (Experimental group) (Fig. 1), using a lottery method.

Intervention

The participants in Group-A performed regular soccer training three times per week for a period of eight weeks. The training programme comprised the following exercises: stretching the upper and lower limb muscle groups (biceps, triceps, hamstring, quadriceps and calf muscle), running (five minutes) and jogging (15 minutes). The stretching exercises were performed as 10 repetitions with a hold duration of 10 seconds for each exercise.

The participants in Group-B followed a calisthenic training protocol together with regular soccer training three times per week for a total duration of eight weeks. The regular training protocol for this group was same as for Group-A (controls).

Calisthenics training protocol

The calisthenic training protocol consisted of three phases, i.e. warm up, calisthenics exercises and cool down. Before each training session, the participants performed a warm-up consisting of brisk walking/jogging for 10 minutes. The calisthenics training included a range of exercises, such as standard push-ups, static lunges, lower abdominal plank, plank push-up hold, pistol squat progression, plyo-jack, prone superman, V-up and mountain climber exercises. The exercises followed a progression from week I to week VIII, as shown in Table 1. Rest periods were provided between exercises (90 seconds) and sets of exercises (120 seconds) for all the sessions of the eight-week calisthenics training.

After week I and II, the repetitions were increased from 10 to 15 for each exercise. Plyo-jacks were added in week III. In week IV, the number of sets was increased from two to three and each exercise was repeated

Tab. 1. Exercise protocol for 8 week calisthenics training

Exercises	Ist	IInd	IIIrd	IVth	Vth	VIth	VIIth	VIIIth
1) Push-ups	2 × 10	2 × 10	2 × 15	2 × 15	3 × 10	3 × 10	3 × 15	3 × 15
2) Lower abdominal plank	2 × 10	2 × 10	2 × 15	2 × 15	3 × 10	3 × 10	3 × 15	3 × 15
3) Static lunges	2 × 10	2 × 10	2 × 15	2 × 15	3 × 10	3 × 10	3 × 15	3 × 15
4) Plank push-up hold	2 × 10	2 × 10	2 × 15	2 × 15	3 × 10	3 × 10	3 × 15	3 × 15
5) Pistol squat progression	2 × 10	2 × 10	2 × 15	2 × 15	3 × 10	3 × 10	3 × 15	3 × 15
6) Plyo-jack			2 × 15	2 × 15	3 × 10	3 × 10	3 × 15	3 × 15
7) Superman					3 × 10	3 × 10	3 × 15	3 × 15
8) V-up					3 × 10	3 × 10	3 × 15	3 × 15
9) Mountain climber							3 × 15	3 × 15

10 times per set. In week V, superman and V-up exercises were added to the training programme. In week VII, the number of repetitions was increased from 10 to 15 for each exercise, and the mountain climber exercise was added. In all classes, a 10 minute cooldown, consisting of brisk walking/ jogging and stretching exercises, was performed at the end of each session [6,14,15].

Outcome measures

The physical fitness parameters assessed in this study included speed, agility, hamstring flexibility, explosive power, balance and sports-specific skill tests. The outcome measures were 30-yard dash test, Illinois agility test, sit-and-reach test, vertical jump height, star excursion balance test, 30m running-with-the-ball test, kicking accuracy test and juggling.

Speed was measured by the 30-yard dash test (30YDT) [19], agility was measured with the Illinois agility test (IAT) [20], hamstring flexibility was measured by the sit-and-reach test (SRT) [21], explosive power was measured by vertical jump height (VJH) [22], and balance was measured by the star excursion balance test (SEBT – dominant leg) [23].

The sports-specific skill test for soccer was measured using SAI tests. The SAI tests for soccer consisted of three tests: 30m running-with-the-ball test, kicking test and juggling. The 30m running-with-the-ball test is used to measure the speed and control of the soccer, kicking accuracy is used to measure the kicking efficiency of soccer players, and juggling is used to measure the balancing and reaction ability, agility and sense of touch of the soccer [11]. The reliability for the 30-yard dash test, Illinois agility test, sit-and-reach test, vertical jump height and star excursion balance test has been reported to be good to excellent (ICC = 0.99, 0.98, 0.886, 0.995 and 0.97 respectively) [19–23]. All the measurements were taken at baseline and after eight weeks, i.e. post-training sessions.

Statistical analysis

The statistical analysis was performed using SPSS (IBM statistical package for social science) software (version 28). Mean, standard deviation, t-value, p-value and Cohen's d value were calculated for all the outcome measures. Within-group and between-group comparisons were made using the paired t-test and independent t-test respectively. The level of significance (p-value) was kept at ≤ 0.05.

Results

The demographic data of all the players, including age (years), height (metres), weight (kilogrammes) and body mass index (kg/m^2), are shown in Table 2. The baseline comparison of demographic data and outcome measures was performed using independent t-test, significant difference was observed between both the groups.

In the control group (Group A), the results of the within-group comparison, carried out using the paired t-test ($p < 0.05$), revealed significant changes over time for outcome measures such as Illinois agility test, 30-yard dash test, sit-and-reach test, vertical jump height, SAI test (30m running test and juggling) and SEBT (Anterior reach) (Tab. 3). In this case, the calculated t-value was greater than the critical or table t-value (1.729) for all the outcome measures except for kicking accuracy test and SEBT (Posterior, medial, lateral, anteromedial, posteromedial, anterolateral, posterolateral reach), indicating statistical significance. Neither the kicking accuracy test nor the SEBT (Posterior, medial, lateral, anteromedial, posteromedial, anterolateral, posterolateral reach) were statistically significant in the control group ($p > 0.05$).

In the experimental group (Group-B), significant improvement was seen during for the Illinois agility

Tab. 2. Baseline comparison of demographic characteristics and outcome measures between the groups (n = 40)

Demographic characteristics/Outcome measures	Group-A (n = 20) (Mean ± SD)	Group-B (n = 20) (Mean ± SD)	p-value
Age (years)	21.10 ± 2.75	20.95 ± 2.01	0.845
Height (m)	1.67 ± 0.07	1.67 ± 0.07	0.770
Weight (kg)	61.50 ± 13.96	60.70 ± 9.21	0.832
Body mass index (kg/m^2)	22.04 ± 4.22	21.62 ± 2.44	0.70
30-yard dash test (sec)	4.95 ± 0.44	4.86 ± 0.51	0.558
Illinois agility test (sec)	17.01 ± 0.72	16.92 ± 0.92	0.725
Vertical jump height (cm)	39.86 ± 7.71	38.47 ± 5.89	0.526
Sit and reach test (cm)	29.68 ± 3.78	29.17 ± 3.42	0.654
SEBT-Anterior (cm)	77.29 ± 7.82	80.04 ± 7.14	0.253
SEBT-Posterior (cm)	68.75 ± 8.63	71.90 ± 7.57	0.228
SEBT-Medial (cm)	77.45 ± 8.35	77.58 ± 9.48	0.963
SEBT-Lateral (cm)	50.37 ± 7.56	51.31 ± 9.10	0.725
SEBT-Antero-Lateral (cm)	69.86 ± 6.56	70.68 ± 9.80	0.803
SEBT-Antero-Medial (cm)	86.57 ± 9.18	87.26 ± 8.15	0.755
SEBT-Postero-Lateral (cm)	63.18 ± 6.33	63.36 ± 6.97	0.936
SEBT-Postero-Medial (cm)	80.56 ± 9.59	80.82 ± 11.08	0.932
30-m running with ball test (sec)	5.75 ± 0.39	5.68 ± 0.49	0.637
Kicking accuracy test (No. of correct shots)	6.15 ± 1.50	6.60 ± 1.35	0.325
Juggling (No. of ball touches to body)	19.55 ± 8.17	21.60 ± 6.83	0.395

SD – Standard Deviation, SEBT – Star excursion balance test

test, 30-yard dash test, sit-and-reach test, vertical jump height, SAI test (30-m running test, kicking accuracy test and juggling) and SEBT (Anterior reach). In this case, the calculated t-value was greater than the critical or table t-value (1.729) for all the outcome measures except for SEBT (Posterior, medial, lateral, anteromedial, posteromedial, anterolateral, posterolateral reach), indicating statistical significance. However, the change in the SEBT (Posterior, medial, lateral, anteromedial, posteromedial, anterolateral, posterolateral reach) was not statistically significant (Tab. 4).

The results of the within-group comparison indicate some improvement in speed, agility, explosive power and hamstring flexibility in both the control and experimental group.

The effect size was calculated using Cohen's d. A value of d = 0.2 is considered a small effect size, 0.5 a medium effect size and 0.8 a large effect size. Hence, if the difference between the two group means is less than 0.2 standard deviations, the difference is negligible, even if it is statistically significant [24]. As a higher Cohen's d value was noted in the experimental group (Group-B) than the control group (Group-A), it appears that calisthenics exercises had a greater effect than a standard training regimen.

The between-group comparison was carried out by applying an unpaired t-test on mean difference scores of outcome measures, such as the 30-yard dash test, Illinois agility test, vertical jump height, sit and reach test, 30m running-with-the-ball test, juggling and anterior reach in star excursion balance test. The result was statistically significant ($p < 0.05$) (Tab. 5).

The kicking accuracy test was not found to be statistically significant ($p > 0.05$), nor was the star excursion balance test, in the seven directions other than anterior reach. For all the outcome measures except for kicking accuracy test and SEBT (Posterior, medial, lateral, anteromedial, posteromedial, anterolateral, posterolateral reach), the calculated t-value was found to be greater than the critical or table t-value (1.686), indicating statistical significance. The calisthenics training group (Group-B) demonstrated greater improvement in the soccer-specific skills measured by SAI tests than the regular soccer training group (Group-A). However, no statistically-significant improvement was observed for balance or coordination in either group.

Tab. 3. Within group comparison scores for various physical components and sports specific skills in Control Group (Group-A)

Outcome measures	Baseline Mean ± SD	After 8 Weeks Mean ± SD	t-value	p-value	Cohen's d
30-yard dash test (sec)	4.95 ± 0.44	4.54 ± 0.45	6.400	< 0.001*	0.284
Illinois agility test (sec)	17.01 ± 0.72	16.47 ± 0.72	8.172	< 0.001*	0.298
Vertical jump height (cm)	39.86 ± 7.71	41.73 ± 7.59	–15.213	< 0.001*	0.549
Sit and reach test (cm)	29.68 ± 3.78	31.59 ± 3.81	–10.716	< 0.001*	0.795
SEBT-Anterior (cm)	77.29 ± 7.82	78.35 ± 6.40	–1.766	0.001*	2.686
SEBT-Posterior (cm)	68.75 ± 8.63	69.72 ± 7.73	–0.393	0.690	11.025
SEBT-Medial (cm)	77.45 ± 8.35	79.26 ± 9.63	–0.591	0.511	13.690
SEBT-Lateral (cm)	50.37 ± 7.56	52.62 ± 6.52	–1.004	0.979	10.012
SEBT-Antero-Lateral (cm)	69.86 ± 6.56	68.58 ± 7.34	0.591	0.862	9.665
SEBT-Antero-Medial (cm)	86.57 ± 9.18	86.24 ± 9.50	0.111	0.828	13.548
SEBT-Postero-Lateral (cm)	63.18 ± 6.33	64.29 ± 7.58	–0.475	0.580	10.497
SEBT-Postero-Medial (cm)	80.56 ± 9.59	80.36 ± 11.24	0.066	0.399	13.235
30-m running with ball test (sec)	5.75 ± 0.39	5.21 ± 0.39	6.864	<0.001*	0.351
Kicking accuracy test (No. of correct shots)	6.15 ± 1.50	6.70 ± 1.63	–1.675	0.110	1.468
Juggling (No. of ball touches to body)	19.55 ± 8.17	22.30 ± 6.50	–2.417	0.026*	5.087

*Significant at 95% confidence level ($p < 0.05$); SD-Standard Deviation; SEBT-Star Excursion Balance Test.

Tab. 4. Within group comparison scores for various physical components and sports specific skills in Experimental Group (Group-B)

Outcome measures	Baseline Mean ± SD	After 8 Weeks Mean ± SD	t-value	p-value	Cohen's d
30-yard dash test (sec)	4.86 ± 0.51	4.27 ± 0.46	10.798	< 0.001*	0.241
Illinois agility test (sec)	16.92 ± 0.92	15.55 ± 0.85	12.609	< 0.001*	0.485
Vertical jump height (cm)	38.47 ± 5.89	42.40 ± 5.73	–12.349	< 0.001*	1.425
Sit and reach test (cm)	29.17 ± 3.42	34.06 ± 3.88	–12.048	< 0.001*	1.817
SEBT-Anterior (cm)	80.04 ± 7.14	84.72 ± 5.41	–5.943	0.001*	3.523
SEBT-Posterior (cm)	71.90 ± 7.57	72.79 ± 7.98	–0.324	0.270	12.336
SEBT-Medial (cm)	77.58 ± 9.48	81.34 ± 8.99	–1.207	0.563	13.931
SEBT-Lateral (cm)	51.31 ± 9.10	51.40 ± 10.21	–0.039	0.079	10.599
SEBT-Antero-Lateral (cm)	70.68 ± 9.80	72.02 ± 10.58	–0.406	0.852	14.740
SEBT-Antero-Medial (cm)	87.26 ± 8.15	86.84 ± 8.63	0.182	0.347	10.471
SEBT-Postero-Lateral (cm)	63.36 ± 6.97	62.34 ± 7.95	0.426	0.901	10.729
SEBT-Postero-Medial (cm)	80.82 ± 11.08	78.91 ± 12.13	0.551	0.641	15.493
30-m running with ball test (sec)	5.68 ± 0.49	4.67 ± 0.50	12.155	< 0.001*	0.371
Kicking accuracy test (No. of correct shots)	6.60 ± 1.35	7.85 ± 1.27	–4.194	< 0.001*	1.332
Juggling (No. of ball touches to body)	21.60 ± 6.83	29.05 ± 8.27	–5.081	< 0.001*	6.557

*Significant at 95% confidence level ($p < 0.05$); SD-Standard Deviation; SEBT-Star Excursion Balance Test.

Tab. 5. Between group comparison scores for various physical components and sports specific skills

Outcome measures	Group-A (n = 20) Mean ± SD	Group-B (n = 20) Mean ± SD	t-value	p-value
30-yard dash test (sec)	0.41 ± 0.28	0.58 ± 0.24	–2.107	0.021*
Illinois agility test (sec)	0.55 ± 0.30	1.37 ± 0.49	–6.455	< 0.001*
Vertical jump height (cm)	–1.87 ± 0.55	–3.94 ± 1.43	6.046	< 0.001*
Sit and reach test (cm)	–1.91 ± 0.80	–4.89 ± 1.82	6.742	< 0.001*
SEBT-Anterior (cm)	–1.06 ± 2.69	–4.68 ± 3.52	3.655	< 0.001*
SEBT-Posterior (cm)	–0.97 ±11.03	–0.89 ± 12.34	–0.020	0.492
SEBT-Medial (cm)	–1.81 ± 13.69	–3.76 ± 13.93	0.446	0.329
SEBT-Lateral (cm)	–2.25 ± 10.01	–0.09 ± 10.60	–0.661	0.256
SEBT-Antero-Lateral (cm)	1.28 ± 9.67	–1.34 ± 14.74	0.663	0.256
SEBT-Antero-Medial (cm)	0.34 ± 13.55	0.43 ± 10.47	–0.023	0.491
SEBT-Postero-Lateral (cm)	–1.11 ± 10.50	1.02 ± 10.73	–0.637	0.264
SEBT-Postero-Medial (cm)	0.20 ± 13.24	1.91 ± 15.49	–0.376	0.355
30-m running with ball test (sec)	0.54 ± 0.35	1.01 ± 0.37	–4.120	< 0.001*
Kicking accuracy test (No. of correct shots)	–0.55 ± 1.47	–1.25 ± 1.33	1.579	0.061
Juggling (No. of ball touches to body)	–2.75 ± 5.09	–7.45 ± 6.56	2.533	0.008*

*Significant at 95% confidence level ($p < 0.05$); SD-Standard Deviation; SEBT-Star Excursion Balance Test.

It was found that the regular soccer training was also effective in improving speed, agility, flexibility, explosive power and strength; however, not much improvement was seen on sports specific skills and balance. In contrast, the calisthenics training group (Group-B) demonstrated improvement in all the variables, together with all sports-specific skills for soccer except balance. These results indicate that supplementation of the regular soccer training protocol with calisthenic exercises can result in greater improvements in sport-specific skills, which may further help in improving overall sports performance.

Discussion

The aim of this study was to determine whether supplementing of eight-week regular soccer training with calisthenics training would improve various physical parameters, *viz.* speed, agility, hamstring flexibility, balance, explosive power and sports-specific skills, in soccer players. Our findings indicate that the combined program yielded a significant improvement in the 30-yard dash test and vertical jump height, which suggest that speed and explosive power were improved in soccer players who underwent calisthenics training. A possible reason for this may be an increase in maximal muscle force, which further improves muscle power and results in improved vertical jump height. Indeed, calisthenics training is known to exploit the adaptation of stretch-shortening cycles through the neuromuscular system, which further helps to increase speed [25].

Furthermore, a significant improvement in the Illinois agility test was also observed among the calisthenics group, suggesting that this group demonstrated greater agility compared to the control group. These changes may be attributed to specific neural adaptations, increased motor unit recruitment and improvement in the coordination of the involved muscle groups [16].

Hamstring flexibility was also significantly increased in the calisthenics group compared to the control group, which may be due to the joints being stretched and bent under the body's own power and load. It has also been proposed that calisthenics exercises also help strengthen joints, drawing blood to the soft tissues, healing them and maintaining the ideal range of motion, which can further increase the flexibility of hamstring muscle [25]. Calisthenic exercises are performed under body weight, and involve repeated short muscle contractions while performing various movements such as jumping, bending, twisting, swinging and kicking; these are known to increase strength and flexibility.

Our present findings are in line with those of another study on swimmers in 2019. It was found that the calisthenics training was effective in improving body composition, flexibility, speed, agility, strength and

balance in swimmers, when performed on stable or unstable grounds [17]. In addition, Gist et al. [26] found that high-intensity calisthenics training may be helpful in improving speed, agility, aerobic and anaerobic capacity in moderately-trained army cadets without using any equipment.

Our findings indicate statistically significant improvements in speed, agility, hamstring flexibility and explosive power among the participants within both the control (soccer training) and experimental (calisthenics training) groups. However, the between-group comparison revealed greater improvements in speed, agility, explosive power, hamstring flexibility in the calisthenics group compared to controls.

In addition, neither group demonstrated any significant improvement in any direction in the star excursion balance test, except in anterior reaching direction or activity. This indicates that calisthenics training was not effective in improving the balance of soccer players. These results contradict those of a previous study which indicated improvement on balance in calisthenics training groups [6, 17]. Genc [6] found that calisthenics exercises proved to be effective in improving static and dynamic balance in tennis players, and Bayrakdar et al. [17] concluded that calisthenics were effective in improving static and dynamic balance in swimmer following exercises performed on stable or unstable ground.

Our present results also indicate a greater improvement in the sports-specific skills (kicking efficiency, juggling control on soccer) in the calisthenics training group than the regular soccer training group. This suggests that calisthenics training was effective in improving sports-specific skills, such as kicking efficiency and juggling control of the soccer. This improvement may be due to the exercises involving only body weight, requiring a full range of motion and utilizing almost all the muscles of the body. In addition, calisthenics training improves the probability of detecting limb-segment position for a certain tracking-trajectory task and also enhances proprioception i.e. accuracy of joint-position sense [6,25]. These may be the reasons why the calisthenics training group demonstrated a greater improvement in sports-specific skills than the regular soccer training group.

Our findings indicate that including the calisthenics training program with regular soccer training can improve the performance of the soccer players, more specifically, by achieving more speed, agility, jumping ability, and soccer control. Hence, calisthenics training appears to be quite effective in improving various physical components such as speed, agility, explosive power, hamstring flexibility and sports-specific skills. Therefore, calisthenics exercises should be considered as a part of regular training for soccer players. Furthermore, coaches and players should be counselled about the benefits of calisthenics exercises on physical fitness parameters and sports-specific skills of soccer players. These improvements in fitness components obtained in response to calisthenics exercises may enhance the overall performance of players and reduce the chance of injuries.

This study does have two limitations: COVID-19 restrictions prevented the possibility for follow-up, and therapist blinding was not possible. In future, studies with longer training durations, and follow-up studies to determine the effects of calisthenic intervention on injury rate and prevalence are recommended.

Conclusion

Implementing calisthenic exercises three times in a week for a period of eight weeks together with soccer training provides additional benefits by improving important physical parameters, such as speed, agility, explosive power, balance, hamstring flexibility and sports-specific skills among soccer players. Hence, it can be said that including a calisthenics training program alongside regular soccer training can improve the overall performance of the soccer players by achieving more speed, agility, flexibility, kicking accuracy, jumping ability and soccer control.

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Conflicts of interests
The authors have no conflict of interest to declare.

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