A Comparative Study of Dynamic Balance Between Yoga Practitioners and Gymnasts Using the Balancing Beam Test

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***Abstract*—This study examined the dynamic balance performance of yoga practitioners and gymnastics athletes using the Balancing Beam Test. The purpose of the study was to determine whether a significant difference existed between the two groups in their balance ability. A comparative design was used with a purposive sample of 40 athletes, consisting of 20 yoga practitioners and 20 gymnastics athletes from local institutions. Descriptive statistics and an independent-samples t-test were applied to analyse the data, along with Cohen's d to determine effect size. The results showed that gymnastics athletes obtained a higher mean score (M = 5.14, SD = 4.79) than yoga practitioners (M = 3.39, SD = 2.41). However, the difference was not statistically significant at the 0.05 level (t = -1.46, p = 0.156), and the effect size was small to moderate (d = -0.46). It was concluded that there was no significant difference in dynamic balance performance between yoga practitioners and gymnastics athletes on the Balancing Beam Test. Therefore, the null hypothesis was accepted, indicating that both forms of training may contribute similarly to the development of dynamic balance in the selected sample**

I. INTRODUCTION

Maintaining control over one's body position, whether in motion or at rest, is a fundamental motor skill and a key component of physical fitness. In sports science, it is described as the capacity to maintain the body's centre of mass above its base of support by combining muscle reactions with sensory information from the vestibular, proprioceptive, and visual systems. Effective performance across a variety of tasks, from everyday actions like standing, walking, and turning to intricate athletic skills such as gymnastics routines, yoga poses, and quick direction changes in games, depends on good balance.

Because it allows a person to control their body position in both static postures and dynamic movements, balance is essential to both physical health and motor skills. When engaging in actions such as standing, walking, jumping, or turning, the visual, vestibular, and proprioceptive systems must work in unison to maintain the body's centre of mass above its base of support. In sports such as gymnastics, yoga, dance, and team sports, athletes with strong balance can execute intricate skills more accurately and efficiently, thereby improving their overall performance. Additionally, maintaining good balance is essential for preventing accidents because it enhances joint stability and neuromuscular control, reducing the likelihood of falls and lower-limb injuries and promoting a safe return to play after rehabilitation. Since balance is the foundation of nearly every movement an athlete makes, it is used in sport as an essential component of training, testing, and performance. To increase overall performance and reduce the risk of injury, coaches utilise balancing exercises to enhance stability, coordination, agility, and effective force production.

Exercises on stable and unstable surfaces, single-leg stances, dynamic beam training, and sport-specific drills that test posture control during jumps, landings, cuts, and rotations are practical ways to teach balance. In high-speed scenarios such as tackling, turning, or dismounting from equipment, these exercises help athletes maintain alignment and quickly adjust their posture by strengthening their core, stabilising muscles, and enhancing neuromuscular control. Research demonstrates the critical role of balance training in long-term athletic development, showing that athletes with improved balance not only execute technical skills more accurately but also sustain significantly fewer lower-limb injuries when balance training is consistently incorporated into their programs.

Static balance:
Static balance is the ability to maintain the body's centre of mass over a stable base of support while the body is not moving, such as holding a yoga tree pose or standing still on a balance beam. It is crucial for postural control, starting positions, and many aesthetic or judged sports skills.

Dynamic balance:
Dynamic balance is the ability to maintain or regain stability. At the same time, the body is in motion or when the base of support is changing, for example, during walking, running, turning, or landing from a jump. This type is essential in most game sports and gymnastics, where athletes must stay balanced while executing rapid, complex movements.

Reactive (or anticipatory) balance:
Reactive balance refers to the capacity to recover stability after an unexpected disturbance, such as being pushed, landing awkwardly, or slipping. It relies on fast reflexes and neuromuscular responses and is vital for injury prevention in high-speed, contact, or acrobatic sports.
Dynamic balance is the ability to maintain stability and control of body position while moving or when the base of support is changing, such as during walking, running, jumping, turning, or landing. In dynamic balance, the centre of mass is constantly shifting relative to the base of support, and the neuromuscular system must continuously adjust to prevent the body from falling.
In sport, dynamic balance is crucial for skills that involve rapid changes of direction, deceleration, and re-acceleration—for example, dodging an opponent, performing a gymnastics dismount, or running and kicking in football. Training methods include tasks such as tandem walking, lunges, single-leg hops, agility drills, and movement on unstable surfaces, which improve coordination, core stability, and the ability to react to sudden perturbations, thereby enhancing performance and reducing the risk of injury.
Beam walking / Balancing beam tests: The performer walks along a narrow beam, often at different speeds or with added tasks (such as turns or head movements), and outcomes include the time taken, the number of errors, or the number of falls. This type of test closely matches the balancing beam data you collected for yoga and gymnastics athletes and is considered a functional measure of dynamic balance.
These tests help coaches and researchers quantify dynamic balance, compare groups (e.g., sports or training methods), and monitor improvements after balance or core-stability training interventions.

Objectives of the Study:
To assess the dynamic balance performance of yoga practitioners and gymnastics athletes using the

Balancing Beam Test.
To determine whether there is a statistically significant difference in dynamic balance between yoga practitioners and gymnastics athletes by applying an independent-samples t-test and calculating effect size.

Hypotheses of the Study:
There is no significant difference in dynamic balance performance, as measured by the Balancing Beam Test, between yoga practitioners and gymnastics athletes.

II. REVIEW OF RELATED LITERATURE

Th. Sham Singh (2022): The aim was to investigate the balance and flexibility among yogic and aerobic gymnastics players. A descriptive survey method was adopted. Twenty (20) girls' Yoga players and aerobic gymnastics players were selected from the age group range of 17–20 years. The selected variables were the administration of balance and flexibility tests. Data were analysed using the mean, standard deviation, and t-test at a significance level of 0.05. There were greater differences in variables, such as sit-and-reach, bass stick, and bridge up, between girls' yoga and aerobic gymnastics players. Whereas there were insignificant differences in variables, viz., stork stand, neck & trunk extension, and shoulder & wrist elevation, among girls' yoga and aerobic gymnastic players
Yuqi Cheng (Jan-2025): In this study, we investigated four parameters related to balance control—anterior-posterior (AP) displacement, medial-lateral (ML) displacement, length, and tilt angle—in 13 elite athletes and 12 freestyle skiing aerial expert athletes. Data were recorded during 30-second trials on both

soft and hard support surfaces, with eyes open and closed. We calculated the CMCI and used four machine learning algorithms—Logistic Regression, Support Vector Machine (SVM), Naive Bayes, and Ranking Forest—to combine these features and assess each participant's balance ability. A classic train-test split method was applied, and the performance of different classifiers was evaluated using Receiver Operating Characteristic (ROC) analysis. The ROC results showed that traditional time-domain features were insufficient for accurately distinguishing athletes' balance abilities, whereas CMCI was more effective.

Zeeshan Bhimani (Sep-2025): Eighty athletes aged 12-18 years from four different sports (gymnastics, judo, soccer, and hockey) participated. Static balance was assessed using the Balance Error Scoring System (BESS) on both firm and foam surfaces. Dynamic balance was evaluated using the Star Excursion Balance Test (SEBT). Results indicated significant differences in dynamic and static balance performance across the sports. Gymnasts demonstrated superior static and dynamic balance compared to the other three groups($p<0.05$). Judo athletes also exhibited better static balance than hockey and soccer players ($p < 0.05$). These findings suggest that sport-specific sensorimotor demands may influence the development of balance skills. This information can inform the design of sport-specific balance training programs to prevent injuries and enhance performance.

III. METHODOLOGY

The study employed a comparative design with a sample of 40 athletes, comprising 20 yoga practitioners and 20 gymnasts, all purposively selected from local institutions. These athletes had at least one year of training experience and were free from recent injury. Descriptive statistics were computed separately for each group, including mean, median, standard deviation, minimum, maximum, range, and standard error of the Balancing Beam Test scores to summarise the central tendency and variability of their dynamic balance performance. The Balancing Beam Test procedure involved athletes performing a standard warm-up, followed by familiarisation trials and then walking along a fixed wooden beam of specified dimensions at a controlled pace; performance was recorded as time taken and/or number of balance errors (e.g., stepping off, using arms excessively), and the best or average trial was taken as the final dynamic balance score for statistical analysis.

IV. DATA ANALYSIS AND INTERPRETATION

Table 01: Descriptive statistics.

Group	n	Mean	Median	SD	Min	Max	Range	SE
Yoga	20	3.39	2.85	2.41	1.01	9.29	8.28	0.54
Gymnastics	20	5.14	3.79	4.79	1.16	22.10	20.94	1.07

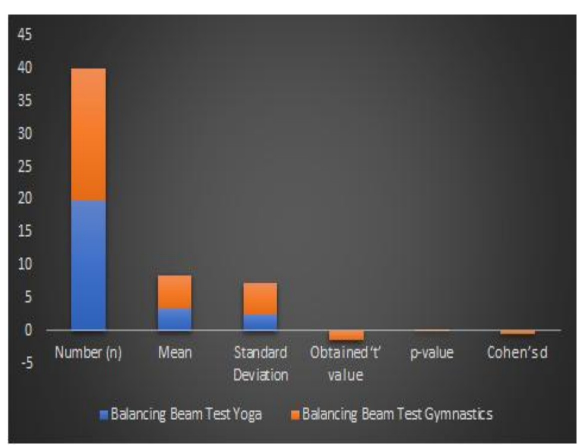
Interpretation: On average, gymnastics athletes scored higher (Mean = 5.14) and showed much greater variability (SD = 4.79, Range = 20.94) than yoga athletes (Mean = 3.39, SD = 2.41, Range = 8.28).

Table 02: A Comparison between the Dynamic Balancing ability of Yoga and Gymnastics athletes.

Variable	Group	Number (n)	Mean	Standard Deviation	Obtained 't' value	p-value	Cohen's d
Balancing Beam Test	Yoga	20	3.39	2.41			
	Gymnastics	20	5.14	4.79	-1.46	0.156	-0.46

The obtained 't' value of -1.46 with p = 0.156 indicates that the difference in dynamic balance performance between yoga practitioners and gymnastics athletes on the balancing beam test is statistically non-significant at the 0.05 level.

V. GRAPHICAL REPRESENTATION



VI. DISCUSSION ON FINDINGS

The descriptive statistics showed that gymnastics athletes obtained a higher mean score (Mean = 5.14) on the Balancing Beam Test than yoga practitioners (Mean = 3.39), and their scores were far more variable (SD = 4.79 vs 2.41; range 20.94 vs 8.28). This suggests that, within the sample, some gymnasts performed extremely well while others performed poorly, whereas the yoga group showed more homogeneous performance. However, the independent-samples t-test revealed that this difference in means was not statistically significant ($t = -1.46$, $p = 0.156$), indicating that the observed gap in balancing beam scores could be due to sampling error rather than a true difference between sports at the population level. The effect size (Cohen's $d = -0.46$) falls in the small-to-moderate range, suggesting a trend favouring gymnasts but not strong enough to meet the conventional 0.05 significance threshold. These results only partly agree with previous research where gymnasts consistently outperformed other athletes in both static and dynamic balance tests, implying that factors such as sample size, training load, test specificity, and age range may have influenced the outcome of the present study.

VII. CONCLUSION

Within the limitations of this study, yoga practitioners and gymnastics athletes did not differ significantly in dynamic balance performance on the Balancing Beam Test at the 0.05 level of significance ($p = 0.156$). Consequently, the null hypothesis stating that there is no significant difference between the two groups is accepted, and the research hypothesis is rejected. Although gymnasts showed a slightly higher mean score and greater variability, these differences were not statistically meaningful, suggesting that both yoga and gymnastics training may develop dynamic balance to a broadly comparable level under the conditions and sample used in this investigation.