# Asymmetries in strength and power of the lower extremities in the Chilean junior national handball team

*Asimetrías en la fuerza y la potencia de las extremidades inferiores en la selección chilena de balonmano categoría junior*

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## Abstract

Introduction. Bilateral asymmetry is defined as the difference between the right and left sides, or between the dominant and non-dominant limbs. In sports, the specific demands of training and competition often favor the development of one limb over the other, potentially leading to muscle imbalances that increase the risk of injury and reduce performance.
Objective: The purpose of this study was to determine lower-limb asymmetry levels using single-leg jump tests, comparing the dominant limb with its contralateral in pre-throw jumps among Chilean junior national handball players.
Methods: A cross-sectional study was conducted with 16 male athletes (mean age: 19.9 ± 1.6 years; mean body mass: 84.3 ± 8.3 kg; mean height: 183.8 ± 5.3 cm). Four single-leg jump tests were performed: squat jump (SJ), countermovement jump (CMJ), drop jump (DJ), and Abalakov jump (ABK). Eleven players demonstrated left-leg dominance, and five right-leg dominance.
Results: No statistically significant differences were observed between limbs in jump height, strength, or power. Relative asymmetry values ranged from 3% to 17% in both groups.
Discussion: Greater asymmetries were found in right-dominant athletes (>10%) compared with left-dominant athletes (<8%), without significant effects on performance. However, monitoring these differences remains important due to their association with injury risk.
Conclusions: Limb dominance did not guarantee superior performance over the contralateral limb. Observed inter-limb differences were mild and non-significant, suggesting that natural asymmetries below 10% may be advantageous in high-performance sports by minimizing injury risk and optimizing athletic performance.

## Keywords

Explosive strength; jump; stretch-shortening cycle; training.

## Resumen

Introducción: La asimetría bilateral se define como la diferencia entre el lado derecho e izquierdo o entre las extremidades dominante y no dominante. En los deportes, la naturaleza de las actividades específicas favorece el desarrollo de una extremidad sobre la otra, lo que puede generar desequilibrios musculares asociados a un mayor riesgo de lesiones y disminución del rendimiento.
Objetivo: Este estudio tuvo como objetivo determinar los niveles de asimetría en las extremidades inferiores mediante pruebas de capacidad de salto unipodal, considerando la extremidad inferior dominante y su contralateral inferior en saltos previos al lanzamiento en jugadores junior seleccionados chilenos de balonmano.
Metodología: Se realizó un estudio transversal con 16 atletas masculinos (edad: 19.9 ± 1.6 años; masa corporal: 84.3 ± 8.3 kg; estatura: 183.8 ± 5.3 cm). Se aplicaron cuatro pruebas de salto unipodal: squat jump (SJ), counter movement jump (CMJ), drop jump (DJ) y salto Abalakov (ABK). Once participantes presentaron dominancia de la extremidad zurda y cinco de la diestra.
Resultados: No se encontraron diferencias estadísticamente significativas entre las extremidades en altura de salto, fuerza o potencia. Las asimetrías relativas oscilaron entre el 3% y el 17% en ambos grupos.
Discusión: Se identificaron mayores asimetrías en sujetos diestros (>10%) frente a zurdos (<8%), sin impacto significativo en rendimiento. No obstante, se resalta la importancia de monitorear estas diferencias por su relación con el riesgo de lesión.
Conclusiones: La dominancia de una extremidad no garantizó mejores rendimientos respecto a su contraparte. Las diferencias observadas entre extremidades fueron leves y no significativas, indicando que asimetrías naturales inferiores al 10% pueden ser beneficiosas para el deporte de alto rendimiento, al minimizar el riesgo de lesiones y optimizar el rendimiento deportivo.

## Palabras clave

Ciclo de estiramiento-acortamiento; entrenamiento; fuerza explosiva; salto.

## Introduction

It is essential to recognize that the human morphostructure naturally exhibits both structural and functional asymmetries. Although the exact cause of these asymmetries is not fully understood, they may be related to anatomical factors, limb dominance, and other functional aspects (Tate et al., 2006). Functional asymmetries, associated with the motor predominance of one limb over the other, originate from ipsilateral or contralateral cerebral dominance, influencing the preferential use of a limb depending on the complexity of the motor task (Chettouf et al., 2020). Moreover, the specific characteristics of sports activities can accentuate this predominance, as they often involve greater workload and prolonged unilateral use of a limb or anatomical structure. Bilateral asymmetry is defined as the difference between the right and left sides or between the dominant and non-dominant limbs, whether in terms of size, strength, length, muscle tone, or mobility (Keeley et al., 2011; Krzykała, 2010). Unilateral increases in muscle strength and volume, often caused by frequent asymmetric activities, can lead to muscle imbalances that increase the risk of overuse injuries (Askling et al., 2003; Croisier et al., 2002; Stewart et al., 2010). Over time, factors such as training duration, competitive level, and the development of physical capacities, including strength and power, may exacerbate these issues, particularly in overuse injuries of the dominant limb (Newton et al., 2006).

In the specific case of handball, motor activities such as jumping and throwing essential to the game-impose high demands on lower and upper limb strength and power, depending on the player's laterality. In this context, predominant laterality is usually defined by the dominant upper limb and its contralateral lower limb, which play a crucial role in performing the jump prior to the throw (Newton et al., 2006). Various protocols have been developed to assess asymmetries, such as the back squat (Flanagan & Salem, 2007), Isometric Mid-Thigh Pull (IMTP) (Bailey et al., 2013), muscle oxygenation levels (Gomez-Carmona et al., 2020), isokinetic knee flexion or extension (Schiltz et al., 2009; Silva et al., 2015), and, extensively, the ratio between agonist and antagonist muscles. In contrast, contralateral asymmetries have received less attention (Newton et al., 2006). It is relevant to highlight that tests such as the squat jump (SJ), countermovement jump (CMJ), and drop jump (DJ) have proven to be accessible, valid, reliable, and practical tools for detecting differences and anomalies in contralateral lower-limb asymmetries (Bishop et al., 2018; Maloney et al., 2016a).

It should also be noted that isometric and isokinetic assessments have been used to evaluate functional differences between limbs, but these are not the most appropriate for extrapolation to sport-specific actions (Impellizzeri et al., 2007; Read et al., 2018). For this reason, single-leg jump assessments have been favored, as they are more representative of handball activity and have yielded higher reliability values (Pérez-Castilla et al., 2021). Furthermore, most motor actions in sports use the limbs unilaterally, as in jumping, striking a ball, sprinting, changing direction, or jumping and throwing a ball, as in the case of handball. When in single-leg support, other control mechanisms such as balance and proprioception are involved, making single-leg jump tests a more precise tool for identifying asymmetries between the lower limbs (Benjanuvatra et al., 2013; Bishop et al., 2017).

The objective of this study is to determine the levels of asymmetry in the lower limbs using single-leg jump tests, considering the dominant limb used for throwing and its contralateral limb involved in the pre-throw jump, in Chilean junior national handball players.

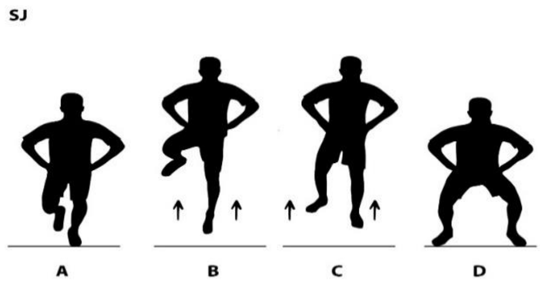
## Method

This quantitative, exploratory, cross-sectional study included assessments of single-leg strength and power using a battery of four single-leg jump tests, designed to measure key performance parameters of the lower limbs. The study participants were junior players from the Chilean national handball team. The dominance of the lower limb used for jumping was determined based on the dominance of the upper limb employed for ball throwing (Tate et al., 2006). In total, 11 players who used the left lower limb for jumping were evaluated (age: 19.5 ± 1.2 years; body mass: 87.2 ± 8.7 kg; height: 183.9 ± 5.1 cm) and five players who used the right lower limb (age: 20.6 ± 1.9 years; body mass: 79.6 ± 5.0 kg; height: 183.6 ± 5.7 cm). All participants were healthy adults with an average of 9 ± 2 years of handball experience.

The evaluation protocol was approved by the Ethics Committee of the University of Playa Ancha (UPLA), as documented in approval record number 010-2022. It was conducted by the recommendations of the Declaration of Helsinki for studies involving human subjects ("World Medical Association Declaration of Helsinki," 2013). Prior to participation, all subjects signed an informed consent form. Subsequently, a detailed description of the evaluations applied to the group of players was carried out.

Four types of single-leg jump tests were performed. The Squat Jump (SJ) test evaluates the maximal power of the lower limbs (McGuigan et al., 2006). In this test, the subject began supported on the jumping lower limb, with hands placed on the hips and maintaining a knee flexion angle between 90° and 100° for three seconds, followed by an upward vertical jump without countermovement (Barraza-Gómez et al., 2023). Landing was performed with both knees semi-flexed, using both limbs, to ensure safety (Figure 1).

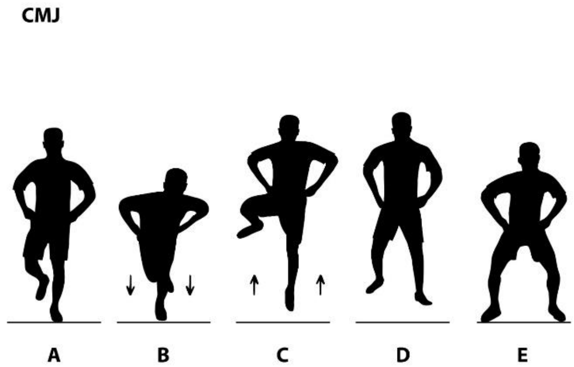
Figure 1. Single-Leg Squat Jump (SJ) Test




Fuente: Barraza-Gómez et al. (2025)

The Countermovement Jump (CMJ) test was also performed. In this test, the subject began in a single-leg extended position with hands on the hips, executed a knee flexion–extension movement to approximately 90°, followed by a vertical jump aimed at reaching the maximum possible height, and concluded with a slight natural knee flexion for landing absorption (Figure 2).

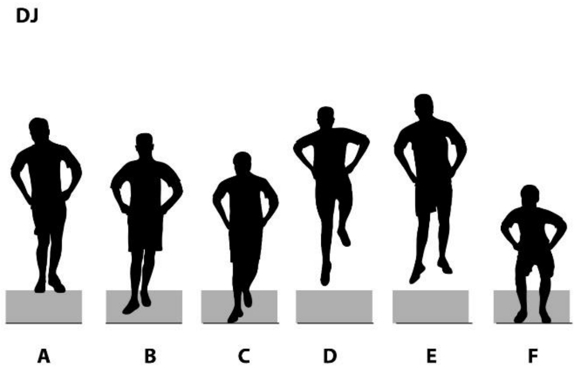
Figure 2. Single-Leg Countermovement Jump Test




Fuente: Barraza-Gómez et al. (2025)

The Drop Jump (DJ) test consisted of the subject stepping off unilaterally from a height of 30 cm, with hands on the hips, performing an eccentric cushioning with one limb, followed by maximal extension and jump height, and finally landing with both feet (Figure 3).

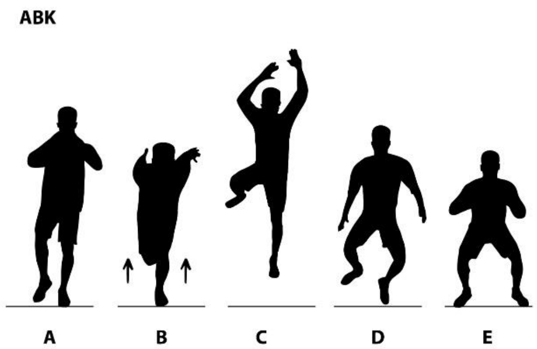
Figure 3. Single-Leg Drop Jump Test




Fuente: Barraza-Gómez et al. (2025)

The Abalakov Jump (ABK) test was performed with the subject in a single-leg extended position and free arms, allowing the active participation of the upper limbs to assist in the execution of the jump. In this test, a knee flexion–extension movement to approximately 90° was performed before attempting to reach the maximum height in a vertical jump, followed by landing with both feet in a slight knee semi-flexion. This jump enabled the assessment of the stretch-shortening cycle of the lower limbs, evaluating both the elastic-explosive component of the jump and the coordination of the upper limbs (Figure 4).

Figure 4. Single-Leg Abalakov Jump Test




Fuente: Barraza-Gómez et al. (2025)

All the described tests were designed to assess lower-limb muscle strength and power and were conducted at the beginning of the training season.

### *All Evaluation Protocols*

Basic anthropometric assessments were conducted to characterize the sample, following the standardized protocol of the International Society for the Advancement of Kinanthropometry (ISAK) (Stewart et al., 2011). Measurements included body mass, recorded with an electronic scale (Jadever JWI 3000; Jadever, Taipéi, Taiwán)) with a precision of 0.20 g. and height, assessed with a portable stadiometer (Seca 213; Seca GmbH & Co. KG, Hamburgo, Alemania).

Lower-limb strength and power were evaluated through single-leg vertical jumps using an iPhone 11 in combination with the mobile application *My Jump 2*. This tool is valid and reliable for measuring parameters associated with vertical jump performance (Balsalobre-Fernández et al., 2015; Haynes et al., 2019; Stanton et al., 2015).

The procedure consisted of recording participants performing the following jump types: Squat Jump (SJ), Countermovement Jump (CMJ), Abalakov Jump, and Drop Jump (DJ). Recordings were made at a speed of 240 frames per second (fps), with the device mounted on a tripod at hip height, approximately 3 meters from the participant, in a lateral position, ensuring full capture of the movement. The tests were conducted indoors, under controlled lighting conditions, with a black background to optimize contrast and facilitate the identification of key jump events.

The application accurately detects the take-off moment (when the feet leave the ground) and the landing moment (when the feet make contact with the ground again) through manual frame-by-frame analysis. Based on flight time, *My Jump 2* estimates jump height using the following formula, derived from the kinematics of uniformly accelerated motion. The described tests were designed to assess lower-limb muscle strength and power and were conducted at the beginning of the training season.

$$\mathrm{h} = \frac{g * (TOF)^2}{8}$$

Where $h$ is the jump height, $TOF$ is the flight time in seconds, and $g$ represents the acceleration due to gravity (9.81 m/s$^2$).

Additionally, the application provides estimates of variables such as applied force (N), take-off velocity (m/s), generated power (W), and inter-limb asymmetry indices, using mathematical models previously validated in the literature (Samozino et al., 2016).

The battery of tests and each jump protocol were familiar to the players, who had progressively learned these techniques from an early age, thereby reducing execution errors and increasing the reliability of the results. A 12-minute warm-up was performed, consisting of light jogging, joint mobility exercises, and stretching of the primary muscles involved in jumping. The sequence of evaluations began with the Squat Jump (SJ), followed by the Countermovement Jump (CMJ), the Drop Jump (DJ), and concluded with the Abalakov Jump (ABK). Two trials were performed for each jump type, with a three-minute seated rest period between each trial, and each jump was executed at maximal intensity.

One week prior to testing, participants were given specific instructions, which included: avoiding the consumption of stimulant foods or beverages such as caffeine or energy drinks; refraining from eating four to five hours before the tests; sleeping at least nine hours the night before; and abstaining from sports activities for 48 hours to optimize performance.

### *Asymmetry Calculation*

Asymmetry was calculated as the percentage difference between the right limb (RL) and the left limb (LL) (Knapik et al., 1991; Guan et al., 2022).

Equation:

Asymmetry (%)=(RL−LL)/LL)×100

For determining the percentage differences between the right and left limbs:

((RL/LL) −1) ×100=Percentage Difference (%)

## Results

The results are presented below in tables summarizing the primary data.

Table 1. Results of differences in body mass (kg) and height (cm) in subjects with left lower limb used for jumping (*n* = 11) and right lower limb (*n* = 5).

| Antropometry | Left | | | Right | | | P < .05 | Δ% |
|---|---|---|---|---|---|---|---|---|
| | M̄ | | SD | M̄ | | SD | | |
| Body mass (kg) | 87.2 | ± | 8.7 | 79.6 | ± | 5.0 | .13 | 9% |
| Height (cm) | 183.9 | ± | 5.0 | 183.6 | ± | 5.6 | .70 | 0% |

kg: kilograms; cm: centimeters; SD: standard deviation; M̄: mean; Δ%: percentage difference; P < .05: statistical difference.

In Table 1, it can be observed that body mass (kg) showed a 9% percentage difference between subjects with left and right jumping limbs, which was not statistically significant. Regarding height, no difference was found.

Table 2. Differences in jump tests (mean ± SD) for the variables of jump height (cm), force (N), and power (W), single-leg left and right limbs, in the evaluation of subjects with right jumping limb (n = 5).

| | Right (jumping) limb | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Left | | | Right | | | | | | |
| Jump SJ | M̄ | | DE | M̄ | | DE | P < .05 | Δ% | Comp* | TE |
| SJ. Jump Height (cm) | 20.5 | ± | 2.8 | 17.2 | ± | 2.5 | .14 | 16% | ED < EZ | 1 |
| SJ. Force (N) | 2321.9 | ± | 158.6 | 2207.8 | ± | 112.9 | .13 | 5% | ED < EZ | 0.58 |
| SJ. Power (W) | 2330.0 | ± | 301.2 | 2028.8 | ± | 220.9 | .13 | 13% | ED < EZ | 0.81 |
| Jump ABK | | | | | | | | | | |
| ABK. Jump Height (cm) | 26.2 | ± | 4.9 | 25.3 | ± | 1.9 | .71 | 3% | ED < EZ | 0.24 |
| ABK. Force (N) | 2497.7 | ± | 200.9 | 2565.0 | ± | 230.7 | .65 | 3% | ED > EZ | 0.22 |
| ABK. Power (W) | 2834.0 | ± | 461.1 | 2792.7 | ± | 252.3 | .86 | 1% | ED < EZ | 0.08 |
| Jump CMJ | | | | | | | | | | |
| CMJ. Jump Height (cm) | 20.4 | ± | 3,8 | 23.9 | ± | 5.0 | .13 | 17% | ED > EZ | 0.50 |
| CMJ. Force (N) | 2351.8 | ± | 215.0 | 2646.3 | ± | 307.2 | .13 | 13% | ED > EZ | 0.78 |
| CMJ. Power (W) | 2360.6 | ± | 441.0 | 2621.3 | ± | 472.3 | .22 | 11% | ED > EZ | 0.40 |
| Jump DJ | | | | | | | | | | |
| Jump Height (cm) | 25.3 | ± | 2.0 | 26.2 | ± | 4.8 | .70 | 3% | ED < EZ | 0.22 |
| Contac Time (ms) | 314.4 | ± | 50.9 | 314.2 | ± | 38.3 | .98 | 0% | ED < EZ | 0 |

SJ: squat jump; ABK: Abalakov jump; CMJ: countermovement jump; DJ: drop jump; ms: milliseconds; cm: centimeters; N: newton; W: watts; SD: standard deviation; M̄: mean; Δ%: percentage difference; RL: right limb; LL: left limb; Comp*: comparison; p < .05: statistical difference; ES: effect size (Cohen's d).

In Table 2, it can be observed that subjects who used their right limb in the SJ jump test showed lower jump height, force, and power compared to the left limb, although these differences were not statistically significant. In the ABK jump, a similar trend was observed, with predominance of jump height and power in the left limb, without significant differences. However, for the force variable, the dominant limb showed higher values, albeit without statistical significance.

In the CMJ test, all variables jump height, force, and power showed a slight predominance in the right limb, without reaching statistical significance. In contrast, in the DJ jump, predominance of the left limb was observed in jump height, while contact time was equal between limbs.

Furthermore, the five subjects who performed the jumps with the dominant right limb in all four jump modalities obtained percentage asymmetry ranges between 3% and 17% in jump height. Overall, the dominant right limb associated with the throwing jump did not show superior performance compared to its contralateral left limb in the tests performed.

Table 3. Differences in jump tests (mean ± SD) for the variables of jump height (cm), force (N), and power (W), single-leg left and right limbs, in the evaluation of subjects with left jumping limb (*n* = 11).

| | Left (jumping) limb | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Left | | | Right | | | | | | |
| Jump SJ | M̄ | | SD | M̄ | | SD | P < .05 | Δ% | Comp* | TE |
| SJ. Jump Height (cm) | 21.1 | ± | 3.4 | 22.1 | ± | 3.9 | .40 | 5% | ED > EZ | 0.24 |
| SJ. Force (N) | 2447.8 | ± | 162.5 | 2469.2 | ± | 165.9 | .53 | 1% | ED > EZ | 0.09 |
| SJ. Power (W) | 2487.9 | ± | 332.5 | 2580.2 | ± | 402.7 | .45 | 4% | ED > EZ | 0.18 |
| Jump ABK | | | | | | | | | | |
| ABK. Jump Height (cm) | 29.4 | ± | 3.7 | 29.7 | ± | 4.7 | .72 | 1% | ED > EZ | 0 |
| ABK. Force (N) | 2728.9 | ± | 246.4 | 2714.6 | ± | 254.0 | .62 | 1% | ED < EZ | 0.04 |
| ABK. Power (W) | 3011.5 | ± | 1000.8 | 3241.9 | ± | 497.9 | .45 | 8% | ED > EZ | 0.02 |
| Jump CMJ | | | | | | | | | | |
| CMJ. Jump Height (cm) | 24.5 | ± | 4.1 | 25.0 | ± | 6.0 | .74 | 2% | ED > EZ | 0.14 |
| CMJ. Force (N) | 2566.9 | ± | 257.5 | 2572.4 | ± | 308.8 | .92 | 0% | ED = EZ | 0.02 |
| CMJ. Power (W) | 2826.1 | ± | 510.2 | 2887.1 | ± | 686.4 | .64 | 2% | ED > EZ | 0.07 |
| Jump DJ | | | | | | | | | | |
| Jump Height (cm) | 28.3 | ± | 6.0 | 26.2 | ± | 5.7 | .11 | 8% | ED < EZ | 0.25 |
| Contac Time (ms) | 349.5 | ± | 79.5 | 335.1 | ± | 126.3 | .61 | 4% | ED < EZ | 0.09 |

SJ: squat jump; ABK: Abalakov jump; CMJ: countermovement jump; DJ: drop jump; ms: millisecond; cm: centimeter; N: newton; W: watt; SD: standard deviation; M̄: mean; Δ%: percentage difference; RL: right limb; LL: left limb; Comp*: comparison; p < .05: statistical difference; ES: effect size (Cohen's *d*).

In Table 3, it can be observed that left-dominant subjects in the SJ jump test presented greater jump height, higher force, and greater power in the non-dominant right limb, with no significant differences compared to the dominant left limb. In the ABK jump, a similar trend was observed, with predominance of the right limb in jump height and power, while the force developed was higher in the dominant left limb, although without statistical significance.

In the CMJ test, a slight predominance of the right limb was identified in jump height and power, while force was equivalent in both limbs. In the DJ jump, the left limb predominated in jump height values, with no statistical significance (p < .05), while contact times were higher in the left limb.

Overall, the percentage variations in the four jump modalities and the associated variables ranged between 1% and 8%. The dominant left limb associated with the throwing jump did not show superior performance compared to its contralateral right limb in the tests performed.

## Discussion

Among the subjects who performed the jump with the right limb, higher percentage differences between limbs were found, ranging from 1% to a maximum of 17%. These values are close to those reported by Bishop et al. (2021), where an asymmetry of 12.5% in jump height was observed, which is consistent with inter-limb asymmetry values of 10.4% for single-leg jump height reported by Lockie et al. (2014).

In contrast, in left-dominant subjects, the maximum asymmetry value was 8% in jump height, which does not involve performance loss since it is considered a minor asymmetry. In the case of left-dominant subjects, values were below 7%, which are classified as low values. These values are not significantly related to decreased sports performance, as observed in a study of junior handball players, where a difference of 8.76% in jump height between the dominant and non-dominant limbs was reported (Madruga-Parera et al., 2021).

In contrast, in right-dominant subjects, values above 10% are considered an adverse factor in the progression of competitive sports performance (Barrera-Domínguez et al., 2021). Asymmetries in power >10% in the single-leg CMJ evaluation resulted in a decrease of 9 cm in jump height, representing a considerable reduction in jump performance (Maloney et al., 2016b). In our study, for CMJ in right-dominant subjects, there was a 16% difference between limbs and a 4 cm reduction in jump height. These values are close to those reported by Cadens (2023), who found an average of 10.8% in single-leg CMJ. Although differences and some variables exceeding 10% and 15% were found in both groups, they were not statistically significant between limbs, which is consistent with what was reported by Cadens (2023).

Contrary to expectations, in this study the dominant side did not show superior performance in the jump tests, suggesting that the relationship between dominance and performance may depend on other factors such as compensatory movement patterns or non-evident muscle imbalances—or simply because the dominant throwing side requires compensation from the contralateral lower limb to perform the jump, which is not necessarily the dominant limb.

In team sports such as handball, jump actions are performed with the leg opposite to the throwing arm. Repetition of the specific skill allows for better development of coordination capacity and jump strength (Madruga-Parera et al., 2020; Stephens et al., 2007). In terms of force and power values, these were between 1% and 13%, which fall within what authors classify as physiological variability in asymmetries ranging between 10% and 15% (Fort-Vanmeerhaeghe et al., 2015; Hewit et al., 2012).

It is important to consider that research suggests that predominance of movement on one side of the body during the application of physical workload to improve physical capacities and technical–tactical skills in preparation for sports competition accentuates these imbalances. Therefore, specific strength and power training targeting the weaker side may be necessary (Newton et al., 2006). It is also important to note that asymmetries reduce athletes' physical performance, affecting speed and strength (Bishop et al., 2021; Bishop et al., 2017; Exell et al., 2017; Cadens et al., 2023; Gonzalo-Skok et al., 2015). Likewise, the probability of developing a pathology associated with physical effort increases (Bell et al., 2014; Newton et al., 2006). It is possible to consider that values above 10% to 20% are relevant when addressing asymmetries that may cause problems and reduce sports performance, potentially triggering associated musculoskeletal pathologies (Barrera-Domínguez et al., 2021; Helme et al., 2021; Impellizzeri et al., 2007; Read et al., 2018; Vargas et al., 2020).

In this regard, Newton (2016) states that jump evaluations help identify asymmetry problems and are also relevant when establishing training plans to improve the weaker limb. Strength and conditioning specialists should be aware of the importance of evaluating their athletes' jumping ability as a means of monitoring and detecting imbalances in the lower limbs (Madruga-Parera et al., 2021). Correcting interlimb imbalances can improve performance and reduce the risk of injury (Newton et al., 2006). Although this study was conducted with men, a greater number of injuries have been reported in women due to asymmetries, such as anterior cruciate ligament rupture (Agel et al., 2005; Dick et al., 2007).

The asymmetries observed in this study, although minor and not statistically significant, could have a cumulative impact on sports performance, especially in this sport where explosive strength and coordination are crucial; therefore, reducing them further becomes critical at this competitive level. According to Vargas et al. (2020), differences greater than 15–20% significantly increase the risk of musculoskeletal injuries and decrease sports performance, reinforcing the need to monitor these disparities.

This study presents some limitations that should be considered when interpreting the results:

The sample size was small and included the entire roster of Chilean junior national team players, which limits the generalization of the findings, though they could be extrapolated to other selected populations. The difference in the number of participants with left dominance ($n$ = 11) and right dominance ($n$ = 5) may have affected the statistical comparison between subgroups. Although the *My Jump 2* application has demonstrated excellent validity and reliability, the measurements were not complemented with laboratory biomechanical tools such as force platforms or motion capture systems.

## Conclusions

The evaluation of the lower limbs through single-leg jump tests, supported by accessible technologies such as the *My Jump* application, proved to be a valuable and effective tool for detecting functional asymmetries in high-performance athletes.

In this study, although differences in jump height, force, and power were identified between limbs in right- and left-dominant subjects, these differences were minor and did not reach statistical significance. This finding can be interpreted as favorable for performance, since low levels of asymmetry do not compromise the players' motor efficiency or functional status.

Furthermore, the results showed that the dominant limb did not necessarily present better performance, suggesting that the specific function of each limb rather than its dominance may determine its performance in sports tasks.

Although asymmetries are natural in the human body, they mustn't exceed the 10% threshold, as higher values could be associated with an increased risk of injury and decreased sports performance.

### *Recommendations*

The following strategies are suggested to reduce functional asymmetries and optimize performance in handball players:

Early intervention: Implement prevention and correction programs for asymmetries starting from youth categories, both in clubs and in national teams, for male and female athletes.

Systematic evaluation: Incorporate single-leg jump test batteries into regular physical assessment processes, both at the beginning and at the end of each training phase.

Specific training: Design single-leg physical training programs aimed at improving strength, power, and functional symmetry between limbs.

Comprehensive approach: Complement functional evaluation with morphostructural analysis for a complete understanding of the athlete's physical status.

Practical application: Include specific unilateral exercises in regular training routines to promote balanced development and prevent compensatory imbalances.

When applied consistently, these actions will help reduce injury risk, improve motor performance, and extend the athletic career of players.

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