Physical Education Theory and Methodology
Теорія та методика фізичного виховання

ISSN 1993-7989 (print)
ISSN 1993-7997 (online)
ISSN-L 1993-7989

Original Scientific Article

Enhancing Physical Fitness in Male Basketball Players through Yogic Asanas: A Randomized Controlled Trial

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Accepted for Publication: February 13, 2025
Published: March 30, 2025

DOI: 10.17309/tmfv.2025.2.11

Abstract

Background. The increasing popularity of yoga as a complementary training method has prompted interest in its effects on physical fitness among male basketball players.

Objectives. This study aimed to assess the impact of yogic asanas on physical fitness variables in male basketball players. The primary objective of this research was to determine the effectiveness of yoga asana practice on cardiorespiratory endurance (CVE), muscular strength (MS), muscular endurance (ME), and flexibility (FLE) in male basketball players.

Materials and methods. A total of 41 male basketball players were involved in the study and randomly assigned to two groups: the Yoga Asanas Group (YAG) comprising 21 players (age: 18.44 ± 0.98 years, height: 171 ± 4.45 cm, weight: 87.94 ± 4.26 kg) and the Control Group (CON) with 20 players (age: 18.93 ± 1.38 years, height: 174 ± 6.21 cm, weight: 91.31 ± 7.00 kg). Physical fitness parameters were assessed before and after the intervention.

Results. The results demonstrated a statistically significant improvement in physical fitness variables among players in the YAG, with p-values less than 0.05 for CVE ($p < 0.001$), MS ($p < 0.001$), ME ($p < 0.001$), and FLE ($p < 0.001$) following yoga asana practice. In contrast, the CON group exhibited no substantial changes ($p > 0.05$).

Conclusions. The findings of this experimental study suggest that incorporating yogic asanas into training regimens significantly enhances physical fitness parameters in male basketball players, highlighting the potential benefits of yoga as an effective training modality.

Keywords: basketball players, yogic asana, muscular strength, muscular endurance, flexibility.

Introduction

High level of physical fitness is a foundation of success in sports especially in fast-paced and high-intensity games like basketball (Farley et al., 2020; Mancha-Triguero et al., 2019). Athletes need a well-versed set of skills, including strength, endurance, agility, and flexibility to stay competitive (Puente et al., 2017). Most of the training programs emphasize drills, strength-building routines and cardio workouts to build these essential qualities. In recent times, there has been a growing interest in integrating the new elements to these traditional methods to enhance overall athletic performance. One practice that is gaining traction is yoga, which promises benefits that extend beyond the purely physical to also support mental well-being (Vogler et al., 2023; Woodyard, 2011).

Yoga has been around for thousands of years, originating in ancient India as a practice that combined physical postures, breathing exercises, and meditation. Over time, it has evolved into a recognized training tool that can improve flexibility, core strength, balance, and mental focus. These attributes are crucial for athletes, especially for basketball players who need to make sharp, quick movements and maintain balance

under pressure (Shao et al., 2023). Yoga has the potential to enhance an athlete's body control with accumulative their adaptability and agility on the court (Alleva et al., 2020; Kaltenborn & Ryba, 2006). In addition to its physical advantages, yoga provides substantial mental and emotional reinforcement (Ross et al., 2013). The pressures associated with competitive sports can be formidable, requiring athletes to execute instantaneous decisions and sustain concentration in critical scenarios. The yoga have demonstrated efficacy in alleviating stress, enhancing concentration, and fostering resilience providing athletes with a psychological advantage that enables them to maintain composure during pivotal moments in competition (Kanaujia et al., 2023).

The investigation into yoga as an adjunctive practice within the realm of sports training has progressively garnered attention over time. Initial research on the advantages of yoga primarily concentrated on its capacity to improve flexibility and alleviate stress. The studies established a basis for understanding the extensive potential of yoga beyond conventional health and wellness domains, demonstrating that consistent practice could yield considerable physical and psychological advantages (Kishan, 2020; Nayak & Verma, 2023; Woodyard, 2011).

Recent scholarly works have increasingly explored the application of yoga within the context of athletic environments. Studies have shown that engaging in yoga can enhance multiple dimensions of physical fitness, such as balance, core stability, and flexibility attributes essential for numerous sports, including basketball (Bucea-Manea-Ţoniş et al., 2023; Kaltenborn & Ryba, 2006; Woodyard, 2011). For example, studies have shown that certain asanas can enhance the range of motion and reduce the risk of injury by improving muscle elasticity and joint health (Halappa, 2023; Niemaszyk & Truszczyńska-Baszak, 2023).

When it comes to cardiovascular endurance (CVE), muscular strength (MS), and muscular endurance (ME), the findings are mixed but promising. Some studies have indicated that incorporating yoga into a training regimen can lead to modest improvements in cardiovascular health and muscular performance (Lau et al., 2015). For example, research conducted on athletes from various disciplines found that integrating yoga sessions into their regular training helped enhance their recovery and overall fitness levels (Bucea-Manea-Ţoniş et al., 2023; Halappa, 2023). However, these studies often focused on general fitness populations or athletes in non-competitive contexts.

While the existing literature supports the idea that yoga offers numerous benefits, the evidence is less robust when it comes to high-performance sports, especially for basketball players. The few studies that have explored yoga's role in competitive sports suggest that it can improve agility and reaction times, but these findings are typically part of broader investigations without a specific focus on key fitness parameters like CVE, MS, ME, and FLE in basketball athletes. The research gap is evident: while yoga's role in improving flexibility and mental health has been documented, comprehensive studies examining its impact on core physical fitness metrics for competitive basketball remain limited (Bucea-Manea-Ţoniş et al., 2023; Vaidya et al., 2021; Woodyard, 2011).

This gap in the literature highlights the need for more targeted research that evaluates the practical application of yoga within structured training programs for athletes. Thus, this study aims to fill that gap by examining the effects of a 12-week yoga asana program on key fitness markers in male basketball players. By using a randomized controlled trial (RCT), we can ensure a fair comparison between players who incorporate yoga into their training (Yoga Asanas Group, YAG) and those who stick to their usual training routines (Control Group, CON). We'll measure their physical fitness before and after the intervention to see if the yoga practice leads to improvements in CVE, MS, ME, and FLE.

Materials and Methods

Study Design

This study was conducted to determine if practicing yogic asanas (specific yoga poses) can improve physical fitness in male basketball players. To do this, we used a method called a randomized controlled trial. In this design, participants were randomly assigned to either a Yoga Asanas Group (who practiced yoga) or a Control Group (who did not practice yoga). This random assignment helps ensure that each group is as similar as possible, except for the yoga intervention. Measurements were taken twice: once before the 12-week yoga program started and again at the end of 12 weeks. This way, we could clearly observe any changes due to the yoga program.

Subjects

At the enrollment stage (Initial stage), male basketball players aged 18 to 24 years from the Indian Institute of Information Technology, Sri City, Chittoor were employed for the participation. Each player and, where needed, their guardians, provided consent to participate after we explained the study procedures to them. We used a careful screening process to select eligible players. This screening involved making sure participants met certain criteria for age, health, and basketball experience, and that they did not have any injuries or conditions that could interfere with yoga practice or the study results.

Sample Size

To decide how many participants we needed, we referred to a previous similar study by (Mohr et al., 2014). According to this study, 41 players would be sufficient to give us reliable results. Thus, we recruited 41 players and randomly assigned them into two groups: the Yoga Asanas Group (YAG) with 21 players and the Control Group (CON) with 20 players. This sample size allows us to make solid conclusions about how yogic asanas might affect physical fitness.

Randomization

In our initial screening, we found 64 players who met the eligibility criteria. However, due to factors like scheduling conflicts or potential dropouts, only 41 were ultimately able to participate in the study depicted in figure 1. Each player was given a clear explanation of the study's aims, methods, and the possibility of dropouts. Then, using a random allocation method, we assigned each player to either the Yoga Asanas Group (YAG) or the Control Group (CON), ensuring that both groups started out with similar characteristics.

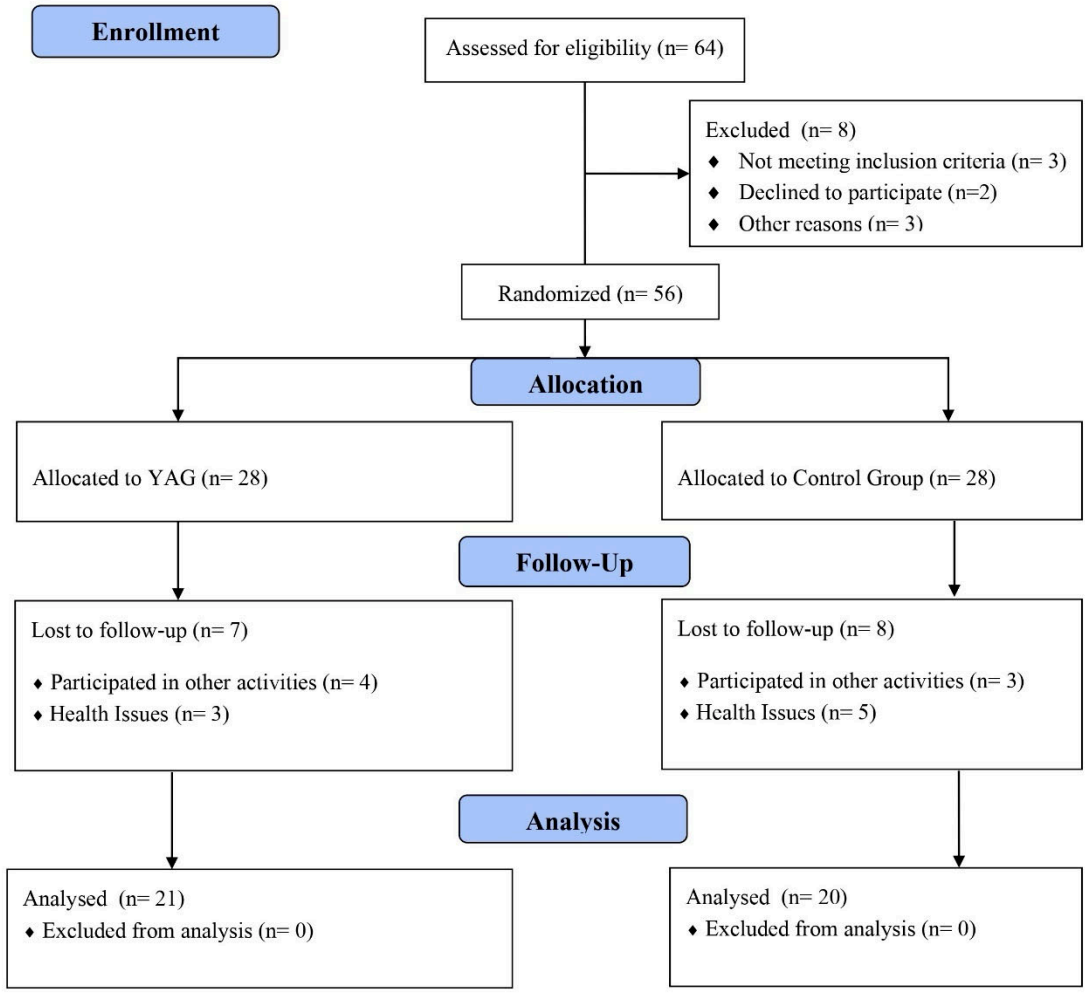

Fig. 1. Subject recruitment flow diagram

Blinding/Masking

We used a technique called "blinding" to help prevent any bias in the results. In this case, the researchers who measured the players' fitness at the end of the study did not know which group each player belonged to. This helped ensure that the results were objective and unaffected by any preconceptions. However, players knew which group they were in, as the yoga practice could not be hidden from them.

Yogic Asanas Intervention

To ensure that all participants understood the purpose and procedures of the study, familiarization sessions were held as part of theory classes. During these sessions, each participant in YAG received a thorough introduction to the study design, objectives, and the specific yoga asanas they would be practicing. These sessions aimed to make participants comfortable with the techniques and terminology involved in yogic practices and ensure their readiness for the physical training sessions. Attendance was strictly recorded for all theory and practice sessions throughout the 12-week study period to monitor participant engagement and ensure consistency in participation. The YAG took part in a structured yoga program led by a certified yoga instructor or a qualified BNYS (Bachelor of Naturopathy and Yogic Sciences) doctor. This program was designed specifically to improve fitness aspects like strength, flexibility, balance, and endurance. Each session lasted 60 minutes and was held three times a week over the 12-week period. Each yoga session included Warm-Up: Gentle stretches and movements to prepare the body for exercise. Yoga Asanas (Postures): Various yoga poses that focused on enhancing physical fitness. These poses were selected based on their potential benefits for athletes, such as improving flexibility, core strength, and balance. Relaxation Techniques: At the end of each session, players practiced relaxation techniques to promote recovery and mental calmness. During this time, the Control Group (CON) did not participate in the yoga program but continued with their regular basketball training routines. This allowed us to compare any changes in fitness between the players who practiced yoga and those who didn't.

Outcome Measure

Anthropometry

Participants' body weight was measured on an electronic scale (Seca, Hamburg, Germany) with a precision

Table 1. Exercise protocols for yoga asana group weekly session (n = 21)

Sl. No	Name of the Yoga Practices	Duration	Weeks
1.	Loosening Exercises Jumping Jacks High Knees Butt Kicks Arm Cercles Leg Swing Legs with a twist Torso Rotation Side shuffles Inchworm Hip circles	15 minutes	1-4
2.	Suryanamasker	12 rounds / 15 minutes	
3.	Asana	30 minutes	
	Tadasana (Mountain pose)	2 minutes	
	Vrikshasana (Tree pose)	2 minutes	
	Utkatasana (Chair Pose)	20 counts / 8 minutes	
	Trikonasana (Triangle pose),	2 minutes	
	Virabhadrasana	2 minutes	
	Malasana	1 minutes	
	Bitilasana (Cat cow Pose)	2 minutes	
	Kopotasana (Pigeon Pose)	3 minutes	
	Bhujangasana (Cobra Pose)	2 minutes	
	Savasana	6 minutes	
	Total	60 Minutes	
Sl. No	**Name of the Yoga Practices**	**Duration**	**Weeks**
1.	Loosening Exercises Jumping Jacks High Knees Butt Kicks Arm Cercles Leg Swing Legs with a twist Torso Rotation Side shuffles Inchworm Hip circles	12 minutes	5-8
2.	Suryanamasker	12 rounds / 15 minutes	
3.	Asana	30 minutes	
	Tadasana (Mountain pose)	2 minutes	
	Vrikshasana (Tree pose)	2 minutes	
	Utkatasana (Chair Pose)	20 counts / 8 minutes	
	Trikonasana (Triangle pose)	2 minutes	
	Parivrttra Trikonasana (Twist triangle pose)	2 minutes	
	Virabhadrasana (Warrior II)	2 minutes	
	Vajrasana	1 minutes	
	Malasana	1 minutes	
	Bitilasana (Cat cow Pose)	2 minutes	
	Kopotasana (Pigeon Pose)	2 minutes	
	Parvatasana (Mountain Pose)	1 minutes	
	Adho Mukha Savasana (Downward Facing Dog)	2 minutes	
	Bhujangasana (Cobra Pose)	1 minutes	
	Savasana	2 minutes	
4.	Meditation Mindfulness meditation	3 minutes	
	Total	60 Minutes	

Table 1 (continued)

Sl. No	Name of the Yoga Practices	Duration	Weeks
1.	Loosening Exercises Jumping Jacks High Knees Butt Kicks Arm Cercles Leg Swing Legs with a twist Torso Rotation Side shuffles Inchworm Hip circles Knee Hugs Ankle Circles Dynamic Squats Forward Lunges Neck Rolls	15 minutes	
2.	Suryanamasker	12 rounds / 12 minutes	
3.	Asana	30 minutes	9-12
	Tadasana (Mountain pose)	2 minutes	
	Vrikshasana (Tree pose)	2 minutes	
	Utkatasana (Chair Pose)	12 counts / 8 minutes	
	Ardha Chandrasana	2 minutes	
	Parivrttra Trikonasana (Twist triangle pose)	2 minutes	
	Virabhadrasana (Warrior II)	2 minutes	
	Matsyendrasana (Fish Pose)	1 minutes	
	Kopotasana (Pigeon Pose)	1 minutes	
	Parvatasana (Mountain Pose)	1 minutes	
	Adho Mukha Savasana (Downward Facing Dog)	1 minutes	
	Setu bandhasana (Bridge Pose)	1 minutes	
	Bhujangasana (Cobra Pose)	1 minutes	
	Supta Padangusthasana	2 minutes	
	Viparitakarani (Legs up the well)	2 minutes	
	Savasana	2 minutes	
4.	Meditation Mindfulness meditation	3 minutes	
	Total	60 Minutes	

of 0.01 kg, while they were barefoot and wearing minimal clothing. Height was recorded to the nearest 0.1 cm using a stadiometer (Seca, Hamburg, Germany) following standardized measurement protocols (Govindasamy et al., 2024).

Cardiovascular Endurance (Cooper's 12-Minute Run)

Participants performed a 12-minute endurance run on an outdoor track, aiming to complete as many laps as possible within the time limit. They were instructed to pace themselves throughout the test. To support pacing, the administrator announced elapsed time intervals at 3, 6, and 9 minutes and provided verbal encouragement. At the end of the 12 minutes, participants were instructed to stop, and the administrator measured any incomplete final lap distance using a measuring wheel. This partial lap distance was added to the total completed laps to determine the final distance covered. The total distance run was then used to estimate VO_2max ($ml \cdot kg^{-1} \cdot min^{-1}$) using Cooper's equation: VO_2max ($ml \cdot kg^{-1} \cdot min^{-1}$) = (22.351 × distance in km) - 11.288 (Suresh et al., 2022).

Muscular Strength

The players begin lying on their back on a mat, with hands positioned beneath the shoulders, fingers extended, and legs straight, slightly apart. From this starting position, the student pushes against the mat until their arms are fully extended, keeping both legs and back straight. They then lower their body until their elbows form a 90-degree angle, with forearms parallel to the floor. Athletes were instructed to perform as many 90-degree push-ups as possible in time with a designated rhythm marked by cues of "down" and "up". The test was stopped if a student committed two faults, such as knees touching the ground, instability in the back,

incomplete arm extension, or failure to reach a 90-degree elbow angle. The final score was the total number of correctly executed push-ups (Govindasamy et al., 2023).

Muscular Endurance (Sit-Up Test)

Muscular endurance was assessed using a sit-up test (BS-SU, InBody, Seoul, Republic of Korea). Prior to the test, participants were instructed to lie supine on a mat, ensuring that their heads and upper backs remained in contact with the surface. Their knees were positioned at a 45° angle with a fist-sized gap between them. Throughout the test (while performing sit-ups), participants were required to keep their hands positioned behind their heads, maintaining this placement while executing sit-ups. They performed sit-ups continuously for a 60-second period, ensuring proper form and adherence to the specified technique. Each sit-up required both elbows to touch the knees before returning to the starting position. The endurance score was based on the total number of sit-ups completed within 30-second intervals. Participants were allowed to practice two to three times with assistance to familiarize themselves with the movement, and repetitions were counted aloud during the assessment to maintain consistency (Suresh et al., 2022).

Flexibility

The sit and reach test was performed according to precise instructions to assess lower body flexibility. While seated, participants extended forward as far as possible with one knee held straight. A sit and reach box was used to measure the reach distance of the hands in centimetres, providing an assessment of flexibility in the lower body (Govindasamy et al., 2023).

Table 2. Demographic parameters of the participants (n = 41)

Variables	Control Group	Yoga Asana Group	p value
Age	18.93 ± 1.38	18.44 ± 0.98	0.218*
Height	174.00 ± 6.21	171.00 ± 4.45	0.198*
Weight	91.31 ± 7.00	87.94 ± 4.26	0.109*

Notes: *Independent t-test result p>0.05

Statistical Analysis

Data were expressed as mean values with standard deviations (SD) for each physical fitness parameter. The normality of the data distribution was assessed using the Kolmogorov-Smirnov test. A p-value greater than 0.05 indicated a normal Gaussian distribution of the data. To evaluate the differences in physical fitness parameters between the two groups (yoga asana and non-yoga asana), paired t-tests were conducted for within-group comparisons. Additionally, between-group differences were analyzed using independent t-tests. Effect sizes were calculated using Cohen's d to determine the magnitude of differences observed. The mean differences between pre- and post-intervention scores were also calculated, providing insights into the extent of improvement attributable to the yoga asana intervention. Statistical significance was set at $p < 0.05$ for all analyses. Confidence intervals (CIs) were computed for mean changes to assess the precision of the estimates.

Results

Table 2 presents the anthropometric parameters of male basketball players divided into two groups: those practicing yoga asanas and those not practicing yoga asanas. At baseline, there were no significant differences in age, height, and other parameters between the two groups. A total of 64 individuals were screened for participation in the study, and out of these, 56 met the specified inclusion and exclusion criteria and were subsequently enrolled. During the study, seven participants from the yoga asana group and eight from the non-yoga asana group withdrew for various reasons, which are detailed in Figure 1. It is important to note that no adverse events were reported among participants who completed the study.

Table 3 illustrates a statistically significant improvement in various physical fitness variables among the basketball players in the yoga asana group, with p-values less than 0.05 for cardiorespiratory endurance (CVE: $p < 0.001$), muscular strength (MS: $p < 0.001$), muscular endurance (ME: $p < 0.001$), and flexibility (FLE: $p < 0.001$) following the yoga asana practice. Conversely, the basketball players in the non-yoga asana group did not exhibit any significant changes ($p > 0.05$) in these fitness parameters (Figure 2).

The yoga asana intervention demonstrated a substantial positive effect on physical fitness, with effect sizes indicating improvements: CVE (1.18), MS (0.92), ME (1.26), and FLE (2.51) (Figure 2). Furthermore, the mean change in physical fitness measures was notable: CVE improved by 2.12 (with a confidence interval of 1.74 to 0.61), MS by 0.36 (1.43 to 0.40), ME by 1.59 (1.83 to 0.67), and FLE by 1.82 (3.38 to 1.61).

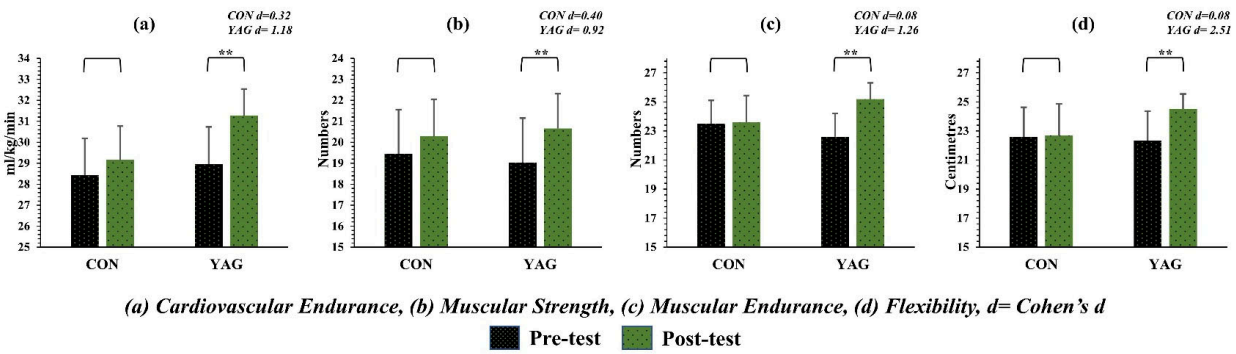

Fig. 2. The bar charts of physical fitness parameters before and after the intervention

Table 3. Comparison of Physical Fitness Parameters Between Basketball Players with Yoga Asanas and Without Yoga Asanas (n = 41)

Physical Fitness Parameters	CON (n=20)		p / % change	Cohen's d	YAG (n=21)		p / % change	Cohen's d	Between group difference (CI)
	Pre (M ± SD)	Post (M ± SD)			Pre (M ± SD)	Post (M ± SD)			
CVE $ml \cdot kg^{-1} \cdot min^{-1}$	28.42 ± 1.77	29.16 ± 1.61	0.16 / (2.60)	0.32	28.96 ± 2.03	31.28 ± 1.26	< .001 / (8.01)	1.18	2.12 (1.74-0.61)
MS Numbers	19.45 ± 2.11	20.30 ± 1.75	0.08 / (4.37)	0.40	19.04 ± 1.39	20.66 ± 1.65	< .001 / (8.50)	0.92	0.36 (1.43-0.40)
ME Numbers	23.50 ± 1.60	23.60 ± 1.84	0.72 / (0.42)	0.08	22.61 ± 2.17	25.19 ± 1.12	< .001 / (11.41)	1.26	1.59 (1.83-0.67)
FLE Centimetres	22.60 ± 2.03	22.70 ± 2.17	0.71 / (0.44)	0.08	22.33 ± 1.52	24.52 ± 1.03	< .001 / (9.80)	2.51	1.82 (3.38-1.61)

Notes: CVE; Cardiovascular endurance, MS; Muscular Strength, ME; Muscular Endurance, FLE; Flexibility, CON; Control group, YAG; Yoga asana group

Discussion

This study's results strongly suggest that a 12-week yogic asanas intervention can statistically significantly increase physical fitness parameters in male basketball players. There were dramatic improvements in these measures: cardiorespiratory endurance (CVE), muscular strength (MS), muscular endurance (ME), and flexibility (FLE) in the yoga group, but no significant changes in the control group. Furthermore, this finding demonstrates that yoga can significantly complement traditional athletic preparation, particularly for basketball.

The 8.01% change in CVE for the yoga group suggests that yoga practices, including breath control and prolonged isometric holds, may substantially affect an athlete's oxygen uptake and respiratory efficiency. Efficient CVE is particularly important in basketball, where players constantly perform at high-intensity efforts spaced by short recovery periods (Delextrat et al., 2018; Flórez Gil et al., 2024; Mihajlovic et al., 2023). Adding Surya Namaskar (Sun Salutation) and asanas that require rhythmic breathing, such as Utkatasana (Chair Pose), may help deliver more oxygen and stabilize cardiovascular stability, enabling athletes to perform consistently over long periods of demanding activity (Deshmukh et al., 2024; Luan et al., 2019). This finding provides evidence of yoga's benefits in enhancing aerobic conditioning as an alternative or additional method to traditional high-impact cardiovascular training with associated injury risk (Beck et al., 2017; Campbell et al., 2019; Ramos-Jiménez et al., 2015). Substituting yoga for endurance conditioning can help coaches and athletic trainers utilize a gentler, still effective way to build cardiovascular fitness in the joints and soft tissues.

A noteworthy finding is the 8.50 % improvement in MS observed in the yoga group in which the yoga intervention consisted of no external weights or traditional resistance exercises. These are asanas requiring prolonged engagement and isometric contraction: Virabhadrasana (Warrior Pose) and Tadasana (Mountain Pose), in which significant gains are had in MS. These poses serve as the foundation for developing multiple muscle groups simultaneously, with a particular emphasis on enhancing the endurance of lower extremity muscles and stabilizing muscles, which are areas where basketball players depend on explosive power for jumping, sprinting and quick direction change (Anversha & Ramalingam, 2023; Luo et al., 2023). This increase in muscular strength from yoga, observed without weight or other equipment loading, suggests that yoga may be a functional and affordable intervention, particularly in environments where such strength training resources are inaccessible. Nevertheless, it should be known that although strength gain was significant, yoga may help strength endurance and muscle tone rather than maximal strength (Hosseini et al., 2018; Sarbaz et al., 2020). Also, future studies would potentially look into ways other styles of yoga, specifically ones that have dynamic transitions and longer holds, influence strength development regarding classic resistant training.

This onefold increase in ME in the yoga group demonstrates the effectiveness of the intervention in promoting continued muscular activation and endurance, most notably in core and lower body muscles (11.41 %). Trikonasana (Triangle Pose) and Vrksasana (Tree Pose), asanas which require balance and need continuous muscle activation (including through muscle contraction), build muscle endurance in muscles needed to stabilize for continuous high-intensity movement involved in basketball (Luo et al., 2023; Rhyu et al., 2018). Lower body endurance for sprinting and jumping and core stability for dynamic movement and impact absorption are the two critical areas of athleticism needed in basketball athletes (Cao et al., 2024; Luo et al., 2023), so yoga will help reach these areas. According to the increase in ME, yoga's approach to continuous, steady muscle engagement may create endurance differently than a regimented, repetition-based protocol. These benefits are apparent, but further investigation is warranted to see if yoga is equally effective at building stamina in fast-twitch muscle fibres as plyometrics or interval training, which are standard ways to build stamina within fast-twitch muscle fibres.

A particularly substantial increase in FLE, at 9.80 %, is a significant boost for those in the athletic field; increased mobility can allow for an increased range of motion, reduce the risk of injury, and increase the efficiency of movement. Bhujangasana (Cobra Pose) and Savasana (Corpse Pose) asanas are great for sports like basketball that require dynamic stretching and muscle lengthening (especially for

movements such as squatting, jumping and going in any direction). Athletes get better depth in their joint movements and less resistance during dynamic actions, leading to better agility, less strain, and less risk of joint injuries (Behm et al., 2023; Read et al., 2016). Flexibility has a large effect size, which indicates that yoga might be the first option of flexibility training for basketball players, and the benefit may be more significant with yoga than with existing static and dynamic stretching exercises. Future research could also explore whether particular asanas are more suited to improving flexibility in areas where basketball players are at increased risk of injury (for instance, the hamstrings, hip flexors and shoulders).

Limitations

The study's findings are promising, but the research did have limitations. Due to only a sample size of 41 male basketball players, results are not generalizable to other demographics: female athletes or those in other sports. Moreover, this is also a 12-week session instead of following up on the benefits of continued yoga practice. Future research could follow interventions for longer periods and follow-ups to see the lasting effects of continued yoga practice. This standardized intervention may not adequately account for possible variations in an individual's fitness level; hence, individualized programs may result in better outcomes. Finally, the psychological benefit was not measured, which is as essential to the athlete's psychological resilience and focus. Yoga could also be the subject of future research to check whether it can be a holistic potential in sports to enhance physical and mental conditioning.

Future Recommendations

Future studies of this nature should involve larger samples made up of more diverse populations of athletes, including athletes from various sports, of different ages and both genders. In addition, the research could explore how the long-term benefits of practising yoga in fitness improve or plateau for continued benefits of the practice in fitness training. Furthermore, the effects of yoga on sport-specific performance metrics such as shooting accuracy, reaction time and agility, along with coupling psychological evaluations, will give a bigger picture of the impact of yoga on total sporting development. Lastly, personalized yoga programs that match an athlete's needs can bring maximal physical benefit with little injury risk, making yoga a commonly overlooked but valuable tool for high-performance athletes.

Conclusion

The results of this study show the effectiveness of yoga as a supplementary programme to the traditional training of basketball players with a marked improvement of CVE, MS, ME and FLE. Yoga is an attractive addition to an athlete's training program as an integrated component because it is a well-rounded approach to physical fitness that may improve performance, decrease the risk of injury, and contribute to mental resilience. Future research in various populations, an extended period of intervention, and sport-specific performance tests are needed, eventually leading to yoga's inclusion as a staple component of modern athletic conditioning.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgement

I would like to express my sincere gratitude to all the participants and their parents for their invaluable cooperation and support throughout the course of this study. Their commitment and willingness to contribute to this research were fundamental to its success.

References

Farley, J. B., Stein, J., Keogh, J. W. L., Woods, C. T., & Milne, N. (2020). The Relationship Between Physical Fitness Qualities and Sport-Specific Technical Skills in Female, Team-Based Ball Players: A Systematic Review. *Sports Medicine - Open, 6*(1), 18. https://doi.org/10.1186/s40798-020-00245-y

Mancha-Triguero, D., García-Rubio, J., Calleja-González, J., & Ibáñez, S. J. (2019). Physical fitness in basketball players: A systematic review. *The Journal of Sports Medicine and Physical Fitness, 59*(9). https://doi.org/10.23736/S0022-4707.19.09180-1

Puente, C., Abián-Vicén, J., Areces, F., López, R., & Del Coso, J. (2017). Physical and Physiological Demands of Experienced Male Basketball Players During a Competitive Game. *Journal of Strength and Conditioning Research, 31*(4), 956-962. https://doi.org/10.1519/JSC.0000000000001577

Vogler, S., Salyer, R. E., & Giacobbi, P. R. (2023). Yoga and Mental Well-being: A Qualitative Exploration of the Lived Experiences of Yoga Practitioners. *International Journal of Yoga, 16*(3), 192-201. https://doi.org/10.4103/ijoy.ijoy_191_23

Woodyard, C. (2011). Exploring the therapeutic effects of yoga and its ability to increase quality of life. *International Journal of Yoga, 4*(2), 49-54. https://doi.org/10.4103/0973-6131.85485

Shao, Z., Bezmylov, M. M., & Shynkaruk, O. A. (2023). Individual characteristics of physical and mental development and their connection with regular physical exercises when playing basketball. *Current Psychology, 42*(30), 25996-26005. https://doi.org/10.1007/s12144-022-03692-w

Alleva, J. M., Tylka, T. L., Van Oorsouw, K., Montanaro, E., Perey, I., Bolle, C., Boselie, J., Peters, M., & Webb, J. B. (2020). The effects of yoga on functionality appreciation and additional facets of positive body image. *Body Image,* 34, 184-195. https://doi.org/10.1016/j.bodyim.2020.06.003

Kaltenborn, J. M., & Ryba, T. V. (2006). The Benefits of Yoga for Athletes: The Body. *Athletic Therapy Today, 11*(2), 32–34. https://doi.org/10.1123/att.11.2.32

Ross, A., Friedmann, E., Bevans, M., & Thomas, S. (2013). National survey of yoga practitioners: Mental and physical health benefits. *Complementary Therapies in Medicine, 21*(4), 313-323. https://doi.org/10.1016/j.ctim.2013.04.001

Kanaujia, S., Saraswati, P., Anshu, null, Singh, N., Singh, S., Kataria, N., & Yadav, P. (2023). Effect of yoga and mindfulness on psychological correlates in young athletes: A meta-analysis. *Journal of Ayurveda and Integrative Medicine, 14*(3), 100725. https://doi.org/10.1016/j.jaim.2023.100725

Kishan, P. (2020). Yoga and Spirituality in Mental Health: Illness to Wellness. *Indian Journal of Psychological Medicine, 42*(5), 411-420. https://doi.org/10.1177/0253717620946995

Nayak, K., & Verma, K. (2023). Yoga-Nidra as a mental health booster: A narrative review. *Journal of Ayurveda and Integrative Medicine, 14*(6), 100842. https://doi.org/10.1016/j.jaim.2023.100842

Bucea-Manea-Țoniș, R., Paun, D. G., Mindrescu, V., & Cătună, C. (2023). Yoga, an Appurtenant Method to Improve the Sports Performance of Elite Romanian Athletes. *Sustainability, 15*(5), 4264. https://doi.org/10.3390/su15054264

Halappa, N. G. (2023). Integration of yoga within exercise and sports science as a preventive and management strategy for musculoskeletal injuries/disorders and mental disorders – A review of the literature. *Journal of Bodywork and Movement Therapies,* 34, 34-40. https://doi.org/10.1016/j.jbmt.2023.04.055

Niemaszyk, M., & Truszczyńska-Baszak, A. (2023). Musculoskeletal Injuries Associated with Yoga Practice—A Literature Review. *Rehabilitacja Medyczna, 27*(1). https://doi.org/10.5604/01.3001.0016.3420

Lau, C., Yu, R., & Woo, J. (2015). Effects of a 12-Week Hatha Yoga Intervention on Cardiorespiratory Endurance, Muscular Strength and Endurance, and Flexibility in Hong Kong Chinese Adults: A Controlled Clinical Trial. *Evidence-Based Complementary and Alternative Medicine:* eCAM, 2015, 958727. https://doi.org/10.1155/2015/958727

Vaidya, S. S., Agarwal, B., Singh, Y., & Mullerpatan, R. (2021). Effect of Yoga on Performance and Physical Fitness in Cricket Bowlers. *International Journal of Yoga Therapy, 31*(1), Article_10. https://doi.org/10.17761/2021-D-20-00060

Mohr, M., Lindenskov, A., Holm, P. M., Nielsen, H. P., Mortensen, J., Weihe, P., & Krustrup, P. (2014). Football training improves cardiovascular health profile in sedentary, premenopausal hypertensive women. *Scandinavian Journal of Medicine & Science in Sports, 24*(S1), 36-42. https://doi.org/10.1111/sms.12278

Govindasamy, K., Gogoi, H., Jebabli, N., Bediri, S. M., Aljahni, M., Parpa, K., Clark, C. C. T., Granacher, U., & Zouhal, H. (2024). The effects of kettlebell training versus resistance training using the own body mass on physical fitness and physiological adaptations in obese adults: A randomized controlled trial. *BMC Sports Science, Medicine and Rehabilitation, 16*(1), 106. https://doi.org/10.1186/s13102-024-00894-6

Suresh, C., Govindasamy, K., Ks, S., Anand, M., Kaur, D., Anitha, J. B., Aloui, A., Boughanmi, H., & Achouri, I. (2022). Role of aerobics exercise and kettlebell training improving on selected health related physical fitness parameters in obese male adults. *Health, Sport, Rehabilitation, 8*(4), 8-19. https://doi.org/10.34142/HSR.2022.08.04.01

Govindasamy, K., Suresh, C., Kaur, D., Pramanik, M., & Anitha, J. B. (2023). Differential effects of a 12-week aerobic exercise program on health-related physical fitness, physiological and biochemical markers among obese adults: A randomized controlled trial. *Health, Sport, Rehabilitation, 9*(2), 6-21. https://doi.org/10.34142/HSR.2023.09.02.01

Delextrat, A., Gruet, M., & Bieuzen, F. (2018). Effects of Small-Sided Games and High-Intensity Interval Training on Aerobic and Repeated Sprint Performance and Peripheral Muscle Oxygenation Changes in Elite Junior Basketball Players. *Journal of Strength and Conditioning Research, 32*(7), 1882-1891. https://doi.org/10.1519/JSC.0000000000002570

Flórez Gil, E., Vaquera, A., Ramírez-Campillo, R., Sanchez-Sanchez, J., & Rodríguez Fernández, A. (2024). Can Complex Training Improve Acute and Long-Lasting Performance in Basketball Players? A Systematic Review. *Applied Sciences, 14*(15), 6839. https://doi.org/10.3390/app14156839

Mihajlovic, M., Cabarkapa, D., Cabarkapa, D., Philipp, N., & Fry, A. (2023). Recovery Methods in Basketball: A Systematic Review. *Sports, 11*(11), 230. https://doi.org/10.3390/sports11110230

Deshmukh, L., Janghel, U., Sonkuwar, A., & Thakur, R. (2024). Exploring the Synergy between Yoga and Mindfulness Sport Practices: Enhancing Mental and Physical Well-Being. *Indian Journal of YOGA Exercise & Sport Science and Physical Education,* 26-32. https://doi.org/10.58914/ijyesspe.2024-9.1.4

Luan, X., Tian, X., Zhang, H., Huang, R., Li, N., Chen, P., & Wang, R. (2019). Exercise as a prescription for patients with various diseases. *Journal of Sport and Health Science, 8*(5), 422-441. https://doi.org/10.1016/j.jshs.2019.04.002

Beck, B. R., Daly, R. M., Singh, M. A. F., & Taaffe, D. R. (2017). Exercise and Sports Science Australia (ESSA) position statement on exercise prescription for the prevention and management of osteoporosis. *Journal of Science and Medicine in Sport, 20*(5), 438-445. https://doi.org/10.1016/j.jsams.2016.10.001

Campbell, K. L., Winters-Stone, K. M., Wiskemann, J., May, A. M., Schwartz, A. L., Courneya, K. S., Zucker, D. S., Matthews, C. E., Ligibel, J. A., Gerber, L. H., Morris, G. S., Patel, A. V., Hue, T. F., Perna, F. M., & Schmitz, K. H. (2019). Exercise Guidelines for Cancer Survivors: Consensus Statement from International Multidisciplinary Roundtable. *Medicine & Science in Sports & Exercise, 51*(11), 2375-2390. https://doi.org/10.1249/MSS.0000000000002116

Ramos-Jiménez, A., Wall-Medrano, A., Corona-Hernández, R., & Hernández-Torres, R. (2015). Yoga, bioenergetics and eating behaviors: A conceptual review. *International Journal of Yoga, 8*(2), 89. https://doi.org/10.4103/0973-6131.158469

Anversha, A. T., & Ramalingam, V. (2023). A Systematic Review: Significance of Plyometric Training on Functional Performance and Bone Mineral Density in Basketball Players of Different Age Groups. *Sports Medicine: Research and Practice, 13*(2), 62-76. https://doi.org/10.47529/2223-2524.2023.2.6

Luo, S., Soh, K. G., Zhao, Y., Soh, K. L., Sun, H., Nasiruddin, N. J. M., Zhai, X., & Ma, L. (2023). Effect of core training

on athletic and skill performance of basketball players: A systematic review. *PLOS ONE, 18*(6), e0287379. https://doi.org/10.1371/journal.pone.0287379

Hosseini, S. S., Rajabi, H., Sahraian, M. A., Moradi, M., Mehri, K., & Abolhasani, M. (2018). Effects of 8-Week Home-Based Yoga and Resistance Training on Muscle Strength, Functional Capacity and Balance in Patients with Multiple Sclerosis: A Randomized Controlled Study. *Asian Journal of Sports Medicine, 9*(3). https://doi.org/10.5812/asjsm.68807

Sarbaz, Y., Beni, K. N., Hosseininejad, A., Eftekharsadat, B., & Jahanjoo, F. (2020). The effect of yoga practice on muscular strength improvement in patients with multiple sclerosis. *International Journal of Therapy and Rehabilitation, 27*(9), 1-10. https://doi.org/10.12968/ijtr.2019.0097

Rhyu, H.-S., Han, H.-G., & Rhi, S.-Y. (2018). The effects of instrument-assisted soft tissue mobilization on active range of motion, functional fitness, flexibility, and isokinetic strength in high school basketball players. *Technology and Health Care, 26*(5), 833-842. https://doi.org/10.3233/THC-181384

Cao, S., Liu, J., Wang, Z., & Geok, S. K. (2024). The effects of functional training on physical fitness and skill-related performance among basketball players: A systematic review. *Frontiers in Physiology,* 15, 1391394. https://doi.org/10.3389/fphys.2024.1391394

Behm, D. G., Alizadeh, S., Daneshjoo, A., & Konrad, A. (2023). Potential Effects of Dynamic Stretching on Injury Incidence of Athletes: A Narrative Review of Risk Factors. *Sports Medicine, 53*(7), 1359-1373. https://doi.org/10.1007/s40279-023-01847-8

Read, P. J., Oliver, J. L., De Ste Croix, M. B. A., Myer, G. D., & Lloyd, R. S. (2016). Neuromuscular Risk Factors for Knee and Ankle Ligament Injuries in Male Youth Soccer Players. *Sports Medicine, 46*(8), 1059-1066. https://doi.org/10.1007/s40279-016-0479-z

Підвищення рівня фізичної підготовленості баскетболістів-чоловіків через застосування йогічних асан: Рандомізоване контрольоване дослідження

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 11 с., 3 табл., 2 рис., 38 джерел.

Історія питання. Зростаюча популярність занять йогою як додаткового методу тренувального процесу спричинила зацікавленість щодо вивчення її впливу на рівень фізичної підготовленості серед баскетболістів-чоловіків.

Мета дослідження. Це дослідження мало на меті оцінити вплив йогічних асан на показники фізичної підготовленості баскетболістів-чоловіків. Головне завдання дослідження полягало у визначенні ефективності практики йогічних асан на стан кардіореспіраторної витривалості (КРВ), м'язової сили (МС), м'язової витривалості (МВ) та гнучкості (ГНУ) у баскетболістів-чоловіків.

Матеріали та методи. У дослідженні взяли участь загалом 41 баскетболіст чоловічої статі, яких було розподілено за методом рандомізації на дві групи: група, що займалася виконанням йогічних асан (ЙАГ) у кількості 21 гравця (вік: 18,44 ± 0,98 років, зріст: 171 ± 4,45 см, вага: 87,94 ± 4,26 кг), та контрольна група (КОН), до якої увійшли 20 гравців (вік: 18,93 ± 1,38 років, зріст: 174 ± 6,21 см, вага: 91,31 ± 7,00 кг). Оцінка параметрів фізичної підготовленості проводилася на етапах перед та після завершення курсу дослідження.

Результати. Результати дослідження продемонстрували статистично значуще покращення показників фізичної підготовленості серед гравців ЙАГ, з рівнями p-значень менше за 0,05 для КРВ ($p < 0,001$), МС ($p < 0,001$), МВ ($p < 0,001$) та ГНУ ($p < 0,001$) після застосування практики йогічних асан. Натомість у контрольній групі суттєвих змін не спостерігалося ($p > 0,05$).

Висновки. Отримані дані експериментального дослідження дозволяють стверджувати, що впровадження йогівських асан у тренувальні програми сприяє значному поліпшенню параметрів фізичної підготовленості баскетболістів-чоловіків, що підкреслює потенційні переваги занять йогою як ефективної форми тренувального процесу.

Ключові слова: баскетболісти, йогічна асана, м'язова сила, м'язова витривалість, гнучкість.

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Cite this article as: Udiyapuram, T., Sigamani Jayasingh Albert, C., Dilpreet, K., Orhan, B. E., Boby, F. A., & Astuti, Y. (2025). Enhancing Physical Fitness in Male Basketball Players through Yogic Asanas: A Randomized Controlled Trial. *Physical Education Theory and Methodology, 25*(2), 301-311. https://doi.org/10.17309/tmfv.2025.2.11

Received: 03.11.2024. Accepted: 13.02.2025. Published: 30.03.2025