Cureus
Part of SPRINGER NATURE

Open Access Original Article

Published via Krishna Vishwa Vidyapeeth (Deemed to be University), Karad.

Effect of Bodyweight Strength Training on Functional and Technical Performance in Amateur Football Players

Received 06/16/2026
Review began 09/30/2026
Review ended 10/27/2026
Published 11/05/2026

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DOI: 10.7759/cureus.119196

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Abstract

Introduction

Football is a skill-dependent sport that demands strength, coordination, agility, and technical proficiency. Bodyweight strength training may provide an accessible and economical approach for improving physical and technical performance among amateur football players. However, limited evidence is available regarding its effects on amateur players.

Methods

Forty-four male amateur football players who met the eligibility criteria were included in the study. Participants were allocated equally into an experimental group (n=22) and a control group (n=22). The experimental group performed bodyweight strength training three times per week on alternate days for six weeks, while the control group maintained their regular football training alone. Outcomes included one-repetition maximum (1RM) back squat, vertical jump height, dribbling performance, and juggling performance. Pre- and post-intervention measurements were compared between and within groups.

Results

Significant enhancements were observed in all outcome measures in group A after the intervention. The mean 1RM Back Squat score increased from 68.41±10.95 kg to 70.11±11.46 kg (p=0.0042), indicating an increase in lower-limb muscular strength. In contrast, group B showed no significant change, with scores increasing from 69.55±9.99 kg to 69.89±9.46 kg (p=0.5253). Between-group analysis revealed no significant differences at baseline (p=0.7210) or post-intervention (p=0.9432).

Conclusion

These findings suggest that structured bodyweight strength training has the potential to enhance lower-limb strength, explosive power, and selected football-specific technical skills among this cohort of amateur football players. Given its minimal equipment requirements and practical application, such a regimen offers a feasible addition to football training programs.

Categories: Sports Medicine, Physical Medicine & Rehabilitation, Orthopedics
Keywords: amateur football players, bodyweight strength training, dribbling, juggling, vertical jump test

Introduction

Physical exercise is crucial for improving health, fitness, and athletic performance [1]. Sports science and medicine play an increasingly important role in optimizing athletic performance and improving training practices [2]. Optimal football performance requires a combination of effective coaching and psychological support to enhance physical, technical, and tactical development [3]. The growing physical demands of football highlight the importance of scientific performance assessment and the development of body strength to support overall player development [4].

Efficient movement is essential for optimal performance, and bodyweight strength training provides a functional means of enhancing movement efficiency by using the individual's body weight as resistance [5-7]. Physical conditioning and scientific performance analysis are essential in football, enabling accurate assessment of player workload, movement patterns, and technical performance. High-intensity actions and technical skills are essential for successful match outcomes [8,9]. Neuromuscular training improves movement efficiency, dynamic stability, and muscular control through balance, proprioceptive, and strengthening exercises, while also contributing to lower-limb injury prevention in athletes [10].

Bodyweight strength training involves using an individual's body weight as resistance to develop muscular

strength, endurance, balance, and functional capacity [11]. It enhances functional strength and movement efficiency without the need for external weights or specialized equipment. Common bodyweight exercises, such as squats, split squats, push-ups, angled rows, and back extensions, help improve strength, endurance, stability, and functional movement by engaging multiple muscle groups. Their simplicity and adaptability make them an effective method for physical conditioning and sports performance enhancement [12-14]. The effectiveness of bodyweight training depends on correct exercise technique, controlled movements, and progressive increases in training intensity [15].

Muscular strength refers to the capacity of a muscle or group of muscles to generate force against an external load or body mass [16,17]. Lower-limb strength is strongly associated with repeated high-intensity actions and physical performance in competitive football players [18]. Muscular performance can be assessed using methods such as isokinetic dynamometry, hand-held dynamometry, power tests, and the one-repetition maximum (1RM) test. Among these, the 1RM test is most commonly used to measure strength [19-21]. Power is the ability to generate force rapidly and is expressed as the product of the amount of force produced and the speed of movement. It is crucial for performing explosive movements such as jumping, sprinting, accelerating, and changing direction [22,23]. Power is an important component that depends on the force and velocity generated during take-off against body weight [24].

Dribbling is considered one of the fundamental skills in football, as players are required to control the ball effectively while moving, standing, passing, or preparing to shoot [25]. It allows players to maintain ball possession, create space, and advance play while demonstrating creativity and control [26]. Speed dribbling involves moving the ball rapidly into open space while maintaining control and forward momentum [27-29]. Juggling is the ability to keep the ball in the air by repeatedly hitting and controlling it using the feet, knees, chest, or head [30]. Ball control, coordination, balance, reaction time, and technical skill can be assessed by recording the number of successful foot juggles [31,32]. Despite the growing popularity of bodyweight strength training, there is a scarcity of literature regarding its effects on both physical and technical performance in football players. We hypothesized that adding a structured bodyweight strength training regimen to regular practice would be associated with positive trends in functional and technical performance measures compared with regular practice alone.

Materials And Methods

A randomized controlled trial was conducted with a total of 44 participants, who were randomly allocated into two groups: an experimental group (n=22) and a control group (n=22). Participants were selected based on specific inclusion and exclusion criteria. Participants were recruited using convenience sampling from football academies in Karad. Male amateur football players aged between 18 and 25 years who regularly participated in football training for approximately eight hours per week and had at least two years of playing experience met the inclusion criteria for this study cohort. Only players who were free from any lower limb injury or deformity at the time of assessment were eligible to participate. Players were excluded if they had a recent history of lower limb injury or surgery, any active lower limb condition within the past six months, or any musculoskeletal deformity. Participants with visual or vestibular problems that could affect their balance and performance were also excluded. In addition, players with less than two years of football training experience were not included in the study.

All eligible participants were informed about the objectives and procedures of the study. Written informed consent was obtained from participants who satisfied the predefined inclusion and exclusion criteria. The study was conducted at Krishna College of Physiotherapy over a period of six weeks. Potential confounding factors, including participants' regular football training, playing experience, training frequency, and adherence to the intervention, were considered during the study. Participants were instructed to maintain their regular football training routine throughout the study period.

Pre-assessment was done using outcome measures including the one-repetition maximum (1RM) back squat, vertical jump test, dribbling test, and juggling test. The 1RM back squat was used to assess lower-limb muscular strength. Each participant was allowed up to three attempts to determine the maximum load they successfully achieved for a single repetition. Load was recorded in kilograms. The starting load was 30 kilograms and was incremented by 2.5 kilograms. The vertical jump test was used to assess lower-limb explosive power using a wall-based jump-and-reach measurement method. Participants' standing reach and maximum jump reach were marked on a wall using chalk, and jump height was determined from the difference between the two measurements in centimeters. Among the three trials, the best score was considered. The dribbling test was used to assess football-specific dribbling ability using a cone-based course. Participants dribbled a ball through a course of five cones with spacing of 3-4 m, and performance was recorded as completion time in seconds. Successful completion of the course without touching or displacing any cone and without allowing the ball to leave the designated course was considered valid. A juggling test was used to assess ball control and technical skill. The maximum number of consecutive ball touches achieved before the ball fell to the ground. Each participant performed three trials, and the best score obtained was considered for analysis. The same assessment procedures were followed during the pre- and post-assessments. All participants were provided with standardized instructions and familiarization with the tests before assessment.

Subjects in experimental group A performed bodyweight strengthening exercises three times a week for six weeks. Each training session consisted of a warm-up followed by bodyweight strengthening exercises performed in prescribed sets and repetitions. The six-week bodyweight strength training program consisted of progressive lower-limb strengthening, core stability, and plyometric exercises. Week 1 included squats, reverse lunges, glute bridge holds, wall sits, and calf raises. Week 2 included squats, step-ups, lateral lunges, single-leg bridge holds, and single-leg calf raises. Week 3 incorporated jump squats, Bulgarian split squats, side plank leg lifts, step-ups, and bird-dog holds. Week 4 included assisted pistol squats, curtsy lunges, glute marching bridges, lateral step-downs, and wall sits. Week 5 consisted of plyometric step-ups, burpees, side lunges with knee drive, wall sits, and superman holds. Week 6 included assisted pistol squats, jump lunges, skater hops, plank reach-outs, and burpees. The training sessions were supervised to ensure proper exercise technique and adherence to the intervention. Whereas control group B continued their regular coaching. The sessions began with a 3-5 minute warm-up. Then, each training session consisted of bodyweight strengthening exercises in sets of repetitions. Later, a post-assessment was taken using the same outcome measures and procedures used during the pre-assessment.

The study protocol was approved by the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad, with reference number KVV/IEC/10/2025. The study was conducted in accordance with the ethical principles. Data were analyzed using descriptive statistics. Within-group pre- and post-intervention differences were analyzed using the paired t-test, while between-group differences were analyzed using the independent t-test. The alpha level for statistical significance was set at $p<0.05$.

Results

A total of 44 participants completed the six-week study, with 22 participants in the experimental group (group A) and 22 in the control group (group B). No dropouts were reported during the intervention period. Data were checked for normality and analyzed accordingly.

Baseline values for the 1RM back squat showed no statistically significant difference between group A (68.41±10.95 kg) and group B (69.55±9.99 kg; p=0.7210), as shown in Table *1*. Following the six-week intervention, group A showed a statistically significant within-group increase in 1RM back squat scores to 70.11±11.46 kg (p=0.0042). In contrast, group B exhibited no significant change, with post-intervention scores tracking at 69.89±9.46 kg (p=0.5253). The between-group analysis post-intervention indicated no statistically significant difference between the two groups (p=0.9432; Table *1*).

1RM back squat	Pre-est (mean±SD)	Post-test (mean±SD)	t-value	p-value	Level of significance
Group A	68.41±10.95	70.11±11.46	-3.215	0.0042	Very significant
Group B	69.55±9.99	69.89±9.46	-0.646	0.5253	Not significant
t-value	-0.360	0.072			
p-value	0.7210	0.9432			
Level of significance	Not significant	Not significant			

TABLE 1: Comparison of pre, post and pre-post test measures of 1RM back squat

1RM - one-repetition maximum

For lower-limb power, baseline vertical jump heights were comparable between group A (37.95±5.61 cm) and group B (39.55±5.54 cm; p=0.3470), as detailed in Table *2*. Post-intervention analysis revealed a statistically significant within-group improvement for group A, with the mean jump height increasing to 39.41±5.34 cm ($p<0.0001$). Group B showed a minor change to 39.82±5.26 cm, which did not reach statistical significance (p=0.3296). Post-intervention between-group comparisons showed no statistically significant difference between the groups (p=0.8016; Table *2*).

Vertical jump test	Pre-test (mean±SD)	Post-test (mean±SD)	t-value	p-value	Level of significance
Group A	45.86±4.05	51.54±3.87	-5.677	<0.0001	Extremely significant
Group B	46.32±4.04	46.23±7.02	0.058	0.9544	Not significant
t-value	-0.373	3.112			
p-value	0.7113	0.0033			
Level of significance	Not significant	Very significant			

TABLE 2: Comparison of pre, post and pre-post test measures of vertical jump test

At baseline, dribbling completion times were similar between group A (13.78±1.62 seconds) and group B (13.88±1.63 seconds; p=0.8354), as summarized in Table *3*. Following the training period, group A showed a statistically significant within-group reduction in completion time, improving to 13.06±1.34 seconds (p<0.0001). Group B displayed an alteration to 13.75±1.54 seconds (p=0.0901). The post-intervention comparison between the two groups indicated that the difference did not reach statistical significance (p=0.1228; Table *3*).

Dribbling Test	Pre-test (mean±SD)	Post-test (mean±SD)	t-value	p-value	Level of significance
Group A	14.07±0.59	13.56±0.45	4.203	0.0004	Extremely significant
Group B	14.12±0.65	14.205±0.82	-0.817	0.4231	Not significant
t-value	-0.267	-3.217			
p-value	0.7908	0.0025			
Level of Significance	Not significant	Very significant			

TABLE 3: Comparison of pre, post and pre-post test measures of dribbling test

Baseline juggling scores were closely matched between group A (23.95±8.16 repetitions) and group B (26.68±9.80 repetitions; p=0.3228), as shown in Table *4*. Post-intervention, group A exhibited a highly significant within-group increase in the number of successful touches, reaching 27.50±8.42 repetitions (p<0.0001). Group B revealed a change to 26.95±9.60 repetitions (p=0.5367). The post-intervention between-group analysis showed no statistically significant difference between the experimental and control cohorts (p=0.8407; Table *4*).

Juggling test	Pre-test (mean±SD)	Post-test (mean±SD)	t-value	p-value	Level of significance
Group A	24.36±4.85	30.73±6.78	-4.483	0.0002	Extremely Significant
Group B	25.32±7.99	26.91±6.16	-1.478	0.1543	Not significant
t-value	-0.479	1.956			
p-value	0.6347	0.0571			
Level of significance	Not significant	Not significant			

TABLE 4: Comparison of pre, post and pre-post test measures of juggling test

Overall, the six-week bodyweight strength training program was associated with positive within-group shifts in lower-limb strength, explosive power, and selected technical skills within the training cohort (group A). However, the post-intervention between-group comparisons indicated no statistically significant differences between group A and group B across all measured parameters. These findings suggest that while structured bodyweight exercises provide a functional and accessible addition to an athlete's routine, a larger

sample size or an extended intervention window may be required to yield definitive statistical variance between training protocols.

Discussion

Participants included in the study were males (n=44). The mean age of participants in group A was 22.23±1.57 years, while that of group B was 23.45±1.59 years, indicating that participants in both groups belonged to a similar age category. The age distribution suggests that the subjects were young adults at an optimal stage for developing strength, power, neuromuscular coordination, and sport-specific skills. The mean BMI of group A was 24.28±0.97 kg/m², whereas group B showed a mean BMI of 24.61±1.12 kg/m². The demographic findings of the present study are comparable with those reported by amateur football studies, where participants were predominantly young adult males with BMI values ranging between 22-25 kg/m². Bogalho et al. reported a mean age of 22.3±3 years and BMI of 24.2±2.6 kg/m² among amateur football players, which closely resembled the characteristics of the present sample [33].

Group A exhibited a statistically significant improvement in 1RM back squat values following bodyweight strength training, with mean values increasing from 68.41±10.95 kg to 70.11±11.46 kg (p=0.0042). In contrast, group B showed only a minimal increase from 69.55±9.99 kg to 69.89±9.46 kg, which was not statistically significant (p=0.5253). The significant improvement in group A may be due to neuromuscular adaptations induced by bodyweight strength training. Exercises such as squats, lunges, and step-ups enhance motor unit recruitment, muscular coordination, and neural activation, enabling greater force production and improved maximal strength [17,34]. Repeated bodyweight training may have enhanced strength in the quadriceps, hamstrings, gluteal muscles, and core stabilizers, which are essential for squat performance. Improved stabilization and force transmission throughout the kinetic chain likely contributed to the observed increase in back squat strength [34,35]. Suchomel et al. emphasized that muscular strength serves as the foundation for athletic performance and is strongly associated with power production, speed, and overall sports performance. Increased strength enhances the athlete's ability to apply force effectively during sport-specific movements [17].

Vertical jump performance is widely used as an indicator of lower-limb power and neuromuscular function [36]. Group A showed a highly significant improvement in vertical jump height, increasing from 45.86±4.05 cm to 51.54±3.87 cm (p<0.0001). Conversely, group B showed no significant change, with values remaining almost unchanged from 46.32±4.04 cm to 46.23±7.02 cm (p=0.9544). Furthermore, post-test comparison between groups revealed a statistically significant difference (p=0.0033), indicating positive comparative trends for bodyweight strength training in improving explosive power within this setting. The improvement in vertical jump performance may be attributed to enhanced neuromuscular efficiency, faster force production, improved stretch-shortening cycle utilization, and greater activation of fast-twitch muscle fibers through functional bodyweight exercises [37]. Markovic and Mikulic suggested that lower-limb muscular strength and neuromuscular coordination are major determinants of vertical jump performance, as stronger muscles can generate greater force within a shorter period of time, thereby enhancing explosive power and jumping ability [38]. Furthermore, improvements in neuromuscular efficiency and rate of force development have been shown to positively influence vertical jump performance among athletes by Aagaard et al. [34]. Findings are consistent with previous research suggesting that strength-oriented training interventions can effectively improve lower-limb power and explosive performance in football players [39,40]. This has important practical implications for amateur football players, as bodyweight exercises are economical, easily accessible, and can be performed in field-based settings with minimal equipment requirements [41].

Effective dribbling enables players to maintain possession, evade opponents, and create attacking opportunities during match play [29,42]. Group A displayed a highly significant improvement in dribbling performance following bodyweight strength training, with mean dribbling time decreasing from 14.07±0.59 seconds to 13.56±0.45 seconds (p=0.0004). In contrast, group B showed no significant improvement, with values changing from 14.12±0.65 seconds to 14.20±0.82 seconds (p=0.4231). Furthermore, the post-test comparison between groups revealed a statistically significant difference (p=0.0025), indicating notable variations in dribbling performance among these amateur players. The findings of the study are supported by the work of Suchomel et al., who reported that muscular strength serves as the foundation for athletic performance and contributes significantly to speed, agility, power, and sport-specific skills [17]. Similarly, Chaouachi et al. suggested that improvements in lower-body strength positively influence change-of-direction ability and movement performance, which are critical components of football dribbling [42]. Strength-oriented training programs improve agility and change-of-direction speed in soccer players. As dribbling performance depends heavily on rapid directional changes while maintaining ball possession, improvements in agility resulting from bodyweight strength training may have translated into better dribbling ability.

Improvements in the physical attributes underlying motor control may positively influence juggling performance [30,43]. Group A exhibited a highly significant improvement in juggling performance following bodyweight strength training, with mean juggling scores increasing from 24.36±4.85 to 30.73±6.78 (p=0.0002). In contrast, group B showed no significant improvement from 25.32±7.99 to 26.91±6.16 (p=0.1543). Although the post-test comparison between groups approached significance (p=0.0571), it did

not reach the conventional level of statistical significance. Exercises such as squats, lunges, single-leg activities, planks, and dynamic stabilization exercises require coordinated activation of multiple muscle groups and improve the body's ability to control movement efficiently. These adaptations are essential during juggling, where players must continuously adjust body position while maintaining precise control of the ball [44]. Hrysomallis et al. emphasized that balance and postural control are critical determinants of football skill performance. Players with superior balance demonstrate greater control during dynamic tasks and are better able to maintain technical precision under varying movement conditions [45]. According to Rahlf et al., strength and neuromuscular training improve proprioceptive awareness and sensorimotor control, enabling athletes to make more accurate adjustments during skill execution [46]. Juggling requires constant feedback regarding ball position, body alignment, and limb movement; therefore, improved proprioception may facilitate better ball control and increased juggling performance [45,46]. The substantial improvement in juggling ability in group A may be attributed to enhanced neuromuscular efficiency and movement coordination, as reported by Impellizzeri et al., which enables more consistent execution of football-specific technical skills [47]. According to Reilly et al., improvements in muscular strength and stability provide a stronger foundation for movement control and coordination, thereby enhancing technical skills such as juggling and overall ball-handling performance [48]. Bodyweight exercises commonly activate the core musculature, which may improve postural control and facilitate more precise ball manipulation [49].

According to Stølen et al., football performance is multifactorial and requires the integration of physical, physiological, and technical abilities. Therefore, evaluating both domains provides a broader understanding of training effects [50]. Finally, the improvements observed in multiple performance variables indicate that bodyweight strength training can positively influence both physical and technical aspects of football performance, providing evidence for its usefulness as a structured training methodology for amateur football players.

However, the study had certain limitations, including a small sample size restricted to male amateur football players and a short intervention duration of six weeks. Adherence to the training program and external factors such as regular football practice, diet, sleep, and physical activity were not strictly controlled. Only selected physical and technical performance outcomes were assessed. Therefore, larger studies with longer intervention periods and better control of confounding factors are warranted.

Conclusions

Bodyweight strength training combined with regular football practice significantly improved vertical jump height and dribbling performance in male amateur football players. However, no significant between-group differences were observed in back squat 1RM or juggling performance. These findings suggest bodyweight strength training as a practical approach to improving selected aspects of football performance.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Shivanjali Jadhav, Neha Bhosale, Smita C. Patil

Acquisition, analysis, or interpretation of data: Shivanjali Jadhav, Neha Bhosale, Smita C. Patil

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Krishna Vishwa Vidyapeeth (Deemed to be University) issued approval KVV/IEC/10/2025. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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