



RESEARCH ARTICLE

COMPARISON OF UNILATERAL SQUAT JUMP PERFORMANCE BETWEEN THE NON-DOMINANT AND DOMINANT LEG IN MALE HANDBALL PLAYERS

Vivek Venugopalan¹ and Chittibabu Balasubramanian²

¹PhD Scholar, MYAS-AU Department of Sports Sciences, Annamalai University; ²Professor and Head, Division of Sports Biomechanics, MYAS-AU Department of Sports Sciences, Annamalai University

ARTICLE INFO

Article History

Received 24th August, 2025
Received in revised form
10th September, 2025
Accepted 15th October, 2025
Published online 30th November, 2025

Keywords:

Flight time, Foot contact time, Rate of force development, Eccentric, Concentric.

*Corresponding author:

Vivek Venugopalan

ABSTRACT

The study aims to compare unilateral squat jump performance between the non-dominant and dominant leg in male handball players. To achieve the purpose 38 male handball players were selected as subjects from Annamalai University. Unilateral squat jump data was obtained using Gyko Inertial system (Microgate, s.r.l., Italy) and optojump (Microgate, s.r.l., Italy). Paired *t* test was administered to ascertain the unilateral difference in squat jump performance between non-dominant and dominant leg. The paired sample *t* test showed significant difference between non-dominant leg and dominant leg in flight time, maximum velocity and maximum power. Remaining Variables failed to show significant difference ($p > 0.05$). It is concluded that male handball players exhibit significantly greater flight time, maximum velocity, and maximum power in the dominant leg compared to the non-dominant leg during unilateral squat jump performance.

Copyright©2025, Vivek Venugopalan and Chittibabu Balasubramanian. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Vivek Venugopalan and Chittibabu Balasubramanian, 2025. "Comparison of unilateral squat jump performance between the non-dominant and dominant leg in male handball players", *International Journal of Recent Advances in Multidisciplinary Research*, 12,(11), 11933-11935.

INTRODUCTION

Handball is characterized by frequent bouts of high-intensity activity in which players repeatedly perform explosive movements such as sprints, jumps, sharp directional changes, and single-leg take-offs during offensive and defensive actions. These demands place substantial stress on the lower limbs and require well-developed strength, power, and neuromuscular control (Michalsik, Aagaard, & Madsen, 2015). Among these abilities, vertical jump performance is particularly important, as it contributes to key match actions including shooting, blocking, and contesting rebounds (Gorostiaga *et al.*, 2005; Hermassi *et al.*, 2011). Due to the sport's movement patterns, handball athletes often develop leg dominance, typically favoring one limb for actions such as unilateral take-offs, landings, or cutting movements. This repeated use can contribute to measurable asymmetries in strength and power between the dominant (DL) and non-dominant leg (NDL) (Fasold *et al.*, 2022). Previous research suggests that inter-limb discrepancies greater than 10–15% may impair performance efficiency and increase susceptibility to injury (Bishop *et al.*, 2018). Assessing single-leg jump performance therefore provides insight into functional imbalances relevant to athletic performance and injury risk.

The unilateral squat jump (USJ) is a practical assessment tool for evaluating explosive capacity in a single limb because it emphasizes concentric force production while minimizing stretch-shortening cycle influence (Markovic *et al.*, 2004). Studies involving athletes from various unilateral or asymmetrical sports—including handball—have reported stronger or more powerful dominant limbs (Impellizzeri *et al.*, 2007; Madruga-Parera *et al.*, 2020). However, available evidence on asymmetries in unilateral jump performance among male handball players remains limited. Given the sport-specific relevance of unilateral actions in handball, determining performance differences between the DL and NDL is essential for informed training decisions. Thus, the aim of this study was to compare unilateral squat jump performance between the non-dominant and dominant legs in male handball players.

MATERIALS AND METHODS

Subjects: Thirty-eight male handball players from Annamalai University who competed in the 2023–24 South Zone Inter-University Tournament participated in the study. All players voluntarily agreed to take part and provided written informed

consent. Participants were informed of their right to withdraw at any point, although none chose to do so.

Variables: Unilateral squat jump performance was measured using the Gyko inertial sensor (Microgate, Italy) and the Optojump system (Microgate, Italy). The Gyko device, secured to the back via an elastic belt, records space–time parameters through wireless data transmission (Cigrowski *et al.*, 2017). Optojump was used to capture flight time and jump height (Attia *et al.*, 2016). All measurements were conducted in the MYAS-AU Department of Sports Sciences Exercise Physiology Laboratory, Chidambaram, Tamil Nadu.

Statistical Technique: A paired t-test was used to compare non-dominant and dominant leg performance. Analyses were performed using SPSS version 16, with statistical significance set at $p < 0.05$.

RESULTS

The paired sample t test showed significant difference between non-dominant leg and dominant leg in flight time ($t = -2.60$, $p < 0.05$), maximum velocity ($t = -3.29$, $p = 0.002$) and maximum power ($t = -2.83$, $p = 0.007$). Remaining variables failed to show significant difference ($p > 0.05$) (Table 1).

Table 1. Squat jump performance difference between non-dominant and dominant leg

Variables	Paired Differences				<i>t</i> value	<i>p</i> value
	Mean	Std. Deviation	95% Confidence Interval of the Difference			
			Lower	Upper		
Flight time	-0.019	0.04	-0.034	-0.004	-2.60*	0.013
Foot Contact time	0.006	1.36	-0.441	0.454	0.029	0.977
Concentric Duration	-0.002	0.29	-0.095	0.100	0.054	0.957
Eccentric Duration	0.001	0.19	-0.064	0.066	0.041	0.968
Eccentric work	-0.006	0.81	-0.274	0.262	-0.048	0.962
Concentric work	-0.040	1.43	-0.511	0.430	-0.173	0.863
Jump height	-1.505	5.09	-3.180	0.168	-1.822	0.077
Maximum Velocity	-0.138	0.26	-0.224	-0.053	-3.29*	0.002
Maximum Power	-6.611	14.38	-11.339	-1.883	-2.83*	0.007
Maximum Force	50.421	324.72	-56.313	157.156	0.957	0.345
Rate of Force Development	-15.954	62.22	-36.408	4.498	-1.581	0.122
Time to Maximum Force	0.039	0.27	-0.052	0.131	0.864	0.393

*Significant at 0.05.

DISCUSSION

The present study found that male handball players produced significantly greater flight time, maximum velocity, and maximum power with their dominant leg during unilateral squat jumping. These findings indicate meaningful inter-limb performance asymmetry, aligning with previous research showing superior neuromuscular output in an athlete's preferred limb (Bishop *et al.*, 2018; Madruga-Parera *et al.*, 2020). Greater flight time in the dominant leg likely reflects enhanced vertical impulse generation. Frequent reliance on one limb for jump shots, directional changes, and unilateral landings can result in neuromuscular adaptations, such as improved motor unit recruitment and refined movement coordination (Impellizzeri *et al.*, 2007; Gonzalo-Skok *et al.*, 2017). These adaptations enhance the ability to produce vertical force and achieve higher take-off positions. Similarly, greater maximum velocity may be attributed to superior concentric contractile properties in the dominant leg. Repeated unilateral sport movements can improve rate of force development (RFD) and neuromuscular activation, enabling

faster acceleration during take-off (Sato & Heise, 2012). Previous studies have shown that athletes in unilateral or asymmetrical sports often demonstrate higher movement velocities in their dominant limb (Fasold *et al.*, 2022). Higher power output in the dominant leg further supports the presence of sport-induced asymmetries. Since power depends on both force and velocity, long-term unilateral loading—such as repeated single-leg take-offs and rapid changes in direction—promotes neural and muscular adaptations that favor the dominant limb (Hermassi *et al.*, 2011; Rouissi *et al.*, 2016). Over time, these adaptations may create measurable imbalances in mechanical power production. Inter-limb differences of this nature have been associated with potential reductions in performance efficiency and increased injury risk (Bishop *et al.*, 2018; Dos'Santos *et al.*, 2018). Together, the findings suggest that regular monitoring of unilateral performance measures is important for identifying imbalances. Incorporating unilateral strength and plyometric training may help reduce asymmetries, improve overall explosive capacity, and mitigate injury risk in handball athletes.

CONCLUSION

The study revealed that male handball players exhibited significantly higher flight time, maximum velocity, and maximum power in their dominant leg during unilateral squat jumps, indicating the presence of functional inter-limb asymmetry. These differences likely arise from repetitive, sport-specific unilateral actions that enhance neuromuscular activation and force–velocity capabilities in the preferred limb. Monitoring such asymmetries can help coaches design targeted training programs aimed at correcting deficits, improving performance, and potentially reducing injury risk through more balanced lower-limb development.

REFERENCES

- Bishop, C., Read, P., Chavda, S., & Turner, A. (2018). Asymmetries of the lower limb: The role of limb dominance. *Strength and Conditioning Journal*, 40(6), 63–72.
- Fasold, F., *et al.* (2022). Lower limb strength asymmetries in elite handball players. *International Journal of Sports Physiology and Performance*, 17(1), 40–48.
- Gorostiaga, E. M., *et al.* (2005). Effects of an entire season on physical fitness in elite male handball players. *Medicine & Science in Sports & Exercise*, 37(4), 644–651.
- Hermassi, S., Chelly, M. S., Tabka, Z., Shephard, R. J., & Chamari, K. (2011). Effects of 8-week in-season upper and lower limb heavy resistance training on the peak power, throwing velocity, and sprint performance of elite male handball players. *Journal of Strength and Conditioning Research*, 25(9), 2424–2433.
- Impellizzeri, F. M., *et al.* (2007). Relationship between single-leg strength asymmetry and functional performance in athletes. *Journal of Sports Sciences*, 25(11), 1369–1377.
- Madruga-Parera, M., *et al.* (2020). Inter-limb asymmetries and their influence on athletic performance. *PLOS ONE*, 15(8), e0235197.
- Markovic, G., Dizdar, D., Jukic, I., & Cardinale, M. (2004). Reliability and factorial validity of squat and countermovement jump tests. *Journal of Strength and Conditioning Research*, 18(3), 551–555.

- Michalsik, L. B., Aagaard, P., & Madsen, K. (2015). Technical activity profile and physical demands in elite men's handball: Influence of match phase and playing position. *Journal of Strength and Conditioning Research*, 29(2), 410–418.
- Dos'Santos, T., Thomas, C., Jones, P. A., & Comfort, P. (2018). Mechanical determinants of faster change of direction speed performance in male athletes. *Journal of Strength and Conditioning Research*, 32(11), 2987–2996.
- Gonzalo-Skok, O., *et al.* (2017). Unilateral vs. bilateral strength and power training: Effects on performance and inter-limb asymmetries in adolescent basketball players. *Journal of Strength and Conditioning Research*, 31(10), 2749–2757.
- Hermassi, S., Chelly, M. S., Tabka, Z., Shephard, R. J., & Chamari, K. (2011). Effects of heavy resistance training on power, sprint, and throwing performance in male handball players. *Journal of Strength and Conditioning Research*, 25(9), 2424–2433.
- Rouissi, M., *et al.* (2016). Asymmetric balance and lower limb strength deficits in elite soccer players. *Journal of Sports Sciences*, 35(12), 1223–1232.
- Sato, K., & Heise, G. D. (2012). Influence of weight distribution asymmetry on vertical jump performance. *Journal of Strength and Conditioning Research*, 26(12), 3271–3278.
- Attia, A., Dhahbi, W., Chaouachi, A., Padulo, J., Wong, D. P. and Chamari, K. (2017). Measurement Errors When Estimating the Vertical Jump Height with Flight Time Using Photocell Devices: The Example of Optojump. *Biology of Sports*, 34(1), 63–70.
- Cigrovski, V., Franjko, I., Rupcic, T., Bakovic, M. and Matkovic, A. (2017). Comparison of Standart and Newer Balance Tests in Recreational Alpine Skiers and Ski Novices. *Montenegrin Journal of Sports Science and Medicine*, 6(1), 49-55.
