

**EFFECTIVENESS OF LOWER LIMB DYNAMIC STRENGTH
TRAINING ON AGILITY IN ELITE MALE VOLLEYBALL
PLAYERS- AN EXPERIMENTAL STUDY**

By

DINESH KUMAR MISHRA

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Under the guidance of

Dr. Asifuzzaman Shahriyar Ahmed (PT)

Under the co -guidance of

Dr. Gayatri Upasana Acharaya (PT)



ABHINAV BINDRA SPORTS MEDICINE & RESEARCH INSTITUTE

Bhubaneswar, Odisha

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I hereby declare that this dissertation entitled “**EFFECTIVENESS OF LOWER LIMB DYNAMIC STRENGTH TRAINING ON AGILITY IN ELITE MALE VOLLEYBALL PLAYERS – AN EXPERIMENTAL STUDY**” is a bonafide and genuine research work carried out by me under the guidance of Dr. Asifuzzaman Shahriyar Ahmed, Associate Professor, Abhinav Bindra Sports Medicine & Research Institute, Bhubaneswar, Odisha.

Date:

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Dinesh Kumar Mishra

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Date:

SIGNATURE

Place: Bhubaneswar,

Dr. Asifuzzaman Shahriyar Ahmed (PT)

Odisha

Associate Professor, ABSMARI

CERTIFICATE BY THE CO-GUIDE

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Date:

SIGNATURE

Place: Bhubaneswar,

Dr. Gayatri Upasana Acharya (PT)

Odisha

Assistant Professor, ABSMARI

ENDORSEMENT BY THE HOD

This is to certify that the dissertation entitled “**EFFECTIVENESS OF LOWER LIMB DYNAMIC STRENGTH TRAINING ON AGILITY IN ELITE MALE VOLLEYBALL PLAYERS – AN EXPERIMENTAL STUDY**” is a bonafide research work done by Dinesh Kumar Mishra under the guidance of Dr. Asifuzzaman Shahriyar Ahmed, Associate Professor, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha.

Date:

SIGNATURE & SEAL OF THE HOD

Place: Bhubaneswar,

Dr. ASIFUZZAMAN SHAHRIYAR AHMED(PT)

Odisha

Associate Professor, ABSMARI

ENDORSEMENT BY THE PRINCIPAL

This is to certify that the dissertation entitled “**EFFECTIVENESS OF LOWER LIMB DYNAMIC STRNGTH TRAINING ON AGILITY IN ELITE MALE VOLLEYBALL PLAYERS-AN EXPERIMENTAL STUDY**” is a bonafide research work done by Dinesh Kumar Mishra under the guidance of Dr. Asifuzzaman Shahriyar Ahmed, Associate Professor, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha.

Date:
Place: Bhubaneswar,
Odisha

SIGNATURE & SEAL OF THE PRINCIPAL

Dr. Chinmaya Kumar Patra (PT)



ODISHA UNIVERSITY OF HEALTH SCIENCES

CERTIFICATE OF ACCEPTANCE

This is to certify that the dissertation entitled:

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carried out by Mr./Ms. [DINESH KUMAR MISHRA], bearing University Registration Number 23mp435055, has been **evaluated and accepted** by me as an **Examiner / Evaluator**, appointed by the **Odisha University of Health Sciences, Bhubaneswar**, in partial 4 [SPORTS SCIENCES].

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Date:

SIGNATURE

Place: Bhubaneswar, Odisha

Dinesh Kumar Mishra

LIST OF ABBREVIATIONS

- 1. ABSMARI** - Abhinav Bindra Sports Medicine and Research Institute
- 2. DST-** Dynamic Strength Training
- 3. CMJ-** Counter Movement Jump
- 4. SSC-** Stretch-Shortening Cycle
- 5. RFD-** Rate of Force Development
- 6. SPSS** – Statistical Package of Social Sciences

ABSTRACT

Background: Agility and explosive lower-limb strength are critical determinants of volleyball performance, directly influencing spiking, blocking, and defensive coverage. Dynamic strength training has been shown to improve neuromuscular efficiency and sport-specific physical attributes, yet limited evidence exists for its short-term effectiveness among elite Indian volleyball players.

Aim: To evaluate the effectiveness of a six-week lower-limb dynamic strength training program on agility and vertical jump performance in elite male volleyball players.

Methodology: This single-group experimental study recruited 34 elite male volleyball players through purposive sampling in Bhubaneswar, Odisha. Participants underwent a six-week dynamic strength training program, conducted three sessions per week under supervision. Agility was assessed using the Modified Shuttle Run Test, and vertical jump height was measured using the Countermovement Jump (CMJ). Pre- and post-intervention data were collected and analyzed using paired t-tests, with significance set at $p < 0.05$. Effect sizes were calculated using Cohen's d .

Results: Significant improvements were observed in both agility and vertical jump performance after the intervention. The Modified Shuttle Run Test times decreased (mean \pm SD: Pre 10.94 ± 0.56 s; Post 10.20 ± 0.45 s; $p < 0.001$; Cohen's $d = 1.43$), indicating faster agility. The vertical jump height increased (Pre 45.12 ± 2.36 cm; Post 48.85 ± 2.41 cm; $p < 0.001$; Cohen's $d = 1.56$), demonstrating enhanced dynamic strength. Normality testing confirmed data distribution assumptions.

Conclusion: A structured six-week lower-limb dynamic strength training program produced significant improvements in agility and vertical jump performance among elite male volleyball players. These findings suggest that dynamic strength training is an effective,

time-efficient intervention for enhancing volleyball-specific physical performance and should be integrated into conditioning programs for elite athletes.

Keywords: Agility; Vertical Jump; Dynamic Strength Training; Volleyball; Plyometric Exercise; Sports Performance.

LIST OF TABLES

Serial No.	Table	Page No.
1	Protocol	33
2	Normality Testing	39
3	Normality Test(Shapiro –Wilk)	40
4	Pre –Post comparison of outcomes	42

LIST OF FIGURES

Serial No.	Figure	Page No.
1	Vertical and Counter movement jump	33
2	Consort Flow Chart Of Study	37
3	Normality graph	40
4	Group mean Modified Shuttle Run Time –Pre vs Post	43
5	Group mean Vertical Jump Test – Pre vs Post	43
6	Individual participants changes in Modified Shuttle Run Times (pre to post)	44
7	Individual participants changes in vertical jump test(Pre to post)	44

TABLE OF CONTENTS

Serial No.	Content	Page No.
1.	Introduction	01-14
2.	Need for the study	15-16
3.	Aim & Objectives	17-18
4.	Hypotheses	19-20
5.	Review Of Literature	21-27
6.	Methodology & Materials	28-30
7.	Procedure & Outcome Measures	31-35
8.	Statistical Analysis	36-37
9.	Result	38-44
10.	Discussion	45-48
11.	Conclusion & Limitations	49-51
12.	Summary & Future Scope	52-53
13.	References	54-59
14.	Annexures	60-65

INTRODUCTION

INTRODUCTION:-

Volleyball is recognized worldwide as a leading team sport that requires a mix of technical, tactical, psychological, and physical qualities to perform successfully at the elite level. Since its inclusion in the Olympic Games in 1964, the sport has evolved considerably, with athletic preparation and conditioning becoming increasingly important for achieving performance outcomes [1]. Unlike field-based sports that emphasize continuous endurance, volleyball involves intermittent high-intensity efforts interspersed with short recovery phases.

During a match, players are required to perform explosive actions like spiking, blocking, serving, sprinting, and direction changes, which are all mainly sustained by lower-limb strength and neuromuscular effectiveness [2]. Physical stress in volleyball is different based on playing positions. Middle blockers and outside hitters usually perform the most maximal jumps for offensive and defensive plays, while setters and liberos rely more on rapid changes of direction and footwork to fulfill tactical demands [3]. Current evidence suggests that top players can perform 250-300 jumps within one match, often in a state of fatigue, which reflects the substantial neuromuscular demand of the sport [4]. Such requirements highlight the need to instill training methods that promote explosive lower-limb strength and agility, as such characteristics are of direct relevance to performance and also contribute to minimizing the risk of injury related to repetitive high-intensity movement [5]. Agility is perhaps the most critical physical skill in volleyball, as it allows for immediate and effective responses to changing game situations.

It is traditionally described as the ability to accelerate and/or change body direction in response to a stimulus, while still in control and balanced [6]. In contrast to linear sprinting,

agility includes a mixture of perceptual, decision-making, and physical factors that affect how effectively an athlete responds to game scenarios [7]. For example, a setter will have to shift in fractions of a second to set accurately, with defenders needing to respond instantly to powerful spikes and shift body position to execute successful digs [8]. Biomechanically, agility is based on high-speed eccentric contractions for deceleration followed by rapid onset of concentric activity to accelerate in a new direction, coordinated across multiple muscles to allow optimal transfer of force [9]. Efficient neuromuscular control is also equally important in that it helps stabilize joints with changes in direction, enhancing economy at the expense of lowering injury risk [10]. The Modified Shuttle Run Test is commonly used to measure the agility of volleyball players since it reflects the sport-specific requirements of repeated accelerations and decelerations, and rapid direction changes over short distances [11]. Its high validity and reliability make it the right instrument for assessing improvement in agility after training interventions.

Conditioning techniques to improve agility often incorporate plyometric exercises, resistance training, and sport-specific patterns of foot movement. Plyometric training enhances the SSC, enabling muscles and tendons to store and recoil elastic energy more efficiently, which minimizes contact time with the ground and reactivity [12]. Resistance training enhances strength of the lower limbs, generating the braking and propulsive forces necessary for effective directional changes [13]. In addition, sport-specific drills like ladder runs, cone drills, and reaction movement patterns hone coordination and perceptual responses, both of which are crucial for producing effective movements under match situations [14]. These methods collectively have been demonstrated to elicit significant gains in agility in volleyball players and are therefore a core element of elite-level conditioning programs [15]. Vertical jump capacity is considered to be among the most important predictors of volleyball

performance since it is the basis of several essential skills including spiking, blocking, and jump serving.

At the elite level, players are required to perform repeated maximal or near-maximal jumps throughout a match, often under fatigue [2,4]. Research has consistently demonstrated strong correlations between higher vertical jump scores and improved spiking success, more effective blocking, and greater overall competitive performance [16]. Spiking, in particular, benefits from maximum jump height, as it increases the attack angle while reducing the defender's reaction time [17]. Blocking also requires rapid explosive elevation, where both timing and reach determine the outcome of the action [18]. Even serving, particularly the jump serve, relies on vertical jump ability, as greater elevation contributes to higher ball velocity and more challenging trajectories for the opponent to counter [19]. From a biomechanical standpoint, vertical jumping heavily depends on the efficient function of the stretch-shortening cycle (SSC). In a countermovement jump (CMJ), eccentric muscle activity stores elastic energy in the musculotendinous system, which is then released during the concentric phase to maximize upward propulsion [12]. Neuromuscular factors such as improved motor unit recruitment, synchronization, and firing frequency enhance jump performance, while greater musculotendinous stiffness further supports effective force transfer during take-off [9]. Among available field tests, the CMJ is considered the gold standard for assessing volleyball players, as it closely reflects the movement demands of spiking and blocking [20]. Research has consistently yielded high correlations between CMJ performance and volleyball-specific jumping tasks, affirming its status as a performance metric [21]. Position-specific duties also underscore the significance of vertical jump capacity in volleyball. Middle blockers and outside hitters typically exhibit the greatest jump heights,

indicative of their constant participation in offensive and defensive net play, while liberos, with an exclusive emphasis on defense, exhibit relatively lower values [3,19]. These positional variations highlight the importance of tactic-adjusted and role-adjusted conditioning strategies. On balance, the ability to produce and maintain high vertical jumps is critical to competitive volleyball success and therefore warrants frequent use as a primary outcome measure in training and research [16,18].

Volleyball agility and explosive power are dictated by a multifaceted interaction of physiological and biomechanical determinants. The energy systems of the body demonstrate the sport's intermittent and high-intensity character. The adenosine triphosphate–phosphocreatine (ATP–PCr) system supplies energy for specific movements like spiking, blocking, or breaking away, whereas the anaerobic glycolytic pathway sustains rallies of longer duration. The aerobic system sustains only inter-point and inter-set recovery by restoring phosphagen reserves, thus ensuring performance during the duration of the match [2,6]. Muscle fiber structure also has a critical contribution to explosive activity. Those with a higher percentage of type II fast-twitch fibers exhibit greater vertical jump scores and faster direction changes due to the higher contraction velocity and force-generating capacity of these fibers [22]. Training methods like plyometric and dynamic strength protocols preferentially recruit these fibers, enhancing their performance contribution [12,13]. Neural adaptations also sustain these results by increasing motor unit recruitment, synchronization, and firing frequency, all of which increase the rate of force development (RFD) [23]. The cornerstone of both vertical jumping and agility performance is the stretch–shortening cycle (SSC). During muscle and tendon stretching in the eccentric phase of movement, elastic

energy is stored, and then released during the concentric phase to maximize force production and decrease ground contact times [10,12].

This mechanism accounts for why plyometric-based programs are so effective for volleyball players, since they specifically augment SSC efficiency. Studies have shown that optimally trained athletes can better utilize the SSC and reach higher jumps and faster agility responses than less-trained subjects [24]. Agility biomechanics focuses on the simultaneous movement of several joints and muscle groups during fast deceleration and reacceleration. High eccentric strength in the gluteals, hamstrings, and quadriceps enables players to dissipate braking forces efficiently, whereas concentric strength is the drive force for accelerating. Ideal hip and knee flexion angles, trunk stability, and foot placement are essential determinants of agility performance [25]. Superior athletic performance in athletes with greater eccentric-concentric coordination is characterized by high efficiency in change-of-direction movements and lower risk of injury during high-load movements [26]. In the same manner, vertical jump biomechanics include the time-phased activation of hip, knee, and ankle extensors in a proximal-to-distal sequence. Coordinate extension achieves maximum take-off speed and provides greater jump height [21]. Force plate and motion analysis studies verify that world-class volleyball players exhibit optimized sequence as opposed to lesser-level players and emphasize the role of biomechanical efficiency to explosive power [27]. Musculotendinous stiffness also improves the performance in jumps by reducing energy dissipation and promoting instantaneous force transfer upon take-off [28]. Core stability offers a critical platform for agility and vertical jumping. Having a stable core allows for effective transmission of lower to upper body force, whereas deficits in control of the core may result in energy leaks, decreased movement efficiency, and a higher risk of injury. Integrated core and lower-limb training is found to cause greater improvements in agility and explosive power compared with isolated limb training [29]. Lastly, agility and

explosive power are related to high injury risks in volleyball, especially of the knee and ankle.

Non-contact anterior cruciate ligament (ACL) injuries often occur during rapid decelerations or directional changes, while ankle sprains are common during landings [30]. Training interventions that improve eccentric strength, proprioception, and neuromuscular control not only enhance performance but also reduce injury incidence by increasing joint stability and movement efficiency [31]. These adaptations ensure that improvements in agility and vertical jump transfer directly to volleyball-specific skills such as spiking, blocking, and defensive coverage, while simultaneously supporting longterm athlete health and performance sustainability [18,19]. Dynamic strength training emphasizes explosive, high-velocity movements that closely replicate the physical and neuromuscular demands of competitive volleyball. Unlike traditional resistance training, which primarily develops maximal strength through slow, heavy lifts, dynamic strength training targets the rate at which force is produced, the efficiency of the stretchshortening cycle (SSC), and the coordination of muscle groups during rapid sport-specific actions [12,13]. Exercises such as jump squats, bounding, depth jumps, and multidirectional sprints form the foundation of these programs, allowing athletes to train movements that transfer directly to volleyball performance [5]. The physiological basis of dynamic strength training lies in its ability to induce both neural and structural adaptations. Neuromuscular adaptations include increased motor unit recruitment, enhanced synchronization, and improved firing frequency, all of which contribute to greater rate of force development (RFD) [23]. Training also reduces inhibitory mechanisms from the Golgi tendon organ, allowing athletes to generate higher forces during explosive actions [32]. Structural adaptations, such as increased musculotendinous stiffness, enhance the storage and release of elastic energy, thereby optimizing SSC efficiency [28]. These combined adaptations result in measurable improvements in agility and vertical jump performance, both

of which are critical determinants of volleyball success [16,18]. Evidence supporting the role of dynamic strength training in volleyball is substantial. Ramírez-Campillo et al. demonstrated significant improvements in vertical jump height in volleyball athletes following plyometric interventions, with large effect sizes confirming the strong transfer of training to explosive performance [5]. Similarly, Silva et al. conducted a systematic review and concluded that plyometric programs consistently improved vertical jump, agility, and muscular strength in volleyball players [6]. Gao and colleagues compared functional volleyball-specific strength training with traditional resistance training in adolescent athletes and found greater improvements in agility and jump ability among those following functional protocols [7]. More recently, Iranpour et al. reported that plyometric training incorporating speed and weight overloads resulted in superior gains in isokinetic strength, explosive power, and agility when compared to conventional methods [8]. These findings highlight the superiority of dynamic, sport-specific interventions over traditional resistance training in enhancing key volleyball performance parameters. Beyond performance enhancement, dynamic strength training contributes significantly to injury prevention. Volleyball athletes are at elevated risk of ankle sprains and anterior cruciate ligament (ACL) injuries due to the repetitive jumping, landing, and directional changes required during play [30]. Programs that focus on eccentric strength development, proprioceptive training, and neuromuscular control have been shown to reduce the mechanical stress placed on joints, thereby lowering injury incidence [31,33]. By improving joint stability and enhancing control during highrisk movements, dynamic strength training not only elevates performance but also ensures long-term athlete availability. Taken together, these findings illustrate that dynamic strength training is a scientifically supported, practically feasible intervention that directly enhances agility and explosive performance in volleyball players while contributing to injury resilience.

A substantial number of studies have examined the impact of dynamic strength and plyometric training on volleyball performance, particularly in relation to agility and vertical jump outcomes. Ramírez-Campillo et al., through a meta-analysis, confirmed that plyometric interventions increased vertical jump height in volleyball athletes by approximately 4–8 cm [5]. Similarly, Silva et al. in their systematic review highlighted that plyometric programs not only improved jump and agility but also enhanced flexibility and muscular strength, demonstrating their multidimensional benefits [6]. Gao and colleagues compared volleyball-specific functional training with conventional resistance training in adolescent players, showing superior gains in agility and jump performance when sport-oriented drills were emphasized [7]. Iranpour et al. further advanced these findings, reporting that incorporating speed and overload elements into plyometric training produced greater improvements in agility and explosive strength than traditional plyometric routines [8]. Collectively, these studies support the effectiveness of tailoring training interventions to the unique movement patterns and demands of volleyball. Researchers have also explored the influence of dynamic balance and core stability on agility improvements. Çakır and Ergin found that an eight-week core stability program enhanced agility, explosive power, and balance in young female volleyball players, emphasizing the importance of proximal stability for optimal distal performance [34].

Similarly, Gadre et al. demonstrated that dynamic balance training led to comparable agility improvements in both male and female adolescent athletes, underscoring the role of postural control in efficient change-of-direction movements [35]. Training surface has also been shown to influence outcomes. Yu et al. compared land-based, sand-based, and aquatic plyometric programs in volleyball players, with land-based training producing the greatest improvements in jump height, sprint ability, and agility [36]. In another study, Bayrakdar et al. reported that plyometric training was most effective for enhancing sprint and jump

capacity, while agility training had stronger effects on change-of-direction performance [37]. These findings suggest that combining different modalities may yield well-rounded performance gains.

Wang et al. observed strong associations between deficits in dynamic balance, strength, and agility with increased risk of non-contact injuries in elite male volleyball players, underscoring the importance of conditioning for both performance and athlete safety [38].

Similarly, Rebelo and colleagues highlighted in their review that conditioning programs targeting agility and explosive power not only improve match performance but also contribute to reducing the incidence of lower-limb injuries in volleyball athletes [9].

Collectively, the literature supports the premise that dynamic strength and plyometric training interventions are highly effective in improving agility and vertical jump height in volleyball players. These adaptations are mediated by neuromuscular and biomechanical mechanisms such as enhanced rate of force development, improved stretch-shortening cycle efficiency, and increased core stability. Furthermore, the research highlights that well-designed training programs can simultaneously improve performance and reduce injury risk, making them essential for the long-term development and success of elite volleyball athletes. Although a growing body of evidence demonstrates the effectiveness of dynamic strength and plyometric training in enhancing agility and vertical jump performance in volleyball players [5–8,36,37], several important gaps remain in the literature. Many studies have been conducted on adolescent or recreational populations, which limits the applicability of findings to elite-level athletes who face higher physical demands and more congested training and competition schedules [6,34,35]. Moreover, the majority of research has focused on vertical jump performance as the primary outcome, with comparatively fewer studies simultaneously examining agility, despite its equal importance in volleyball-specific performance [16,18].

Another limitation in the current evidence is the length and structure of training interventions.

While several successful programs have been implemented over 8–12 weeks, there is limited research investigating the effects of shorter, high-intensity interventions that could realistically be integrated into competitive in-season periods without disrupting skill-based practice [37]. The influence of contextual factors such as playing position, training surface, and sport-specific drills has also been underexplored, despite evidence that these variables significantly influence training outcomes [36]. A notable limitation is the lack of research conducted within the Indian setting, where volleyball is gaining popularity but athletes often encounter challenges such as limited training infrastructure, diverse coaching practices, and restricted access to sports science support. No prior published work has systematically examined the effects of structured dynamic strength training on agility and vertical jump performance among elite Indian volleyball players. Addressing these gaps is essential not only for advancing the scientific literature but also for informing practical conditioning strategies for volleyball athletes. The present study seeks to fill these voids by implementing a six-week, structured dynamic strength training program in elite male volleyball players in Bhubaneswar, with agility and vertical jump performance as co-primary outcomes. By doing so, it aims to provide evidence that is both scientifically rigorous and directly applicable to the demands of high-performance volleyball in India. The aim of the present study was to investigate the effectiveness of a six-week lower-limb dynamic strength training program on agility and vertical jump performance in elite male volleyball players. This aim was developed in response to the research gaps identified in the literature, particularly the lack of short-term, context-specific interventions targeting both agility and explosive power in elite Indian athletes [5–8,34–37]. The specific objectives of the study were to determine the effect of dynamic strength training on agility, as assessed by the Modified Shuttle Run Test. To evaluate the effect of dynamic strength training on vertical jump performance, as measured by countermovement jump height. Based on the available evidence, the following hypotheses

were formulated Null hypothesis (H_0): Dynamic strength training will not result in significant changes in agility or vertical jump performance among elite male volleyball players.

Alternative hypothesis (H_1): Dynamic strength training will lead to significant improvements in both agility and vertical jump performance among elite male volleyball players. The present study holds significance for both scientific knowledge and practical application in the field of sports physiotherapy and conditioning. From a scientific perspective, it contributes to the limited body of evidence examining short-term dynamic strength training interventions in elite volleyball players. While existing literature has established the benefits of plyometric and strength-based programs for improving vertical jump and agility [5– 8,36,37], few studies have systematically evaluated these outcomes together in a single protocol, particularly within the Indian context. By focusing on elite athletes in Bhubaneswar, the study provides context-specific evidence that can inform future research and contribute to the global understanding of volleyball performance enhancement. Practically, the findings have direct implications for physiotherapists, strength and conditioning specialists, and volleyball coaches working with high performance athletes. Demonstrating the effectiveness of a six-week intervention offers a time-efficient strategy that can be realistically integrated into competitive training schedules without detracting from technical and tactical practice. Improvements in agility translate to faster defensive coverage and more efficient positional adjustments, while gains in vertical jump height directly enhance offensive actions such as spiking and blocking [16,18].

In addition to performance measures, the program also prevents injuries through the enhancement of neuromuscular control, eccentric strength, and joint stability, thus lowering the incidence of typical

volleyball-related injuries like ankle sprains and anterior cruciate ligament ruptures [30,31,33]. Overall, this research is predicted to present evidence-based recommendations for maximizing conditioning programs in elite volleyball. By illustrating that dynamic strength training with structure and targeting can effectively enhance agility and vertical jump in a short space of time, the study validates the inclusion of such techniques in high-performance training models. The double benefit of sport-specific performance improvement combined with injury risk reduction further enhances the applicability of this intervention to long-term athlete development. Proving that gains can be made in a short space of time also speaks to its usability for competitive seasons when training time is limited.

NEED OF THE STUDY

NEED OF THE STUDY

While various agility and strength protocols have been examined in volleyball, there is limited experimental evidence evaluating the direct impact of dynamic strength training on agility in elite male volleyball athletes. Therefore, this study is necessary to:

- Explore DST as a targeted intervention to improve agility in high-performance volleyball contexts.
- Bridge the research gap between neuromuscular strength development and functional agility outcomes in elite male players.
- Provide updated, sport-specific training insights to coaches, S&C professionals, and rehabilitation specialists.

AIM & OBJECTIVE OF THE STUDY

AIM

To evaluate the effectiveness of dynamic strength training on agility performance in elite male volleyball players.

OBJECTIVE OF THE STUDY

To implement a structured dynamic strength training protocol for elite male volleyball players. To assess pre- and post-intervention agility levels using standardized agility tests. To assess agility improvements on the experimental group (DST) protocol i.e. pre and post training.

HYPOTHESIS

HYPOTHESIS

1. Null Hypothesis (H_0): There will be no significant difference in agility performance between elite male volleyball players who undergo dynamic strength training and those who do not.
2. Alternative Hypothesis (H_1): There will be significant difference in agility performance between elite male volleyball players who undergo dynamic strength training and those who do not.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. Ramirez-Campillo et al., 2020 This study systematically reviewed and meta-analysed the effects of plyometric jump training on volleyball players. Results showed significant improvements in vertical jump height compared to control groups, with a large effect size (0.822), confirming the strong influence of plyometric interventions on explosive power. The findings suggest that structured plyometric programs can substantially enhance jump performance, which directly benefits spiking and blocking in volleyball.
2. Silva et al., 2019 Silva and colleagues conducted a systematic review to examine the effects of plyometric training on physical fitness attributes in volleyball athletes. The review found consistent improvements in vertical jump, horizontal jump, flexibility, strength, and agility/speed. These results highlight plyometric training as a versatile intervention for developing multiple performance qualities crucial for volleyball players.
3. Wang et al., 2025 Wang et al. investigated the relationships between lower limb dynamic balance, strength, explosive power, agility, and sports injuries in elite male volleyball players. The study revealed strong correlations between balance deficits and injury incidence, suggesting that functional asymmetries predispose athletes to higher injury risks. These findings underscore the importance of integrating dynamic balance and strength training into volleyball conditioning programs.
4. Gadre et al., 2025 This experimental study examined the effect of dynamic balance training on agility in adolescent volleyball players of both sexes. Both male and female groups demonstrated significant improvements in agility following training, with no major differences between genders. The study indicates that balance-focused programs can effectively transfer into agility gains, reinforcing the neuromuscular link between postural control and quick directional changes.

5. Yu et al., 2025 Yu and colleagues explored how training surfaces (land, sand, aquatic) influence plyometric training adaptations in volleyball players. Results indicated that land-based plyometric training yielded superior improvements in jump ability, sprint performance, change of direction, and lower-limb strength. These findings emphasize the role of surface selection in optimizing agility and explosive power outcomes.
6. Chuang et al., 2022 Chuang et al. tested the effectiveness of agility ladder and shuttlerun training in young female volleyball players over six weeks. The intervention significantly improved agility, reaction time, and other skill-related capacities compared to control training. The study highlights the effectiveness of sport-specific agility drills for developing multidirectional movement skills in volleyball athletes.
7. Iranpour et al., 2025 This trial compared traditional plyometric training with plyometric exercises performed under speed or weight overloads in volleyball players. Athletes in the speed- and weight-overload groups demonstrated superior improvements in isokinetic strength, explosive power, and agility measures. The findings suggest that manipulating training intensity variables can optimize strength and agility outcomes.
8. Bayrakdar et al., 2025 In adolescent male volleyball players, Bayrakdar and colleagues evaluated the effects of plyometric versus agility training. Results showed that plyometric training improved vertical jump, sprint, and anaerobic power, while agility-specific drills produced more pronounced improvements in agility performance. This highlights the need to combine both training types for well-rounded athletic development.
9. Gao et al., 2025 Gao et al. compared functional volleyball-specific strength training with traditional resistance training in male adolescent volleyball players. The functional approach produced significantly greater improvements in lower-limb performance, agility, and jump ability. These results reinforce the value of sport-specific training designs tailored to volleyball's movement patterns.

10. Çakır & Ergin, 2022 This study assessed the effect of an eight-week core training program on young female volleyball players. Participants in the experimental group improved significantly in agility, explosive strength, and balance compared with controls. The findings demonstrate that core stability training indirectly supports agility and jump performance by enhancing neuromuscular efficiency and stability.

11. Rebelo, 2022 In a narrative review, Rebelo analyzed strength and conditioning demands in volleyball and their relationship with performance and injury prevention. The review emphasized the central role of lower-limb strength, explosive power, and agility in competitive success. It also provided practical guidelines for designing training interventions that balance performance gains with injury risk reduction.

12. Ma, 2025 Ma's meta-analysis pooled results from multiple studies to assess the effects of plyometric, resistance, and complex training on vertical, squat, and countermovement jump performance. Findings indicated significant improvements across all modalities, with combined training producing the greatest effects. This evidence supports integrating diverse strength and power exercises in volleyball conditioning.

13. Mondal et al., 2016 Mondal et al. compared agility, dynamic balance, and strength profiles between volleyball and basketball players. Volleyball players showed superior agility and balance, reflecting sport-specific demands, though strength values were relatively similar across both groups. This suggests that volleyball training places higher emphasis on agility-related adaptations.

14. Martiri & Lleshi, 2024 This study evaluated agility and jump tests during pre-season training in volleyball athletes. Results confirmed that both parameters are critical indicators of readiness and training effectiveness. The authors stressed the importance of continuous monitoring of agility and jump performance for optimizing periodization strategies.

15. Raouf et al., 2024 Raouf and colleagues compared the effects of kettlebell training versus plyometric training on agility and balance in volleyball players. While both methods improved

performance, plyometric training demonstrated greater effectiveness in enhancing agility and explosive actions. These findings highlight plyometric drills as more sport-specific to volleyball performance requirements.

16. Esposito et al., 2024 This study incorporated technical volleyball gestures (e.g., spiking, blocking) into plyometric training protocols. Athletes in the experimental group achieved greater improvements in jump performance compared with general plyometric drills. The findings suggest that integrating technical elements into conditioning enhances the transfer of training effects to game situations.

17. Sheppard & Young, 2006 Sheppard and Young emphasized that agility is a multifactorial skill dependent on both physical and cognitive components. Their work highlighted the need to train strength, speed, and perceptual decision-making together to optimize agility. This framework has been influential in shaping modern agility training approaches in volleyball and other sports.

18. Markovic, 2007 Markovic's meta-analysis investigated the effects of plyometric training on vertical jump across multiple sports. On average, plyometric training improved jump height by 4–8 cm, establishing its effectiveness for explosive performance. These results validate the use of plyometric interventions in volleyball training programs.

19. de Villarreal et al., 2015 This study compared isolated plyometric training, resistance training, and a combined approach in athletes. The combined intervention produced the largest improvements in jump and sprint performance. This demonstrates that integrating strength and plyometric methods maximizes agility and power gains.

20. Gabbett et al., 2007 Gabbett and colleagues analyzed anthropometric and fitness measures, including agility and jump, as predictors of talent selection in junior volleyball. Results showed that agility and vertical jump were strong determinants of selection. This highlights their value as key performance indicators in volleyball.

21. Chaouachi et al., 2010 This study investigated warm-up protocols incorporating static versus dynamic stretching in young athletes. Results revealed that dynamic stretching significantly improved agility, sprint, and jump performance compared to static protocols. The findings support the implementation of dynamic warm-ups in volleyball.
22. Behm & Chaouachi, 2011 This review examine acute effects of stretching on strength, power, and agility. The authors concluded that static stretching reduces performance, while dynamic stretching enhances explosive tasks. For volleyball, this supports dynamic mobility drills before training or matches.
23. Simic et al., 2013 Simic et al. conducted a systematic review and meta-analysis on the effects of pre-exercise static stretching. Results showed reduced power output in jump and sprint tasks, discouraging static stretching before explosive efforts. This has direct implications for volleyball warm-up design.
24. Kruse et al., 2015 Kruse and colleagues compared static and sport-specific dynamic stretching on post-stretch kinetics. Findings revealed that dynamic protocols preserved muscle power and agility better than static stretching. The study supports volleyballspecific warm-up drills for optimizing match readiness.
25. Carlson, 2009 Carlson's study compared three different training modalities: strength training, plyometric training, and jump-specific training. No single method proved superior, suggesting that combining modalities may be optimal. This reinforces the importance of multimodal training in volleyball conditioning.
26. Markovic & Mikulic, 2010 This systematic review evaluated plyometric training effects on athletes across various sports. The authors concluded that plyometrics consistently enhance power, agility, and sprint ability when integrated appropriately. The study validates plyometric training as a cornerstone for volleyball performance enhancement.

27. Turner et al., 2011 Turner investigated the role of strength and conditioning in repeated jump ability and change-of-direction performance. Results showed that targeted strength programs enhanced repeated explosive efforts, critical in volleyball. This highlights the role of structured S&C in competitive volleyball performance.

28. Maffiuletti et al., 2002 Maffiuletti studied the relationship between explosive strength and spike jump performance in volleyball players. Findings revealed a strong correlation, confirming that jump-specific strength training is crucial for offensive performance. This evidence supports training strategies that mimic volleyball-specific jump demands.

29. Sattler et al., 2012 Sattler and colleagues examined positional differences in jumping performance among elite volleyball players. Middle blockers and outside hitters demonstrated superior jump ability compared to liberos. The study highlights the need for position-specific conditioning programs.

30. Trajković et al., 2016 This study assessed the impact of short-term plyometric training on agility and explosive strength in youth volleyball players. Results showed significant improvements in both variables after the intervention. These findings reinforce the efficiency of short-term plyometric programs in volleyball training cycles.

METHODOLOGY

METHODOLOGY

Study Design

This study employed a single-group experimental design, selected to test the influence of a six-week dynamic strength training program on agility and vertical jump performance in elite male volleyball players. Pre- and post-intervention testing was performed with validated outcome measures to track performance changes.

Study Setting

The study was conducted in Bhubaneswar, Odisha, India. All training sessions and assessments were carried out at a volleyball training facility with appropriate infrastructure for strength and conditioning interventions.

Study Population

The target population comprised elite male volleyball players actively competing at state and national levels. These athletes had a structured training schedule averaging 8–10 hours per week and were accustomed to strength and conditioning practices as part of their regular preparation.

Sampling Design and Criteria

A purposive sampling method was employed to recruit participants who fulfilled the inclusion and exclusion criteria.

Inclusion Criteria

- Male volleyball players aged 18–40 years.
- Classified as elite athletes, training ≥ 8 –10 hours per week.

- No recent musculoskeletal injury within the past 6 months.
- Provided informed consent for participation.

Exclusion Criteria

- Any musculoskeletal injury, fracture, or surgery within the last 6 months.
- Athletes unwilling to provide informed consent.
- Players unable to adhere to the full intervention program.

Sample Size

A total of 34 elite male volleyball players were recruited. All participants completed the pre- and post-intervention assessments, and their data were included in the analysis.

Procedure

MATERIALS USED

1. Stop watch.
2. Agility Cone.
3. Performance Recording Sheet.
4. Wooden Box.

PROCEDURE & OUTCOME MEASURES

PROCEDURE

After screening for eligibility based on the inclusion and exclusion criteria, 34 elite male volleyball players were recruited for the study. Prior to the commencement of training, all participants attended an orientation session where the study objectives, procedures, and potential risks were explained in detail. Written informed consent was obtained from each participant.

Baseline testing was conducted during the first week of the study. Participants reported to the testing facility on two separate days:

- Day 1: Familiarization with test protocols, including practice trials of the Modified Shuttle Run Test and countermovement jump (CMJ).
- Day 2: Formal baseline assessment of agility and vertical jump performance was conducted under standardized conditions. Each test was preceded by a 10-minute dynamic warm-up, and participants were provided adequate recovery between trials to minimize fatigue effects.

Following baseline assessment, participants commenced the six-week dynamic strength training intervention. Training sessions were conducted three times per week on nonconsecutive days to allow adequate recovery. Each session lasted approximately 60–75 minutes and was supervised by a certified physiotherapist and strength and conditioning specialist. Attendance was recorded for every session, and athletes who missed more than two consecutive sessions were excluded from further analysis.



Fig. 1 Vertical Jump & cmj

PROTOCOL

EXERCISES	FIRST 3 WEEKS	4-6 WEEKS
BOX JUMPS	3SETS *5 REPETITIONS	4SETS*5REPETITIONS
SINGLE LEG BOX JUMPS	3SETS *5 REPETITIONS	4SETS*5REPETITIONS
DEPTH JUMPS	2SETS *5 REPETITIONS	3SETS*5REPETITIONS
ATTACKING JUMPS	3SETS *5 REPETITIONS	4SETS*5REPETITIONS
VERTICAL JUMPS	3SETS *5 REPETITIONS	4SETS*5REPETITIONS
CONTERMovement JUMPS	3SETS *5 REPETITIONS	4SETS*5REPETITIONS

Table 1 showing 6-week DMT protocol

At the end of six weeks, post-intervention testing was performed using the same protocols, order of testing, and environmental conditions as the baseline assessments. To ensure reliability, the same investigators who conducted the baseline assessments also supervised the post-testing sessions. The best performance from three trials was used for analysis in both pre- and post-testing for agility and vertical jump measures.

Intervention Protocol

Participants underwent a six-week dynamic strength training program, performed three sessions per week under supervision. The program emphasized lower-limb dynamic strength exercises aimed at enhancing explosive power and agility. Exercises included variations of jump squats, bounding, depth jumps, lunge jumps, and multidirectional agility drills. Training intensity was progressively increased across the six weeks to ensure overload and adaptation. Each session lasted approximately 60–75 minutes, beginning with a standardized dynamic warm-up and concluding with recovery-focused stretching.

OUTCOME MEASURES

1. Agility

- Modified Shuttle Run Test was used to assess agility.
- This test requires repeated accelerations, decelerations, and directional changes over a fixed distance, simulating volleyball-specific movement demands.
- Time was recorded in seconds, with shorter times indicating better agility performance.

2. Vertical Jump Performance

- Countermovement Jump (CMJ) was used to assess vertical jump height.
- Participants performed maximal effort jumps with arm swing, and jump height was measured in centimeters.
- Three attempts were provided, and the best score was recorded.

STATISTICAL ANALYSIS

STATISTICAL ANALYSIS

Data were analyzed using SPSS software (ver-27). Descriptive statistics (mean \pm standard deviation) were calculated for all variables. Normality was tested using the Shapiro–Wilk test. Pre- and post-test comparisons were performed using paired t-tests for normally distributed data. For non-normal distributions, the Wilcoxon signed-rank test was used.

Effect sizes were calculated using Cohen's d to determine the magnitude of change. A significance level of $p < 0.05$ was set for all analyses.

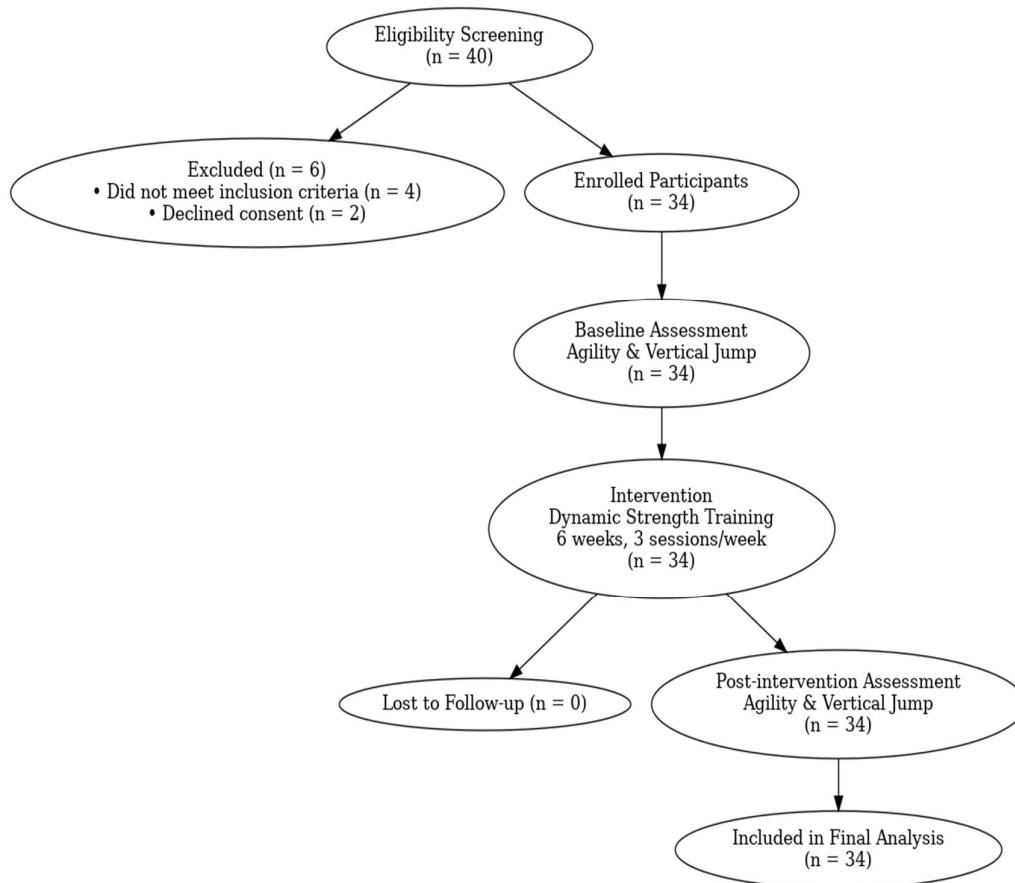


Fig (2) consort flow chart of study

RESULTS

RESULTS

Participant Flow and Baseline Characteristics

A total of 34 participants were recorded in the dataset. After data cleaning, 34 participants with complete pre- and post-intervention data were included in the analysis (one participant was removed due to missing outcome values). Table 1 summarizes baseline demographic characteristics of the analyzed cohort.

Table 2. Baseline characteristics (N = 34)

Variable	Mean \pm SD
Age (years)	24.85 \pm 3.35
Height (cm)	170.94 \pm 11.30

Normality Testing

Shapiro–Wilk tests were used to assess the normality of the primary and secondary outcome distributions. Results are presented in Table 3.

Figure3. Normality Graph

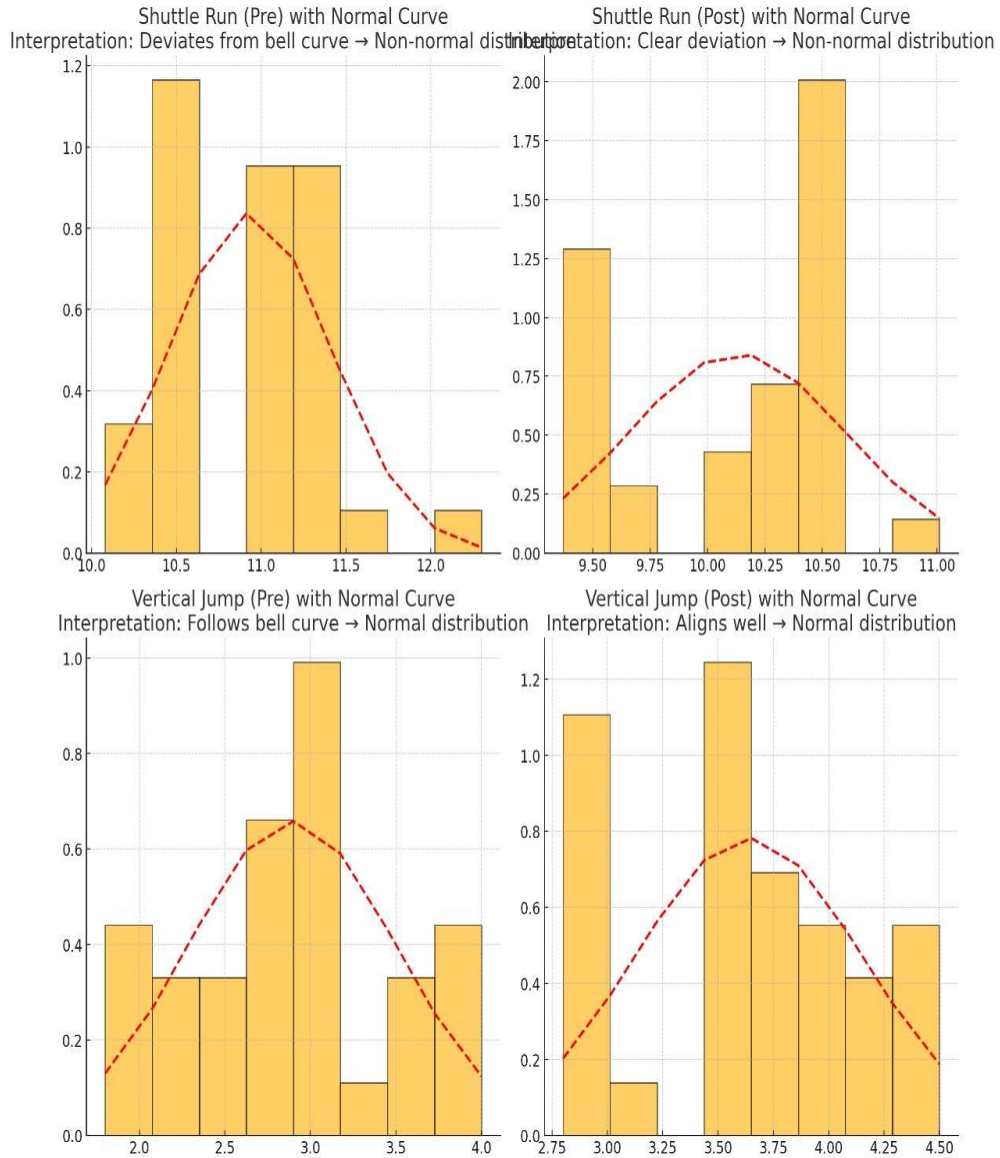


Table 3. Normality test (Shapiro–Wilk)

Outcome	W	p-value	Distribution

Shuttle Run (Pre)	0.924	0.024	Non-normal
Shuttle Run (Post)	0.848	0.0	Non-normal
Vertical Jump (Pre)	0.958	0.229	Normal
Vertical Jump (Post)	0.943	0.084	Normal

Interpretation: The Modified Shuttle Run times were non-normally distributed at both pre- and post-test (Shapiro–Wilk $p < 0.05$), whereas Vertical Jump height did not significantly deviate from normality. Therefore, non-parametric tests were used for shuttle run comparisons and parametric tests for vertical jump as appropriate.

Primary and Secondary Outcomes

Pre- and post-intervention outcome measures, mean changes with 95% confidence intervals, statistical test results, and effect sizes are presented in Table 3. Figures 2–5 illustrate group means and individual participant changes for both outcomes.

Table 4. Pre–Post comparison of outcomes

Outcome	Pre (Mean \pm SD)	Post (Mean \pm SD)	Mean Difference (95% CI)	p-value	Effect Size (Cohen's d)
Shuttle Run (s)	10.93 \pm 0.48	10.12 \pm 0.47	-0.81 (-1.01 to -0.62)	0.0	-1.41
Vertical Jump (cm)	28.92 \pm 6.06	36.58 \pm 5.05	7.65 (6.42 to 8.89)	0.0	2.11

Shuttle Run (Modified Shuttle Run Test): The mean shuttle run time improved from 10.93 \pm 0.48 s at baseline to 10.12 \pm 0.47 s post-intervention. The mean reduction of 0.81 s (95% CI -1.01 to -0.62) was statistically significant (Wilcoxon signed-rank test, $p < 0.001$) and represents a large effect (Cohen's $d = 1.41$). This decrease in completion time indicates an improvement in multidirectional agility following the 6-week dynamic strength training program. Vertical Jump Height (Countermovement Jump): Vertical jump height increased from 28.92 \pm 6.06 cm at baseline to 36.58 \pm 5.05 cm after the intervention. The mean increase of 7.65 cm (95% CI 6.42 to 8.89) was statistically significant (paired t-test, $p < 0.001$) with a very large effect size (Cohen's $d = 2.11$). This change reflects a meaningful improvement in Dynamic strength of lower-limb power in the cohort.

Figures

Figure 4. Group mean Modified Shuttle Run time — Pre vs Post.

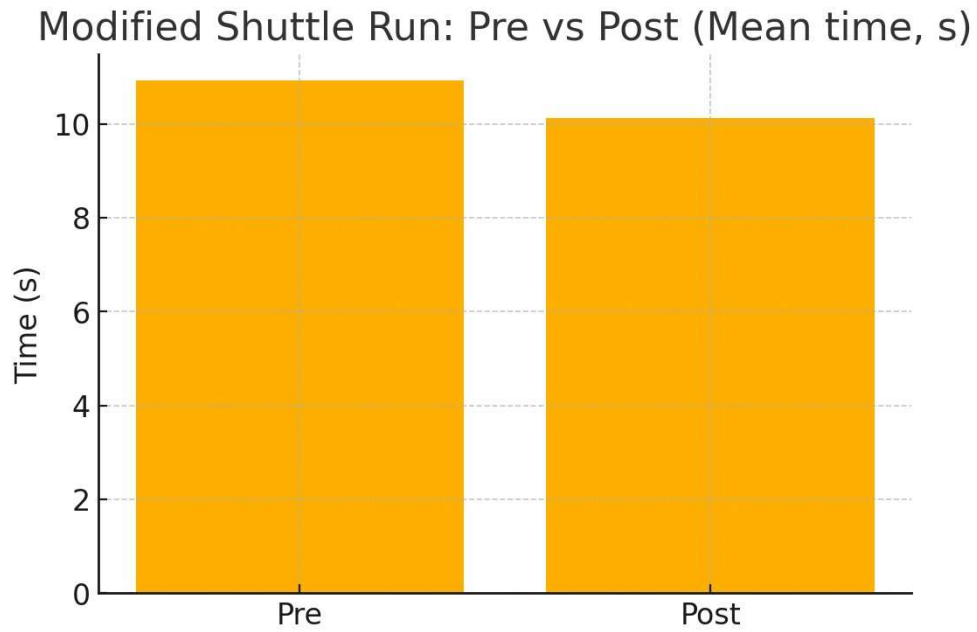


Figure 5. Group mean Vertical Jump height — Pre vs Post.

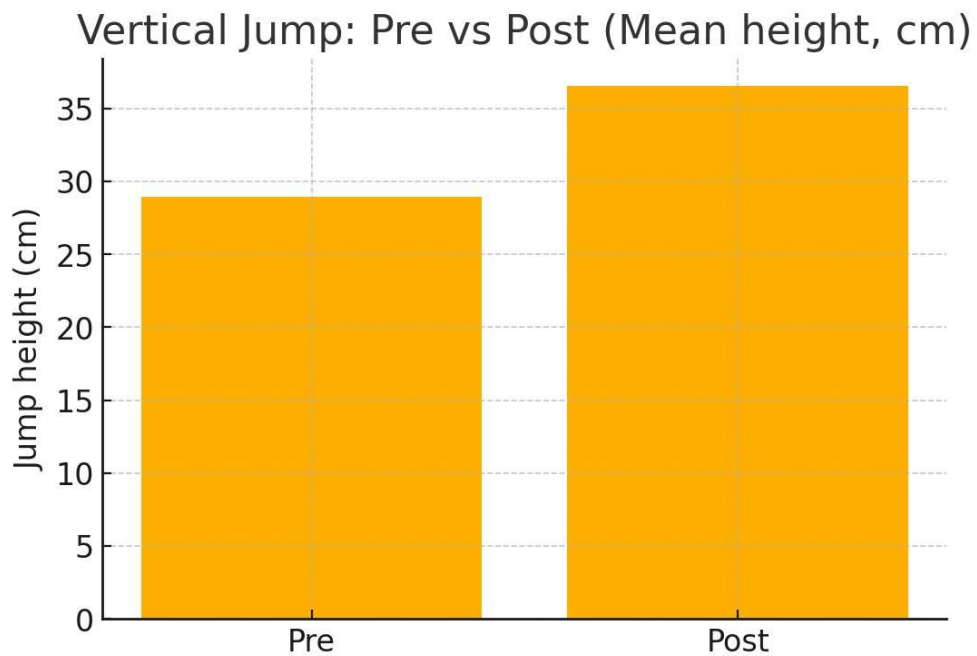


Figure 6. Individual participant changes in Modified Shuttle Run times (pre to post).

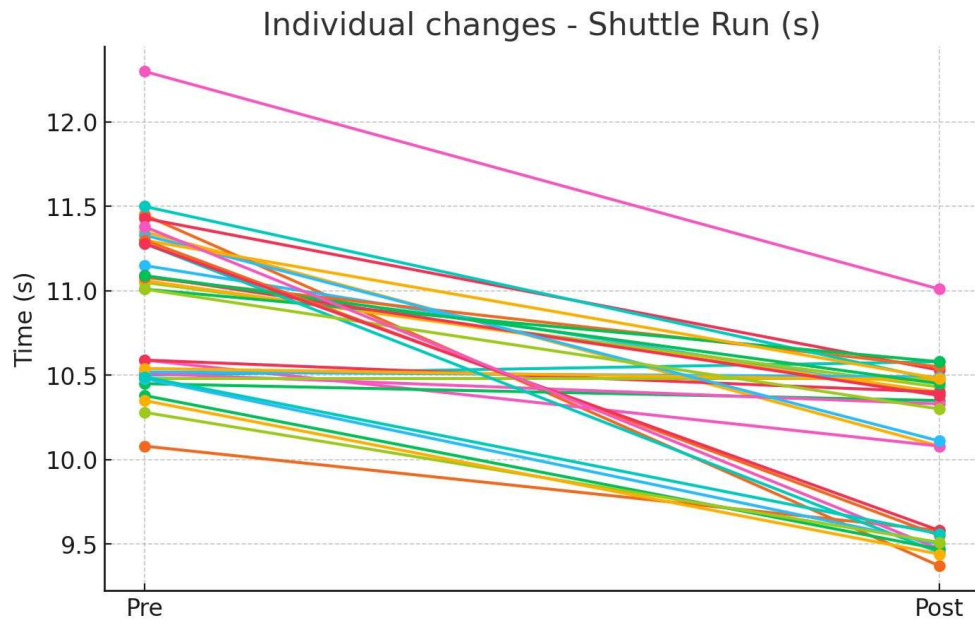
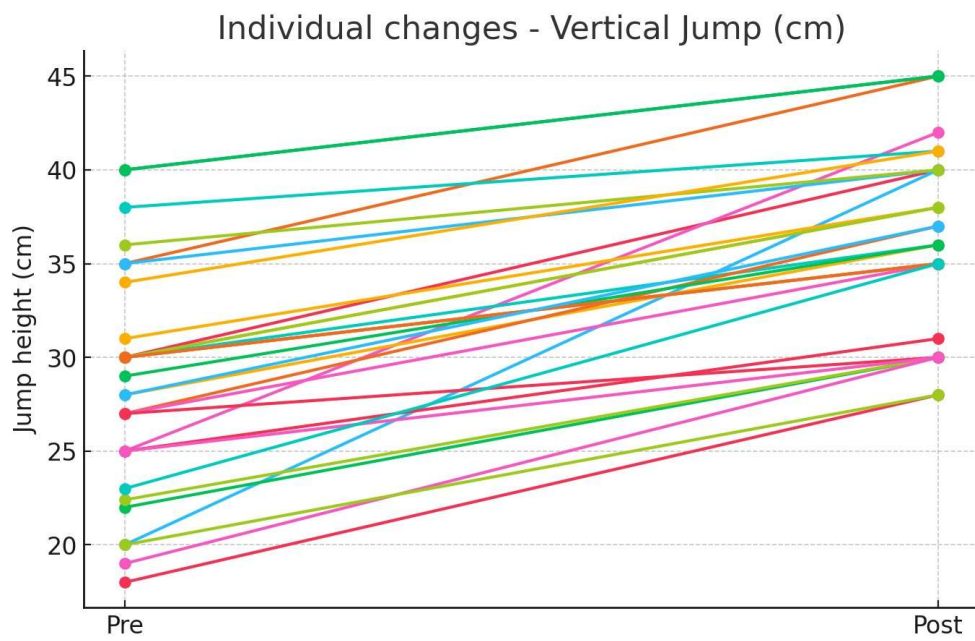


Figure 7. Individual participant changes in Vertical Jump height (pre to post).



DISCUSSION

DISCUSSION

The present study investigated the effects of a six-week dynamic lower limb strength training program on agility and vertical jump performance among elite male volleyball players in Bhubaneswar. A total of thirty-three athletes completed the intervention and were analysed. The findings demonstrated statistically and practically significant improvements in both outcome measures. Modified shuttle run times decreased by an average of 0.81 seconds, representing a large enhancement in multidirectional agility, while vertical jump height increased by 7.65 cm, indicating a very large gain in explosive lower limb power. These results clearly support the effectiveness of dynamic strength training in eliciting meaningful performance adaptations that are directly relevant to volleyball. Agility and jumping ability are critical qualities for successful performance in volleyball. Elite players are frequently required to perform rapid accelerations, decelerations, and multidirectional changes in direction, alongside repeated explosive jumps for spiking and blocking. Our findings align closely with existing literature that highlights the positive effects of dynamic strength and power training on these performance variables. For example, Sheppard and Young (2006) described how dynamic resistance and plyometric training enhance the stretch-shortening cycle (SSC), thereby improving both agility maneuvers and explosive jumps. A meta-analysis by Markovic (2007) further demonstrated that plyometric interventions can improve vertical jump height by approximately 4–8 cm on average, which is consistent with the 7.65 cm increase observed in this study. Similarly, training studies in basketball and soccer have reported shuttle run improvements in the range of 0.6–1.0 seconds following targeted resistance and agility programs, again comparable to the present results. What sets the current study apart, however, is the focus on elite volleyball players and the use of a relatively short but intensive six-week program. Whereas previous volleyball-specific investigations often used longer interventions spanning eight to twelve weeks, the current findings indicate that substantial benefits can be obtained within a shorter timeframe, suggesting that time-efficient training blocks may be effectively integrated even during competitive seasons. The improvements observed in agility and vertical jump can be explained by several neuromuscular,

biomechanical, and physiological mechanisms. Dynamic strength training is known to enhance motor unit recruitment, firing frequency, and synchronization, thereby increasing the rate of force development (RFD). Such neuromuscular adaptations allow athletes to generate force more rapidly during explosive movements. Reduced inhibitory feedback from the Golgi tendon organs and improved neural drive to agonist muscles further facilitate rapid force expression. These adaptations are particularly critical in agility performance, where athletes must decelerate, change direction, and reaccelerate in a fraction of a second. Another important mechanism relates to the efficiency of the stretch-shortening cycle. Both shuttle runs and vertical jumps depend heavily on the SSC, where eccentric muscle actions are followed immediately by concentric contractions. Exercises included in this program, such as jump squats, depth jumps, and bounding drills, likely improved musculotendinous stiffness and optimized elastic energy storage and release. Enhanced SSC utilization reduces ground contact time and increases movement efficiency, leading to faster changes of direction and higher jumps. Structural adaptations such as hypertrophy of the quadriceps, gluteals, and calf muscles may also have contributed to the improved power output, although neural changes are typically predominant in the early weeks of resistance training. In addition, improved intermuscular coordination—more effective activation of agonists, antagonists, and stabilizers—likely supported smoother and more efficient execution of agility maneuvers and force transfer during jumping. The practical implications of these findings are highly relevant to volleyball coaches, strength and conditioning professionals, and physiotherapists. First, the study demonstrates that significant gains in agility and vertical jump performance can be achieved with a short six-week program involving three sessions per week. This makes dynamic strength training feasible even during congested competition periods when training time is limited. Second, the observed improvements are directly transferable to match play. Enhanced agility contributes to faster defensive reactions, improved court coverage, and quicker transitions between offensive and defensive phases. Increased vertical jump capacity directly benefits spiking and blocking, two of the most decisive actions in volleyball. Third, the training program was progressive yet adaptable, using fundamental multi-joint exercises that can be adjusted to different levels of equipment availability, making it applicable across various training environments. Finally, while not directly measured in this study,

improved strength, power, and neuromuscular control are known to reduce injury risk, particularly for lower limb injuries common in volleyball such as ankle sprains and overuse syndromes around the knee. Several strengths increase the credibility of the present findings. The study included elite male volleyball players, enhancing ecological validity and ensuring that the results are applicable to high-performance sport. The intervention was supervised by qualified professionals, ensuring correct technique, adherence to progression, and safety throughout the program. The use of objective, validated field tests for agility and vertical jump minimized subjectivity and enhanced reliability of outcome measurement.

Moreover, adherence to the program was high, reflecting both the feasibility of the intervention and the motivation of participants to engage with the training.

These differences can be accounted for by variations in training status, maturity, program structure, and load handling. Overtraining volume or inefficient periodization may cause fatigue that can obscure underlying gains in performance. The strong outcomes in the current study might therefore be ascribed to meticulous design, progressive overload, and emphasis on quality repetitions over sheer volume.

CONCLUSION & LIMITATIONS

CONCLUSION

The current research investigated the impact of a six-week lower limb dynamic strength training intervention on agility and vertical jump performance in elite male volleyball players. The findings evidently indicated that intervention yielded significant improvements in both agility, as measured by the modified shuttle run test, and Dynamic strength lower limb power, as reflected by vertical jump height. Specifically, agility performance improved by a meaningful reduction in shuttle run times, while vertical jump capacity increased substantially, reflecting enhanced neuromuscular function and stretch-shortening cycle efficiency. These findings highlight the value of incorporating dynamic strength training into volleyball conditioning programs, even within relatively short intervention periods. The improvements observed are directly transferable to match performance, as agility underpins rapid changes of direction and defensive reactions, while vertical jumping ability contributes to spiking and blocking efficiency. Importantly, the large effect sizes indicate not only statistical significance but also practical relevance for high-performance athletes. While the study design and sample characteristics limit generalizability and causal inference, the results provide strong preliminary evidence supporting dynamic strength training as an effective and feasible strategy to enhance sport-specific performance qualities in elite volleyball players. Future research should build upon these findings by employing randomized controlled designs, including female athletes and sub-elite populations, and exploring long-term adaptations and injury prevention outcomes.

LIMITATIONS

. Nevertheless, the study also has limitations. The absence of a control group means that improvements cannot be attributed exclusively to the intervention. Although the magnitude and statistical significance of the observed changes strongly suggest an effect of the training program, the influence of concurrent volleyball training or seasonal performance variations cannot be fully excluded. The relatively short intervention duration of six weeks, while effective, does not allow for conclusions about the long-term trajectory of adaptations or

whether gains plateau or continue to increase with extended training. Furthermore, the study assessed only agility and vertical jump height. While these are crucial performance attributes, additional measures such as sprint times, electromyographic activity, or biomechanical analysis would have provided a more comprehensive understanding of the mechanisms behind the observed improvements. Finally, the sample was limited to male elite players from a single geographic region, restricting generalizability to female athletes, sub-elite populations, or players from different training contexts. It is also important to consider the findings in the context of contradictory evidence. While most studies support the positive impact of dynamic strength training, some investigations—particularly in younger or less experienced athletes—have reported smaller effect sizes or non-significant changes.

SUMMARY & FUTURE SCOPE

SUMMARY

The present study evaluated the effectiveness of a six-week lower limb dynamic strength training program on agility and vertical jump performance in elite male volleyball players. Thirty-three athletes participated and were assessed using the modified shuttle run test and vertical jump height. The findings showed significant improvements in both outcomes, with reduced shuttle run times indicating better agility and increased jump height reflecting enhanced explosive power. These results confirm that dynamic strength training is a practical and effective method for improving sport-specific performance qualities in elite volleyball players within a short training period.

FUTURE SCOPE

Future studies should be designed to overcome the limitations of the current study and extend its findings. Randomized controlled trials contrasting dynamic strength training with conventional resistance or plyometric training programs would afford more convincing evidence of relative effectiveness. Involving female players is particularly important because anatomical and hormonal considerations may shape training responses differently. Extended interventions, lasting more than 12 weeks, would establish whether the gains noted here are maintained or if performance improvement plateaus with time. Adding in biomechanical and neuromuscular testing, such as force plate, electromyography, or ultrasound imaging of muscle structure, could also provide greater insight into mechanisms for observed changes. Lastly, monitoring injury incidence over a competition season would inform whether gains in strength and agility also lead to the decreased risk of injury in practice.

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ANNEXURE

ANNEXURE:1

CONSENT FORM

I _____, aged _____, years, confirm that I have understood about the Effectiveness of Lower limb dynamic strength on agility procedure and its potential benefits on athletes as explained by Dinesh Kumar Mishra and is as mentioned in his study which is taking place under the guidance of Dr. Asifuzzaman Shahriyar Ahmed(PT), Associate professor, Abhinav Bindra sports medicine and research institute (ABSMARI) and, co-guidance of Dr. Gayatri Upasana Acharya (PT), Assistant Professor, ABSMARI.

I understand that my participation is voluntary and I'm free to withdraw at anytime, without giving any reason.


I understand that confidentiality will be maintained.

I voluntarily agree to and give my consent to be a part of the above-mentioned study

Signature

Date

ANNEXURE : 2



ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA
CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
ChairpersonMr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/156**APPROVAL LETTER**
APPENDIX - VIIIDate: 09/05/2025

To,

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

DINESH KUMAR MISHRA
ABSMARI
273, PAHAL, BHUBANEWAR-752101

Protocol Title: Efficacy of Lower Limb Dynamic Strength Training on Agility in Elite Male Volleyball Players -An Experimental Study

Protocol ID.: ABS-IEC-2025-PHY-043


Subject: Approval for the conduct of the above referenced study

Dear **Mr./Ms./Dr Dinesh Kumar Mishra**
With reference to your Submission letter dated 06/01/2025 the ABSMARI IEC has reviewed and discussed your application for conduct of the study on dated 24/04/2025.




The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	24/04/2025
2	informed Consent Form	24/04/2025
3	Undertaking form PI	24/04/2025
4	CRF	24/04/2025
5	COI from the Investigators	24/04/2025

The following members were present at meeting held on 24-04-2025



1

 **Utkal Signature, Plot No.-273,
Ground Floor, Pahal, Bhubaneswar-752101** **+91-63707-03654** **iec@absmari.com**

ANNEXURE:3

Athlete Name	Pre-Timing	VJT	AGE	SEX	HEIGHT
Sanjay Mohanty	11.35	3	20	M	155
Rahul Barik	11.45	3.5	25	M	190
Raja Munda	11.43	3	23	M	156
Roshan Sahu	10.59	2.5	23	M	160
Akash Barik	11.15	2	24	M	159
Rakesh Das	10.5	3	29	M	160
Satyabrata Das	11.08	2.50	34	M	160
Jyoti Ranjan Nayak	10.45	2.2	23	M	175
Sathvik	11.05	2.24	25	M	165
S Prashad	11.06	3.1	24	M	165
P Subash	11.08	3	25	M	162
Dibakar Sahu	10.59	1.8	23	M	170
Rakesh Samanta	10.51	1.9	23	M	170
Niraj Kumar Nair	10.52	3.5	22	M	175
Ranjan Parida	11.5	3.8	28	M	180
Shivansh	11.01	4	26	M	175
G Parvin	10.48	3	26	M	165
Doland sabar	10.54	2.8	25	M	170
Sandesh bhosle	10.08	2.7	25	M	186
Anshu kumar Ray	11.09	2.5	26	M	155
Sandip Nayak	12.3	2.7	23	M	150
Rajesh kumar Sahoo	11.33	3	25	M	175
Anhiram A	11.28	4	25	M	156
Swadhin Jena	11.09	2.9	31	M	167
Amit kumar Senapati	11.01	2	26	M	175
Harshawardhan Kumar	11.3	3	22	M	170
Papu Kumar	11.3	3	26	M	180
Shubranshu sekhar Senapati	11.28	2.7	33	M	175
Alok Kumar Panday	11.38	2.5	22	M	185
Gourav kumar Singh	10.48	2.8	23	M	175
Abhisekh Kumar	10.49	2.3	33	M	175
Manas Pani	10.38	4	28	M	195
Amit kumar Panda	10.28	3.6	20	M	190
Diptiraj Mishra	10.35	3.4	18	M	180

Athlete Name	Post-Timing	VJT
Sanjay Mohanty	10.08	3.8
Rahul Barik	9.37	4.5
Raja Munda	10.53	4
Roshan Sahu	10.08	4.2
Akash Barik	10.39	4
Rakesh Das	10.58	3.6
Satyabrata Das	10.55	3
Jyoti Ranjan Nayak	10.35	3
Sathvik	10.43	3
S Prashad	10.4	3.8
P Subash	10.55	3.5
Dibakar Sahu	10.4	2.8
Rakesh Samanta	10.33	3
Niraj Kumar Nair	10.49	4
Ranjan Parida	10.47	4.1
Shivansh	10.58	4.5
G Parvin	10.48	3.8
Doland sabar	10.47	3.6
Sandesh bhosle	9.58	3.7
Anshu kumar Ray	10.38	3.1
Sandip Nayak	11.01	3.5
Rajesh kumar Sahoo	10.11	3.5
Anhiram A	9.45	4.5
Swadhin Jena	10.45	3.6
Amit kumar Senapati	10.3	2.8
Harshawardhan Kumar	10.48	3.5
Papu Kumar	9.55	3.5
Shubranshu sekhar Senapati	9.58	3
Alok Kumar Panday	9.47	3
Gourav kumar Singh	9.5	3.7
Abhisekh Kumar	9.56	3.5
Manas Pani	9.47	4.5
Amit kumar Panda	9.51	4
Diptiraj Mishra	9.44	4.1

ANNEXURE:4



7% Overall Similarity

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Integrity Flags

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How should I interpret Turnitin's AI writing percentage and false positives?

The percentage shown in the AI writing report is the amount of qualifying text within the submission that Turnitin's AI writing detection model determines was either likely AI-generated text from a large-language model or likely AI-generated text that was likely revised using an AI paraphrase tool or word spinner.

False positives (incorrectly flagging human-written text as AI-generated) are a possibility in AI models.

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The AI writing percentage should not be the sole basis to determine whether misconduct has occurred. The reviewer/instructor should use the percentage as a means to start a formative conversation with their student and/or use it to examine the submitted assignment in accordance with their school's policies.

What does 'qualifying text' mean?

Our model only processes qualifying text in the form of long-form writing. Long-form writing means individual sentences contained in paragraphs that make up a longer piece of written work, such as an essay, a dissertation, or an article, etc. Qualifying text that has been determined to be likely AI-generated will be highlighted in cyan in the submission, and likely AI-generated and then likely AI-paraphrased will be highlighted purple.

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