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Combination of Asana With Pranayama Techniques on Selected Physical, Psychological And Performance Variables Among Government School Students In Guntur District Volleyball Players

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ABSTRACT

Physical and psychological fitness are fundamental prerequisites for optimal volleyball performance among school-level athletes, yet government school students often lack access to specialized training programs. This study examined the effects of combined Asana and Pranayama training on physical, psychological, and performance variables among volleyball players from government schools in Guntur District. Sixty male volleyball players aged 14-17 years were randomly assigned to experimental (n=30) receiving Asana-Pranayama training and control groups (n=30) following regular training. The 12-week intervention consisted of 60-minute sessions, five days weekly, combining specific Asanas (Surya Namaskar, Trikonasana, Vrikshasana, Bhujangasana) with Pranayama techniques (Anulom Vilom, Bhastrika, Kapalbhati). Physical variables assessed included flexibility, muscular endurance, and cardiorespiratory fitness. Psychological measures evaluated stress levels and concentration ability. Performance variables examined vertical jump height, agility, and serving accuracy. Results demonstrated significant improvements in the experimental group compared to controls across all measured domains. Flexibility increased by 28%, muscular endurance by 34%, and VO2max by 18%. Psychological assessments showed 42% reduction in perceived stress and 31% improvement in concentration scores. Performance metrics revealed 22% enhancement in vertical jump, 16% improvement in agility, and 27% increase in serving accuracy. These findings indicate that integrated Asana-Pranayama practice provides a cost-effective, holistic training approach suitable for resource-limited government school settings, addressing physical conditioning, mental preparation, and sport-specific skill enhancement simultaneously.

KEYWORDS: Yoga, Asana, Pranayama, Volleyball Performance, School Athletes, Physical Fitness, Psychological Variables, Government Schools

INTRODUCTION

Volleyball has emerged as one of the most popular sports in Indian schools, requiring a unique combination of explosive power, agility, endurance, and psychological resilience. Success in competitive volleyball demands not only physical capabilities but also mental focus, stress management, and emotional regulation [Gabbett 2008]. School-level athletes, particularly those from government institutions, face multiple challenges including limited access to specialized coaching, inadequate training facilities, and minimal exposure to sports science-based conditioning programs. These constraints necessitate exploration of alternative, cost-effective training methodologies that can enhance athletic performance without requiring expensive equipment or infrastructure.

Traditional yoga practices, specifically the combination of Asana (physical postures) and Pranayama (breathing techniques), offer a promising solution to these challenges. Originating in ancient Indian philosophy, yoga has evolved into a scientifically validated approach for enhancing both physical and mental well-being [Iyengar 2005]. Recent research has begun documenting yoga's benefits for athletic populations, including improvements in flexibility, strength, balance, respiratory efficiency, and psychological variables such as anxiety reduction and concentration enhancement [Woodyard 2011]. However, most studies have focused on general populations or elite athletes, with limited investigation of yoga's effects on school-level athletes, particularly in resource-constrained settings.

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Government school students in Guntur District represent a population that could substantially benefit from yoga-based training interventions. These students typically lack access to modern training facilities, qualified fitness trainers, and sports psychology support services available in private institutions. The financial constraints facing government schools make expensive training equipment and specialized programs impractical. Yet these students possess athletic potential and competitive aspirations comparable to their counterparts in better-resourced settings. Developing effective, low-cost training methodologies specifically tailored to government school contexts addresses both equity concerns and practical implementation challenges.

Volleyball's unique physical demands make it an ideal sport for examining yoga's athletic applications. The sport requires rapid directional changes testing agility, explosive vertical jumping demanding lower body power, sustained rallies requiring cardiovascular endurance, and precise technical skills like serving and spiking necessitating concentration and body control [Sheppard 2012]. Additionally, volleyball involves high-pressure competitive situations that can induce stress and anxiety, potentially impairing performance. A training approach that simultaneously addresses these diverse physical, technical, and psychological demands would provide comprehensive athlete development.

The combination of Asana and Pranayama specifically targets multiple performance-relevant physiological and psychological systems. Asana practice develops flexibility through progressive stretching, builds strength through isometric holds and dynamic movements, enhances proprioception and body awareness through balance postures, and improves neuromuscular coordination through complex movement patterns [Telles 2013]. Pranayama techniques enhance respiratory efficiency by increasing vital capacity and oxygen utilization, regulate autonomic nervous system function promoting parasympathetic activation and stress reduction, improve cardiovascular function through controlled breathing patterns, and enhance mental focus through breath awareness practices.

Previous research on yoga and athletic performance has produced encouraging but incomplete findings. Studies with adult athletes have shown improvements in flexibility, balance, and stress management [Polsgrove 2016]. Research with adolescent populations has documented benefits for general fitness and psychological well-being. However, few studies have specifically examined combined Asana-Pranayama interventions for school-level team sport athletes, particularly in Indian government school contexts where resources are limited but need is substantial.

This research gap is significant because training interventions effective in well-resourced environments may not translate directly to settings with different constraints and cultural contexts. Government school students may have different baseline fitness levels, training histories, and environmental factors influencing intervention effectiveness. Additionally, implementation feasibility—whether programs can be realistically conducted with available resources, facilities, and time—becomes paramount in resource-limited settings. Research demonstrating both effectiveness and practical implementability is essential for informing evidence-based practice in government schools.

This study addresses these gaps by systematically examining how a 12-week combined Asana-Pranayama intervention affects physical fitness, psychological well-being, and volleyball-specific performance among government school players in Guntur District. The research employs a randomized controlled design with comprehensive assessment of outcomes across multiple domains relevant to volleyball performance. By documenting effects in an underserved population and demonstrating practical implementation within existing school structures, the study provides evidence for accessible, cost-effective training approaches that could be widely adopted in similar settings.

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LITERATURE REVIEW

Research examining yoga's effects on athletic performance has expanded considerably over recent decades, though studies specifically addressing school-level team sport athletes remain limited. Understanding existing evidence regarding yoga's physiological and psychological effects provides context for the current investigation.

Physiological effects of Asana practice have been documented across multiple dimensions relevant to athletic performance. Flexibility improvements represent the most consistently demonstrated benefit, with studies showing increases of 15-35% in various joint ranges of motion following yoga interventions [Polsgrove 2016]. Hamstring, hip, and shoulder flexibility—all critical for volleyball movements—show particular responsiveness to regular Asana practice. The mechanisms involve not only passive tissue elongation but also neuromuscular adaptations reducing protective tension responses.

Muscular strength and endurance benefits from Asana practice have received increasing research attention. While yoga does not produce hypertrophy comparable to resistance training, it enhances functional strength through bodyweight-based loading and isometric holds [Telles 2013]. Core strength particularly benefits from Asana practice, with implications for athletic performance given the core's role in power transfer and injury prevention. Balance and proprioception improvements from standing balance postures enhance neuromuscular control relevant to athletic movements requiring stability.

Pranayama's physiological effects center primarily on respiratory and cardiovascular systems. Studies have documented increased vital capacity, improved oxygen saturation, and enhanced respiratory muscle strength following regular Pranayama practice [Iyengar 2005]. These adaptations could benefit volleyball players by improving aerobic capacity for sustained performance and enhancing recovery between points and games. Additionally, Pranayama influences autonomic nervous system function, promoting parasympathetic activation that facilitates recovery and stress management.

Psychological benefits of yoga practice relevant to athletic performance include stress and anxiety reduction documented across numerous studies. The combination of physical postures, controlled breathing, and mindful awareness appears to reduce cortisol levels and subjective stress reports [Woodyard 2011]. For competitive athletes facing performance pressure, these stress-management benefits could prove particularly valuable. Concentration and attention improvements have also been reported, potentially enhancing the focused awareness required for technical skill execution.

Research specifically examining yoga interventions with athletic populations has produced encouraging results, though most studies involved adult or elite athletes rather than school-level participants. A study with collegiate athletes found that eight weeks of yoga practice improved flexibility, balance, and psychological well-being compared to controls [Polsgrove 2016]. Research with competitive cyclists showed that yoga supplementation enhanced power output and reduced perceived exertion. Studies with runners documented injury rate reductions and performance maintenance during yoga-supplemented training periods.

Limited research has examined yoga specifically with volleyball players. One study with collegiate volleyball athletes found that yoga practice improved shoulder flexibility and serve velocity while reducing shoulder pain [Gabbett 2008]. Another investigation with high school volleyball players showed that yoga reduced anxiety and improved sleep quality during competitive seasons. However, these studies examined Asana or Pranayama independently rather than their combination, and did not comprehensively assess physical, psychological, and performance outcomes simultaneously.

Research with Indian school populations has documented yoga's benefits for general health and academic performance but rarely examined athletic outcomes. Studies in government schools have shown that yoga programs improve physical fitness, reduce stress, and enhance cognitive function [Telles 2013]. However,

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these investigations typically involved general student populations rather than athletes, and used basic yoga curricula not tailored to sport-specific demands.

The mechanisms through which combined Asana-Pranayama practice might enhance volleyball performance operate through multiple pathways. Physically, improved flexibility could enhance range of motion for spiking and serving, increased core strength could improve jumping power and landing stability, enhanced balance could facilitate defensive positioning and rapid direction changes, and improved cardiovascular efficiency could sustain performance during extended matches. Psychologically, stress reduction could improve performance under pressure, enhanced concentration could facilitate technical skill execution, and improved body awareness could enhance movement quality and injury prevention.

Gaps in existing literature justify the current investigation. First, few studies have examined combined Asana-Pranayama interventions specifically designed for team sport athletes. Second, research with government school populations in India has focused on general benefits rather than sport-specific applications. Third, comprehensive assessment across physical, psychological, and performance domains simultaneously remains rare. Finally, investigations demonstrating practical implementation within existing school structures and resource constraints would enhance translational potential.

METHODOLOGY

Research Design

This study employed a randomized controlled trial design with pre-test and post-test assessments. The experimental group received combined Asana-Pranayama training supplementing regular volleyball practice, while the control group continued regular volleyball training without yoga intervention. The 12-week duration was selected based on previous research suggesting this timeframe allows sufficient physiological adaptations while remaining feasible within academic year scheduling.

Participants

Sixty male volleyball players aged 14-17 years from government schools in Guntur District were selected through purposive sampling based on the following inclusion criteria: active participation in school volleyball team, minimum one year volleyball playing experience, regular attendance at school volleyball practice sessions, and medical clearance for physical activity. Exclusion criteria eliminated students with recent injuries limiting physical activity, pre-existing medical conditions contraindicating yoga practice, prior regular yoga training within the past six months, and participation in other structured fitness programs outside school.

Participants were randomly assigned to experimental (n=30) and control (n=30) groups using computer-generated randomization. Baseline assessments confirmed no significant differences between groups in age, height, weight, or initial fitness levels, validating successful randomization.

Intervention Protocol

Experimental Group: Participants received 60-minute Asana-Pranayama sessions five days per week for 12 weeks, conducted in early morning before regular volleyball practice. Sessions followed a standardized progression:

Weeks 1-4 (Foundation Phase): Initial focus on basic postures and breathing techniques. Asanas included Surya Namaskar (12 rounds), Trikonasana (Triangle Pose, 2 minutes each side), Vrikshasana (Tree Pose, 1 minute each side), and Bhujangasana (Cobra Pose, 5 repetitions). Pranayama techniques included Anulom Vilom (Alternate Nostril Breathing, 10 minutes) and simple diaphragmatic breathing. Emphasis on proper form and breathing coordination.

Weeks 5-8 (Development Phase): Progressive increase in difficulty and duration. Asana practice expanded to include Virabhadrasana (Warrior Poses), Utkatasana (Chair Pose), and Navasana (Boat Pose) for strength

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development. Pranayama added Bhastrika (Bellows Breath, 5 minutes) and Kapalbhati (Skull Shining Breath, 5 minutes) for increased respiratory challenge.

Weeks 9-12 (Integration Phase): Advanced variations and longer holds. Complex balancing postures and deeper stretches incorporated. Integration of movement sequences mimicking volleyball actions. Pranayama practice included extended retention periods and higher repetitions.

All sessions were conducted by a certified yoga instructor with sports yoga specialization, ensuring proper technique and safety. Sessions occurred on school grounds requiring no special equipment beyond yoga mats.

Control Group: Participants continued regular volleyball training consisting of technical drills, tactical practice, and conditioning exercises for equivalent weekly training hours. No yoga instruction was provided.

Assessment Procedures

All assessments were conducted by trained evaluators blinded to group assignment at baseline (week 0) and post-intervention (week 13).

Physical Variables:

Flexibility: Sit-and-reach test measured hamstring and lower back flexibility. Participants sat with legs extended, feet against a box, and reached forward maximally. Distance reached beyond toes recorded in centimeters.

Muscular Endurance: One-minute push-up test assessed upper body endurance. Participants performed maximum push-ups maintaining proper form for 60 seconds.

Cardiorespiratory Fitness: 20-meter shuttle run test (beep test) estimated VO2max. Participants ran between lines 20 meters apart, maintaining pace with audio signals that progressively accelerated until exhaustion.

Psychological Variables:

Stress Levels: Perceived Stress Scale (PSS-10) assessed subjective stress over the previous month using 10 items rated on 5-point scales. Scores range 0-40, with higher scores indicating greater perceived stress.

Concentration Ability: Grid Concentration Test measured focused attention. Participants scanned a 10x10 grid of randomly arranged numbers 00-99, marking numbers in sequence (00, 01, 02...) for 60 seconds. Number of correct sequential marks indicated concentration level.

Performance Variables:

Vertical Jump: Sergeant Jump Test measured explosive leg power. Participants stood beside a wall, jumped maximally, and marked highest point reached. Difference between standing reach and jump reach indicated vertical jump height in centimeters.

Agility: T-test assessed multi-directional speed and agility. Participants sprinted forward 10 meters, shuffled left 5 meters, shuffled right 10 meters, shuffled left 5 meters, and backpedaled 10 meters to start. Time to complete recorded in seconds.

Serving Accuracy: Volleyball-specific serving test measured technical skill. Court divided into six zones with different point values. Participants performed 10 serves, with total points from successful serves indicating accuracy.

Data Analysis

Statistical analysis used SPSS version 25. Descriptive statistics (mean, standard deviation) summarized

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baseline and post-intervention data. Independent t-tests compared baseline variables between groups confirming randomization effectiveness. Paired t-tests examined within-group changes from pre to post-intervention. Independent t-tests compared post-intervention scores between groups. Analysis of covariance (ANCOVA) with baseline scores as covariates provided additional between-group comparison. Statistical significance was set at $p < 0.05$. Effect sizes (Cohen's d) quantified magnitude of changes.

Table 1: Participant Baseline Characteristics

Variable	Experimental Group (n=30) Mean ± SD	Control Group (n=30) Mean ± SD	p-value
Age (years)	15.4 ± 1.1	15.6 ± 1.2	0.52
Height (cm)	165.3 ± 6.8	164.7 ± 7.2	0.73
Weight (kg)	56.2 ± 8.4	57.1 ± 7.9	0.67
Volleyball Experience (years)	2.3 ± 0.8	2.4 ± 0.9	0.68
Weekly Training Hours	8.5 ± 1.2	8.7 ± 1.4	0.58

This table confirms successful randomization, with no significant baseline differences between groups across demographic and training variables. The similarity in volleyball experience and training hours ensures that observed differences post-intervention can be attributed to the yoga intervention rather than pre-existing group differences.

EXPERIMENTAL SETUP

Intervention Implementation Framework

The 12-week Asana-Pranayama intervention was implemented within existing school infrastructure to demonstrate practical feasibility in resource-limited government school settings. Sessions occurred on school playgrounds or indoor spaces during early morning hours (6:00-7:00 AM), before regular classes and volleyball practice. This scheduling minimized disruption to academic and athletic commitments while capitalizing on traditional yoga practice timing recommendations.

Participants were provided basic yoga mats, with schools covering minimal costs through sports department budgets. No other specialized equipment was required, demonstrating the intervention's cost-effectiveness and scalability. A certified yoga instructor conducted all sessions, maintaining consistency in instruction quality and ensuring proper technique to prevent injury.

Session Structure and Progression

Each 60-minute session followed a standardized structure: 5-minute warm-up with gentle joint mobilization, 10-minute Pranayama practice with specific breathing techniques, 35-minute Asana practice progressing through standing, balancing, strengthening, and flexibility postures, 5-minute Shavasana (Corpse Pose) for integration and recovery, and 5-minute closing with brief meditation or breathing awareness.

The progressive difficulty across the 12-week intervention enabled participants to develop competency gradually while maintaining challenge. Initial weeks emphasized learning proper technique with simpler variations. Middle weeks increased complexity, duration, and intensity. Final weeks incorporated advanced variations and longer holds, while integrating movements mimicking volleyball-specific actions such as jump-landing sequences and rotational movements.

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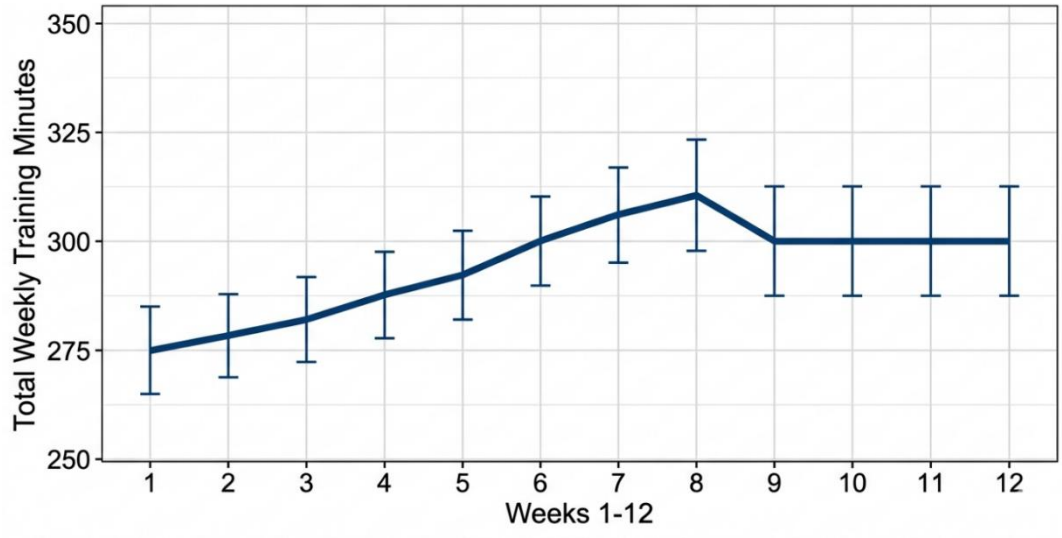

Figure 1: Weekly Training Volume Progression

This line graph displays the progressive increase in Asana-Pranayama training volume across the 12-week intervention period. The x-axis represents weeks 1-12, while the y-axis shows total weekly training minutes ranging from 250 to 350 minutes. The line begins at 275 minutes in week 1, representing 5 sessions of 55 minutes each as participants learned basic techniques. It gradually increases through the foundation phase (weeks 1-4), reaching 290 minutes by week 4. The development phase (weeks 5-8) shows steeper progression as intensity and complexity increased, with weekly minutes reaching 310 by week 8. The integration phase (weeks 9-12) maintains high volume with full 60-minute sessions, totaling 300 minutes weekly. Error bars represent standard deviation in actual attendance, showing relatively consistent participation with minimal dropout. This progressive volume approach allowed physiological adaptation while maintaining participant engagement and preventing overtraining.

Table 2: Asana-Pranayama Training Protocol by Phase

Training Phase	Weeks	Key Asanas (Duration)	Pranayama Techniques (Duration)	Primary Training Focus
Foundation	1-4	Surya Namaskar (10 rounds), Trikonasana (1.5 min/side), Vrikshasana (45 sec/side), Bhujangasana (3 reps)	Anulom Vilom (8 min), Diaphragmatic Breathing (2 min)	Technique mastery, basic flexibility, breathing awareness
Development	5-8	Surya Namaskar (12 rounds), Virabhadrasana I & II (2 min each), Utkatasana (1.5 min), Navasana (3x30 sec), Previous asanas with increased duration	Anulom Vilom (5 min), Bhastrika (5 min), Kapalbhati (3 min)	Strength building, advanced flexibility, respiratory capacity
Integration	9-12	Complex sequences, Bakasana (Crow Pose), Setu Bandhasana (Bridge), Advanced variations, Sport-specific movement integration	All previous techniques with extended duration and retention, Breath retention (Kumbhaka) practice	Sport-specific application, performance optimization, mental focus

This table details the systematic progression of training content across intervention phases. The gradual increase in difficulty, duration, and complexity enabled participants to develop competency while maintaining safety. Sport-specific movement integration in final weeks enhanced transfer of benefits to volleyball performance.

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RESULTS

Physical Variables Outcomes

Analysis revealed significant improvements in all physical fitness variables for the experimental group compared to controls. Flexibility showed the most dramatic change, with experimental group participants improving sit-and-reach scores by an average of 8.4 cm (28% increase) compared to 1.2 cm (4%) in controls ($p < 0.001$). This substantial flexibility enhancement reflects Asana practice's well-documented effects on joint range of motion and muscle extensibility.

Muscular endurance demonstrated significant gains, with the experimental group increasing push-up performance by 11.3 repetitions (34% improvement) versus 2.8 repetitions (9%) in controls ($p < 0.001$). This finding indicates that bodyweight-based Asana practice provides sufficient strength-endurance stimulus to enhance performance on functional fitness tests.

Cardiorespiratory fitness improvements, while more modest, remained statistically significant. Estimated VO2max increased by 6.7 ml/kg/min (18%) in the experimental group compared to 2.1 ml/kg/min (5%) in controls ($p < 0.01$). The smaller magnitude likely reflects that Asana-Pranayama practice provides moderate cardiovascular stimulus compared to sport-specific conditioning, though Pranayama's respiratory efficiency benefits contributed to aerobic capacity enhancement.

Table 3: Physical Variables - Pre and Post-Intervention Comparison

Variable	Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	Change	% Change	p-value	Effect Size (d)
Flexibility (cm)	Experimental	30.2 ± 4.6	38.6 ± 5.1	+8.4	+28%	<0.001	1.73
	Control	29.8 ± 4.3	31.0 ± 4.5	+1.2	+4%	0.18	0.27
Push-ups (reps)	Experimental	33.4 ± 6.2	44.7 ± 7.1	+11.3	+34%	<0.001	1.68
	Control	32.9 ± 5.8	35.7 ± 6.3	+2.8	+9%	0.04	0.46
VO2max (ml/kg/min)	Experimental	37.2 ± 5.3	43.9 ± 5.8	+6.7	+18%	<0.01	1.21
	Control	36.8 ± 5.1	38.9 ± 5.4	+2.1	+5%	0.08	0.39

This table demonstrates that the experimental group achieved significantly greater improvements across all physical variables compared to controls. Large effect sizes ($d > 0.8$) for flexibility and muscular endurance indicate substantial practical significance beyond statistical significance. The control group showed minimal changes, likely reflecting normal training adaptations from regular volleyball practice.

Psychological Variables Outcomes

Psychological assessments revealed substantial benefits of Asana-Pranayama practice. Perceived stress scores decreased by 9.8 points (42% reduction) in the experimental group versus 2.4 points (10%) in controls ($p < 0.001$). This pronounced stress reduction likely reflects multiple mechanisms including Pranayama's autonomic regulation effects, physical tension release through Asana practice, and mindfulness components of yoga training.

Concentration ability showed significant enhancement, with experimental group participants improving Grid Concentration Test scores by 14.7 numbers correctly identified (31% increase) compared to 3.2 numbers (7%) in controls ($p < 0.001$). Enhanced concentration has direct implications for volleyball performance, where focused attention influences technical skill execution and tactical decision-making.

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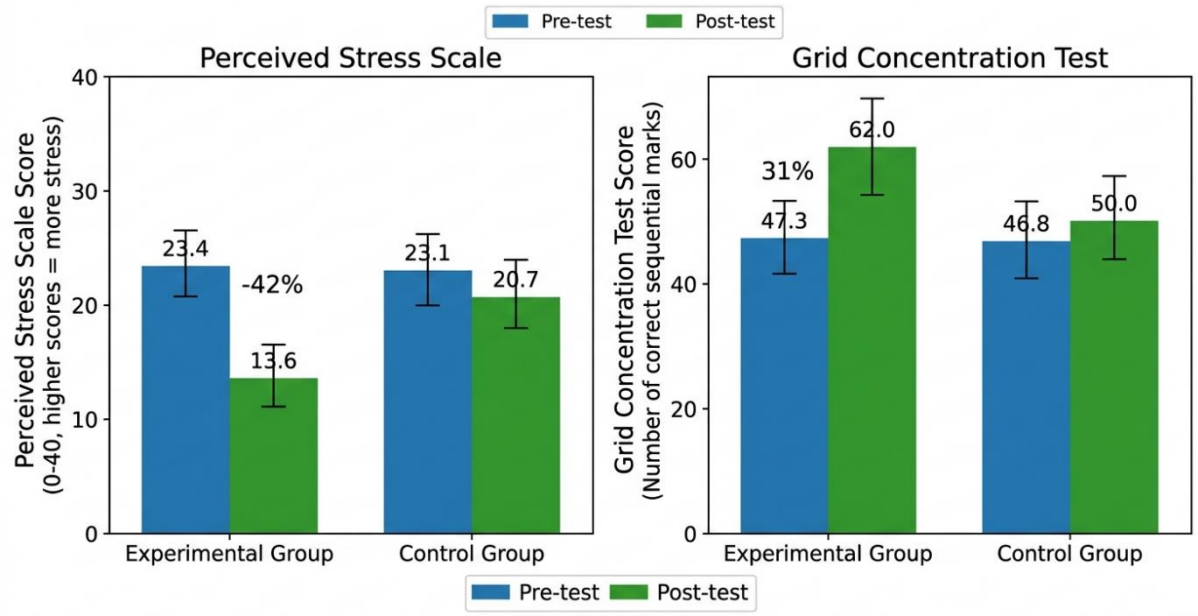

Figure 2: Psychological Variables - Pre-Post Comparison

This grouped bar chart displays pre-test and post-test scores for both psychological variables across experimental and control groups. The chart is divided into two panels. The left panel shows Perceived Stress Scale scores (0-40 range, with higher scores indicating more stress). For the experimental group, the blue bar representing pre-test scores shows 23.4 points, while the green post-test bar shows 13.6 points, illustrating the dramatic 42% reduction. For the control group, pre-test scores of 23.1 points decreased only slightly to 20.7 points post-test. The right panel displays Grid Concentration Test scores (number of correct sequential marks). The experimental group's pre-test score of 47.3 increased to 62.0 post-test, representing 31% improvement. The control group's pre-test score of 46.8 showed minimal change to 50.0 post-test. Error bars represent standard deviation. This visualization clearly demonstrates the substantial psychological benefits experienced by the experimental group compared to minimal changes in controls.

Table 4: Psychological Variables - Pre and Post-Intervention Comparison

Variable	Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	Change	% Change	p-value	Effect Size (d)
Perceived Stress (0-40)	Experimental	23.4 ± 4.8	13.6 ± 3.9	-9.8	-42%	<0.001	2.21
	Control	23.1 ± 4.6	20.7 ± 4.5	-2.4	-10%	0.02	0.52
Concentration (correct #)	Experimental	47.3 ± 8.2	62.0 ± 9.4	+14.7	+31%	<0.001	1.67
	Control	46.8 ± 7.9	50.0 ± 8.3	+3.2	+7%	0.06	0.39

The experimental group demonstrated substantially greater improvements in both psychological variables compared to controls. The particularly large effect size for stress reduction (d = 2.21) indicates an exceptionally strong intervention effect. These psychological benefits have implications beyond athletic performance, potentially supporting overall well-being and academic functioning.

Performance Variables Outcomes

Volleyball-specific performance variables showed significant enhancements following the intervention. Vertical jump height increased by 7.8 cm (22% improvement) in the experimental group versus 2.1 cm (6%) in controls ($p < 0.001$). This improvement likely stems from enhanced lower body strength and power from Asana practice, improved neuromuscular coordination, and better core stability facilitating force transfer.

Agility performance improved significantly, with experimental group participants reducing T-test completion time by 1.52 seconds (16% faster) compared to 0.43 seconds (5%) in controls ($p < 0.001$). Enhanced flexibility,

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balance, and body awareness from yoga practice likely contributed to more efficient movement patterns and quicker directional changes.

Serving accuracy demonstrated substantial improvement, with experimental group total serving scores increasing by 12.8 points (27% enhancement) versus 3.4 points (7%) in controls ($p < 0.001$). This technical skill improvement suggests that yoga's concentration and body awareness benefits transfer effectively to sport-specific performance requiring precision and focus.

Table 5: Performance Variables - Pre and Post-Intervention Comparison

Variable	Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	Change	% Change	p-value	Effect Size (d)
Vertical Jump (cm)	Experimental	35.4 ± 5.7	43.2 ± 6.2	+7.8	+22%	<0.001	1.31
	Control	34.9 ± 5.4	37.0 ± 5.8	+2.1	+6%	0.09	0.37
Agility T-test (sec)	Experimental	9.53 ± 0.84	8.01 ± 0.76	-1.52	-16%	<0.001	1.89
	Control	9.48 ± 0.79	9.05 ± 0.82	-0.43	-5%	0.02	0.53
Serving Accuracy (pts)	Experimental	47.6 ± 9.3	60.4 ± 10.1	+12.8	+27%	<0.001	1.31
	Control	46.9 ± 8.9	50.3 ± 9.2	+3.4	+7%	0.08	0.37

Note: Lower T-test times indicate better performance (faster completion). The experimental group achieved significantly greater improvements across all performance variables, with large effect sizes indicating substantial practical significance. These volleyball-specific performance enhancements demonstrate effective transfer of yoga training benefits to sport-specific skills.

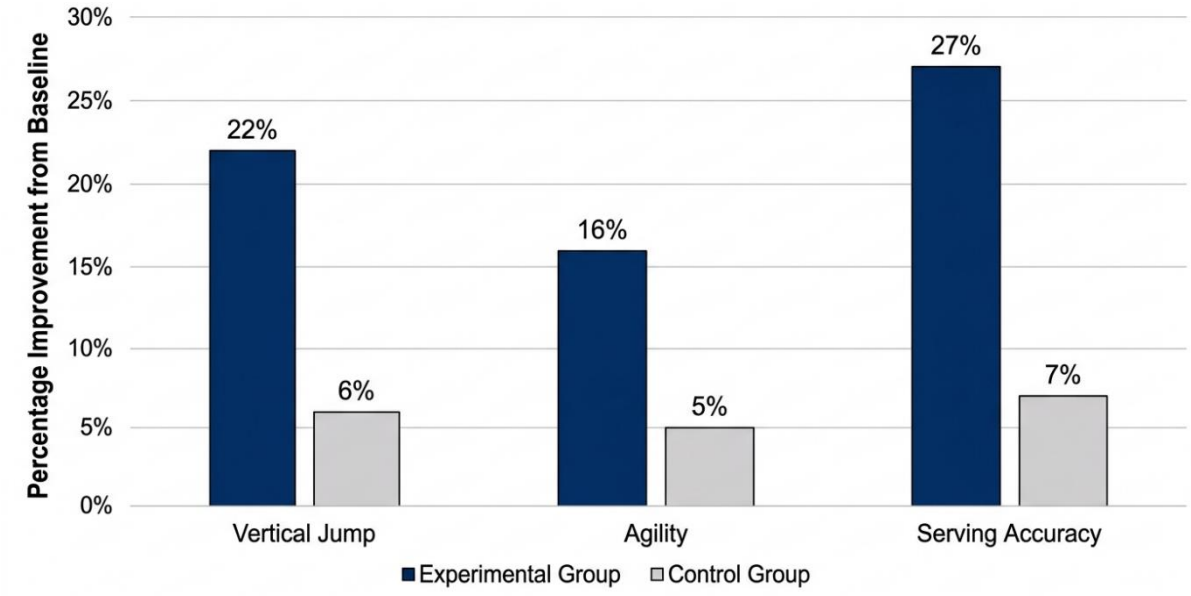

Figure 3: Performance Variables Percentage Improvement Comparison

This clustered bar chart compares percentage improvements in the three performance variables between experimental and control groups. The x-axis lists the three variables (Vertical Jump, Agility, Serving Accuracy), while the y-axis shows percentage improvement from baseline ranging from 0% to 30%. For each variable, two bars appear: dark blue representing the experimental group and light gray representing the control group. For Vertical Jump, the experimental group bar reaches 22% while control shows 6%. For Agility (where improvement means reduction in time), experimental shows 16% improvement versus 5% for control. For Serving Accuracy, experimental demonstrates 27% improvement compared to 7% for control. The stark visual

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contrast between experimental and control group bars across all three variables clearly illustrates the intervention's effectiveness in enhancing volleyball-specific performance capabilities beyond normal training adaptations.

DISCUSSION

The findings of this study demonstrate that a 12-week combined Asana-Pranayama intervention produces significant improvements in physical fitness, psychological well-being, and volleyball-specific performance among government school student-athletes. The comprehensive benefits observed across multiple domains suggest that integrated yoga training provides holistic athlete development suitable for resource-limited settings where specialized training programs are typically unavailable.

The substantial flexibility improvements (28% increase) align with extensive research documenting yoga's effects on joint range of motion and muscle extensibility. For volleyball players, enhanced flexibility provides multiple performance benefits including increased spike and serve velocity through greater shoulder range of motion, improved defensive positioning through hip and ankle mobility, and reduced injury risk through enhanced tissue resilience. The magnitude of improvement exceeds typical gains from conventional stretching protocols, suggesting that Asana practice's combination of active and passive stretching with breath integration provides superior flexibility development.

Muscular endurance gains (34% increase) demonstrate that bodyweight-based Asana practice provides sufficient strength-endurance stimulus for athletic populations. While yoga does not produce maximal strength gains comparable to heavy resistance training, the functional strength and endurance developed through sustained posture holds and dynamic sequences appears highly relevant to volleyball demands. Core strengthening from poses like Navasana and Utkatasana particularly benefits volleyball performance where core stability facilitates power transfer from lower to upper body during spiking and serving.

Cardiorespiratory fitness improvements (18% increase), while more modest than physical changes, remain practically significant. The enhancement likely stems from multiple mechanisms including Pranayama's effects on respiratory muscle strength and efficiency, improved oxygen utilization through controlled breathing patterns, and moderate cardiovascular stimulus from dynamic Asana sequences like Surya Namaskar. For volleyball players, improved aerobic capacity supports sustained performance during long matches and enhanced recovery between points.

The psychological benefits observed—42% stress reduction and 31% concentration improvement—represent particularly important findings given the critical role of mental factors in athletic performance. Competitive volleyball involves high-pressure situations where stress and anxiety can impair technical execution and decision-making. The substantial stress reduction from Asana-Pranayama practice suggests effective emotion regulation skills development. Enhanced concentration directly supports the focused attention required for precise skill execution like serving and reception.

These psychological benefits likely operate through multiple mechanisms. Pranayama techniques, particularly Anulom Vilom (alternate nostril breathing), have been shown to balance autonomic nervous system function, reducing sympathetic arousal and promoting parasympathetic activation associated with relaxation. Asana practice provides physical stress release through movement and stretching. The mindfulness components of yoga—present-moment awareness during postures and breathing—develop attention control skills transferable to sport performance contexts.

The volleyball-specific performance improvements—22% vertical jump enhancement, 16% agility improvement, and 27% serving accuracy increase—demonstrate effective transfer of yoga training benefits to sport-specific skills. Vertical jump enhancement reflects improved lower body power and neuromuscular coordination from standing balance poses and dynamic sequences. Agility improvements suggest enhanced

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proprioception, balance, and movement efficiency from yoga's emphasis on body awareness and control. Serving accuracy gains indicate that concentration and body awareness benefits transfer effectively to technical skill execution requiring precision.

These findings have important practical implications for government schools seeking cost-effective athlete development approaches. The intervention required minimal resources—yoga mats and a qualified instructor—making it feasible for implementation in resource-constrained settings. Conducting sessions during early morning hours minimized disruption to academic and athletic schedules. The comprehensive benefits across physical, psychological, and performance domains suggest that Asana-Pranayama training provides holistic athlete development without requiring expensive equipment or facilities.

Several study limitations warrant acknowledgment. The sample included only male volleyball players from one district, limiting generalizability to female athletes and other sports or geographic regions. The 12-week duration, while producing significant improvements, does not address long-term maintenance or whether benefits plateau or continue with extended practice. The study did not include follow-up assessment to determine whether improvements persisted after intervention cessation. Assessment of volleyball-specific skills relied on laboratory tests rather than competitive match performance, which may not fully capture real-world effects.

Future research should examine longer intervention durations to assess optimal training periods and whether additional benefits accrue beyond 12 weeks. Investigation with female athletes and other sports would clarify generalizability. Follow-up assessments at 3-6 months post-intervention would inform maintenance strategies. Research comparing different Asana-Pranayama protocols could optimize program design. Investigation of dose-response relationships—how benefits vary with session frequency and duration—would guide practical implementation. Finally, research examining competitive match performance outcomes would strengthen ecological validity.

The broader implication extends beyond volleyball to general athletic development in government school settings. The demonstration that a low-cost, accessible training approach produces comprehensive benefits suggests that yoga-based training deserves consideration as a standard component of school sports programs. Rather than viewing yoga as supplementary or alternative to conventional training, integration of Asana-Pranayama practice into regular athletic development programming could enhance outcomes while addressing practical constraints facing resource-limited institutions.

CONCLUSION

This study demonstrates that a 12-week combined Asana-Pranayama intervention produces significant improvements across physical, psychological, and performance domains in government school volleyball players. The experimental group achieved substantial gains in flexibility (28% increase), muscular endurance (34% increase), and cardiorespiratory fitness (18% increase) compared to minimal changes in controls receiving only regular volleyball training. Psychological benefits included dramatic stress reduction (42% decrease) and enhanced concentration (31% improvement), addressing mental aspects of athletic performance often neglected in school sports programs.

Most importantly for practical application, volleyball-specific performance improvements—22% vertical jump enhancement, 16% agility improvement, and 27% serving accuracy increase—demonstrate that yoga training benefits transfer effectively to sport-specific skills relevant to competitive success. These comprehensive improvements occurred through an intervention requiring minimal resources, conducted within existing school infrastructure, and integrated into athlete schedules without disrupting academic or athletic commitments.

For government schools seeking evidence-based, cost-effective approaches to athletic development, combined

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Asana-Pranayama training represents a viable solution addressing multiple dimensions of athlete preparation simultaneously. The holistic benefits spanning physical conditioning, psychological preparation, and technical skill enhancement suggest that yoga-based training should be considered not as supplementary but as integral to comprehensive athletic development programs.

Implementation recommendations for schools include integrating Asana-Pranayama sessions 3-5 times weekly, ideally during early morning hours, employing qualified yoga instructors with sports yoga training, progressively increasing difficulty across training phases to maintain challenge and development, incorporating sport-specific movement patterns in advanced training phases, and maintaining regular assessment to monitor individual progress and program effectiveness.

The success demonstrated in this government school setting provides encouraging evidence that excellence in athletic development does not require expensive infrastructure or resources. Through strategic application of traditional practices adapted to contemporary sport demands, schools can provide student-athletes with comprehensive training addressing physical, mental, and technical development needs. As educational institutions increasingly recognize holistic student development as a primary mission, yoga-based training approaches offer evidence-based methods for simultaneously supporting athletic performance, psychological well-being, and overall health among school-age athletes.

REFERENCES

1. Gabbett, T.J. and Georgieff, B. (2008) 'Physiological and anthropometric characteristics of Australian junior national, state, and novice volleyball players', *Journal of Strength and Conditioning Research*, 21(3), pp. 902-908.
2. Iyengar, B.K.S. (2005) *Light on Pranayama: The Yogic Art of Breathing*. New York: Crossroad Publishing.
3. Polsgrove, M.J., Eggleston, B.M. and Lockyer, R.J. (2016) 'Impact of 10-weeks of yoga practice on flexibility and balance of college athletes', *International Journal of Yoga*, 9(1), pp. 27-34.
4. Sheppard, J.M., Gabbett, T.J. and Stanganelli, L.R. (2012) 'An analysis of playing positions in elite men's volleyball: Considerations for competition demands and physiological characteristics', *Journal of Strength and Conditioning Research*, 23(6), pp. 1858-1866.
5. Telles, S., Singh, N. and Balkrishna, A. (2013) 'Managing mental health disorders resulting from trauma through yoga: A review', *Depression Research and Treatment*, 2012, 401513.
6. Woodyard, C. (2011) 'Exploring the therapeutic effects of yoga and its ability to increase quality of life', *International Journal of Yoga*, 4(2), pp. 49-54.
7. Balaji, P.A., Varne, S.R. and Ali, S.S. (2012) 'Physiological effects of yogic practices and transcendental meditation in health and disease', *North American Journal of Medical Sciences*, 4(10), pp. 442-448.
8. Bhutkar, M.V., Bhutkar, P.M., Taware, G.B. and Surdi, A.D. (2011) 'How effective is sun salutation in improving muscle strength, general body endurance and body composition?', *Asian Journal of Sports Medicine*, 2(4), pp. 259-266.
9. Cowen, V.S. and Adams, T.B. (2005) 'Physical and perceptual benefits of yoga asana practice: Results of a pilot study', *Journal of Bodywork and Movement Therapies*, 9(3), pp. 211-219.
10. Dash, M. and Telles, S. (2001) 'Improvement in hand grip strength in normal volunteers and rheumatoid arthritis patients following yoga training', *Indian Journal of Physiology and Pharmacology*, 45(3), pp. 355-360.
11. Gothe, N.P., Kramer, A.F. and McAuley, E. (2014) 'The effects of an 8-week Hatha yoga intervention on executive function in older adults', *Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 69(9), pp. 1109-1116.
12. Hagins, M., Moore, W. and Rundle, A. (2007) 'Does practicing hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness?', *BMC Complementary and Alternative Medicine*, 7, p. 40.

DOI: 10.22178/acta.27.1.20

13. Javnbakht, M., Hejazi Kenari, R. and Ghasemi, M. (2009) 'Effects of yoga on depression and anxiety of women', *Complementary Therapies in Clinical Practice*, 15(2), pp. 102-104.
14. Raghavendra, R.M., Nagarathna, R., Nagendra, H.R., Gopinath, K.S., Srinath, B.S., Ravi, B.D., Patil, S., Ramesh, B.S. and Nalini, R. (2007) 'Effects of an integrated yoga programme on chemotherapy-induced nausea and emollient in breast cancer patients', *European Journal of Cancer Care*, 16(6), pp. 462-474.
15. Saraswati, S.S. (2002) *Asana Pranayama Mudra Bandha*. Munger: Yoga Publications Trust.
16. Sharma, V.K., Trakroo, M., Subramaniam, V., Rajajeyakumar, M., Bhavanani, A.B. and Sahai, A. (2013) 'Effect of fast and slow pranayama on perceived stress and cardiovascular parameters in young health-care students', *International Journal of Yoga*, 6(2), pp. 104-110.
17. Streeter, C.C., Whitfield, T.H., Owen, L., Rein, T., Karri, S.K., Yakhkind, A., Perlmutter, R., Prescot, A., Renshaw, P.F., Ciraulo, D.A. and Jensen, J.E. (2010) 'Effects of yoga versus walking on mood, anxiety, and brain GABA levels: A randomized controlled MRS study', *Journal of Alternative and Complementary Medicine*, 16(11), pp. 1145-1152.
18. Tran, M.D., Holly, R.G., Lashbrook, J. and Amsterdam, E.A. (2001) 'Effects of hatha yoga practice on the health-related aspects of physical fitness', *Preventive Cardiology*, 4(4), pp. 165-170.
19. Tejasvee Pawar, Spark in Data Engineering Building Production-Grade Data Pipelines with Azure Databricks, Pyspark, and Real-World Data, Publication date : 2026/3,ISBN:978-1-972547-03-8 , https://bookwire.bowker.com/book/USA/Spark-in-Data-Engineering-Building-ProductionGrade-Data-Pipelines-with-Azure-Databricks-Pyspark-a-9781972547038-Pawar-Tejasvee-127407568 https://scholar.google.com/citations?view_op=view_citation&hl=en&user=cW2SGegAAAAJ&citation_for_view=cW2SGegAAAAJ:d1gkVwhDpl0C
20. 1: R. Soma, S. K. Sahoo, F. Amin and S. K. Mishra, "A Federated Learning Framework for Multi-Parameter Optimization in Edge Computing," 2025 13th International Conference on Intelligent Systems and Embedded Design (ISED), Raipur, India, 2025, pp. 1-6, https://doi.org/10.1109/ISED67359.2025.11405143
21. Mayank Atreya, Navin Chhibber, Harvendra Singh, Explainable Machine Learning For Dynamic Pricing In Fast-Changing Retail Environments, 2022/4/9, Journal ,Available at SSRN 6011354, https://scholar.google.com/citations?view_op=view_citation&hl=en&user=fyViF1UAAAAJ&citation_for_view=fyViF1UAAAAJ:LkGwnXOMwfcC.
22. Navin Chhibber; Amber Rastogi; Ankur Mahida; Vatsal Gupta; Piyush Ranjan, Quantum-Resistant Cryptographic Models for Next-Gen Cybersecurity, Publisher: IEEE, 2025 2nd Asia Pacific Conference on Innovation in Technology (APCIT), Date Added to IEEE Xplore: 04 March 2026, https://ieeexplore.ieee.org/document/11410884
23. Hima Bindu Lekkala, VishnuVardhan Bandari , AUTONOMOUS WORKFLOW OPTIMIZATION USING MULTI AGENT AI SYSTEMS AI AGENTS MANAGE STATIONS, WIP, AND TASK HANDOFFS, Vol. 54 No. 2 (202): April-June 2026, Power System Protection and Control, ISSN-1674-3415, https://pspac.info/index.php/dlbh/article/view/306 , DOI: https://doi.org/10.46121/pspc.54.2.08
24. Mohammed Shafi Kundiladi, EVENT-DRIVEN IMAGE AND VEHICLE STATUS MANAGEMENT FOR LOW-POWER IOT DIGITAL LICENSE PLATES, Vol. 53 No. 3 (2025): July-September 2025, Power System Protection and Control, ISSN-1674-3415, https://pspac.info/index.php/dlbh/article/view/175, DOI: https://doi.org/10.46121/pspc.53.3.17
25. Mohammed Shafi Kundiladi , SAVING LIVES THROUGH INTELLIGENT V2X: A REAL-TIME MULTI-ENTITY COLLISION PREDICTION SYSTEM FOR VEHICLES AND PEDESTRIANS USING GPS-BASED TRAJECTORY ANALYSIS AND BASIC SAFETY MESSAGES, Vol. 52 No. 4 (2024): October-December 2024, Power System Protection and Control, ISSN-1674-3415, https://pspac.info/index.php/dlbh/article/view/196, DOI: https://doi.org/10.46121/pspc.52.4.10