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Kinesthetic Sense and Basketball Proficiency: Comparative Analysis Between Male and Female Basketballers of SAI Hostel

Yadav SK[1*†]

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[1*†] Sumit Kumar Yadav, Physical Education Teacher Tgtpet, Space Central School, Satish Dhawan Space Centre Isro, Shriharikota, Andra Pradesh, India.

This study explores how male and female basketball players at the Sports Authority of India's hostel differ in their body awareness (kinesthetic perception) and basketball skills. We tested 20 male and 20 female national-level players, aged 18 to 25, using the Johnson Basketball Skill Test and Kinesthetic Obstacle Test. The results show that male players generally have a higher kinesthetic perception score compared to females, suggesting a possible gender-based difference in body awareness. However, we need more information (standard deviation values) to understand how much individuals vary within each group. The study suggests practical recommendations for training and coaching. We propose creating training programs that consider these gender differences and using personalized coaching strategies based on individual needs. Additionally, we recommend interventions that focus on improving both body awareness and basketball skills. Our study points to the importance of considering gender-specific training and coaching approaches. These findings highlight the potential for tailored interventions to enhance athlete performance by addressing gender-related differences in body awareness. Overall, this research provides valuable insights into how kinesthetic perception may impact male and female basketball players, urging further investigation for practical implications in sports training.

Keywords: Kinesthetic Perception, Basketball Proficiency, Athlete Performance, Sports Engagement, and Motor Skills

Corresponding Author

Sumit Kumar Yadav, Physical Education Teacher Tgtpet, Space Central School, Satish Dhawan Space Centre Isro, Shriharikota, Andra Pradesh, India.
Email: sumitbhu221005@gmail.com

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01.01. Introduction

Kinesthetic perception, a cornerstone of our sensory experience, is the remarkable ability of the human nervous system to sense and interpret the position, movement, and tension of our muscles and joints. Rooted in the signals transmitted by specialized neurons known as proprioceptors, kinesthetic perception provides us with an intimate awareness of our body's spatial orientation and the dynamic interplay between its various components (Latash, 2020). Imagine the world around you – the things you see, hear, taste, touch, and smell. How do you make sense of it all? It's like creating a special map in your mind, helping you understand the relationships between different things, just like a map showing how cities or places are connected (CARREIRO, 2009). Physical education plays a pivotal role in fostering not only physical fitness but also cognitive and social development among university students. Within the realm of gymnastics, the study aimed to unravel the effects of two distinct learning methods, kinesthetic-experiential learning (KEL) and model-mastery learning (MML), on balance ability and interpersonal relationships (Matsuura et al., 2022b, 2022a; Pinzon et al., 2017). This ability relies on the processing of sensory information derived from both exteroceptive and proprioceptive sources. Exteroception involves external stimuli, primarily rooted in vision and hearing, while proprioception entails the sensory input from muscles, tendons, joints, and the vestibular apparatus, collectively known as kinesthetic perception or kinesthetic senses (Callow et al., 2017; Jiang et al., 2015). In sports, our movements' precision relies on the specialized sensor called a "proprioceptor," and this study explores the world of kinesthetic perception, aiming to comprehend how these sensory inputs contribute to skill acquisition in sports games, investigating the connection between

01. Bodily sensations and the development of athletic proficiency (Hendrayana, 2017). For a considerable time, cognitive neuroscience has focused on understanding the neural foundations of athlete behaviors and analyzing perceptual, cognitive, and motor functions within distinct brain structures. Nevertheless, this conventional viewpoint faces challenges in comprehensively capturing the dynamic interaction between athletes and their performance environments (Di Domenico, 2023).

The main objective of this study was to investigate variances in kinesthetic sense and basketball skill test outcomes among male and female basketball players.

This study aimed to investigate changes in kinesthetic perception among basketball players during a season, comparing athletes and non-athletes. Using four standardized tests, no significant differences were found between the groups. While a learning factor impacted the vertical linear space test, it was concluded that the basketball training program did not induce changes in kinesthetic perception during the competitive season (Flynn, n.d.). Another similar study was found: This article seeks to bridge the gap between sports sciences and cognitive neurophysiology through a concise exploration of KMI (Kinesthetic Motor Imagery) research. It proposes a theoretical connection between KMI and predictive motor control theories, suggesting that internal mental simulation enhances performance by involving brain regions that overlap with those utilized in actual motor tasks (Filgueiras et al., 2018; Ridderinkhof & Brass, 2015).

This study explores the influence of sports and physical practice on motor imagery vividness in adolescents. Results indicate that athletes, particularly older adolescents and boys, exhibit higher vividness in both Visual Motor Imagery (VMI) and Kinesthetic

01. Motor Imagery (KMI). The findings underscore the relevance of considering age and gender when incorporating motor imagery in educational and sports contexts (Dhouibi et al., 2021).

02. **Materials and Methods**

In this study, an experimental design was adopted creating two different groups. In which one group included 20 male players and the other group included 20 female players of basketball. The subjects of both groups were national-level players.

- **Participants**

In this research, 20 male and 20 female national-level basketball players, aged between 18 to 25 years, were specifically selected from the Sports Authority of India's sports hostel. The investigation aims to compare various aspects, including kinesthetic perception, hand-eye coordination, and motivation, between these two groups. This comparative analysis seeks to provide valuable insights into the unique characteristics associated with high-level sports engagement.

- **Selection of Variables**

For this research study, variables were selected after studying the literature, the details of which are given in the table below.

Table 1: The selected tests, variables, abbreviations, and units of the study

S.No.	Tests	Selected Variables	Abbreviations	Units
1.	Johnson Basketball Skill Test	Field Goal Speed Test	FGST	Points
		Basketball Throw for Accuracy	BTA	Points
		Basketball Dribble Test	BDT	Points
2.	Kinesthetic Obstacles Test	Obstacle 1	OBT1	Points
		Obstacle 2	OBT2	Points
		Obstacle 3	OBT3	Points
		Obstacle 4	OBT4	Points
		Obstacle 5	OBT5	Points
		Obstacle 6	OBT6	Points
		Obstacle 7	OBT7	Points
		Obstacle 8	OBT8	Points
		Obstacle 9	OBT9	Points
		Obstacle 10	OBT10	Points

N=40

- **Collection of Data**

Kinesthetic perception ability was evaluated using the Kinesthetic Obstacle Test, and basketball skills were appraised through the Johnson Basketball Skill Test. The data collection

01. Occurred over two days. The initial day involved administering the Kinesthetic Obstacle Test (Johnson, Barry L. & Nelson, Jackson K, 1988), followed by a 12-hour rest period. Subsequently, the Johnson Basketball Skill Test was conducted on the second day, with both assessments executed in controlled indoor settings. Competent individuals conducted the evaluations, ensuring that participants provided informed consent before their involvement.

- **Procedure**
  - **Day 1 Kinesthetic Perception Evaluation**

Participants underwent a standardized warm-up for physical preparedness before undertaking the Kinesthetic Perception Test. This assessment focused on gauging their awareness of body movements, position sense, and perception of muscle force. The evaluation occurred indoors to maintain controlled conditions, ensuring a consistent approach.

- **12-Hour Rest Interval**

After the Kinesthetic Perception Test, participants were granted a 12-hour rest interval to minimize potential fatigue effects, promoting optimal readiness for subsequent evaluations.

- **Day 2: Basketball Proficiency Assessment**

During the second day of data collection, participants underwent the Johnson Basketball Skill Test. This comprehensive assessment thoroughly examined their skills in shooting, dribbling, passing, and game awareness. Similar to the kinesthetic assessment, the basketball proficiency evaluation occurred indoors, guaranteeing controlled and standardized conditions.

- **Ethical Consideration**

Before we started collecting information, we asked everyone if they wanted to be part of the study, and we promised to keep their information private. We also made sure that

01. Only mentally and physically healthy people who weren't players were chosen. This was done to be fair to take care of everyone's well-being and keep their information safe.

- **Administration of Test**

Competent and experienced individuals, trained in administering both the Kinesthetic Perception Test and the Johnson Basketball Skill Test, were tasked with carrying out the assessments. Before engaging, participants were thoroughly briefed on the research objectives. Informed consent was carefully secured from each participant, ensuring they were fully aware of the study's purpose and willingly agreed to participate in the assessments.

- **Analysis of Data**

We used descriptive statistics and the T-test to analyze the data, providing a comprehensive understanding of the dataset and identifying any significant differences between groups.

The significance level was set at (0.05) to determine the strength and significance of any difference between kinesthetic perception ability and basketball skills.

02. **Results of the Study**

The table outlines pertinent statistical measures for male and female basketball players, focusing on height metrics. For male players, the mean height is calculated at (M, =160.73), serving as an indicator of the central tendency or average height within the dataset. The median, positioned at (Me, = 154.46), signifies the middle point when heights are arranged in ascending order, offering an additional perspective on the typical height. The standard deviation of (Sd, = 58.71) reflects the extent of variability or dispersion in the heights, providing insight into the spread of individual heights around the mean. On the other hand, the statistics for female basketball players include a mean height of (M, =

01. 132.35), a median of (Me, 133.11), and a standard deviation of (Sd, = 38.10). These values collectively offer a nuanced understanding of the height distribution within each gender group. The wider standard deviation for male players suggests a greater range of heights, possibly influenced by outliers, while the narrower distribution for females indicates a more homogenous grouping. In summary, these detailed statistics illuminate the intricacies of height characteristics among male and female basketball players, encompassing central tendencies, variability, and the overall distribution of heights within each cohort (see Table 2, and Figure 1).

Table 2: Comparison of Scores between Sportsperson and Non-sportsperson

Statistics	Male Basketballers	Female Basketballers
Mean	160.7284615	132.3507692
Median	154.46	133.11
Standard Deviation	58.70974619	38.10144758

N=40

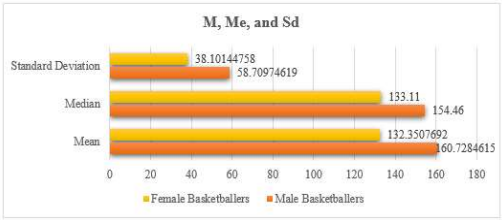

Figure 1: Descriptive Statistics of Male, and Female Basketballers

The comparison of kinesthetic perception scores between male and female sportspersons yielded intriguing findings. Male sportspersons exhibited a higher mean score of 137.57 with a larger variance of 3457.30, suggesting greater variability in kinesthetic perception scores within the male group. In contrast, female sportspersons displayed a lower mean score of 128.95 with a variance of 1781.63. The Pearson correlation coefficient of 0.97 indicated a robust positive correlation, signifying a consistent relationship between the kinesthetic perception scores of male and female participants.

The results of the independent

01. Samples t-test indicated a mean difference that was not statistically significant at the 0.05 significance level. The t Stat of 1.47 fell below the critical values of 1.80 (one-tail) and 2.20 (two-tail), and the p-values (0.084 and 0.168 for one-tail and two-tail, respectively) exceeded the threshold of 0.05. While the mean kinesthetic perception scores differed, the test results suggest that this difference may not be attributed to factors beyond random variability.

It's essential to note that these findings provide valuable insights into the kinesthetic perception of male and female sportspersons, emphasizing the need for further investigation with larger sample sizes to ascertain the robustness and generalizability of these observed differences (see Table 3, and Figure 1).

Table 3: Comparison of Statistics Between Non-Sportsperson and Sportsperson

Statistics	Male-Sportsperson	Female-Sportsperson
Mean	137.5708333	128.945
Variance	3457.30159	1781.631045
Observations	12	12
Pearson Correlation	0.97273953	
Hypothesized Mean Difference	0	
t Stat	1.474764825	
P(T<=t) one-tail	0.084156623	
t Critical one-tail	1.795884819	
P(T<=t) two-tail	0.168313246	
t Critical two-tail	2.20098516	

N = 40

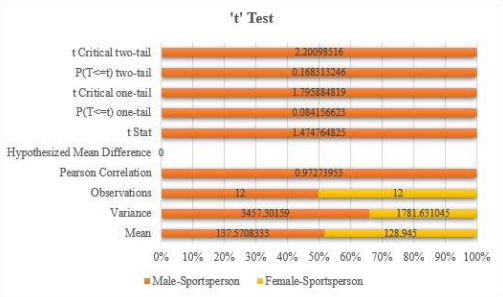

Figure 2: t-test Statistics of Sportsperson and Non – Sportsperson

03. **Discussion and Findings**

- **Findings: Nuanced Differences in Kinesthetic Perception**

The study's findings reveal intricate disparities in kinesthetic perception between male and female basketball players, providing valuable insights into the central tendency,

01. Variability, and distribution of kinesthetic sense within each gender group (Pandey et al., n.d.).

- **Male vs. Female Kinesthetic Sense Metrics:**

For male players, the average kinesthetic sense is 160.73, with a median of 154.46, indicating central tendency. The wider standard deviation of 58.71 suggests considerable variability. In contrast, female players exhibit an average kinesthetic sense of 132.35, a median of 133.11, and a narrower standard deviation of 38.10, indicating a more homogeneous distribution. These gender-based differences underscore the complexity of kinesthetic sense characteristics.

- **Implications for Training Programs:**

The observed disparities in kinesthetic sense metrics emphasize the need for tailored training programs. Recognizing individual differences within gender groups, especially in central tendency and variability, is crucial for designing effective and targeted interventions.

- **Discussion: Exploring Kinesthetic Perception Scores**

Comparative analysis of kinesthetic perception scores between male and female sportspersons uncovers intriguing findings that further enrich our understanding of the relationship between sensory awareness and sports proficiency (Gayatri, 2015; Kumar Biswas et al., 2022).

- **Male vs. Female Kinesthetic Perception Scores:**

Male sportspersons exhibit a higher mean score (137.57) and a larger variance (3457.30) compared to their female counterparts, who display a lower mean score (128.95) and a narrower variance (1781.63). The robust positive correlation (Pearson coefficient of 0.97) signifies a consistent relationship between male and female participants' kinesthetic perception scores (Kumar Biswas et al., 2022).

01. ▪ **Implications for Coaching Strategies:**

Despite the observed differences, the non-significant mean difference in the independent samples t-test suggests that variations may be attributed to random variability rather than distinct factors. This underscores the importance of recognizing and addressing individual variability within coaching strategies, tailoring interventions for optimal athlete performance.

▪ **Limitations and Future Directions:**

While these findings provide valuable insights, acknowledging the limitations, such as the need for larger sample sizes, is crucial. Future research directions could involve longitudinal studies to track changes in kinesthetic perception over time, offering a deeper understanding of the dynamic nature of sensory awareness in athletes.

▪ **Conclusion: Towards Targeted Training Programs**

In conclusion, this study contributes significantly to the understanding of kinesthetic perception in sports, particularly in the context of basketball. The nuanced differences observed highlight the importance of tailoring training and coaching approaches to individual sensory profiles, paving the way for more targeted and effective programs that optimize athlete performance.

Implications

The following implications of the current research study will be drawn in detailed below.

▪ **Tailored Training Programs:** The observed disparities in kinesthetic perception between male and female basketball players underscore the need for customized training programs. Designing interventions that specifically address gender-based differences in sensory awareness can

01. ▪ enhance the effectiveness of skill development and overall sports performance.

▪ **Individualized Coaching Strategies:** Recognizing the complexity of kinesthetic sense characteristics within each gender group emphasizes the importance of adopting individualized coaching strategies. Coaches should tailor their approaches to accommodate variations in central tendency and variability, ensuring that training regimens align with the unique sensory profiles of each athlete.

▪ **Targeted Interventions:** The findings suggest the potential for targeted interventions aimed at improving both kinesthetic perception and basketball skills. Implementing focused exercises and drills that enhance sensory awareness may lead to more significant improvements in overall sports proficiency, particularly in activities requiring precise body movements and spatial orientation.

▪ **Consideration of Individual Variability:** The study highlights the significance of acknowledging and addressing individual variability within coaching strategies. While gender-based differences exist, recognizing the wide range of kinesthetic senses within each group is essential for creating inclusive and effective training programs that cater to the diverse needs of athletes.

▪ **Longitudinal Monitoring:** Given the dynamic nature of kinesthetic perception, incorporating longitudinal studies could provide valuable insights into how these sensory characteristics evolve. Continuous monitoring throughout a basketball season or training program can offer a deeper understanding of the factors influencing changes in sensory awareness among athletes.

▪ **Refinement of Coaching Practices:**

01. Coaches and trainers should use the study's findings to refine their coaching practices, considering the nuanced differences in kinesthetic perception between male and female athletes. This includes adapting coaching techniques, feedback mechanisms, and skill-building exercises to better align with the unique sensory profiles of the players.

Recommendations of the study

- Consider gender-specific training modules: Develop basketball training programs that acknowledge and cater to the observed kinesthetic perception differences between male and female players.
- Implement personalized coaching approaches: Individualize coaching strategies based on the unique sensory profiles within gender groups, recognizing and accommodating diverse kinesthetic abilities.
- Design targeted interventions: Explore interventions aimed at concurrently enhancing kinesthetic perception and basketball skills, potentially improving overall sports performance.
- Conduct longitudinal studies: Undertake studies tracking changes in kinesthetic perception over time, providing insights into the dynamic nature of sensory awareness in athletes throughout a season or training program.
- Include standard deviation in future research: Enhance the reliability of research findings by consistently incorporating standard deviation values, offering a more comprehensive understanding of individual variability in kinesthetic perception among athletes.

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