COMPARISON OF Y-BALANCE TEST IN BADMINTON AND TABLE-TENNIS PLAYERS: AN OBSERVATIONAL STUDY

INTRODUCTION

- **Background on Balance in Sports**

Balance is a critical component of athletic performance, influencing movement precision, postural control, and injury prevention. It is the ability to maintain the body's center of gravity (COG) over its base of support (BOS), both while stationary (static balance) and during movement (dynamic balance) [1]. Dynamic balance, in particular, plays a central role in sports requiring sudden directional changes, complex coordination, and high neuromuscular demand. Racket sports, such as badminton and table tennis, rely extensively on dynamic balance due to the high-speed, multidirectional nature of play [2].

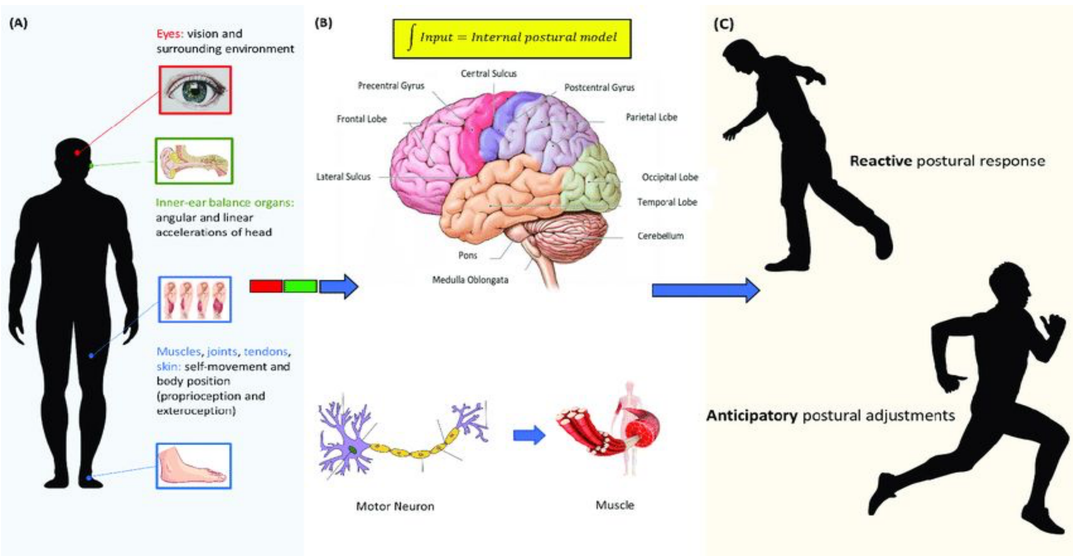

Figure 1.1

Research indicates that athletes with superior balance not only perform movements more efficiently but are also less likely to suffer injuries related to poor posture or improper landing mechanics [3]. Maintaining dynamic balance during explosive movements, such as lunging or side-stepping, requires coordination among visual, vestibular, and proprioceptive systems [4]. These systems provide real-time feedback to adjust the body's position in space, ensuring stability during rapid transitions

Figure 1.2

Figure 1.3

- ## Physiological Mechanisms of Balance

Balance control involves the integration of three key sensory systems:

• The visual system, which provides external cues about the body's position in space.

• The vestibular system, located in the inner ear, which senses head motion and orientation.

• The proprioceptive system, which gives feedback from muscles and joints about body position [5,6].

The central nervous system (CNS), particularly the cerebellum and brainstem, processes this sensory information and generates coordinated motor responses to maintain equilibrium. Functional deficits in any of these systems can lead to impaired balance, increasing the risk of injury during sports participation [7].

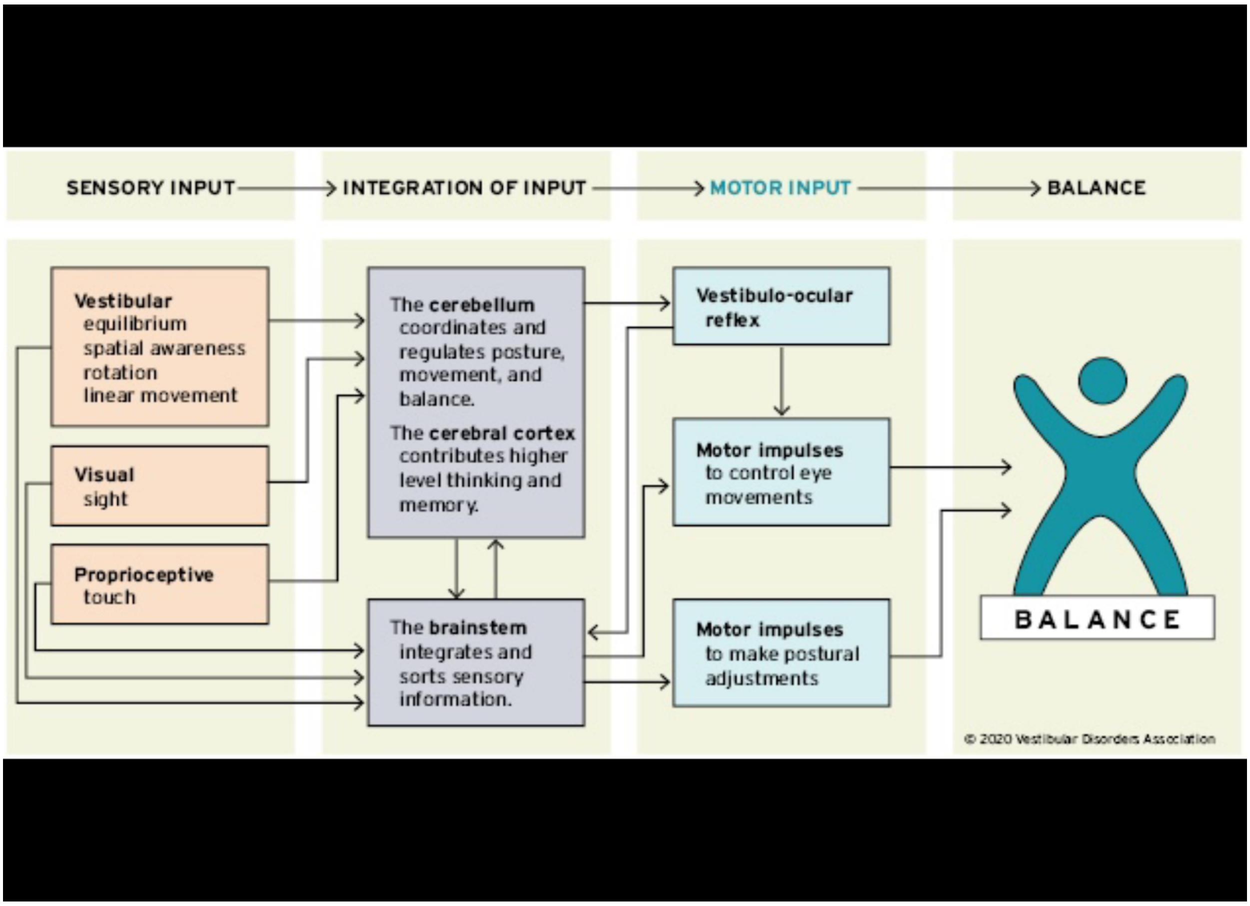

Figure 1.4

- ## Importance of Dynamic Balance in Racket Sports

Dynamic balance is essential in racket sports, where athletes frequently shift weight, execute rapid footwork, and engage in unilateral limb movements. In badminton, players perform explosive lunges, vertical jumps, and high-speed directional changes, demanding substantial lower limb stability and neuromuscular control [8]. In contrast, table tennis emphasizes rapid, short-range lateral movements, precise timing, and fine motor control, placing greater reliance on core stability and reflexive postural adjustments [9].

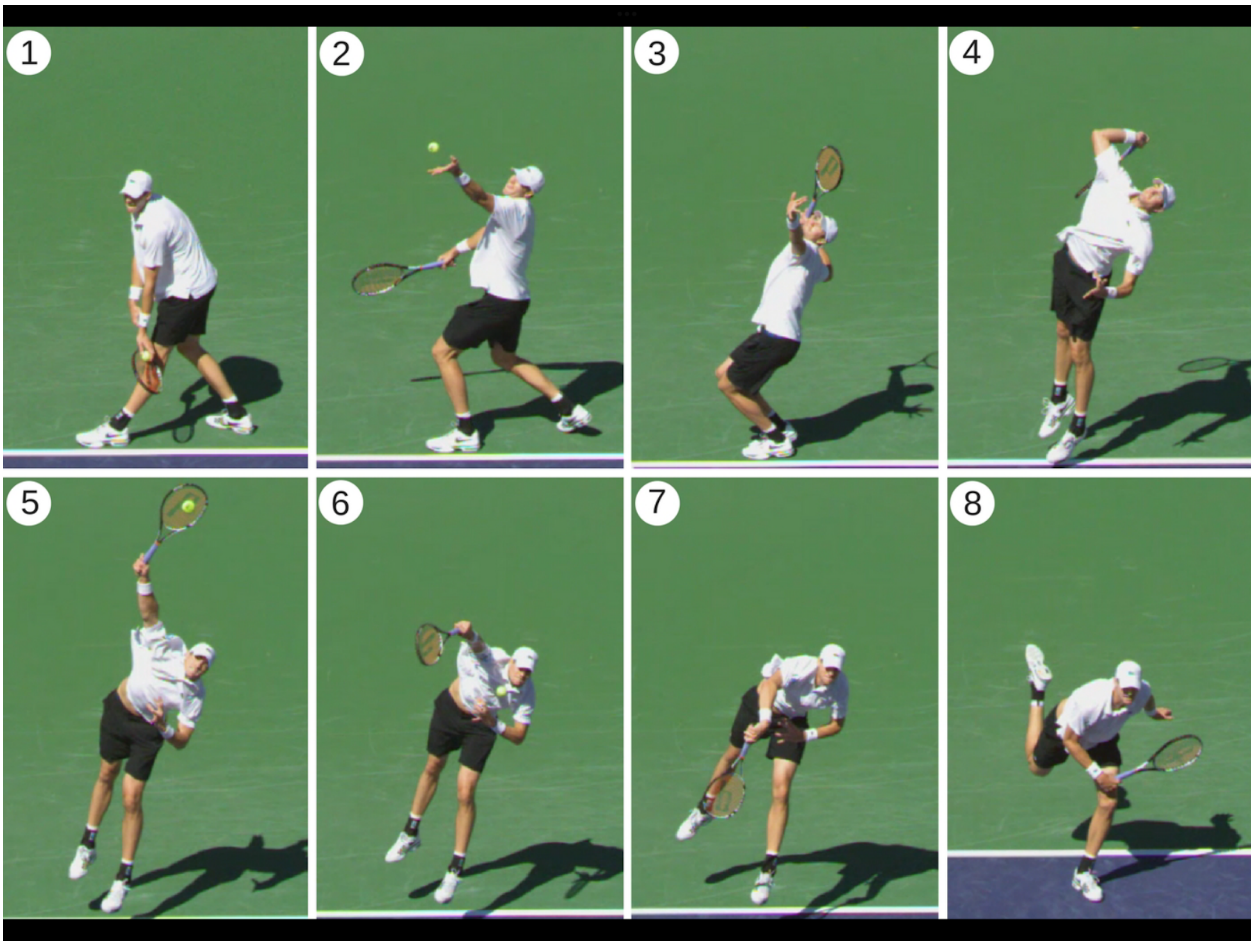

Figure 1.5

Athletes with better balance show improved agility, shot accuracy, and injury resistance. Several studies have shown that balance training improves movement efficiency and reduces lower limb injury rates in racket sports [10]. Poor dynamic balance may contribute to instability during landings or direction changes, leading to ankle sprains, knee ligament injuries, and overuse syndromes [11].

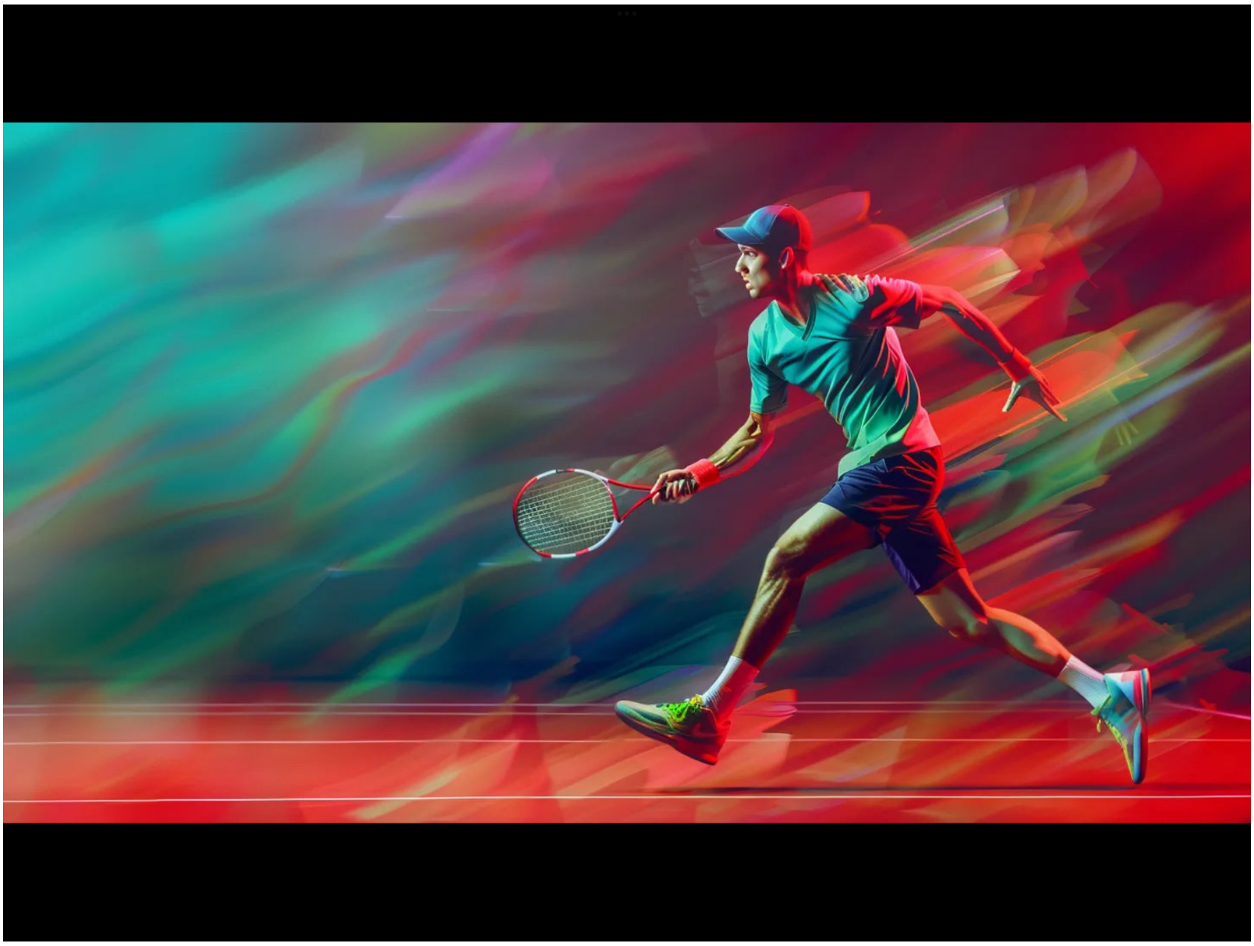

Figure 1.6

- **Differences in Movement Patterns and Balance Demands in Badminton vs. Table Tennis.**

Despite both being racket sports, the biomechanical and neuromuscular demands in badminton and table tennis differ considerably:

- Badminton involves large-range, high-impact movements such as overhead smashes, backward shuffles, and deep lunges. These movements place high mechanical loads on the hip, knee, and ankle joints. Consequently, badminton players are more susceptible to acute injuries like ankle sprains and meniscal tears [12].

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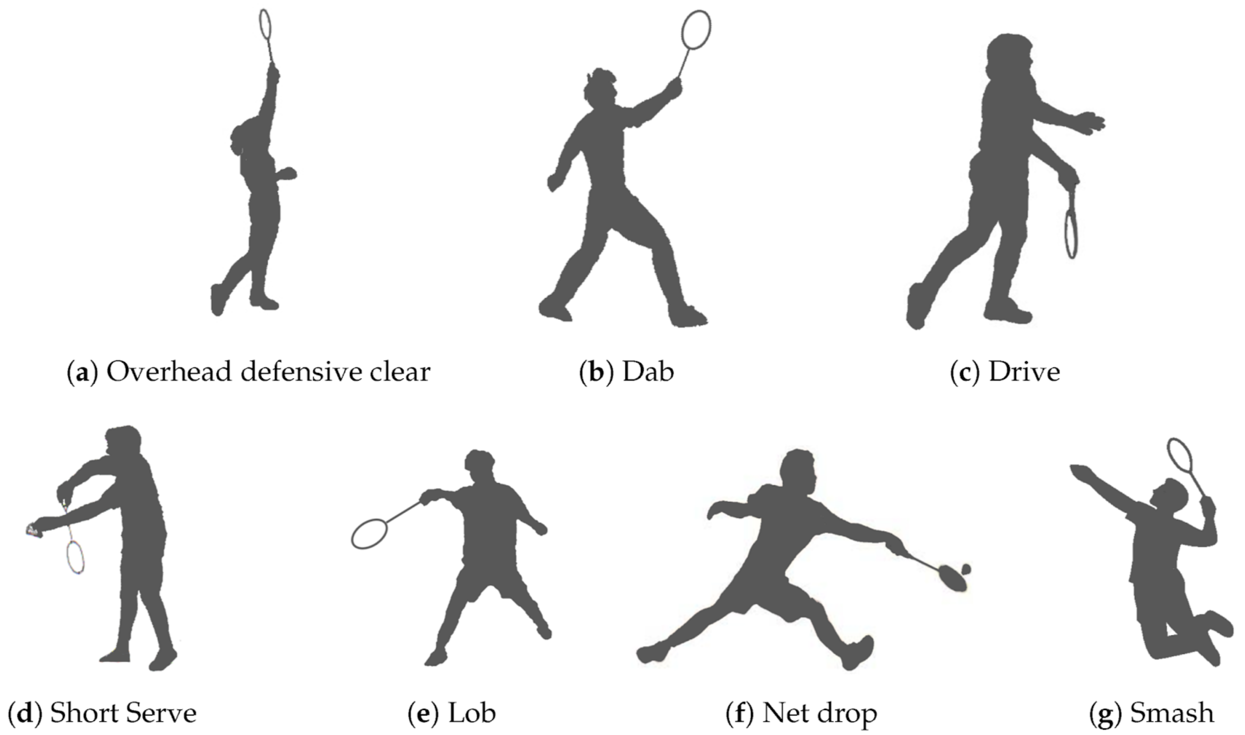

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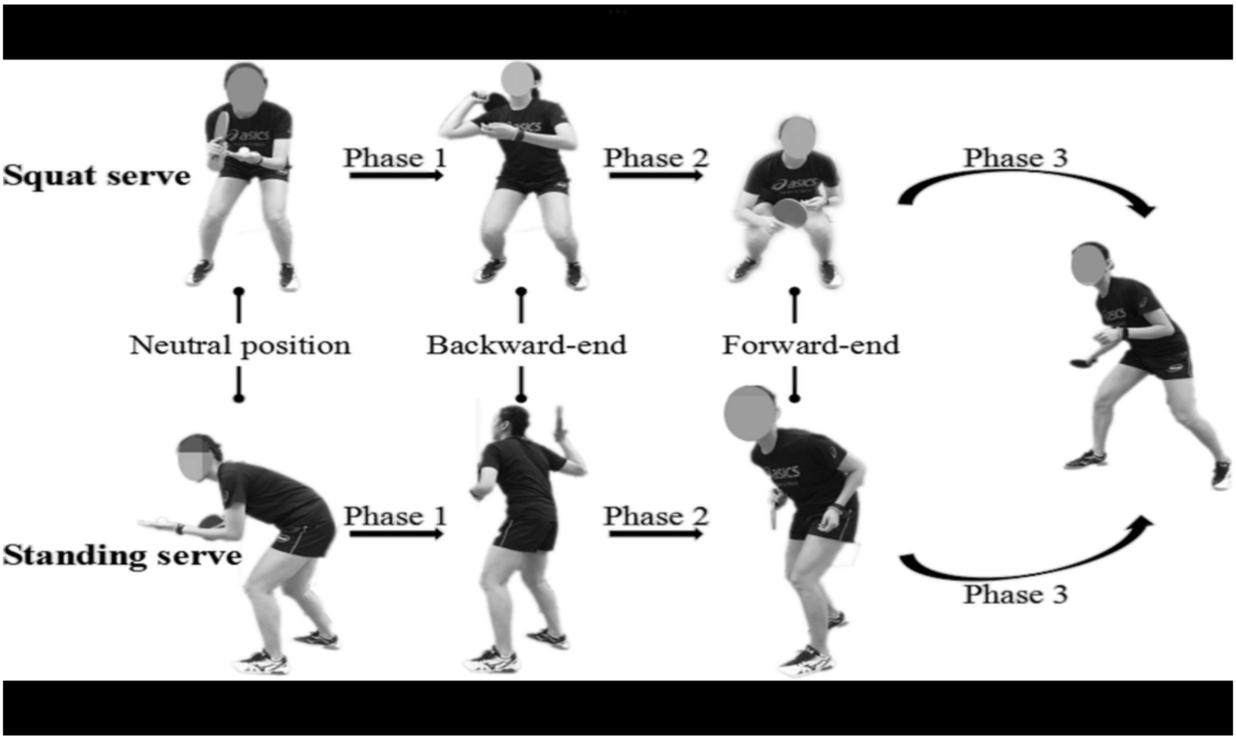
Figure 1.7

- Table Tennis, although low-impact, is played at extremely fast speeds and requires precise trunk rotation, efficient footwork, and whole-body coordination to produce controlled yet powerful strokes within limited reaction times. The biomechanics of lower limbs directly influence upper limb performance. Improper technique can alter movement mechanics, increasing injury risk. High-level players demonstrate unique motor patterns and refined control, suggesting that movement demands vary significantly by skill level. Understanding these distinctions is crucial for designing sport-specific balance and injury prevention strategies [13].



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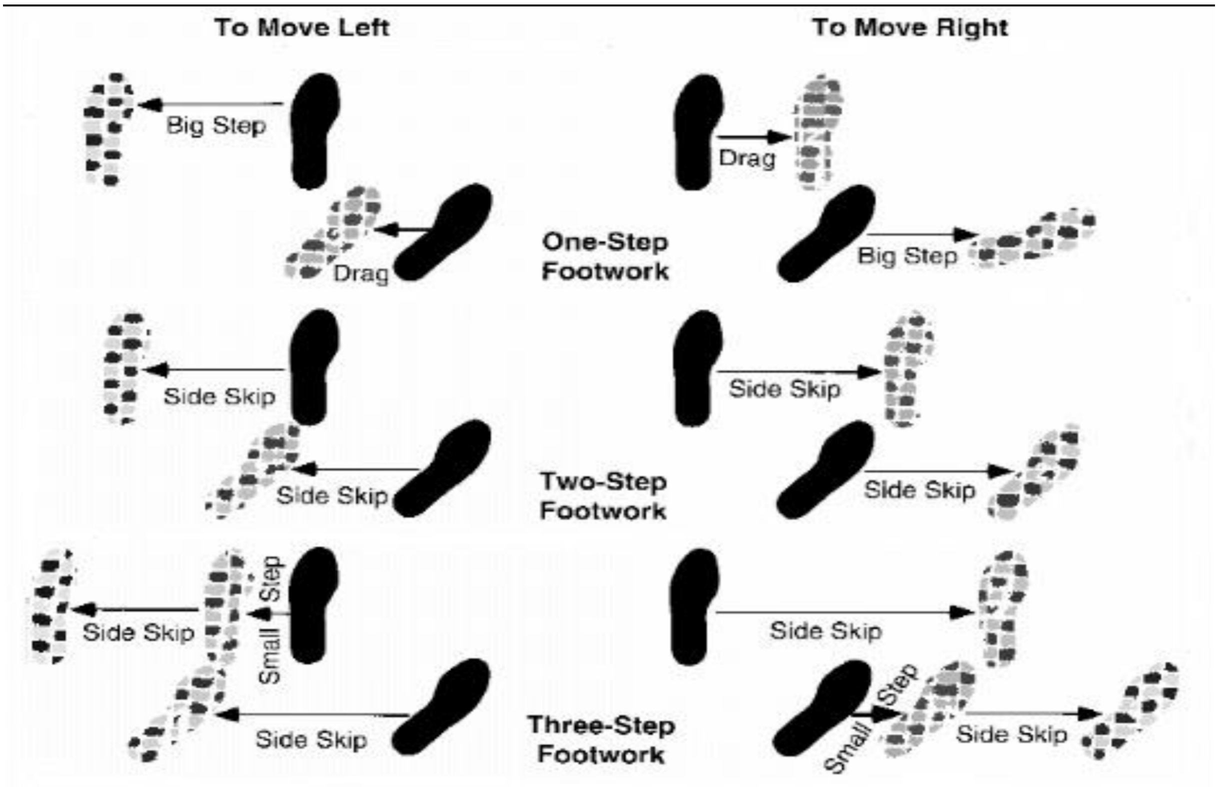


Figure 1.9

Understanding these differences is vital for developing sport-specific training programs that enhance balance and reduce injury risk.

• Y Balance Test as an Assessment Tool

The Y Balance Test (YBT) is a tool used to test a person's risk for injury. It can be used for both the upper quarter and lower quarter. The YBT for the lower quarter (LQYBT) has been thoroughly researched as its protocol is based on research done on the Star Excursion Balance Test. The Star Excursion Balance Test demonstrated reliable results on its ability to predict LE injury in high school basketball players, and the LQYBT has identified athletes at increased risk for injury [14] .

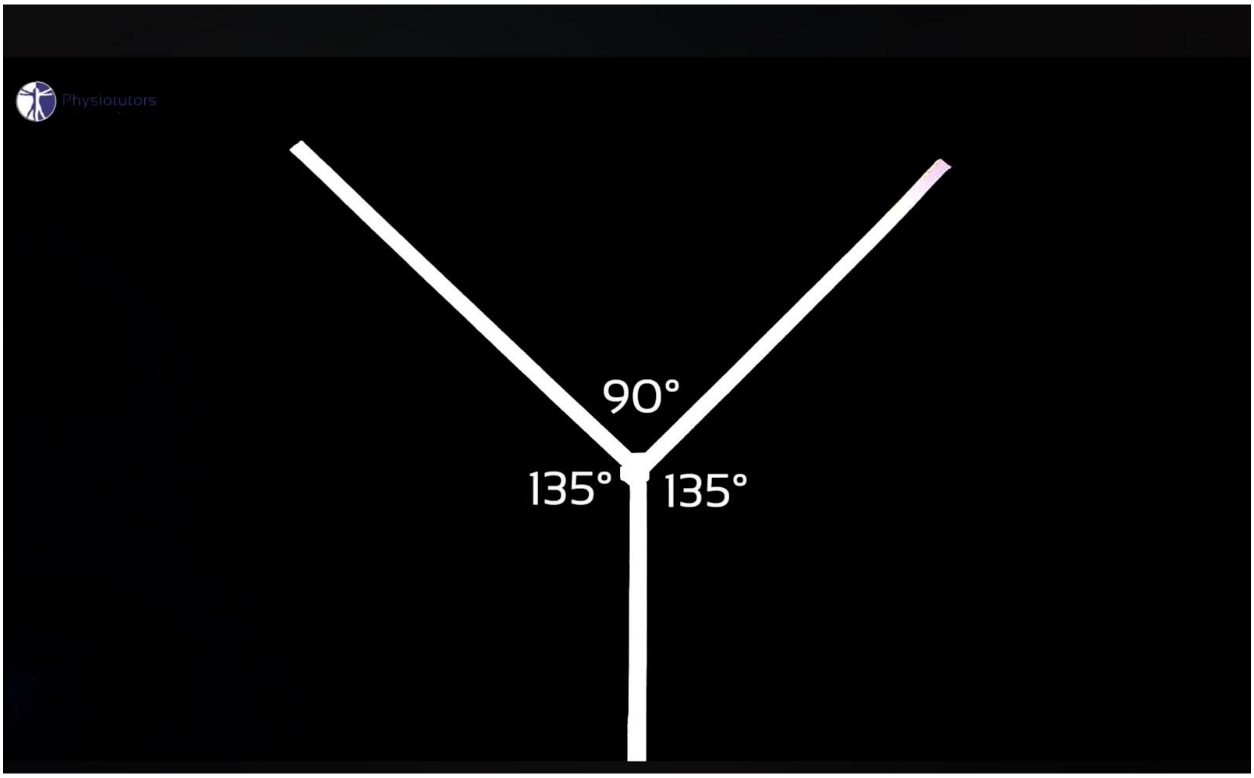


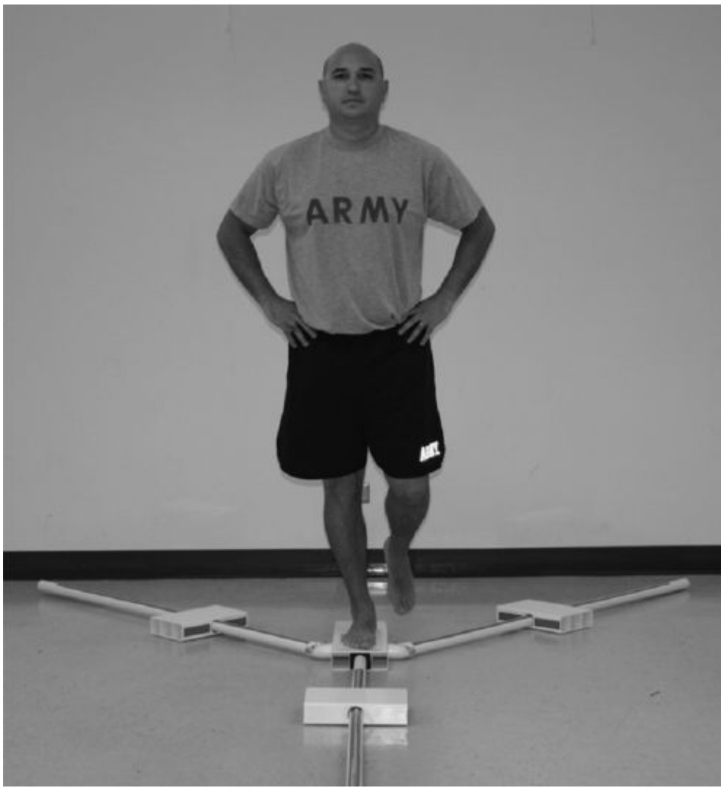
Figure 1.10

Lower YBT scores and side-to-side asymmetries have been associated with increased risk of ankle sprains, ACL injuries, and poor performance outcomes in dynamic sports [15]. Studies support its use in both clinical and performance settings, particularly in racket sports where balance and unilateral loading are critical [16].

Technique -

The LQYBT has the patient stand on one leg while reaching out in 3 different directions with the other lower extremity. They are anterior, posteromedial and posterolateral. When using the Y-Balance test kit, the 3 reaches yield a "composite reach distance" or composite score used to predict injury. Research shows that collegiate football players with a composite score below 89% had an increased probability of injury from 37.7% to 68.1% . Therefore a cut point of 89% composite reach on the YBT was established (with a sensitivity of 100% and a +LR of

3.5) [17]. For high school basketball players, the cut point was 94% [14]. These studies reveal that each sport/population has it's own risk cutpoint.



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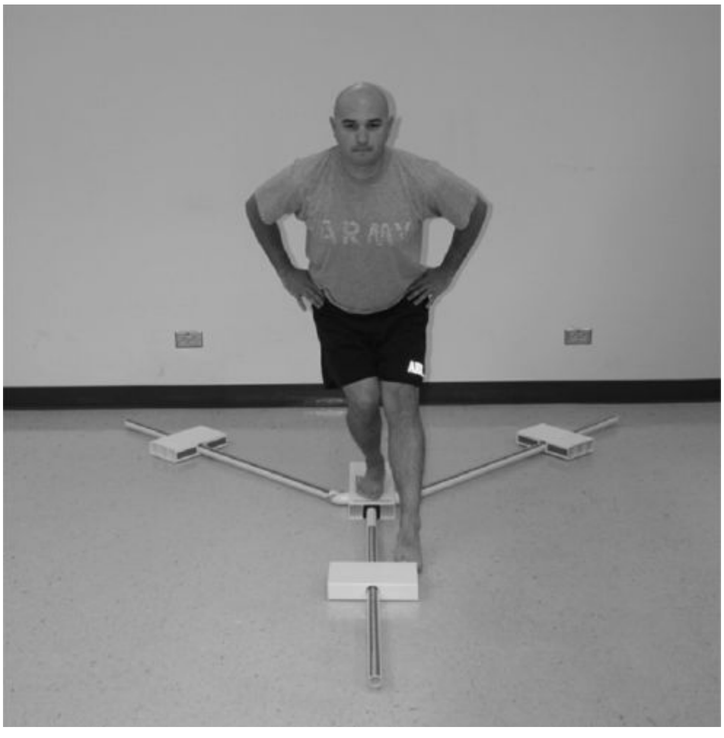

Figure 1.12

Figure 1.13

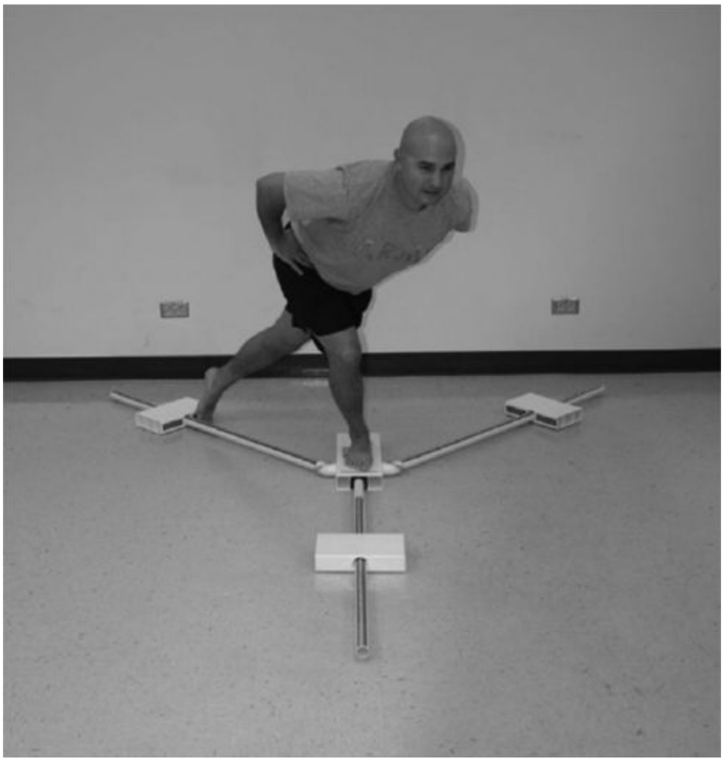

Figure 1.14

AIMS OF THE STUDY

To compare the dynamic balance performance between badminton and table tennis players using the Y Balance Test and to identify sport-specific balance adaptations and potential injury risk factors.

OBJECTIVES OF THE STUDY

1.To assess dynamic balance performance in badminton and table tennis players using the Y Balance Test (YBT).

2.To compare YBT reach distances and composite scores between the two groups across all three directions: anterior, posteromedial, and posterolateral.

3.To analyze side-to-side asymmetries in dynamic balance within each sport group.

REVIEW OF LITERATURE

Introduction

Balance is a key component of physical fitness and plays a vital role in athletic performance, especially in sports that involve rapid directional changes, jumping, and unilateral limb activities such as badminton and table tennis. Balance can be categorized into static balance—the ability to maintain a position without movement, and dynamic balance—the ability to maintain stability during motion. Racket sports, due to their nature of high-speed and multidirectional movements, demand superior dynamic balance for performance and injury prevention.

The Y Balance Test (YBT) is widely used in sports science for assessing dynamic balance. It evaluates an individual's ability to reach in three directions (anterior, posteromedial, and posterolateral) while maintaining a single-leg stance. Several studies have validated YBT as a reliable tool to detect balance asymmetries and to predict the risk of lower extremity injuries. This literature review critically analyzes studies related to dynamic balance assessment in athletes, especially focusing on badminton and table tennis players.

1.**Dashondi et al. (2024)** examined the Correlation Between Dynamic Balance, Grip Strength, and Eye-Hand Coordination With Smash Performance in Elite Badminton Players. This observational study evaluated how dynamic balance (using the Y Balance Test), grip strength, and eye–hand coordination relate to smash performance in 30 elite badminton players. Results showed a strong correlation between dynamic balance and smash accuracy, highlighting the importance of postural control in executing high-performance strokes. Grip strength and coordination also showed moderate to low associations with performance, supporting multi-domain physical conditioning in training.

2. **Malwanage et al. (2022)** studied the effect of Balance Training on Footwork Performance in Badminton. This study investigated the effectiveness of incorporating a 30-minute balance training program into the regular training schedule of adolescent competitive badminton players over eight weeks. The findings indicated significant improvements in dynamic balance and on-court sport-specific footwork performance in the intervention group, whereas the control group showed no significant changes.

3. **Ko et al. (2022)** evaluated the validity of the Y Balance Test (YBT) in racket sport athletes. The study concluded that YBT is a reliable tool for detecting side-to-side imbalances and balance deficits that could contribute to injury, reinforcing its application in sports performance screening.

4.**Solanki & Gill (2021)** reviewed the Effect of Core Stability Training on Dynamic Balance and Smash Stroke Performance in Badminton Players. This evidence-based review analyzed 12 studies on core stability training's impact on dynamic balance and smash performance in badminton players. Findings indicate that core stability training effectively enhances both dynamic balance and smash stroke performance, suggesting its integration into training regimens.

5.**Bańkosz et al. (2020)** investigated Kinematic Differences in Racket Sports. In their comparative study, Bańkosz, Winiarski, and Andrzejewski analyzed topspin forehand strokes in table tennis and badminton. They concluded that table tennis requires more trunk rotation precision and faster hand response, whereas badminton players show more explosive lower limb coordination. These biomechanical differences indicate varied balance demands in both sports.

6. **Wong et al. (2019)** studied Balance Control, Agility, Eye–Hand Coordination, and Sports Performance in Amateur Badminton Players. This cross-sectional study compared badminton players and physically active non-athletes in terms of balance (Y Balance Test), agility, and eye–hand coordination. While badminton players showed significantly better performance in serving accuracy, there were no major differences in balance, agility, or coordination. The study highlights that sports-specific skills may not always align with general motor control tests.

7. **Atar (2018)** compared Static and Dynamic Balance Parameters of Athletes in Tennis and Badminton Sports. This study compared static and dynamic balance in elite tennis and badminton players. While dynamic balance showed no significant differences, static balance was significantly better in badminton players. The study suggests that differences in equipment and playing surfaces may influence balance parameters.

8.**Vora et al. (2018)** analyzed Static, Dynamic, and Pelvic Stability in Junior Badminton Players. This study assessed static, dynamic, and pelvic stability in 106 junior badminton players across South Asia using advanced biomechanical tools. It found significant differences in pelvic stability related to age and competitive level. The research emphasizes the need to include balance and pelvic control in early athlete development, particularly in high-impact sports like badminton.

9. **Goh et al. (2018)** explored Injury Risk in Badminton. Goh and colleagues conducted a clinical study on injury prevalence among elite badminton players and found a high incidence of ankle sprains and lower limb injuries. They attributed these to repetitive unilateral landings and explosive directional changes—indicating the importance of dynamic balance control.

10.**Smith et al. (2015)** assessed Injury Prediction Using YBT Asymmetries. This study found that a difference of more than 4 cm in anterior reach between limbs predicted a higher likelihood of lower extremity injury. This reinforces the use of YBT in preseason screening for athletes, particularly in sports with unilateral demands like badminton and table tennis.

11.**Smith et al. (2015)** also investigated the Association of Y Balance Test Reach Asymmetry and Injury in Division I Athletes. This study examined the link between Y Balance Test (YBT) reach asymmetry and injury incidence among Division I athletes. It found that greater asymmetry in reach distances was associated with a higher risk of lower extremity injuries, suggesting that YBT can be a useful screening tool for identifying athletes at risk.

12.**Kartal (2014)** compared Static Balance in Different Athletes. This study assessed static balance among athletes from various sports (tennis, soccer, basketball, volleyball) using the Flamingo test. Tennis players exhibited superior static balance compared to other groups. The findings suggest that sport-specific demands influence balance abilities.

13. **Shaffer et al. (2013)** evaluated the Reliability of YBT Across Raters. Shaffer's study confirmed the inter-rater and intra-rater reliability of the Y Balance Test. It also linked lower composite scores and asymmetries to an increased risk of musculoskeletal injuries, further supporting its clinical use in athlete screening and pre-participation evaluations.

14. **Golshaei (2013)** analyzed Dynamic and Static Balance Differences Based on Gender and Sport Participation. This thesis compared balance performance between athletes (soccer players) and sedentary individuals, as well as between genders. Athletes demonstrated significantly better balance than non-athletes, while no significant gender differences were observed. The study highlights the positive impact of sports participation on balance.

15. **Hrysomallis (2011)** discussed the Role of Balance in Sports Performance. Hrysomallis emphasized the importance of balance ability as a key component in injury prevention and athletic performance. The study reviewed various sports and found that both static and dynamic balance training improve postural control and reduce lower limb injuries. This foundational work supports the integration of balance tests like YBT in athlete evaluations.

16.**Plisky et al. (2006)** developed the Development of the Y Balance Test. Plisky and colleagues introduced the Y Balance Test (YBT) as a refined version of the Star Excursion Balance Test. It measures reach distance in three directions while standing on one leg and helps detect asymmetries that predict injury risk. The study validated the test for use in various athletic populations.

MATERIALS AND METHODOLOGY

STUDY DESIGN:

The study is designed as a cross-sectional observational study aimed at comparing the dynamic balance performance of badminton and table tennis players using the Y Balance Test (YBT).

SAMPLING DESIGN:

A purposive sampling method was used. Athletes who met the eligibility criteria and were actively training at the selected sports academies were recruited for participation.

STUDY SETTING:

The study was conducted at:

- Propel Racquet Sports Academy, Surat
- SMC Sports Complex, Surat

Both facilities provided appropriate indoor court environments and training populations for racket sports

SAMPLE SIZE:

The study involved a total of 128 male athletes:

- 64 badminton players
- 64 table tennis players

AGE GROUP:

Participants included male athletes aged between 18 to 30 years

STUDY DURATION:

The total duration of the study, including recruitment, data collection, and analysis, was 6 months

MATERIALS AND APPARATUS :

- standardized banner markings
- Measuring tape

- Chalk/marker
- Data collection sheets
- Consent forms

OUTCOME MEASURES:

The primary outcome was the Composite Score (%) from the Y Balance Test, calculated using the reach distances in three directions:

- Anterior
- Posteromedial
- Posterolateral

INCLUSION CRITERIA:

- Male badminton or table tennis players
- Age between 18–30 years
- Minimum of 1 year of continuous training experience
- Willingness to participate and provide written informed consent.

EXCLUSION CRITERIA:

- musculoskeletal injury in the lower limb in the last 6 months
- Neurological or vestibular disorders affecting balance
- Any current pain or discomfort that restricts movement

COURSE LAYOUT:

The YBT layout included:

- One line extending anteriorly
- Two lines extending posteromedially and posterolaterally at 135° from the anterior axis
- Lines intersecting at a central stance platform

Participants stood on one leg at the center and reached with the free leg in each of the three directions.

PREPARATIONS:

Participants were briefed and given a demonstration

- They performed 2–3 practice trials before actual testing
- Testing was performed barefoot for accuracy.

Verbal Instructions for the Test

"Stand on your dominant leg, and reach out with the other leg as far as possible in the instructed direction without losing balance or touching the floor with your reaching foot. Return to the start position after each reach. Do not shift your stance foot.''

Introducing the Test

The tester explained:

- The three directions (ANT, PM, PL)
- Demonstrated how the participant should reach
- Allowed practice rounds to build familiarity and reduce variability

Starting the Test

The participant began standing on the dominant leg at the center. Each direction was tested three times, and the best score was recorded for each direction.

During the Test

- The participant reached in the indicated direction
- Maintained balance throughout the movement
- No touching the floor with the reaching leg
- Test stopped if balance was lost or errors occurred

Finishing the Test

Once all three directions were tested on the dominant leg, the same procedure was repeated for the non-dominant leg. Scores were noted, and rest was given if needed between attempts.

Scoring and Calculation

The reach distances were recorded in centimeters for:

- Anterior (ANT)

- Posteromedial (PM)
- Posterolateral (PL)

The Composite Score (%) was calculated using the formula:

{Composite Score} = ({ANT} + {PM} + {PL} / 3 * leg length)*100

Target Population

The target population was male amateur and semi-professional badminton and table tennis players aged 18–30 years residing in Surat and actively participating in training.

RESULT

Descriptive Statistics

A total of 128 athletes (aged 18–30 years) participated in the study, with an average age of 24.02 years (SD = 4.11). The mean leg length was 90.11 cm (SD = 3.19). Normalized reach distances were calculated for each limb and direction to allow fair comparison across individuals.

The overall mean normalized reach distances were:

- **Anterior**: 74.86% (SD = 3.12)
- **Posteromedial**: 80.69% (SD = 3.42)
- **Posterolateral**: 77.25% (SD = 2.99)
- **Composite Score**: 86.22% (SD = 3.62)

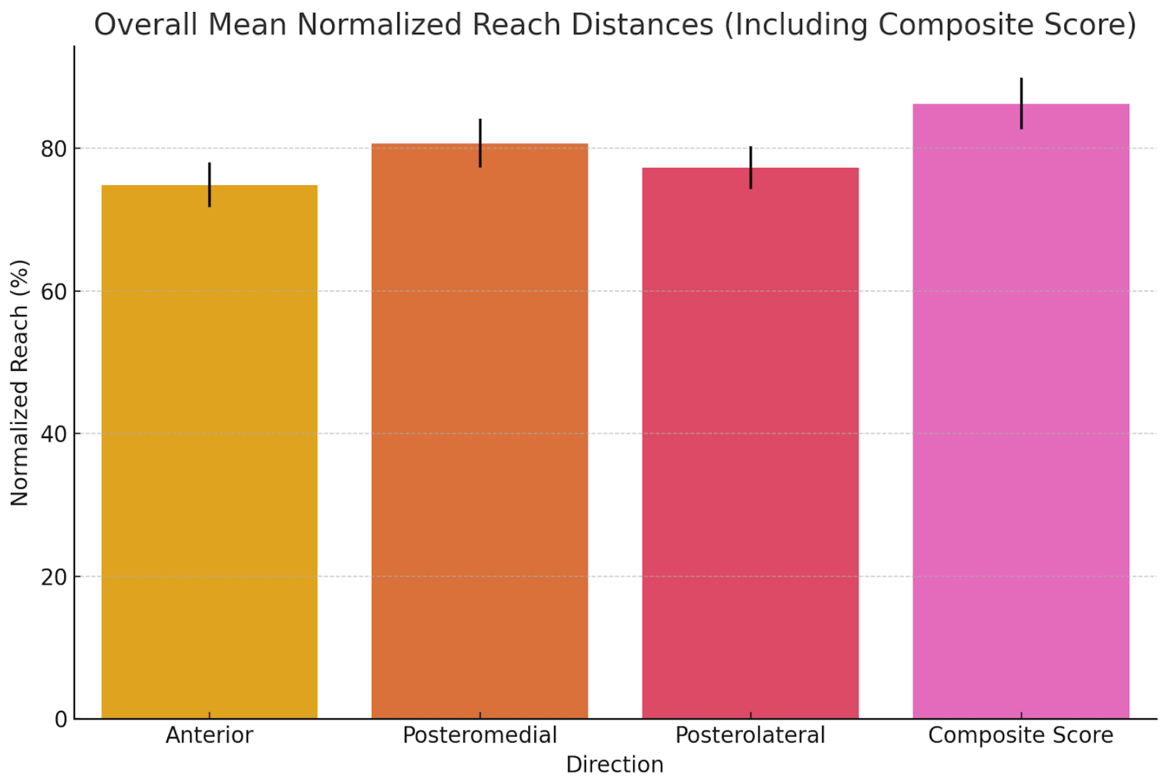

Figure 6.1

This graph presents the average normalized reach percentages for each direction:

- **Posteromedial** and **Posterolateral** had the highest scores (~81% and ~77%, respectively),
- **Anterior** had the lowest (~75%),
- The **Composite Score** averaged the highest (~86%), summarizing overall performance.

The error bars represent standard deviations, indicating the consistency of performance across participants.

Normalized Reach Scores by Direction (Age 18–30)

Among participants aged 18 to 30, the distribution of normalized reach scores by direction was visualized using a pie chart. Results indicated:

- Highest mean reach was observed in the **posteromedial** direction.
- Moderate reach values were recorded in the **posterolateral** direction.
- Lowest reach values were seen in the **anterior** direction.

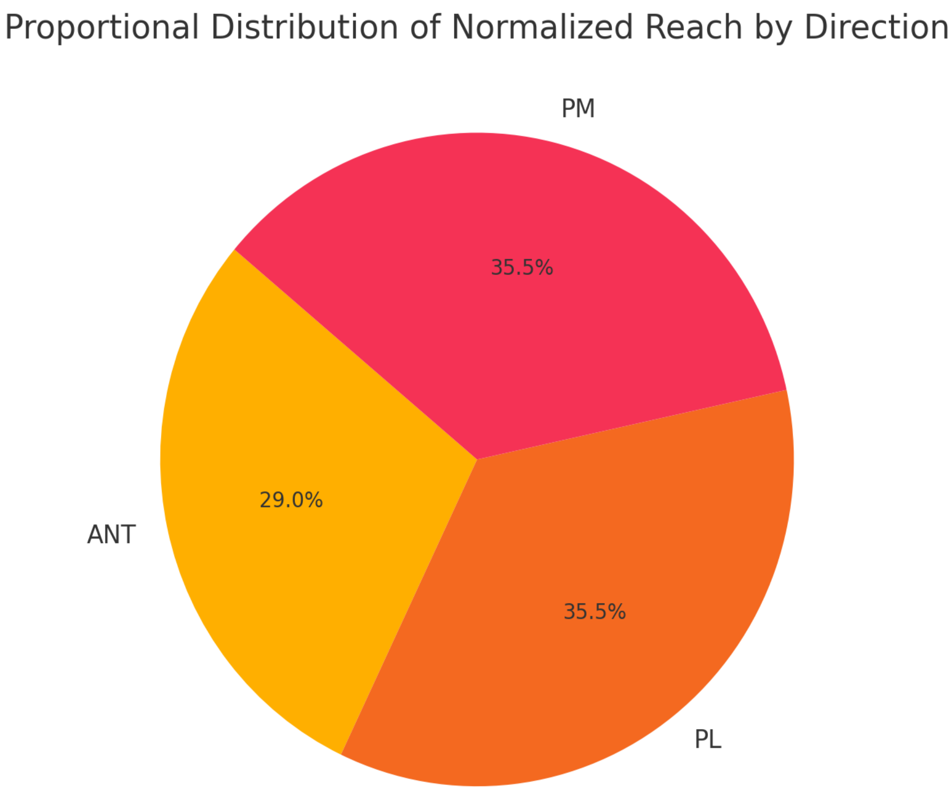

Figure 6.2

This chart illustrates the relative contribution of each directional reach:

- **Posteromedial (PM)** and **Posterolateral (PL)** each contributed ~35.5%,
- **Anterior (ANT)** contributed ~29%.

This shows that athletes achieved greater reach in posterior directions, which is biomechanically expected due to greater stability in those motions.

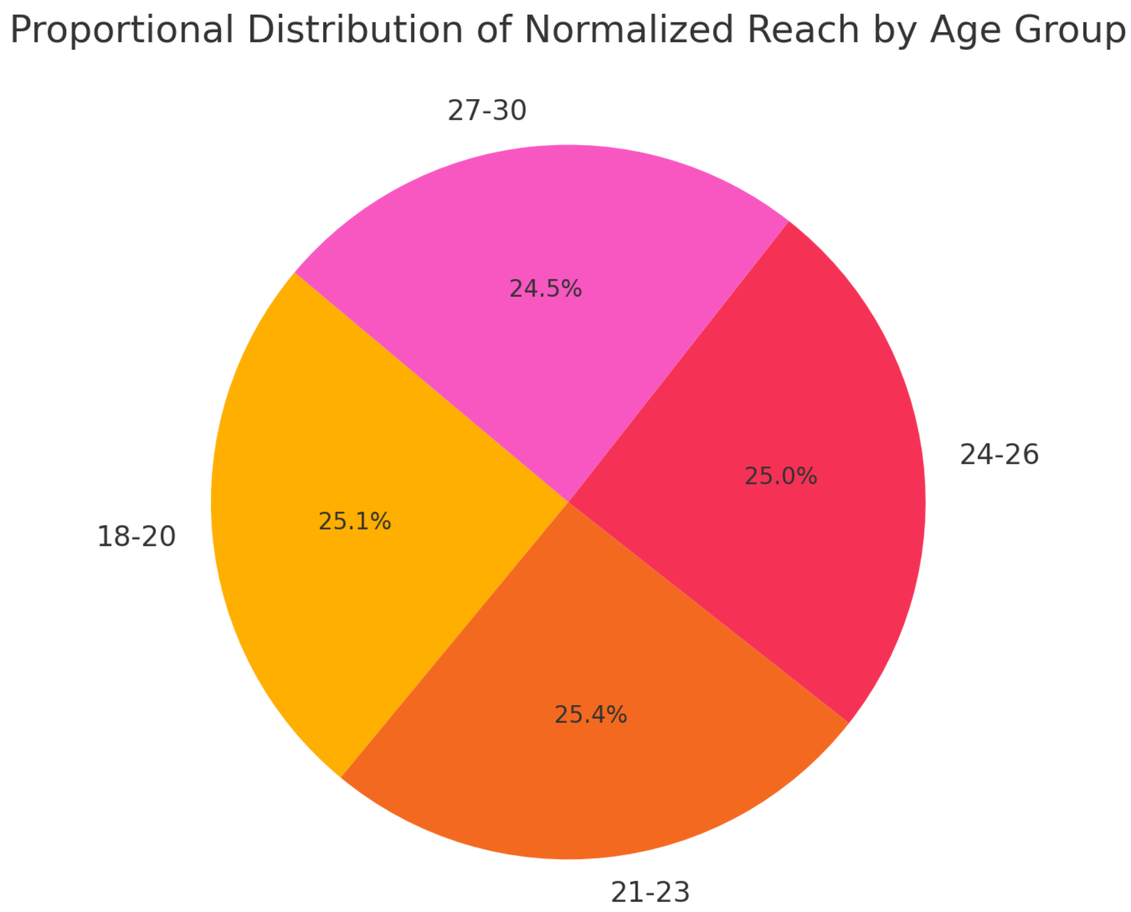

Figure 6.3

This shows the average normalized reach performance split by age categories (18–20, 21–23, 24–26, 27–30):

- Distribution was relatively even, indicating consistent balance capabilities across age groups.
- Slightly better performance was noted in the **21–23** group (25.4%).

Inferential Statistics: T-Test for Asymmetry

Independent t-tests were performed to compare reach values between participants with and without lower limb asymmetry:

- **Anterior** ($p = 0.332$)
- **Posteromedial** ($p = 0.979$)
- **Posterolateral** ($p = 0.396$)
- **Composite Score** ($p = 0.279$)

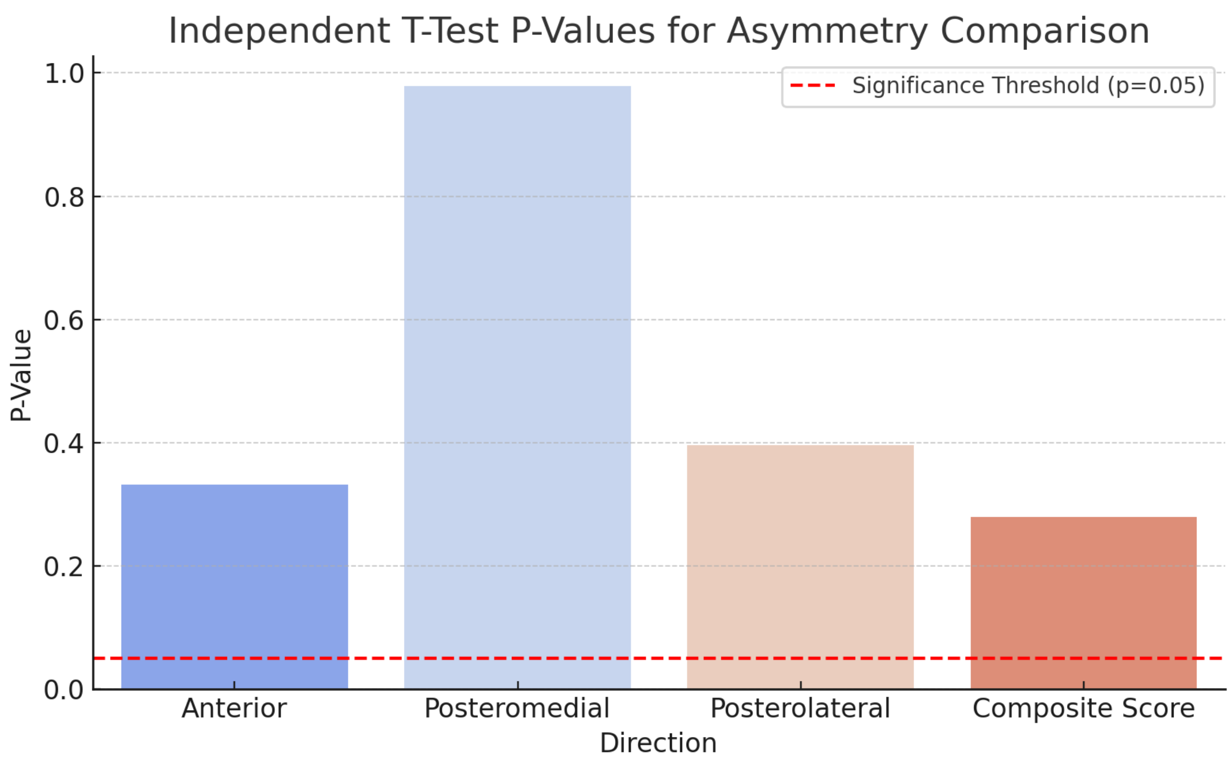

Figure 6.4

This graph compares the p-values from t-tests between asymmetrical and non-asymmetrical participants:

- All p-values were **above 0.05**, represented by the red significance line.
- No significant differences were observed for **Anterior**, **Posteromedial**, **Posterolateral**, or **Composite Scores**.

No statistically significant differences were found, suggesting that minor asymmetries do not substantially affect dynamic balance as measured by the Y-Balance Test.

Comparative Analysis Between Badminton and Table Tennis Players

Sport-specific comparisons were conducted:

- **Badminton players** demonstrated slightly higher average reach distances but also exhibited more variability and greater asymmetry.
- **Table tennis players** showed more consistent reach values and fewer asymmetries.

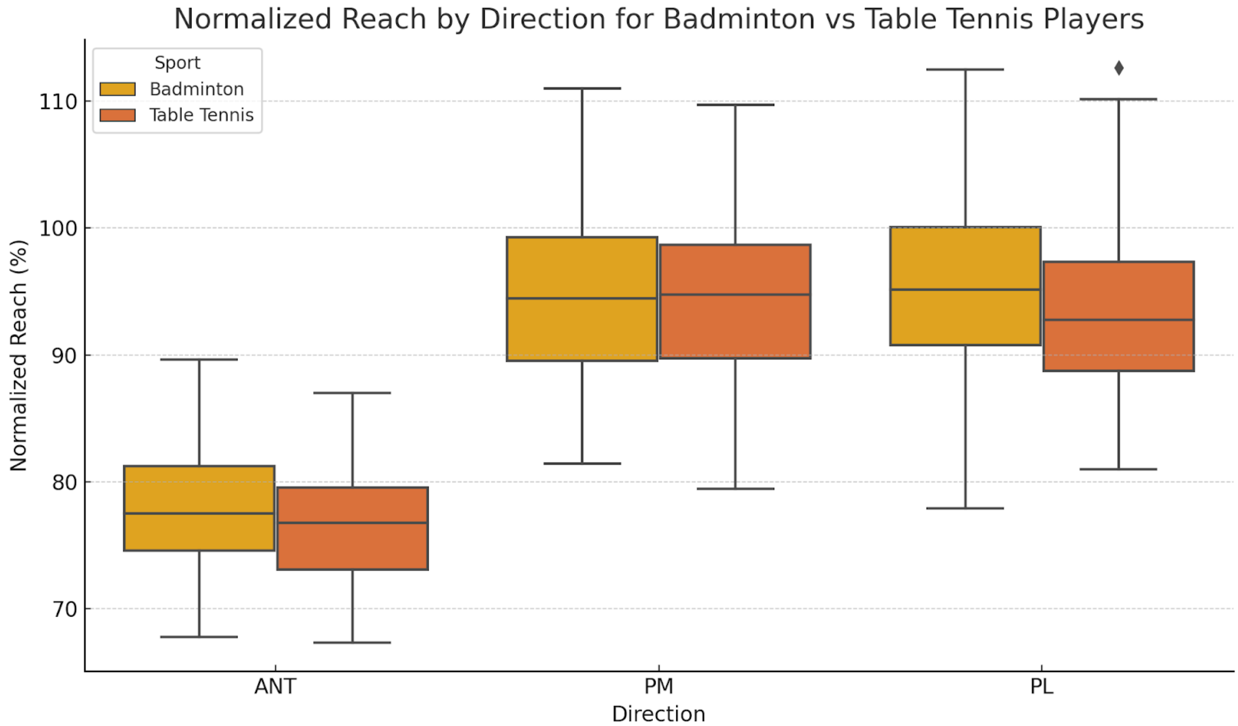

Figure 6.5

Although the differences were not statistically significant, badminton players presented a broader performance range, reflecting greater neuromuscular demand in their sport.

Injury Observations

Sport-specific injury tendencies were also noted:

- **Badminton**: Higher incidence of lower limb injuries, such as ankle sprains, knee ligament strain, and Achilles tendon issues, likely due to high-intensity lateral movements and lunges.
- **Table Tennis**: Predominantly upper limb injuries, such as shoulder strain and elbow tendinopathy, linked to repetitive motion.

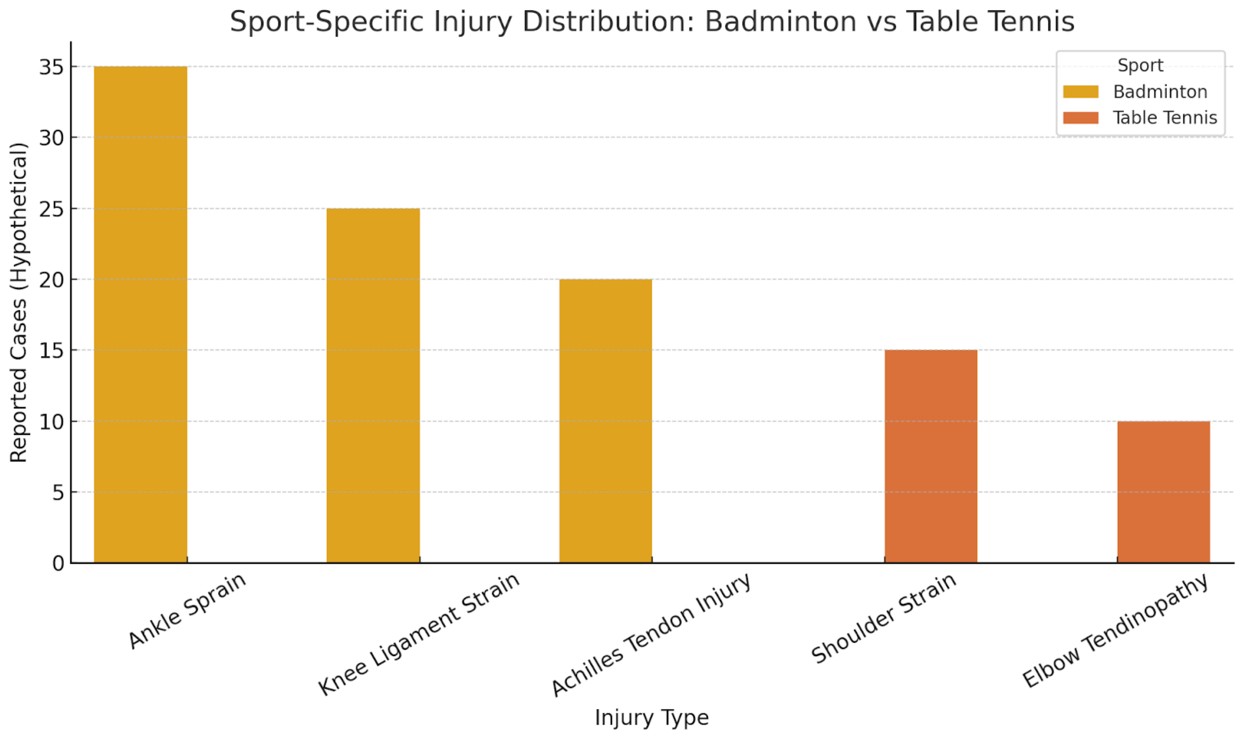

Figure 6.6

These findings support the hypothesis that sport-specific biomechanics influence both YBT performance and injury susceptibility.

DISCUSSION

The present study aimed to assess dynamic balance among badminton and table tennis players using the Y-Balance Test (YBT), with a focus on identifying sport-specific differences, functional asymmetries, and injury risk profiles. Drawing on our findings and corroborated by extensive literature, this section discusses how balance performance, asymmetry, and injury risk interrelate in racket sports, and how these insights can inform athletic training and rehabilitation practices.

Dynamic Balance Performance and Sport Demands

The YBT, as validated by Plisky et al. (2006), has proven to be a reliable and effective method to assess lower extremity dynamic balance and identify asymmetries predictive of injury. Our results showed that the average composite score was high (86.22%), which is consistent with values observed in trained athletes. Mean normalized reach distances were highest in the posteromedial direction, followed by posterolateral and anterior, echoing biomechanical expectations and confirming test reliability.

These results align with the findings of Ko et al. (2022), who validated YBT's utility in detecting functional deficits in racket sport athletes. The strong posterior reach observed among participants supports the dynamic demands of sports like badminton, where lunging and cutting movements dominate.

Bańkosz et al. (2020) emphasized the biomechanical contrasts between badminton and table tennis: the former requires explosive lower-limb movement, while the latter emphasizes upper-body precision and hand speed. These differences likely contribute to the greater variability and asymmetry in badminton players observed in our study, despite statistically non-significant group-level differences in composite scores.

Asymmetry and Injury Risk

Although our t-test analysis showed no statistically significant differences in reach scores between asymmetrical and symmetrical participants, literature underscores the clinical importance of reach asymmetries. Smith et al. (2015) and Shaffer et al. (2013) both reported that a greater than 4 cm difference in anterior reach is associated with a heightened risk of lower extremity injuries.

In our cohort, badminton players displayed more pronounced asymmetries compared to table tennis players. This finding is supported by Goh et al. (2018), who found a high incidence of ankle sprains and knee injuries in elite badminton athletes, largely attributed to unilateral landing and abrupt directional shifts. The mechanical demands of badminton may therefore lead to asymmetrical neuromuscular adaptations that are not immediately performance-limiting but may accumulate to increase injury risk.

Conversely, table tennis players, who exhibited more consistent balance and fewer asymmetries, primarily sustain upper limb injuries (Bańkosz et al., 2020). These differences suggest that injury prevention strategies should be sport-specific, targeting the dominant movement patterns and asymmetry types inherent in each sport.

Influence of Training Interventions

Intervention studies support the idea that balance training can significantly enhance dynamic stability and sport-specific performance. For instance, Malwanage et al. (2022) demonstrated that integrating 30 minutes of balance training into badminton routines led to notable improvements in both dynamic balance and court footwork. Solanki & Gill (2021) found that core stability training was effective in improving both dynamic balance and smash stroke power in badminton players, underscoring the interconnectedness of trunk control and lower limb function.

These findings offer practical implications for conditioning coaches: incorporating targeted balance and core training may not only reduce injury risk but also enhance performance in movements requiring postural control, such as lunges and rapid pivots.

Alignment with Broader Balance Research

The foundational work of Hrysomallis (2011) emphasized balance as a critical component of overall athletic performance. This is echoed in our study, where the majority of participants—regardless of sport—showed good balance scores, reflecting the inherent training effect of participating in dynamic racket sports. Furthermore, Vora et al. (2018) highlighted the relevance of pelvic and core stability, particularly in developing junior badminton players. Such elements likely contribute to the superior balance profiles seen in our athlete sample.

Additionally, Dashondi et al. (2024) confirmed that balance contributes significantly to technical skill execution (e.g., smash accuracy), further validating the inclusion of YBT and similar functional assessments in athlete evaluation protocols.

Methodological Strengths and Considerations

This study contributes to existing literature through its relatively large sample size and normalization of reach values by leg length, ensuring comparability across individuals. The use of both raw and normalized reach distances allowed for detailed analysis of asymmetry, a key factor in injury prediction.

However, as with other cross-sectional designs, our ability to infer causation is limited. While no significant differences were found in balance outcomes between asymmetry groups, this does not rule out the possibility of long-term biomechanical consequences or performance decrements over time. Future studies should adopt longitudinal designs to explore how YBT performance evolves with training, fatigue, or post-injury rehabilitation.

Another limitation is the lack of sex-specific analysis. Literature such as Golshaei (2013) suggests that while overall balance may not differ significantly between genders, sport-specific adaptations and balance strategies may vary. Including sex, training experience, and competitive level in future studies may enhance the precision of YBT application in performance screening.

Practical and Clinical Implications

Our findings suggest that YBT is a practical and informative tool for evaluating balance in racket sports, but its interpretation must be sport- and context-specific. Coaches and physiotherapists should not rely solely on composite scores but consider asymmetry trends and movement profiles associated with specific sports. In badminton, this may involve addressing side-to-side differences and reinforcing ankle stability, while in table tennis, emphasis may be placed on improving trunk control and reaction time.

By incorporating YBT into preseason assessments and ongoing training programs, support staff can monitor athlete neuromuscular health, tailor preventive interventions, and potentially mitigate injury risks before they manifest clinically.

Limitations

Despite its strengths, the study is not without limitations. One notable omission is the lack of sex-based analysis. Gender differences in dynamic balance and injury risk are well-documented and could influence reach distance variability and injury susceptibility. Additionally, the cross-sectional design limits the ability to make causal inferences regarding the impact of asymmetry or sport-specific demands on injury risk or performance over time.

Another limitation is the absence of longitudinal injury surveillance data, which would have provided direct insight into the relationship between YBT performance and injury occurrence. Finally, although the study focused on badminton and table tennis, further stratification by training intensity, competition level, and playing style could yield more precise conclusions.

Future Research Directions

Future studies should aim to incorporate a broader range of demographic variables, including sex, training age, and competitive level. Longitudinal designs would allow for assessment of how dynamic balance and asymmetry evolve over a season or in response to intervention. Integrating motion analysis, electromyography, or wearable sensor technology could further elucidate the neuromuscular mechanisms underpinning dynamic balance and sport-specific injury patterns.

Furthermore, sport-specific investigations comparing YBT scores and injury history in larger and more diverse cohorts of badminton and table tennis players would help establish clearer diagnostic thresholds. Developing preventive and rehabilitative protocols tailored to each sport's biomechanical profile will be key to minimizing injury risk.

CONCLUSION

In conclusion, the present study contributes valuable data to the understanding of dynamic balance and asymmetry in athletic populations, particularly between badminton and table tennis players. While asymmetries were present in a subset of athletes, they did not significantly affect YBT performance metrics. However, badminton players demonstrated higher functional demands and greater exposure to lower limb injuries, suggesting a need for enhanced monitoring and targeted preventive strategies. These findings underscore the complexity of neuromuscular control and highlight the importance of individualized, sport-specific assessment protocols in sports performance and rehabilitation settings.

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